INTERCONNECTION SERVICE MANUAL

VOL II

JULY 1977

INTERCONNECTION SERVICE MANUAL

VOLUME II

Bell System

325-006

JULY 1977

Interconnection Service Manual Vol. II

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INTERCONNECTION SERVICE MANUAL VOL. II

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Introduction

This manual is a compilation of BSPs covering the more commonly used Interconnecting Arrangements. The manual is intended to support the Plant Craftsman in his daily work operations while installing and maintaining Interconnect Arrangements.

For information not contained in this manual, refer to the standard BSP files.

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●	463-340-105	2	Protective Connecting Arrangement AD1 — 23A Coupler
	463-340-110	4	Voice Connecting Arrangements RDL and RDM
	Add 463-340-111	1	
	463-340-111	2	Voice Connecting Arrangements RDL and RDM — KS-19522, List 1 or List 2 Recorder Coupler Used With KS-16765, List 1 Announcement Set
	463-340-112	1	Voice Connecting Arrangement GTS
●	Add 463-340-120	1	
●	463-340-120	5	Protective Connecting Arrangements RCZ, RTT, and RC1 — and 4-Wire Service KS-19645 Type Recorder Connector

TELEPHONE COMPANY PROVIDED EXCHANGE LINE CONNECTION — MULTILINE

	Section Number	Issue	Subject
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●	463-341-101	4	Protective Connecting Arrangements STP and C2F
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LISTING OF USOC CODES AND RELATED BELL SYSTEM PRACTICES

USOC CODE	BSP NUMBER	VOLUME	USOC CODE	BSP NUMBER	VOLUME
AD1	463-340-105	I	CD5	463-311-103	I
CAU	463-340-100	I	CD6	463-350-105	II
CBF	463-300-112	I	CD7	463-350-106	II
CBS	590-103-104	II	CD8	463-350-106	II
CBS	590-103-111	II	CD9	463-350-106	II
CBT	590-103-106	II	CEBAV	463-311-106	I
CBT	590-103-109	II	CEBAW	463-311-106	I
CDA	463-350-100	II	CEBAX	463-311-104	I
CDA	463-350-101	*	CEBBX	463-311-104	I
CDB	463-331-100	*	CED	463-350-107	II
CDB	463-331-101	I	CEK	463-380-100	II
CDH	463-350-104	II	CET	463-350-108	II
CDN	463-300-140	*	CEZ	463-311-108	I
CDN	463-311-103	I	CTD	463-382-101	II
CDQ2W	463-360-101	II	CTH	463-382-103	II
CDQ2X	463-360-101	II	C1V	463-382-100	II
CDQ4W	463-360-100	II	C1Y	463-380-102	II
CDQ4X	463-360-100	II	C2ACP	463-341-100	I
CDT	590-103-103	II	C2AKS	463-311-107	I
CDX	463-331-104	I	C2F	463-341-101	I
CDY	463-312-100	I	C2H	463-370-101	II
CD1	463-300-110	*	C2K	463-370-102	II
CD4	463-300-130	*	C22	463-350-109	II
CD4	463-331-103	I	C24	463-370-101	II
CD5	463-300-150	*	C25	463-380-101	II

USOC CODE	BSP NUMBER	VOLUME	USOC CODE	BSP NUMBER	VOLUME
C27	463-370-102	II	RC1	463-340-120	I
C232W	463-360-103	II	RDL	463-340-110	I
C234W	463-360-102	II	RDL	463-340-111	I
DCK	463-332-100	I	RDM	463-340-110	I
DCT	463-332-110	I	RDM	463-340-111	I
DCW	463-332-120	I	RDMZR	463-340-101	I
FTM	463-341-103	I	RDY	463-340-101	I
FTP	463-341-102	I	RTT	463-340-120	I
GC2	463-382-100	II	STC	463-340-103	I
GTS	463-340-112	I	STP	463-341-101	I
HZM	463-382-102	II	STS	463-340-102	I
JTA	463-322-101	I	SU3	463-340-100	I
JTC	463-322-100	I	SUT	463-331-106	*
KTX	463-382-104	II	SU4	463-340-100	I
LOH	463-331-105	I	SU6	463-340-100	I
LVH	463-311-105	I	SU6AQ	463-340-102	I
PVF	463-390-100	*	SU7	463-340-100	I
QKP	463-311-109	I	SU7QW	463-340-104	I
QKT	463-311-100	I	TAS	463-350-110	II
RCX	463-382-100	II	TSPZ1	463-382-105	II
RCZ	463-340-120	I	TSPXY	463-382-105	II
			VCP	463-300-109	I

* Because of limited application, BSP is not included in this manual.

VOICE CONNECTING ARRANGEMENT CDA
INTERCONNECTING SERVICE UNIT F-58003 AND ASSOCIATED
F-58004 KTU AND F-58015 CONSOLE

1. GENERAL

1.01 This section provides identification, installation, operation, maintenance, and connection information for Voice Connecting Arrangement CDA used to terminate a line from a customer-provided (CP) PBX to the telecommunications network.

1.02 Information in this section was formerly contained in Section 463-300-101 which is hereby canceled.

1.03 The customer must be informed by the manufacturer or supplier of the equipment of the proper use and operation of Voice Connecting Arrangement CDA with his equipment.

1.04 If the customer wants a copy of the Technical Reference which covers this interface specification, the customer should contact the local Telephone Company Business Office or the Marketing Representative.

2. IDENTIFICATION

(a) ***Purpose***

- The F-58003 Interconnecting Service Unit (ISU) (Fig. 1 and 2), equipped with a number of F-58004 Key Telephone Units (KTUs) equal to the number of central office lines required, and the associated F-58015 console (Fig. 3) provides 2-wire manual access between Bell System Lines and a CP manual PBX arranged for supervision. Fig. 4 shows a typical arrangement for up to five Voice Connecting Arrangements CDA, Fig. 5 shows a typical arrangement of the maximum of 17 Voice Connecting Arrangements CDA.

- The arrangement limits excessive levels from customer-provided equipment and provides protection for personnel and equipment against hazardous voltages.

(b) ***Ordering Guide***

- Unit, Service, Interconnecting, F-58003 (one per five CO lines)

- Unit, Key Telephone, F-58004 (one per CO line)

- Console, F-58015 (equipped with one 599A and one 598A key)

Note: First production models were supplied in light beige -60 only. Later production models are supplied in moss green -52, white -58, light beige -60, and light gray -61.

- Block, Connecting, 66M1-50

- Block, Connecting, 66B3-50

- Cord, Power

  P-40J326 (1-1/2 ft)

  P-40J327 (2 ft)

  P-40J328 (4 ft)

  P-40J329 (6 ft)

  P-40J099 (12 ft)

Replaceable Components (Console and ISU)

- Unit, Power, 28A1

- Cover, P-44C515

- Key, 598A

- Key, 599A

- Dial, 8C

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(c) ***Design Features***

Interconnecting Service Unit

- Approximate dimensions are 16-1/2 inches high, 13-1/2 inches wide, and 10-1/2 inches deep (Fig. 2).
- Consists of three receptacles which house five 913A connectors into which five F-58004 KTUs can be plugged (Fig. 1).
- A 28A1 plug-in type power unit that supplies negative 24 volts battery and ground (Fig. 1).
- Components are mounted on a 31B apparatus mounting which is mounted on a 177-type backboard (A569329).

Console

- The F-58015 console is supplied with one 599A key, one 598A key, and one 105B apparatus blank. If the 105B apparatus blank is replaced by a 598A key, the console will provide a maximum of 17 pickup buttons and one release button.

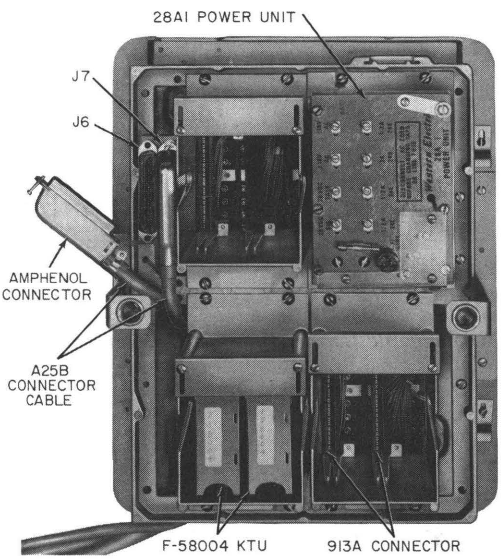


Fig. 1—F58003 Interconnecting Service Unit (Cover Removed)

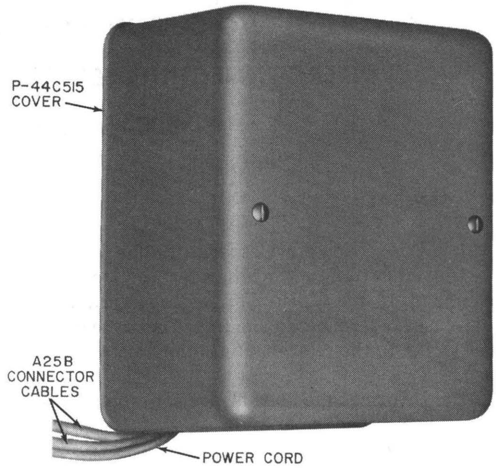


Fig. 2—F-58003 Interconnecting Service Unit (With Cover)

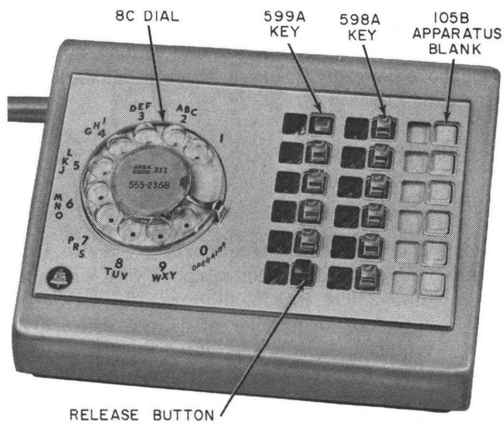


Fig. 3—F58015 Console

3. INSTALLATION

3.01 The ISU will mount to any surface. A backboard is not required unless mounting to a damp surface or when a backboard would facilitate mounting.

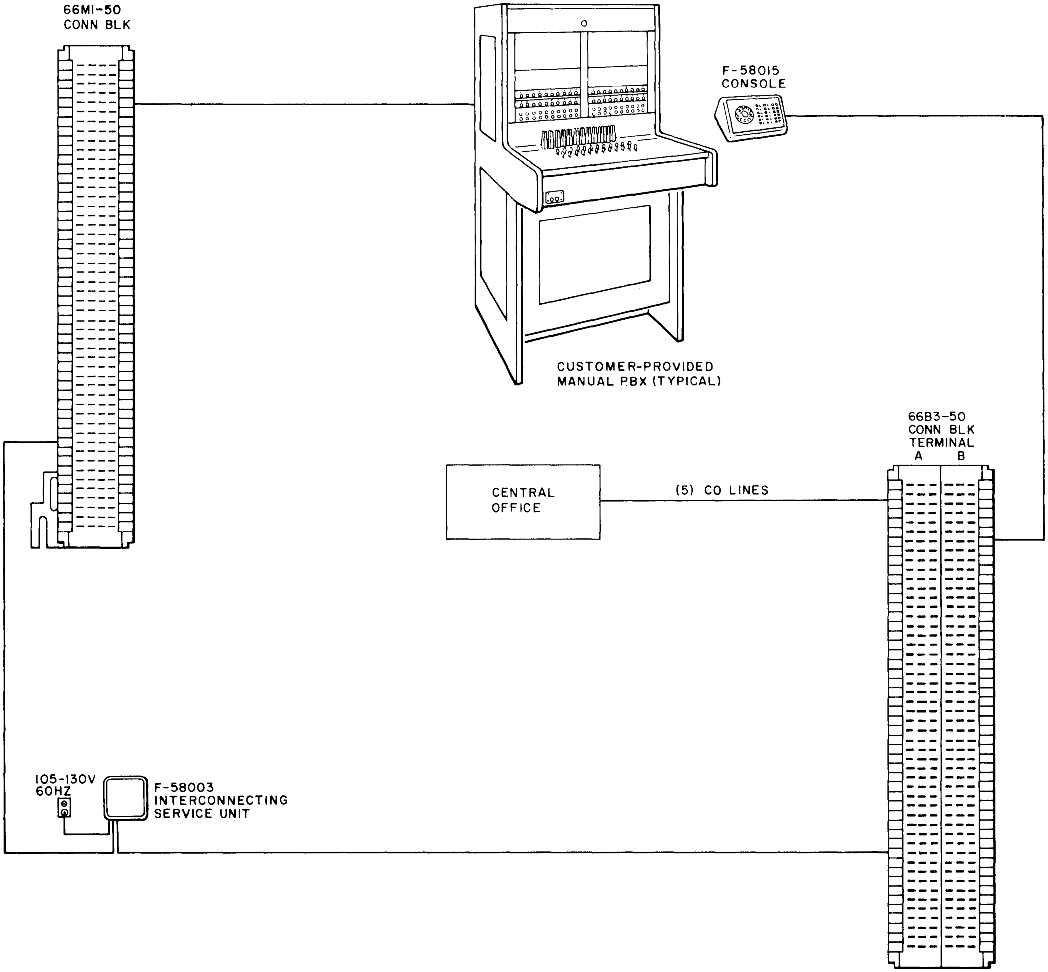


Fig. 4—Typical Installation of up to Five Voice Connecting Arrangements CDA

3.02 Refer to the Plant Series section in Division 463 for mounting backboards.

3.03 Refer to the Plant Series section in Division 461 for mounting 66B3-50 and 66M1-50 connecting blocks.

3.04 The interconnecting service unit may be used with CP manual type PBXs.

3.05 The customer must provide a 105-130 volt, 60 Hz outlet. This outlet should not be under control of a wall switch.

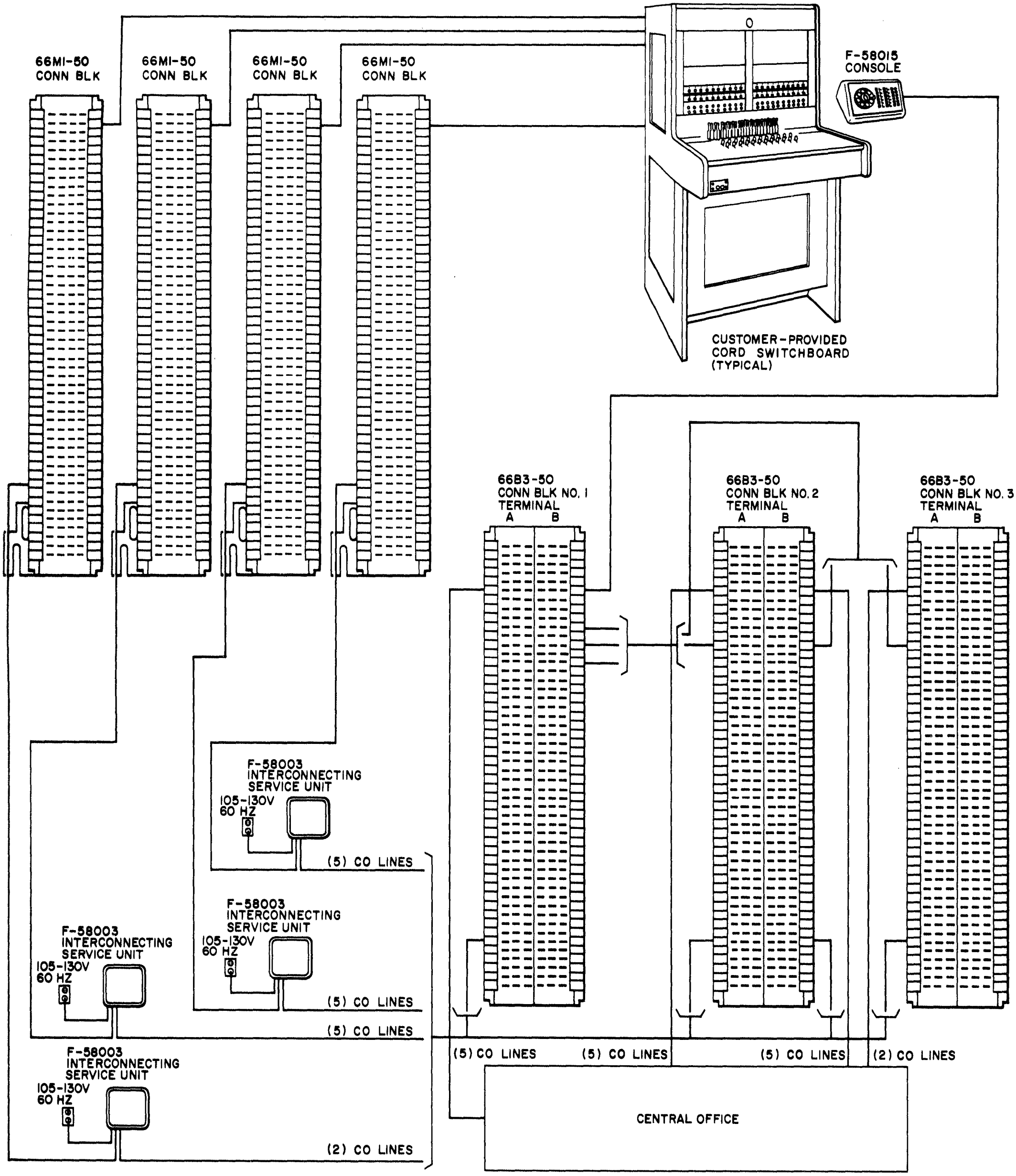


Fig. 5—Typical Installation of 17 Voice Connecting Arrangements CDA

3.06 Refer to Plant Series section in Division 167 for proper grounding of power plants.

4. METHOD OF OPERATION

Incoming Call

4.01 Ringing current over a central office line operates R relay which closes contacts over the C1 and C2 leads to operate a signal circuit in the CP PBX. The operator answers a call at switchboard providing an off-hook indication (contact closure on CS and CG leads) operating an S relay. Operation of S relay opens the ringing circuit and establishes a talking path.

4.02 When the operator gets on-hook supervision from the called party the connection is broken at the switchboard opening the CS and CG leads which releases S relay, restoring the circuit to normal.

Outgoing Call

4.03 The operator at the PBX connects to a vacant trunk and provides an off-hook indication contact closure on CS and CG leads to the F-58003 ISU. Ground on the A lead operates an S relay which disconnects the ringing circuit and completes a talking path to the central office. The operator then depresses the pickup button on the F-58015 console associated with the trunk. The depressed button closes ground through the contacts to operate a D relay in a particular F-58004 KTU. D relay, operated, places the pulsing and off-normal contacts of the dial into the circuit. After completion of dialing, the release button on the console is depressed, releasing the pickup button causing D to release which disconnects the console from the circuit.

4.04 When the operator gets on-hook supervision from the calling party, the connection is broken at the switchboard opening the CS and CG leads which releases S relay, restoring the circuit to normal.

5. MAINTENANCE

5.01 When trouble is reported, open circuit leads at interface connecting block and verify whether the trouble is in the CP equipment or in the ISU and associated apparatus, by performing the following tests.

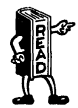
5.02 ***Transmission Test:*** Connect a 1013A (or equivalent) test set across T and R leads. Set TALK-MON switch of the test set to TALK position. Connect a short between A and A1 leads. Dial tone should be heard on the test set receiver.

5.03 ***Dialing Test:*** Push the dialing button on the F-58015 console associated with the interconnecting arrangement under test; then, dial operator using the F-58015 console dial.

5.04 ***Ringing Test:*** Request that the central office ring the CO line connected to the voice connecting arrangement under test. Disconnect the short between CS and CG leads. Connect an 81A test set between leads C1 and C2 to check the continuity during the ringing cycle. Continuity shows the NO contacts are closed indicating R relay in the ringing bridge circuit is operated. Connect a short between CS and CG leads to answer the call.

5.05 ***Customer False Dialing Test:*** Connect a 1013A (or equivalent) test set across CS and CG leads. Set TALK-MON switch to the TALK position. Dial 0 using the test set dial. Observe the interconnecting circuit S relay to make sure it does not follow the dial pulses.

5.06 If the trouble is in the CP equipment, inform the customer that the trouble tests toward his equipment.

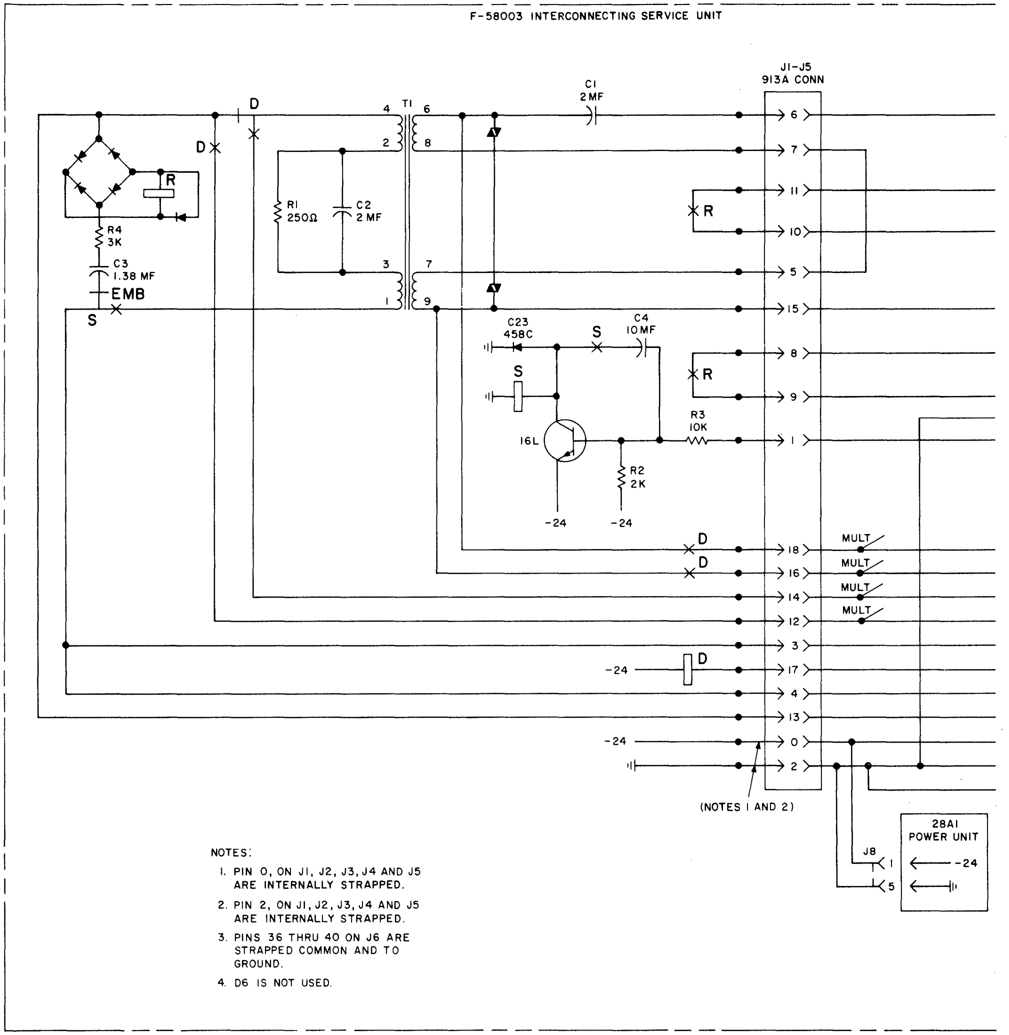


Do not attempt any repairs to the CP equipment.

5.07 Maintenance is limited to checking connections on connecting blocks, replacement of F-58004 KTUs, or 28A1 power unit, and components shown in Ordering Guide.

6. CONNECTIONS

6.01 Refer to Tables A, B, C, Fig. 6 and 7.



NOTES:

1. PIN 0, ON J1, J2, J3, J4 AND J5 ARE INTERNALLY STRAPPED.
2. PIN 2, ON J1, J2, J3, J4 AND J5 ARE INTERNALLY STRAPPED.
3. PINS 36 THRU 40 ON J6 ARE STRAPPED COMMON AND TO GROUND.
4. D6 IS NOT USED.

Fig. 6—Connections for Voice Connecting Arrangement CDA (Sheet 1)

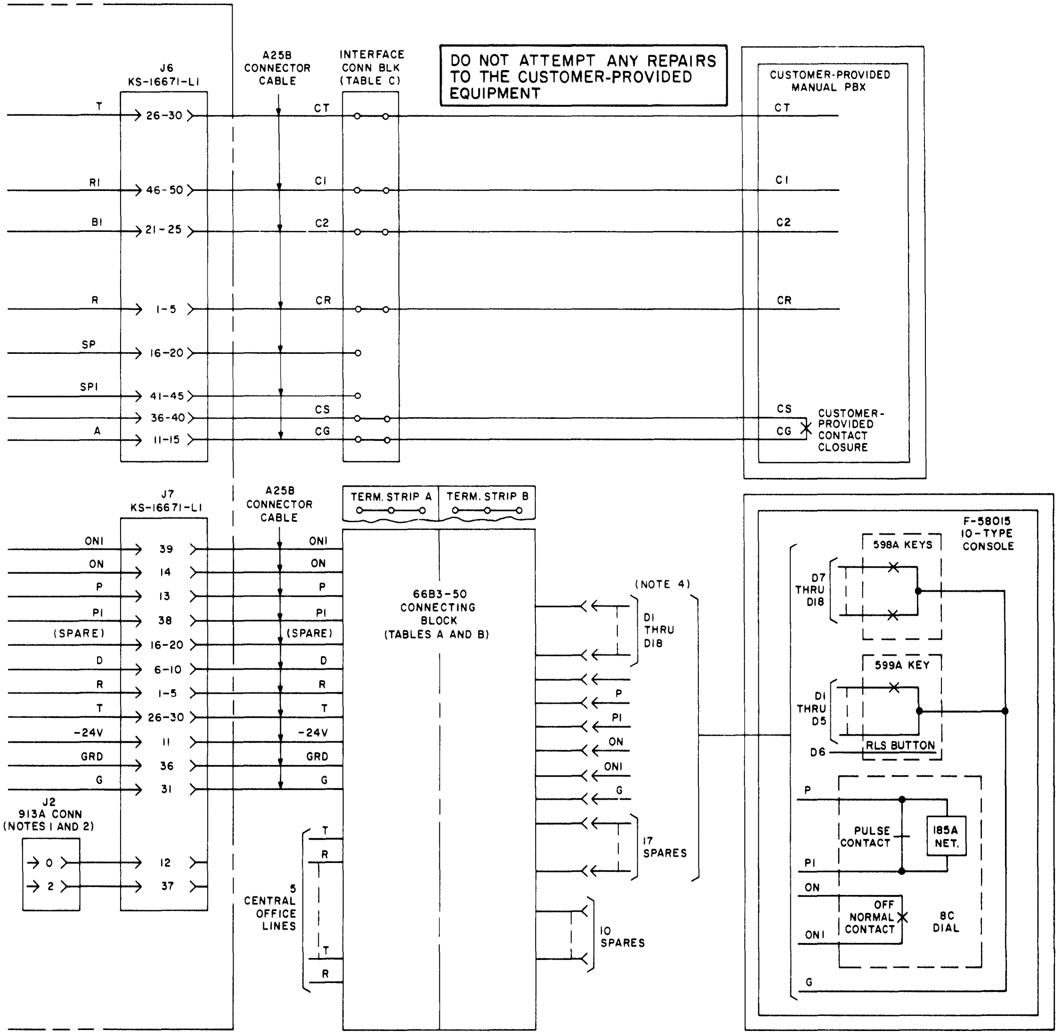


Fig. 6—Connections for Voice Connecting Arrangement CDA (Sheet 2)

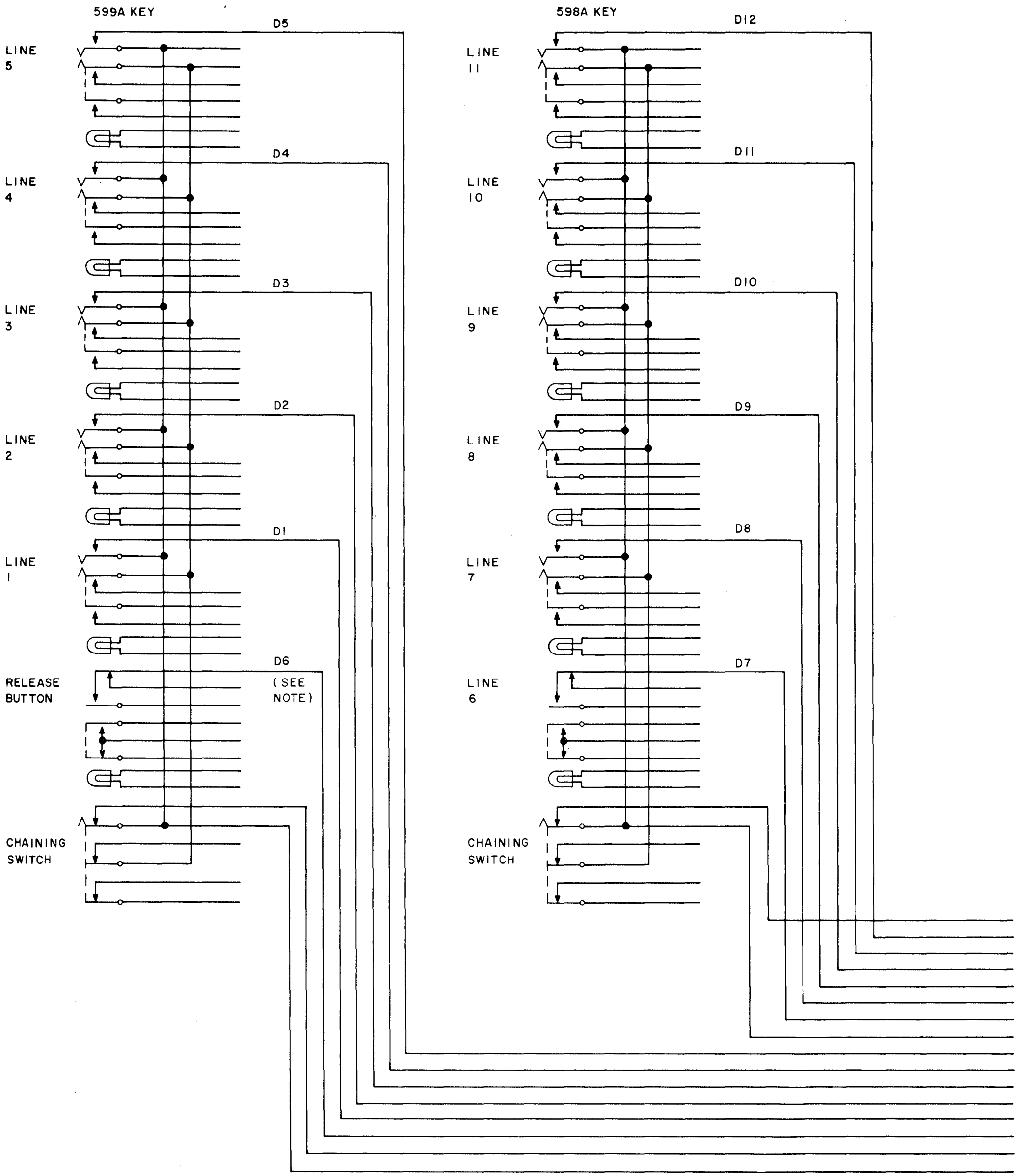


Fig. 7—F-58015 Console Circuit (Sheet 1)

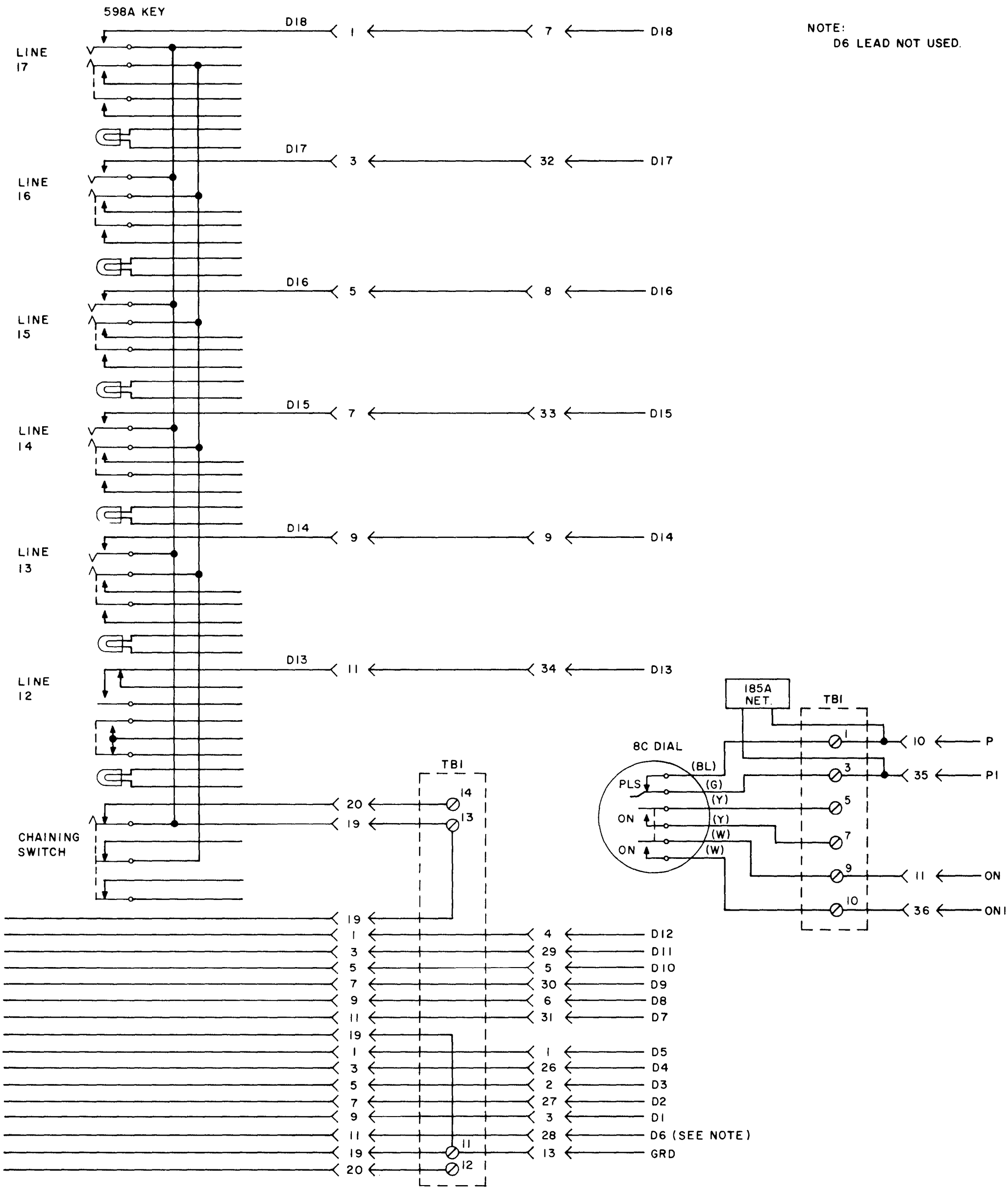


Fig. 7—F-58015 Console Circuit (Sheet 2)

TABLE A

CONNECTIONS FOR 66B3-50 CONNECTING BLOCK

FROM F-58003 INTERCONNECTING SERVICE UNIT			A25B CONN. CABLE	FROM F-58015 CONSOLE	
AMP CONN. PIN NO.	LEAD DESIG.	66B3-50 CONN. BLOCK TSA	COLOR	66B3-50 CONN. BLOCK TSB	LEAD DESIG.
26	T†	1	W-BL	1	D2
1	R†	2	BL-W	2	D1
27	T†	3	W-O	3	D4
2	R†	4	O-W	4	D3
28	T†	5	W-G	5	D6‡
3	R†	6	G-W	6	D5
29	T†	7	W-BR	7	D8
4	R†	8	BR-W	8	D7
30	T†	9	W-S	9	D10
5	R†	10	S-W	10	D9
31	G	11	R-BL	11	D12
6	D1	12	BL-R	12	D11
32		13	R-O	13	D14
7	D2	14	O-R	14	D13
33		15	R-G	15	D16
8	D3	16	G-R	16	D15
34		17	R-BR	17	D18
9	D4	18	BR-R	18	D17
35		19	R-S	19	P1
10	D5	20	S-R	20	P
36	GRD	21	BK-BL	21	ON1
11	−24 BATT	22	BL-BK	22	ON
37	GRD	23	BK-O	23	SPARE
12	−24 BATT	24	O-BK	24	SPARE
38	P1	25	BK-G	25	
13	P	26	G-BK	26	GRD
39	ON1	27	BK-BR	27	SPARE
14	ON	28	BR-BK	28	
40		29	BK-S	29	
15		30	S-BK	30	
41		31	Y-BL	31	
16	*	32	BL-Y	32	
42		33	Y-O	33	
17	*	34	O-Y	34	
43		35	Y-G	35	
18	*	36	G-Y	36	
44		37	Y-BR	37	
19	*	38	BR-Y	38	
45		39	Y-S	39	
20	*	40	S-Y	40	
46		41	V-BL	41	
21		42	BL-V	42	
47		43	V-O	43	
22		44	O-V	44	
48		45	V-G	45	
23		46	G-V	46	
49		47	V-BR	47	
24		48	BR-V	48	
50		49	V-S	49	
25		50	S-V	50	

Note: Add F-58003 for each additional five central office lines and terminate A25B connector cable on 66-type connecting block. Duplicate connections on TSA.

* Spare

† Terminate pairs from central office on TSA 1 thru 10

‡ Spare at release button

TABLE B

STRAPS REQUIRED ON 66B3-50 CONNECTING BLOCK

	66B3-50 CONNECTING BLOCK	
	TERM NUMBER	TSB CONN BLOCK 1
	FROM	TO
LINES 1 THRU 5 TSA CONN. BLOCK 1	11	26
	12	2
	14	1
	16	4
	18	3
	20	6
	25	19
	26	20
	27	21
	28	22
LINES 6 THRU 10 TSA CONN. BLOCK 2	11	26
	12	8
	14	7
	16	10
	18	9
	20	12
	25	19
	26	20
	27	21
	28	22
LINES 11 THRU 15 TSB CONN. BLOCK 2	11	26
	12	11
	14	14
	16	13
	18	16
	20	15
	25	19
	26	20
	27	21
	28	22
LINES 16 AND 17 TSA CONN. BLOCK 3	11	26
	12	18
	14	17
	25	19
	26	20
	27	21
	28	22

TABLE C

CONNECTIONS ON 66M1-50 CONNECTING BLOCK

LEAD DESIG.	A25B CONN. CABLE COLOR	66M1-50 CONN. BLOCK PAIR
CT	W-BL	1
CR	BL-W	
CT	W-O	2
CR	O-W	
CT	W-G	3
CR	G-W	
CT	W-BR	4
CR	BR-W	
CT	W-S	5
CR	S-W	
SPARE	R-BL	6
	BL-R	
	R-O	7
	O-R	
	R-G	8
	G-R	
	R-BR	9
	BR-R	
	R-S	10
	S-R	
CS	BK-BL	11
CG	BL-BK	
CS	BK-O	12
CG	O-BK	
CS	BK-G	13
CG	G-BK	
CS	BK-BR	14
CG	BR-BK	
CS	BK-S	15
CG	S-BK	
SP1	Y-BL	16
SP	BL-Y	
SP1	Y-O	17
SP	O-Y	
SP1	Y-G	18
SP	G-Y	
SP1	Y-BR	19
SP	BR-Y	
SP1	Y-S	20
SP	S-Y	
C1	V-BL	21
C2	BL-V	
C1	V-O	22
C2	O-V	
C1	V-G	23
C2	G-V	
C1	V-BR	24
C2	BR-V	
C1	V-S	25
C1	S-V	
	SPARE	26

PROTECTIVE CONNECTING ARRANGEMENTS CDH AND CBF

1. GENERAL

1.01 This section provides identification, installation, operation, maintenance, and connection information for the 101-type interconnecting unit (IU) and associated 69G apparatus mounting, 604-type panel, or 615A panel when used for Protective Connecting Arrangement (PCA) CDH. It also covers the 75A control unit used for PCA CBF, the KS-20944 protector used for PCA VCP, and Uniform Service Order Codes (USOC) PFB and PFC; all of these features can be associated with PCA CDH.

1.02 This section is reissued to:

- Include information on the 101C IU which replaces the 101B (MD)
- Rate the 604B panel MD
- Replace the term Voice Connecting Arrangement (VCA) with Protective Connecting Arrangement (PCA)
- Add comcode numbers to piecepart numbers
- Add new Table A.

1.03 For detailed information on specified associated apparatus, refer to the following sections:

463-300-101—604A Panel

463-300-102—604B and 604C Panels; 21A Apparatus Unit

463-300-104—615A Panel

463-300-109—KS-20944 Protector

463-300-112—75A Control Unit

463-300-113—142A Test Set

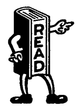
1.04 The 101C IU (Fig. 1) is an improved version of the 101B (MD) (Fig. 2) and is the preferred unit for new installations and replacements. Existing installations with 101A (MD) and 101B (MD) IUs may be encountered in the field; do not replace these units unless they are defective. Furthermore, available stock of these MD IUs should be used if possible. Refer to Table A for a summary of the applications and limitations of the three 101-type IUs.

> *Note:* In existing installations using pulse corrections, the 103A (MD) pulse corrector must be removed when replacing a 101A with a 101B or C.

1.05 The 604B panel (Fig. 3 and 5) is now rated MD but may be used when available; an installed 604B should be replaced with a 604C (Fig. 3 and 4) only when defective. These conditions also apply to the MD rated 604A-type panel (Fig. 6).

> ***Caution: When 101A and 101B/C IUs are installed in the same 604B or C panel, do not use a 101A for trunk 9 (position 13) if 101B/Cs are used for trunks 1 or 3 (positions 1 or 4), and do not use a 101A for trunk 14 (position 14) if 101B/Cs are used for trunks 5 or 7 (positions 7 or 10). If these rules are violated, the AGC leads of the 101B/Cs will be shorted.***

1.06 For mounting one to six 101-type IUs, use 615A panels. For over six circuits, use a 604-type panel. Consider both the size of the initial installation and the expected future growth in selecting the proper mounting equipment.



Do not use the 69G apparatus mounting for any new installations. Information is supplied in this practice only for servicing existing installations of the 69G.

1.07 The customer should contact the local Telephone Company Business Office or the

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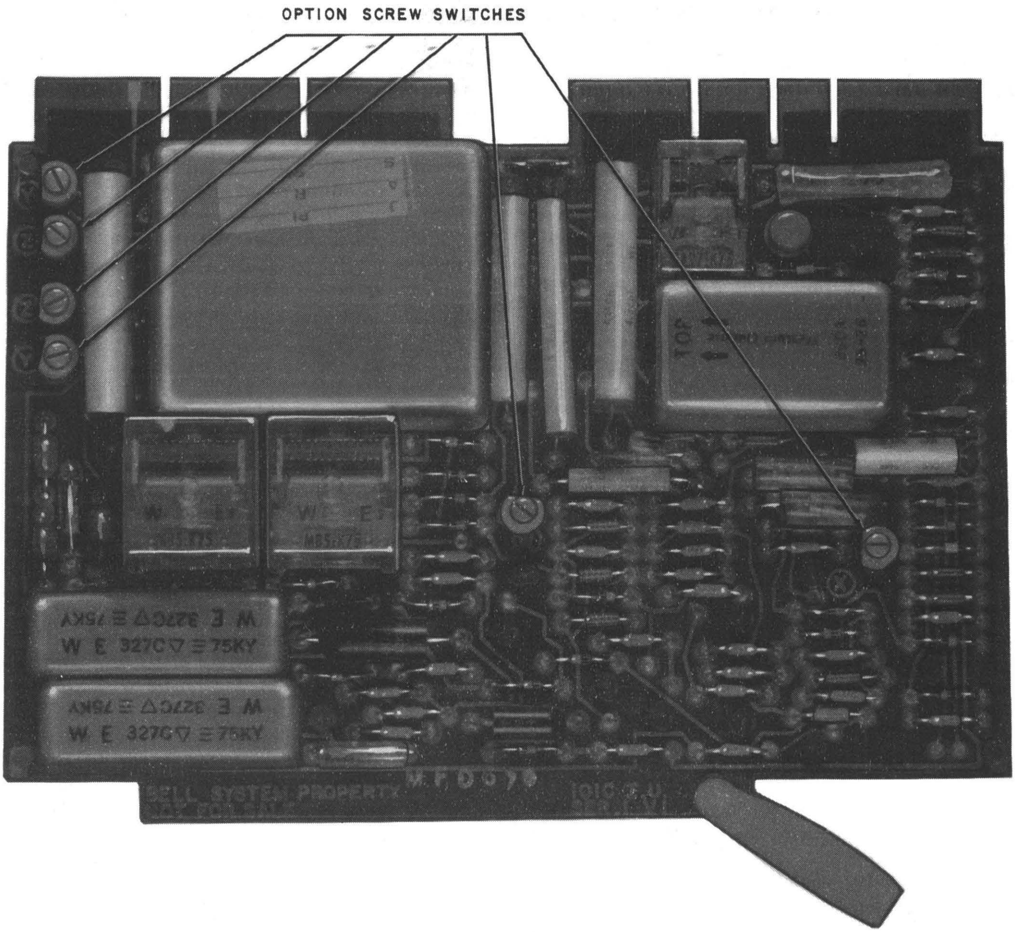


Fig. 1—101C IU

Marketing Representative to obtain a copy of the Technical Reference covering this interface specification.

1.08 This issue of the section is based on the following drawings:

SD-1E201-01, Issue 5B (101A IU)

SD-1E238-01, Issue 6B (101B IU)

SD-1E294-01, Issue 2D (101C IU)

SD-1E200-01, Issue 2D (604A Panel)

SD-69599-01, Issue 2A (69G Apparatus Mounting)

SD-69631-01, Issue 3D (Power Failure Transfer)

SD-1E246-01, Issue 2A (75A Control Unit)

If this section is to be used with equipment or apparatus reflecting later issue(s) of the drawing(s),

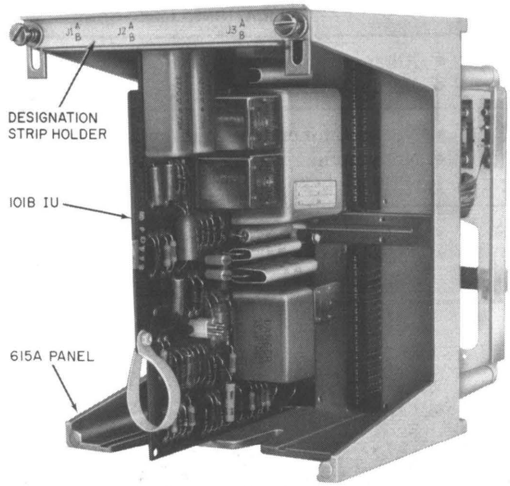
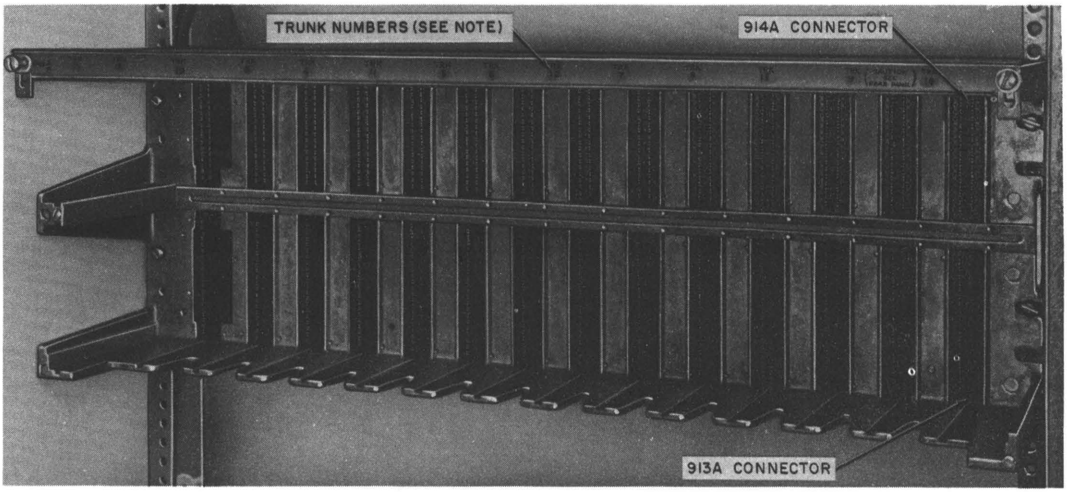


Fig. 2—101B (MD) IU Mounted in 615A Panel

TABLE A

APPLICATIONS OF 101-TYPE IUs

IU	APPLICATIONS/LIMITATIONS
101C	• All applications. • No limitations.
101B (MD)	• Not recommended for use with panel COs. • Not recommended for use with CPE equipped with electronic toll restriction circuitry.
101A (MD)	• Not recommended for use with panel COs. • Cannot be used in conjunction with 75A control units (PCA CBF).



NOTE: ON OLDER 604B PANELS, POSITION NUMBERS APPEAR INSTEAD OF TRUNK NUMBERS.

INSTALLATION SEQUENCE OF 101-TYPE INTERCONNECTING UNITS

TRUNK NO.	1	2	10	3	4	11	5	6	12	7	8	13	9	14
POSITION NO.	1	2	3	4	5	6	7	8	9	10	11	12	13	14

Fig. 3—604B (MD) or 604C Panel, Front View

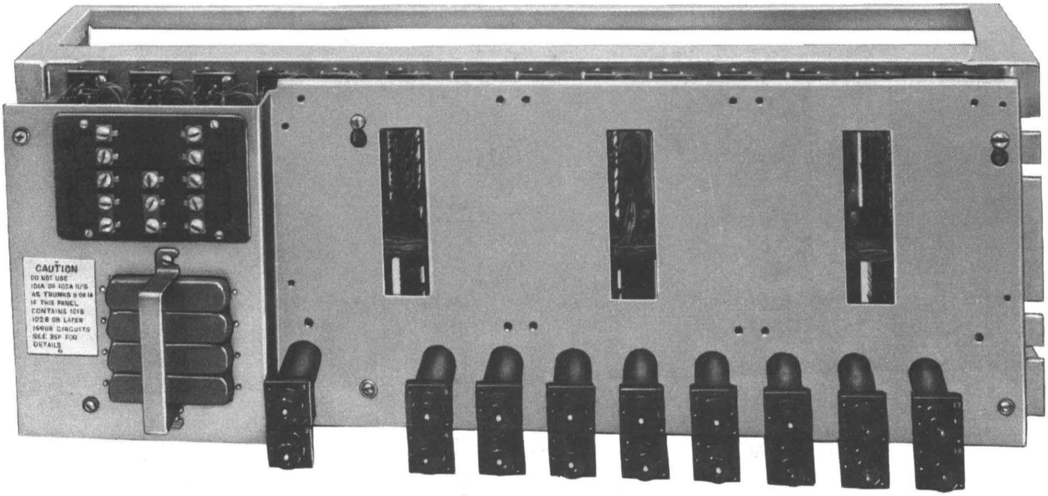


Fig. 4—604C Panel, Rear View (21A Apparatus Unit Not Installed)

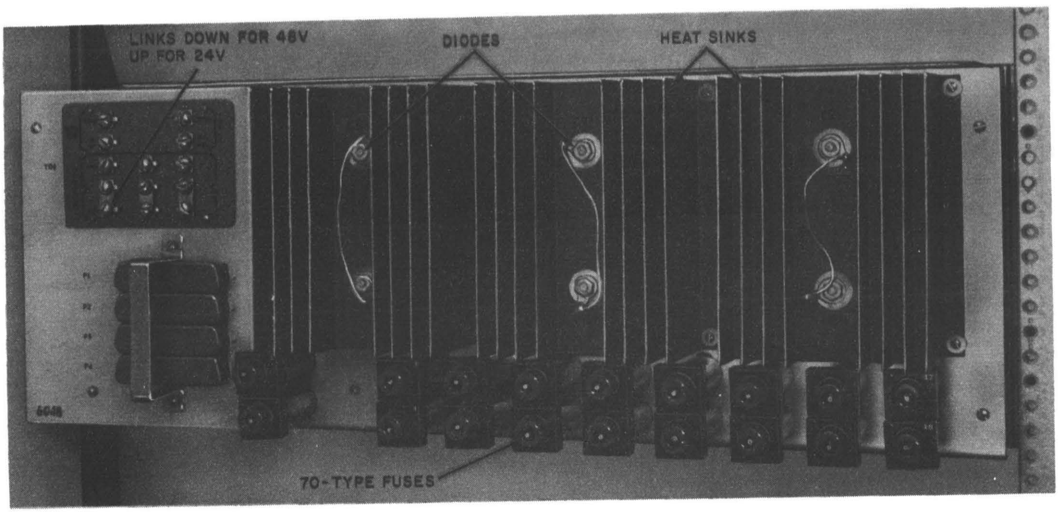


Fig. 5—604B (MD) Panel, Rear View

INSTALLATION SEQUENCE OF 101B INTERCONNECTING UNITS

TRUNK NO.	POSITION NO.
1	1
2	2
3	4
4	5
5	7
6	8
7	10
8	11
9	13
10	3
11	6
12	9
13	12
14	14

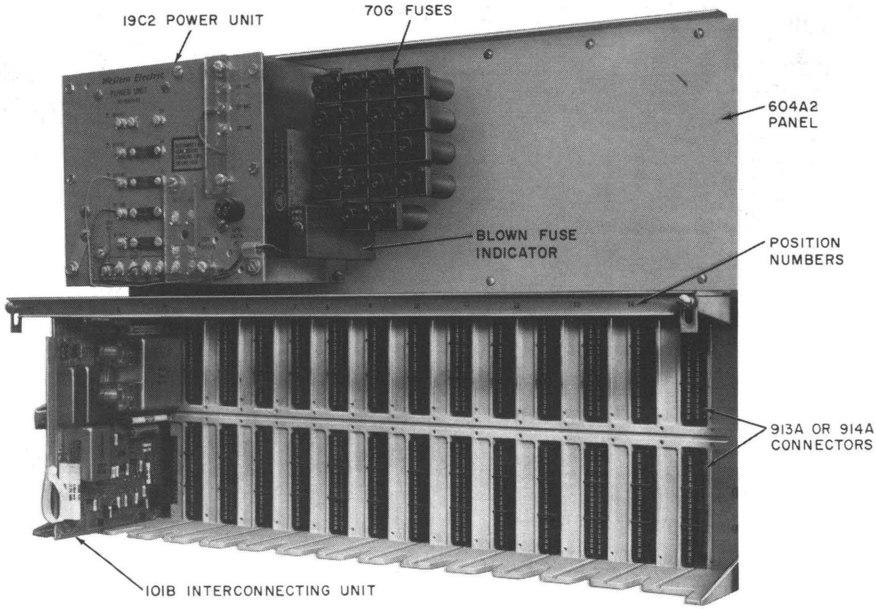


Fig. 6—101B (MD) IU Mounted in 604A2 (MD) Panel

reference should be made to the SDs and CDs to determine the extent of the changes and the manner in which the section may be affected.

2. IDENTIFICATION

PURPOSE

PCA CDH

- To provide an interface between 2-way ground start CO trunks and a customer-provided (CP) dial PBX
- To provide voiceband transmissions
- To limit excessive voice signal power levels from customer-provided equipment (CPE)
- To provide protection for telephone company personnel against hazardous voltages
- To transmit network control signaling functions.

PCA CBF

- To limit excessive data and voice signal power levels from CPE.

USOC PFB or PFC

- To provide telephone service during commercial power failure.

PCA VCP

- To provide an interface between CP power supply and PCA CDH
- To provide protection for telephone company personnel against hazardous voltages.

ORDERING GUIDE

(a) ***For PCA CDH***

- Unit, Interconnecting, 101C (one per CO trunk) (Fig. 1).

(b) ***Associated Apparatus (Order Separately)***

Note: If a 23-inch relay rack is not provided on customer premises, provide a 16C apparatus mounting, or equivalent, for the 615A panel or an ED-91180-72 Group 21 cabinet for the 604-type panel, or their local equivalent.

- Panel, 615A (includes fuse panel only, no power unit; mounts up to three 101-type IUs) (Fig. 2)
- Bracket, 99B (one per one, two, or three 615A panels when mounted in 16C or in relay rack)
- ♦Adapter, 262A (one per 19C2 power unit mounted in 16C)♦

or

- Panel, 604C (24V operation; includes fuse panel only, no power unit; mounts up to fourteen 101-type IUs or twelve 101-type IUs and two 75A control units) (Fig. 3 and 4)
- Unit, Apparatus, 21A (converts 604C panel to 48V operation)
- Cable, A25B (one per 615A panel or one, two, or four per 604-type panel) (Table B)
- Cable, A50B (one per 604-type panel) (Table B)
- Cable, A75A (one per 604-type panel) (Table B)
- Block, Connecting, 66M1-50 (as required) (Fig. 7)

Note: Other type blocks may be used when specified by local engineering. (66M1-50 should be used for interface with CPE to facilitate testing with 142A test set.)

- Clip, Bridging, B (25 per pack, as required) (Fig. 7)
- Cable, D Inside Wiring, or equivalent (for connecting 615A panel to connecting block for CO terminations)
- Wire, D station, or equivalent (for connecting external power supplies to 604-type or 615A panels)
- Unit, Power, 19C2, or equivalent (for 615A, 604A1, 604B, or 604C panels)
- Unit, Power, 29C1, or equivalent (for 604B or 604C panels with 75A control units)
- Cord, Power (for 19C2 power unit)

♦824013262 (P40J326) (1-1/2 feet)

824013270 (P40J327) (2 feet)

824013288 (P40J328) (4 feet)

824013296 (P40J329) (6 feet)

824010995 (P40J099) (12 feet)♦

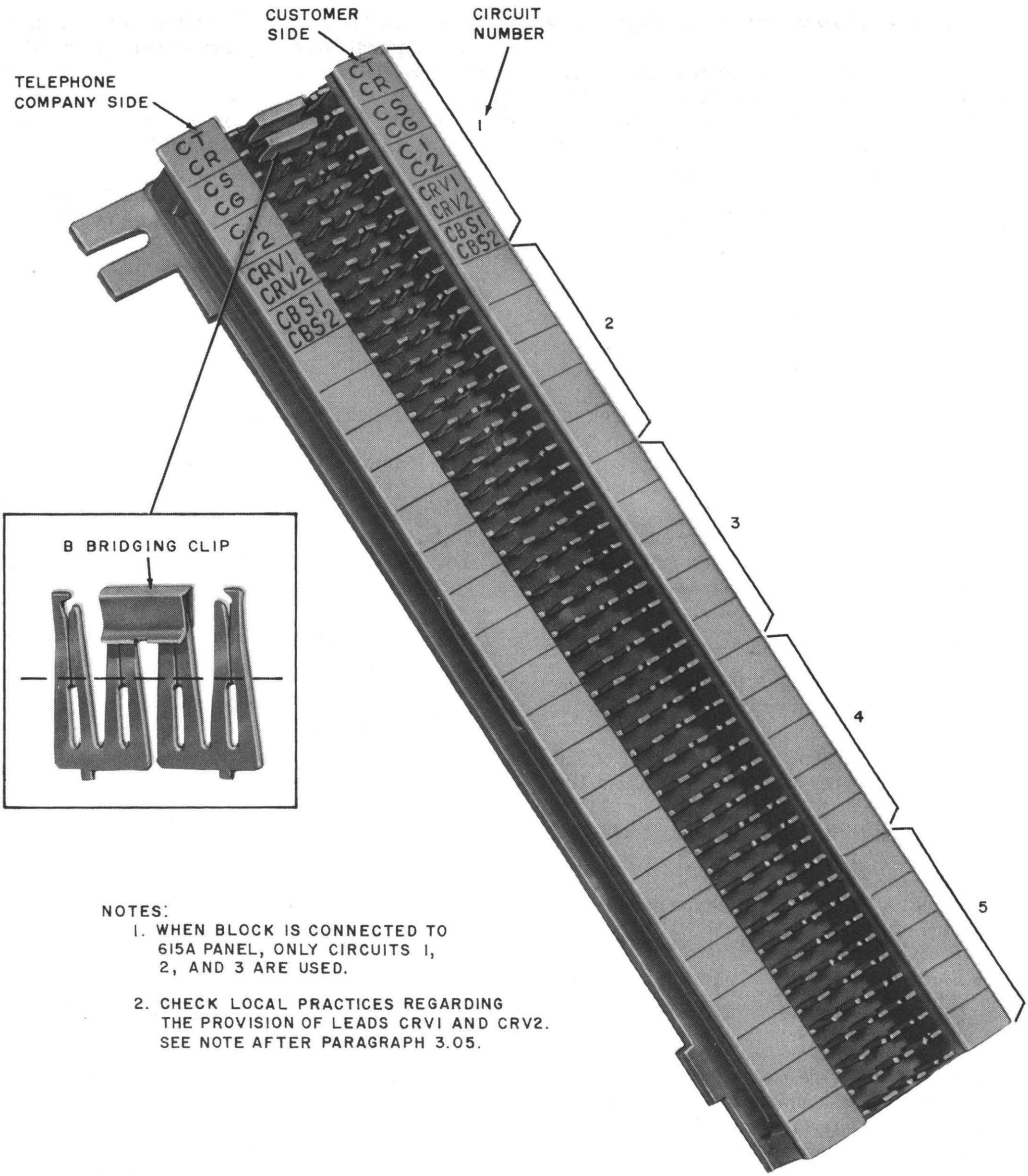
(c) ***For Power Failure Transfer (USOC PFB or PFC)***

- Set, Telephone, 500C/D or 554A/B (one per arrangement)
- Cord, Mounting, D4BJ (if delayed restoral is used, PFC)
- Unit, Telephone Key, 229B—one per four arrangements if immediate restoral (PFB) is used; one per arrangement if delayed restoral (PFC) is used
- Indicator, Lamp, 15-type or equivalent (one per telephone set when Z option provided, delayed restoral only, PFC)
- Key, Nonlocking, 551A (one per telephone set)
- Bracket, 77A (one per telephone set).

(d) ***For Data Transmission (PCA CBF)***

- Unit, Control, 75A (one per six 101B or C IUs in 604B or 604C panel) (Fig. 8)

(e) ***For Power Protection Unit (PCA VCP)***



NOTES:

1. WHEN BLOCK IS CONNECTED TO 615A PANEL, ONLY CIRCUITS 1, 2, AND 3 ARE USED.
2. CHECK LOCAL PRACTICES REGARDING THE PROVISION OF LEADS CRV1 AND CRV2. SEE NOTE AFTER PARAGRAPH 3.05.

Fig. 7—66M1-50 Interface Connecting Block

- KS-20944, L1 Protector (must be provided when a CP dc power supply is used) (Fig. 9).

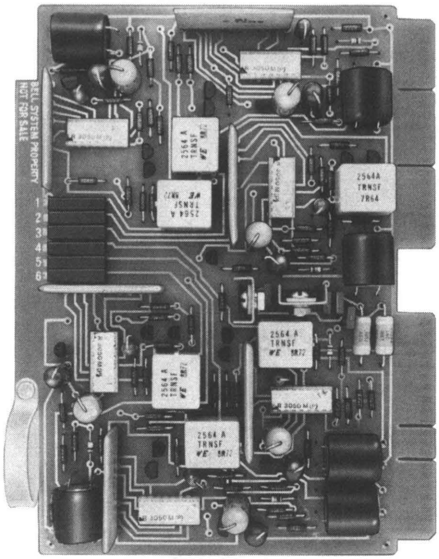


Fig. 8—75A Control Unit

(f) ***Replaceable Components (For 604-Type or 615A Panels)***

- Unit, Power, 19C2 (for 604A2 panel) (Fig. 6)
- Fuses, 70G (1/2 ampere, 18 per 604A-type panel)
- Fuses, 70F (1/4 ampere, 13 per 604B or 604C panel)
- Fuses, 70G (1/2 ampere, two per 604B or 604C panel)
- Fuses, 70A (1-1/3 ampere, three per 604B or 604C panel)
- Fuses, 24E (1/2 ampere, eight per 615A panel)
- Indicator, 17C-49 (for optional fuse alarm, if required, 604B or 604C panel only).

DESIGN FEATURES

101-Type Interconnecting Unit

- Components mounted on epoxy coated 8-inch 80-pin board
- Features ground start operation
- Approximate dimensions: 7-1/2 inches by 5-1/2 inches
- Options connected by straps on 101A and 101B; by screw switches on 101C (Fig. 1)
- Features line impedance matching (101B and C only)
- Data transmission capability (101B and C only)
- Ambient operating temperature range 0°F to 120°F
- Maximum current requirement at 26 volts dc: 0.160 ampere (101A); 0.126 ampere (101B); ▶0.143 ampere (101C).◀

3. INSTALLATION

69G Apparatus Mounting (Fig. 10 and 11)

3.01 The 69G apparatus mounting should not be used for new installations of PCA CDH. Refer to Fig. 11 for connections used in existing installations.

604-Type Panel (Fig. 12 and Tables C, D, E, F, I, K and L)

3.02 Mount the 604-type panel on a standard relay rack or in an ED-91180-72, Group 21, 18-plate equipment cabinet. Locate the panel within 200 feet (18 ohms loop resistance) of the CPE for the 101A IU or within 1000 feet (100 ohms loop resistance) for the 101B or C. Connect a separate ground wire to relay rack or cabinet. The ED-91180-72 cabinet will hold a maximum of two 604A-type panels or three 604B or C panels (power unit located externally) or two 604B or C panels

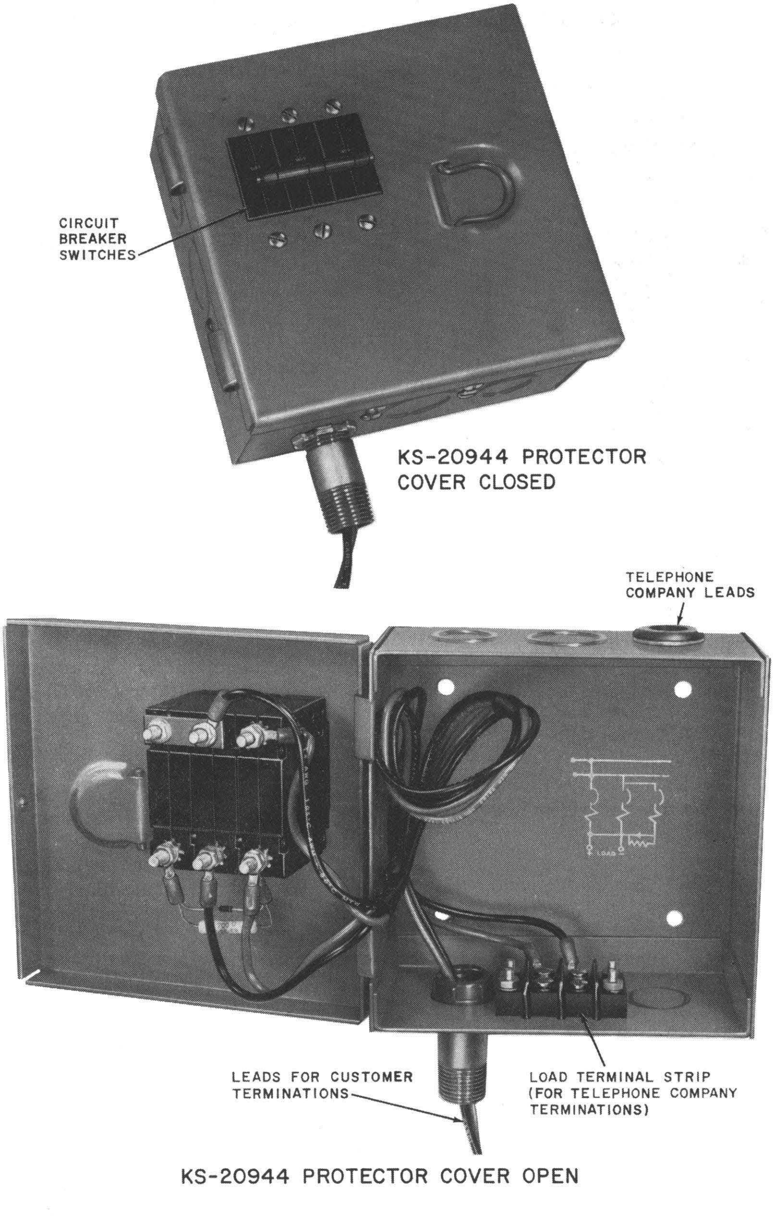


Fig. 9—KS-20944 Protector

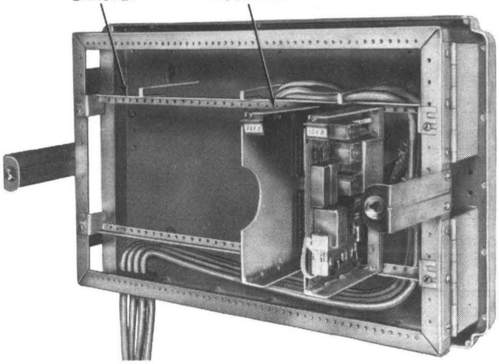


Fig. 10—69G Apparatus Mounting With 101B IU Mounted in 16C Apparatus Mounting

and a power unit when the drawing holder on the lower half of its cover is removed. Mount the 66M1-50 interface connecting block within 25 feet of the panel and in a position which will facilitate testing between the block and the panel.

3.03 Make electrical connection to the 604-type panel with connector cables. Arrangement of the plugs on the panel restricts plug P1 (CO lines) to an A25B connector cable. Plugs 2 through 4 (CPE connections) are arranged to accept a choice of cable sizes (see Table B). For example, in the first arrangement an A25B can be used for plug 1, single A75A for plugs 2 through 4, or a separate A25B can be used for each plug. Plug 5 (604A panel only) is not used with PCA CDH.

3.04 Terminate the stub end of the connector cable from P1 on one side of a 66B4-25 connecting block for CO lines (Table C).

3.05 Terminate the stub end of the connector cable(s) from P2, P3, and P4 on the telephone company side of the 66M1-50 interface connecting block (Tables D, E, and F). Stencil lead designations on fanning strips and use B bridging clips to connect columns B and C together on the connecting block (Fig. 7).

> ***Note:*** ➧Check local practices regarding the provision of leads CRV1 and CRV2. In some companies, these leads are not terminated on the interface connecting block unless the customer has ordered toll call indication.➧

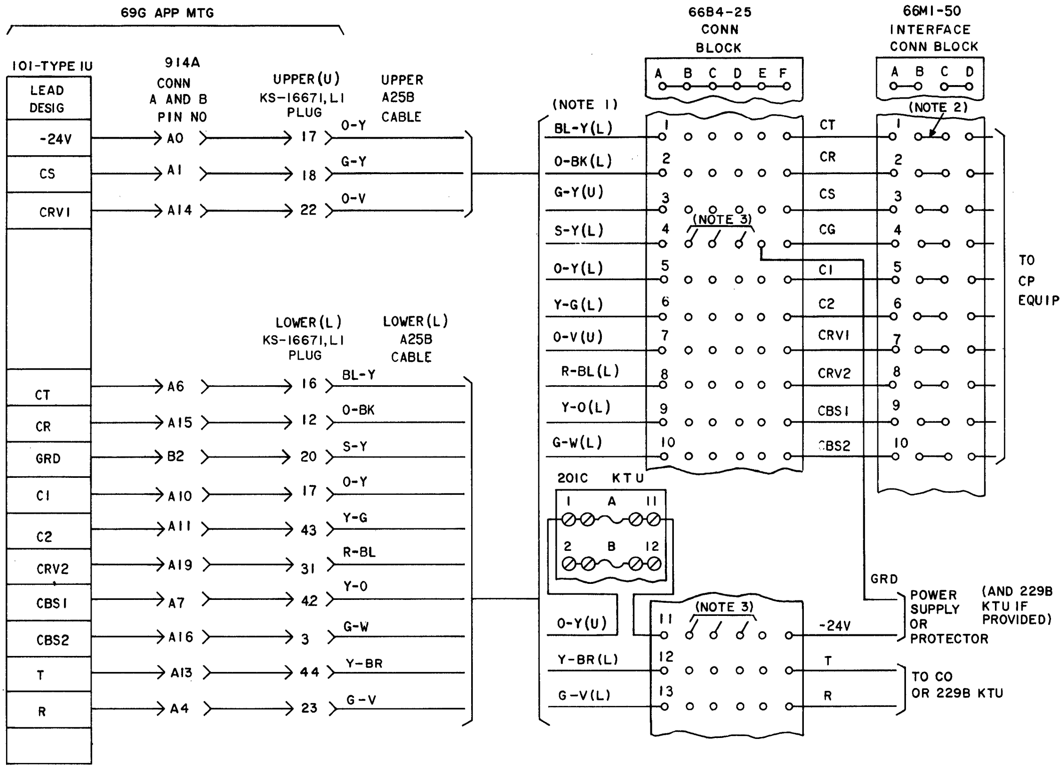
3.06 The 604A1, 604B, and 604C panels operate on externally supplied −24 volts. The 604B can be adapted to −48 volt operation by putting the option straps in the down position (Fig. 5). The 604C can be adapted to −48 volt operation by adding a 21A apparatus unit and putting the option straps in the down position. Attach the 21A to the rear of the 604C using the four 8-32 by 3/16-inch screws supplied with the apparatus unit as a loose item. Electrical connection to the 604C is made by attaching each red wire to a 48-volt terminal and each red-black wire to a 24-volt option terminal.

3.07 When a telephone company power unit is used, the customer must provide a separately fused 105- to 130-volt, 60-Hz outlet within reach of available power cords (see ORDERING GUIDE for cord lengths) and not under control of a wall switch. Mount the power unit in the same rack or cabinet with the 604-type panel it supplies, if possible, or in a nearby location (see ORDERING GUIDE for recommended units). When using the 604B or C panel with twelve 101B or C IUs and two 75A control units, use a 29C1 power unit or equivalent. The extra current drain by the 75A units (0.720 ampere maximum) will overload a 19C2 power unit. If CP power is used, it must be supplied through a KS-20944 protector (see 3.24).

3.08 Connect external power to terminals on rear of 604-type panel as shown in Table I. Refer to the appropriate section in Division 518 for proper grounding of power plants, which is important to prevent damage from power line surges.

615A Panel (Fig. 12 and Tables G, H, I, and M)

3.09 Mount the 615A panel on a standard relay rack or on a 16C apparatus mounting using a 99B bracket. Remove the center mounting bar from the 16C to allow the 615A to fit on the 99B bracket. The bracket holds up to three 615A panels or two 615A panels and a 19C2 power unit mounted with a 262A adapter; up to three 101-type IUs can be installed in each panel. Locate the panel within 200 feet (18 ohms loop resistance) of the CPE for the 101A IU or within 1000 feet (100 ohms loop resistance) for the 101B or C. Connect



NOTES:
1. INSULATE AND STORE SPARE LEADS
2. B BRIDGING CLIP OR WIRE STRAP
3. MULTIPLE TO OTHER CIRCUITS.

Fig. 11—Connection Diagram—69G Apparatus Mounting With 101-Type IU

a separate ground wire to relay rack or apparatus mounting.

3.10 Use D station wire or D inside wiring cable to run T and R leads from the 66T1 block on the 615A panel to one side of a 66B4-25 connecting block where CO lines are terminated (Table G).

3.11 Use an A25B connecting cable to connect the 615A panel to a 66M1-50 interface connecting block located within 25 feet of the panel. Connect the plug end of the cable to P1 on the 615A panel and terminate the stub end on the telephone company side of the connecting block (Table H). Stencil lead designations on fanning strips and use B bridging clips to connect columns B and C together on the connecting block (Fig. 7; see ***Note*** after 3.05).

3.12 When used with PCA CDH, the 615A panel operates on −24 volts supplied from associated equipment, a separate telephone company power unit, or from the customer's power supply. When

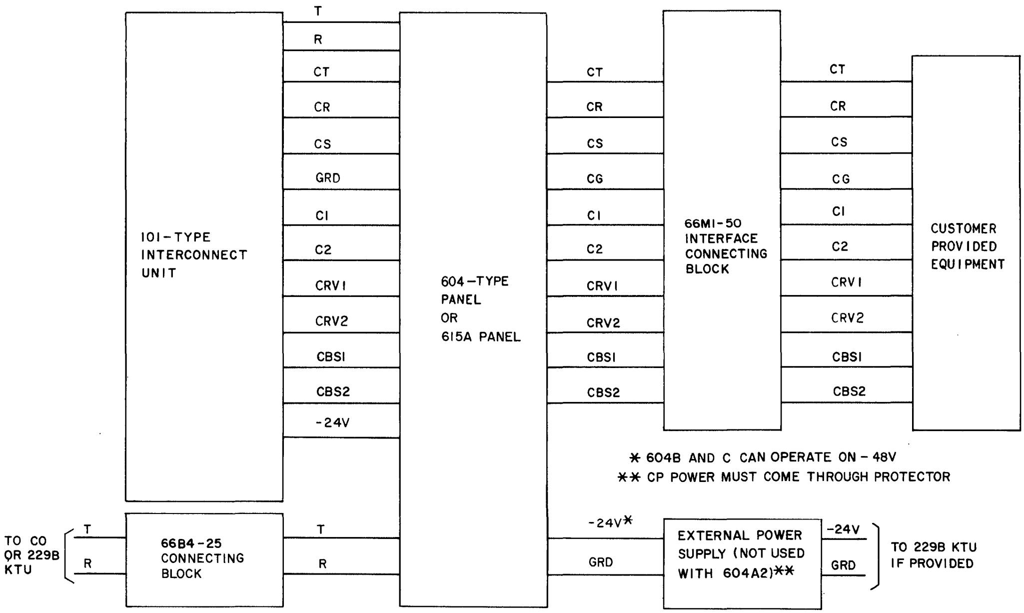


Fig. 12—Block Diagram—PCA CDH Using 604-Type or 615A Panel

a telephone company power unit such as the recommended 19C2 is used, the customer must provide a 105- to 130-volt, 60-Hz outlet within reach of available power cords (see ORDERING GUIDE for cord lengths) and not under the control of a wall switch. Mount the power unit in the same rack or apparatus mounting with the 615A panel it supplies, if possible, or in a nearby location. If CP power is used, it must be supplied through a KS-20944 protector (see 3.24).

3.13 Use 20-gauge wire to connect external power to the 66T1 connecting block on rear of 615A panel as shown in Table I. Refer to appropriate section in Division 518 for proper grounding of power plants, which is important to prevent damage from power line surges.

101-Type Interconnecting Unit (Fig. 1, 13, 14, and 15)

3.14 ***Options—101A IU:*** Install proper option straps with 24-gauge bare wire (see Fig. 13):

- Option W: Required when CO is step-by-step.
- Option Y: Always required.
- Option Z: Install when CO loop resistance (including resistance of CO) is greater than 500 ohms.

READ ***Be sure all option straps have been installed and check continuity of option straps after they are in place.***

3.15 ***Options—101B or C IU:*** Install proper option straps with 24-gauge bare wire or by screwing down screw switches on 101C (see Fig. 14 or 15):

- Option W: Install when CO loop resistance (including resistance of CO) is greater than 800 ohms.
- Option X: Required when CO is step-by-step.
- Option Y: Normally required; factory installed. Provides impedance ratio of 600

ohms to 600 ohms between CPE and CO lines.

- Option Z: Provides impedance ratio of 600 ohms to 900 ohms between CPE and CO lines, respectively. Required only when PBX-CO trunk facility is designed with terminating sets or 837-type impedance compensators that have 900 ohms input impedance.

The sequence of installing 101-type IUs in the panels is important. Refer to the tables in Fig. 3 and 6 for the correct sequence for 604A and 604B or C panels. Note that the trunk number does not necessarily correspond to the position number in the panel. For example, the IU for trunk 3 must be installed in position 4. (The designation strip holders on the 604C panel and on some newer 604B panels show the trunk number associated with each position. The 604A and older 604Bs have only the position number.) In the 615A panel, install the IUs for trunks 1, 2, and 3 in J1, J2, and J3, respectively (see Fig. 2).

3.16 ***Refer to CAUTION preceding 1.06 before installing 101A and 101B or C IUs in the same 604B or 604C panel.*** When installing the 101-type IU, raise the designation strip holder on the panel, position the board in the guide grooves of the 604-type or 615A panel, and slide the 101-type IU in until it is properly seated and electrically connected to the 913A or 914A connectors. The guide grooves prevent improper insertion of the 101-type IUs.

Note: The connectors in the 604B and C panels are equipped with index clips to match the code slots in the 101B and C IUs. When using 101A IUs, pull out the clips between contacts 9 and 10 in the B connectors.

3.17 Make certain designation strip holder is properly positioned to hold the IUs in place.

3.18 Perform tests shown in Part 5 after installation.

Power Failure Transfer (Fig. 16 and 17)

3.19 When power failure transfer with delayed restoral is required, the 229B KTU must be mounted externally and wired to the 615A or 604-type panel and selected telephone set as shown in Fig. 16 and Table J. Replace the D3BN mounting cord with a D4BJ mounting cord. If Z option (indicator lamp) is required, install per local practices.

3.20 When power failure transfer with immediate restoral is required, the 229B KTU must be mounted externally and wired to the 615A or 604-type panel and selected telephone set as shown in Fig. 17. No telephone set modification is required.

3.21 The 77A bracket is equipped with two screws and nuts for mounting the 551A nonlocking key. The bracket is equipped with friction pads and is arranged to mount over the lip on the base of the telephone set. The bracket is held in place by the housing. Connect the 551A ground start switch to C and G of network in telephone set.

75A Control Unit

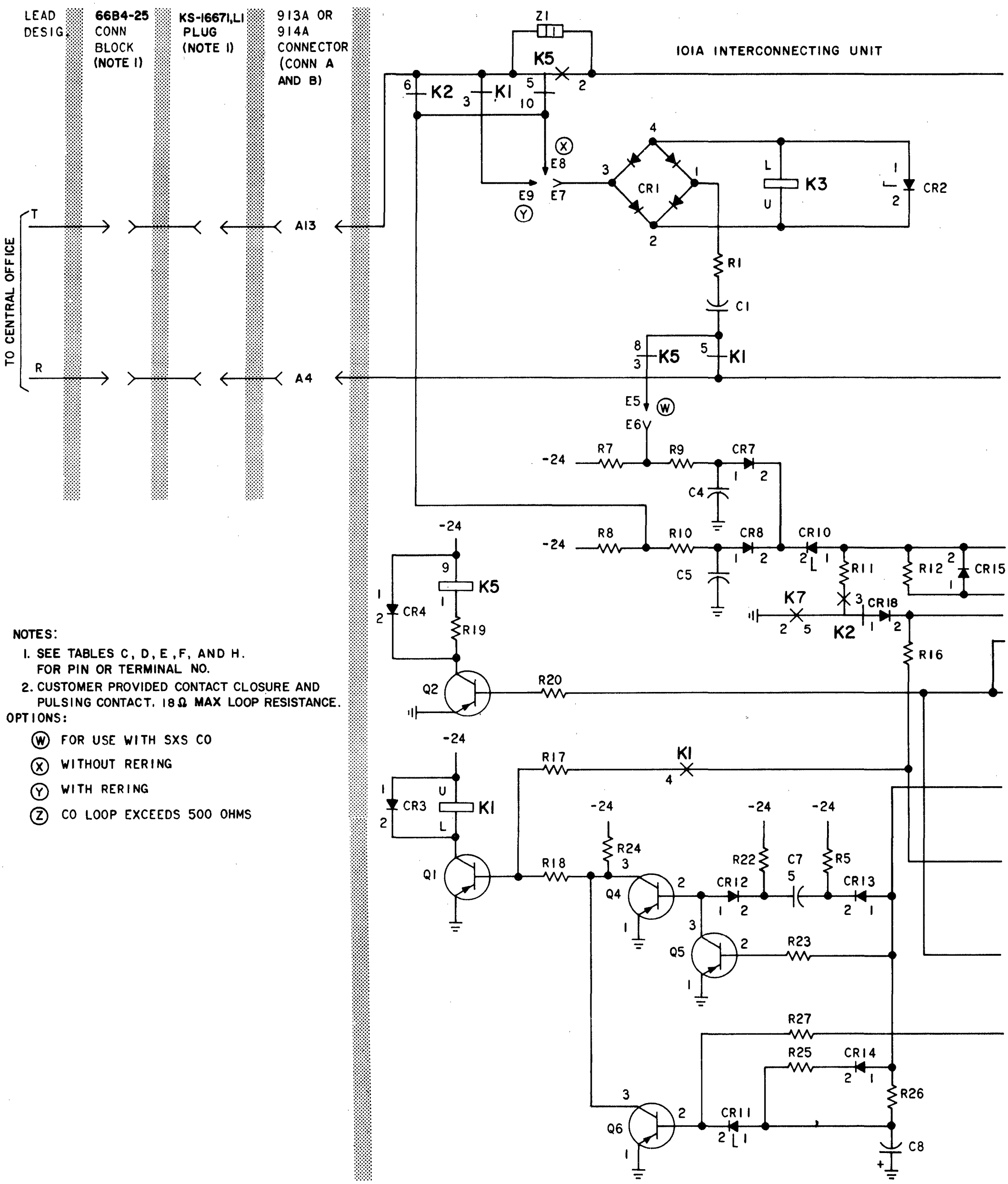
3.22 The 75A control unit is plugged into position 13 of the 604B or C panel to furnish ALC to IUs in positions 1 through 6 or plugged into position 14 for positions 7 through 12. Since the 604B or C panel is prewired for the 75A, all connections are made when it is plugged into the panel.

The electrical design of the 75A control unit protects it from voltage surges, and it may be installed or removed without disturbing service to the associated IUs.

3.23 After installation adjust the limiting level threshold by setting the six level control potentiometers as shown in Section 463-300-112.

KS-20944 Protector (Fig. 18)

3.24 When voltage protection is required, the KS-20944 protector must be mounted externally and wired to the power supply terminals of the 615A or 604-type panel (Fig. 12). Refer to Section 463-300-109 for connections to multiple installations.



NOTES:

1. SEE TABLES C, D, E, F, AND H. FOR PIN OR TERMINAL NO.
2. CUSTOMER PROVIDED CONTACT CLOSURE AND PULSING CONTACT. 18 Ω MAX LOOP RESISTANCE.

OPTIONS:

(W) FOR USE WITH SXS CO
(X) WITHOUT RERING
(Y) WITH RERING
(Z) CO LOOP EXCEEDS 500 OHMS

Fig. 13—Schematic—101A (MD) IU (Sheet 1)

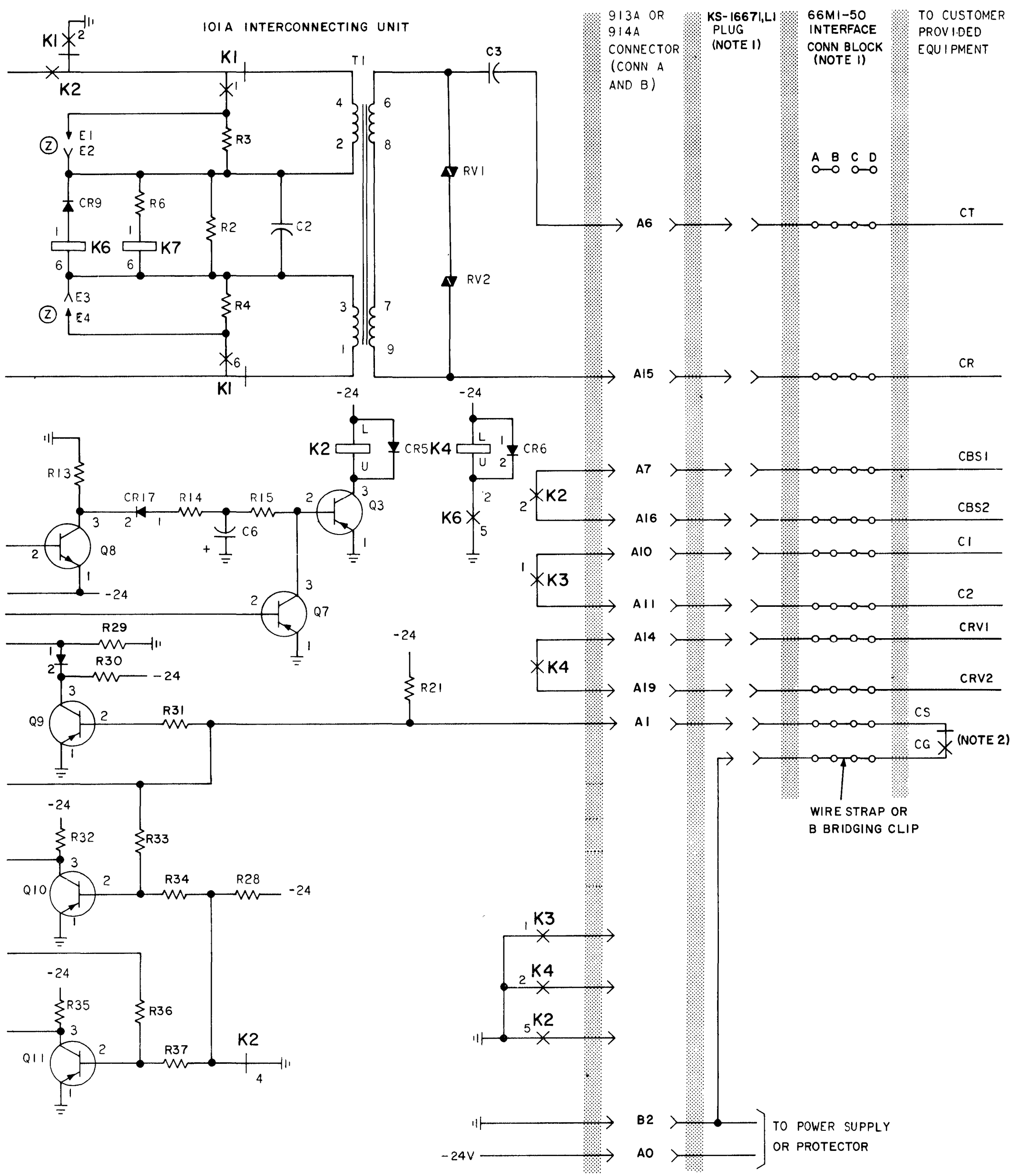
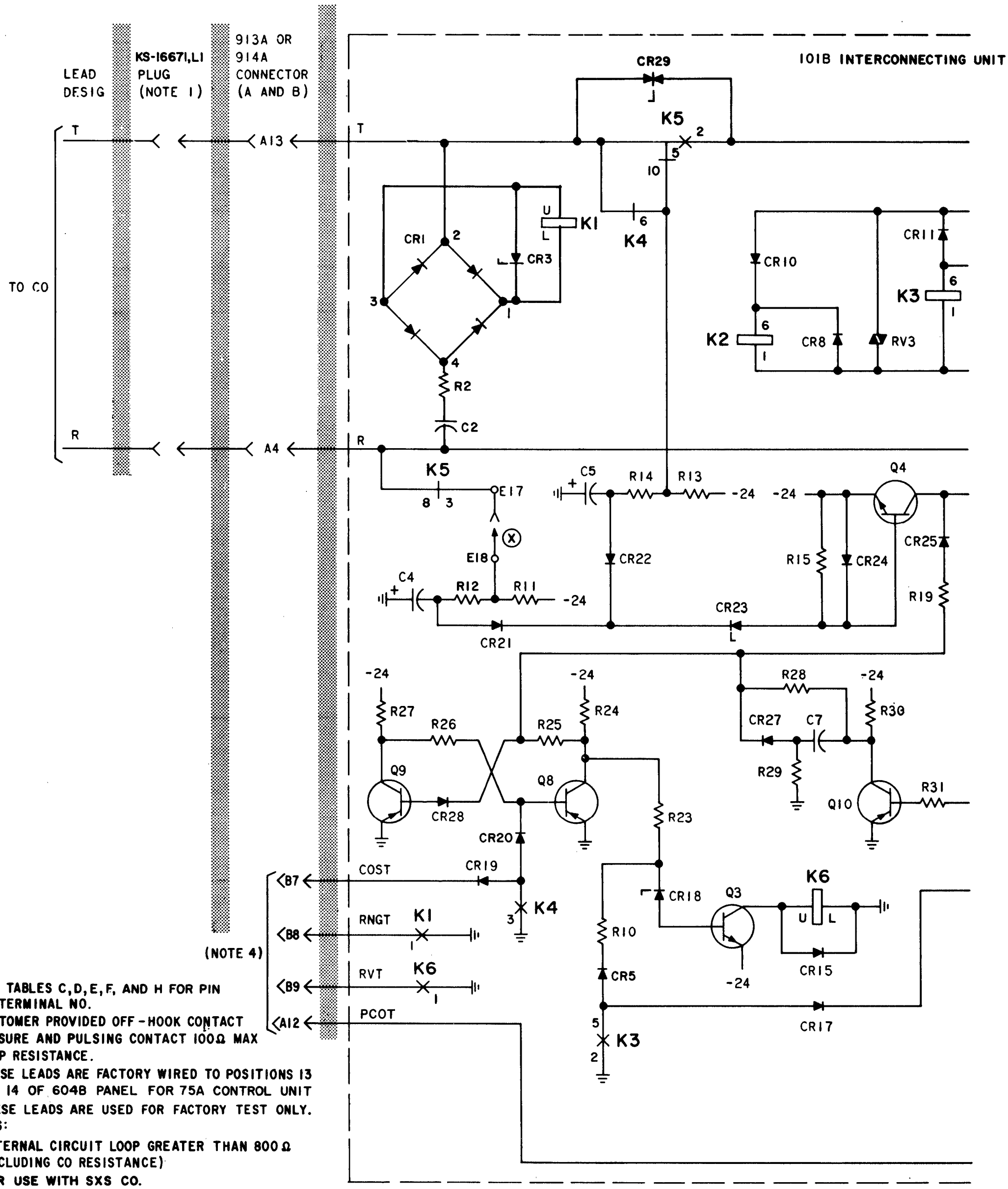


Fig. 13—Schematic—101A (MD) IU (Sheet 2)



NOTES:

1. SEE TABLES C, D, E, F, AND H FOR PIN OR TERMINAL NO.
2. CUSTOMER PROVIDED OFF-HOOK CONTACT CLOSURE AND PULSING CONTACT 100Ω MAX LOOP RESISTANCE.
3. THESE LEADS ARE FACTORY WIRED TO POSITIONS 13 AND 14 OF 604B PANEL FOR 75A CONTROL UNIT
4. THESE LEADS ARE USED FOR FACTORY TEST ONLY.

OPTIONS:

(W) EXTERNAL CIRCUIT LOOP GREATER THAN 800Ω (INCLUDING CO RESISTANCE)
(X) FOR USE WITH SXS CO.
(Y) 600Ω CO LINE IMPEDANCE. FACTORY INSTALLED.
(Z) 900Ω CO LINE IMPEDANCE.

Fig. 14—Schematic—101B (MD) IU (Sheet 1)

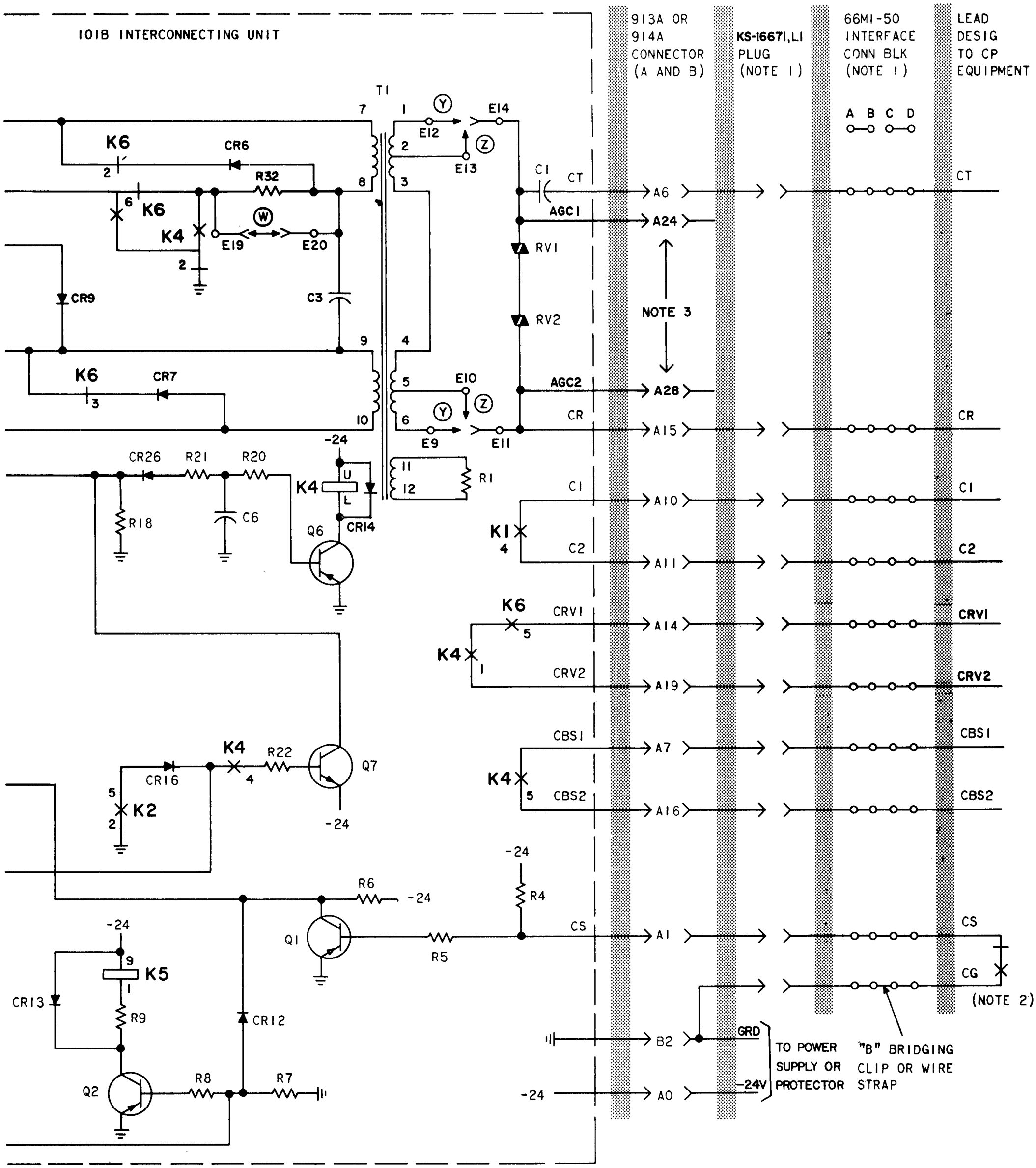
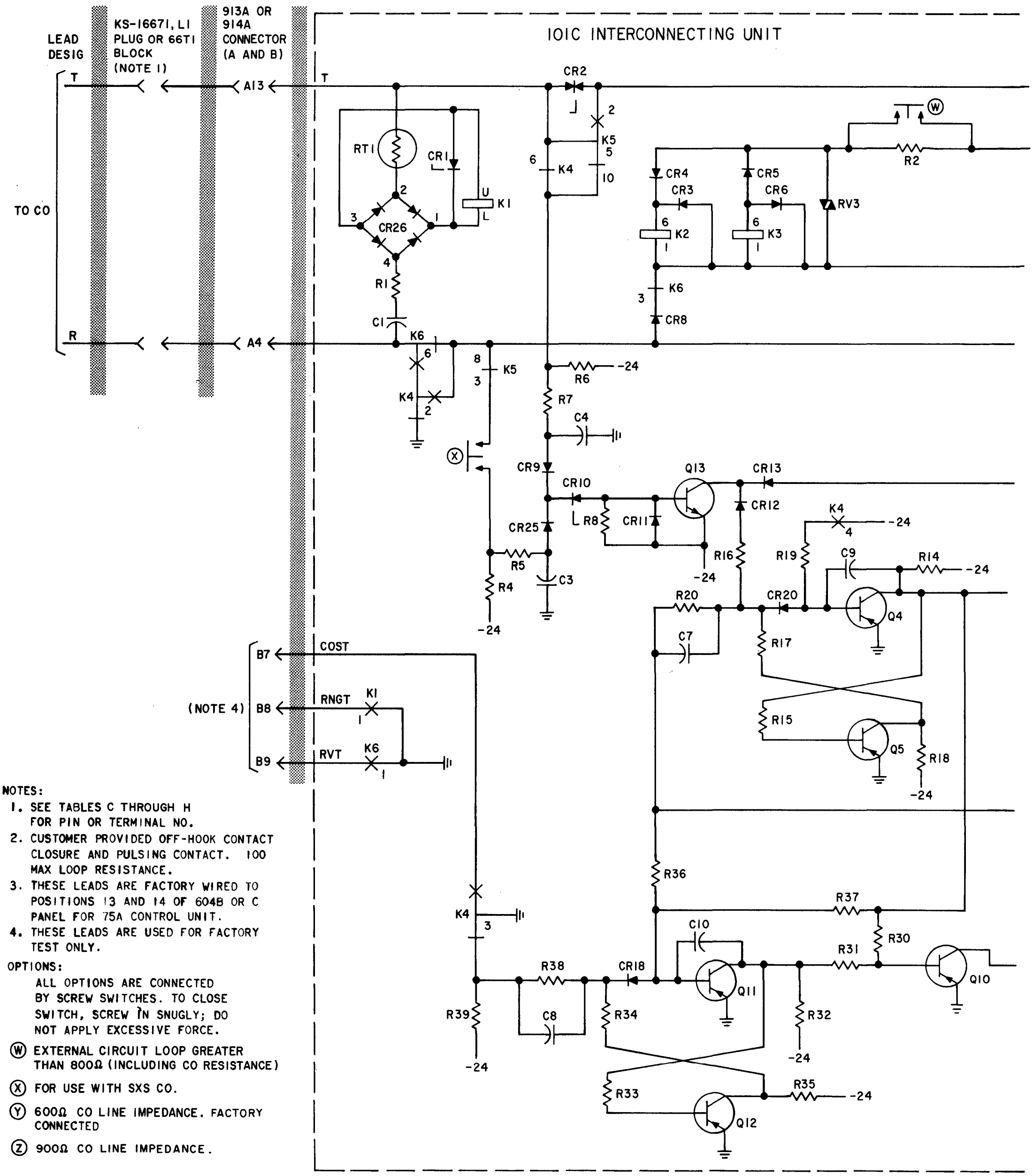


Fig. 14—Schematic—101B (MD) IU (Sheet 2)



NOTES:

1. SEE TABLES C THROUGH H FOR PIN OR TERMINAL NO.
2. CUSTOMER PROVIDED OFF-HOOK CONTACT CLOSURE AND PULSING CONTACT. 100 MAX LOOP RESISTANCE.
3. THESE LEADS ARE FACTORY WIRED TO POSITIONS 13 AND 14 OF 604B OR C PANEL FOR 75A CONTROL UNIT.
4. THESE LEADS ARE USED FOR FACTORY TEST ONLY.

OPTIONS:

ALL OPTIONS ARE CONNECTED BY SCREW SWITCHES. TO CLOSE SWITCH, SCREW IN SNUGLY; DO NOT APPLY EXCESSIVE FORCE.

Ⓦ EXTERNAL CIRCUIT LOOP GREATER THAN 800Ω (INCLUDING CO RESISTANCE)

Ⓧ FOR USE WITH SXS CO.

Ⓨ 600Ω CO LINE IMPEDANCE. FACTORY CONNECTED

Ⓩ 900Ω CO LINE IMPEDANCE.

Fig. 15—Schematic—101C IU (Sheet 1)

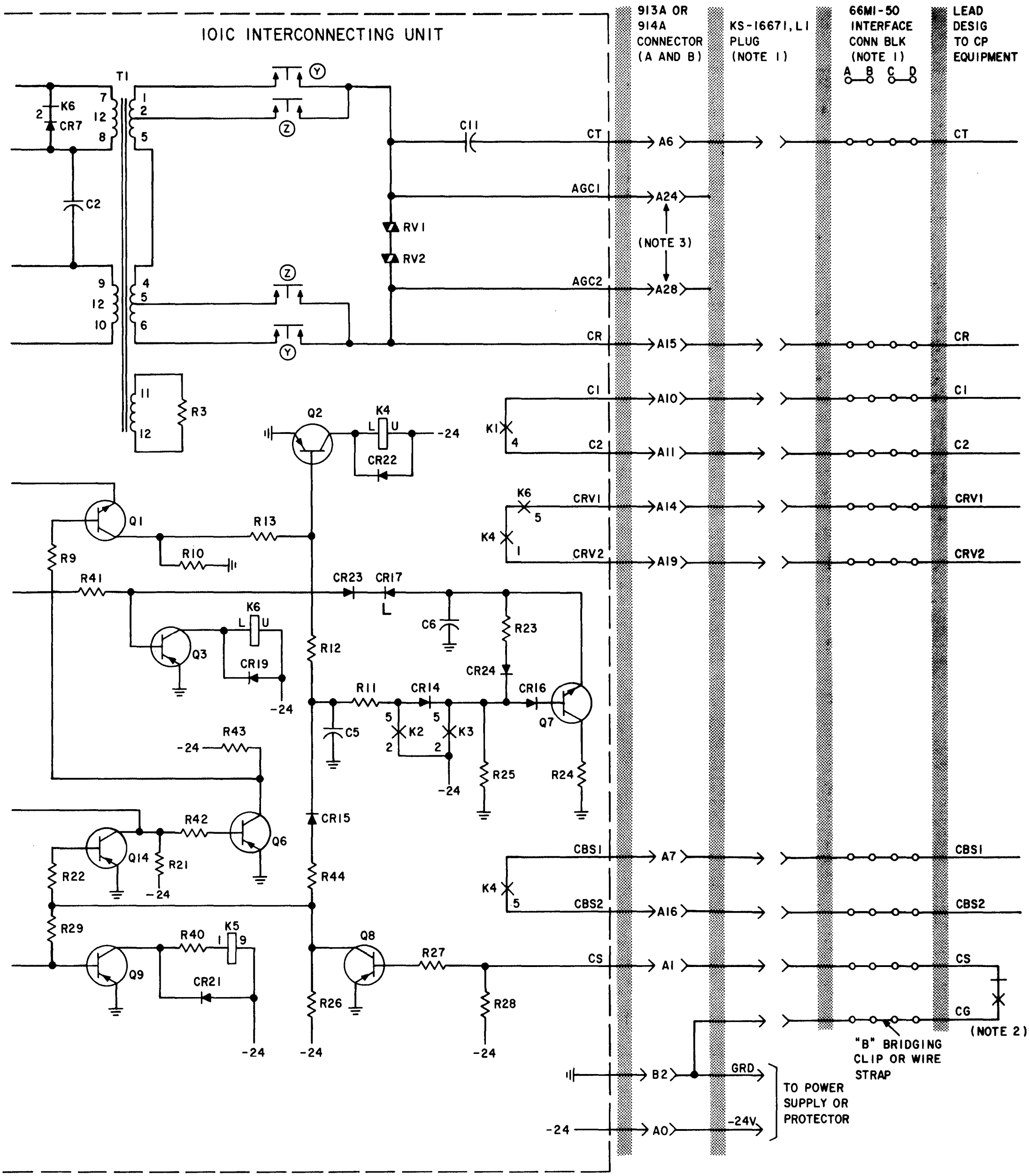
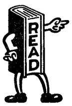


Fig. 15—Schematic—101C IU (Sheet 2)

Warning: Voltage will be present on upper terminals of circuit breakers as soon as customer power is connected.

3.25 Set circuit breaker switch lever to OFF and connect as shown in Fig. 18 following local wiring instructions. The customer must connect his power supply to the red (GRD) and black (−V) wires extending from the unit.



Check for correct polarity and ground before closing circuit breaker.

4. OPERATION

A. 101B or C Interconnecting Unit (Fig. 14 or 15)

Incoming Call

4.01 When the CO seizes this circuit, ground is placed on the tip (or ground on the ring if a SXS toll call) which activates the ground detector circuit, causing K4 relay to operate. Operation of K4 relay provides a contact closure on the CBS1 and CBS2 leads to the CPE indicating a seizure (busy condition) on this trunk.

4.02 Ringing current is supplied by the CO over the tip and ring to operate the ring relay K1. The K1 relay operates and releases to provide a closure on the C1 and C2 leads to the CPE which follows the ringing cycle. K4 remains operated during ringing.

4.03 ▶The customer's equipment should recognize an incoming call only when both closures, CBS1-CBS2 and C1-C2, are present. This will prevent false incoming call indications caused by transients momentarily operating K1. However, in the event of a trouble condition within the CO, where battery is reversed on T and R from a non-SXS CO (option X not provided) and ringing is applied, only the C1-C2 closure occurs. Under this condition, the incoming call cannot be recognized or answered, as described in 4.04, because relay K4 is not operated.◀

4.04 When the customer goes off-hook to answer the call, the CPE provides a contact closure across the CS and CG leads causing the K5 relay to operate. The K5 relay operated closes the loop to the CO, removes the ground detector circuit, trips the CO ringing which releases K1, and cuts through the transmission path to the CT and CR leads. The CO detects the loop closure and returns talk battery which operates the K2 relay. K2 relay operated holds K4 relay operated.

Outgoing Call

4.05 ***101B Only:*** When the customer seizes this circuit outgoing (goes off-hook to dial), a contact closure in the CPE across the CS and CG leads operates the K5 and K6 relays. The K6 relay operated grounds the ring side of the CO trunk to seize the CO, and the K2 relay operates from this ground to CO battery. The CO equipment returns ground on the tip to release the K6 relay and to operate K4 relay, removing the ground detector. The K4 relay operated provides a contact closure on the CBS1 and CBS2 leads to the CPE, indicating seizure. When K6 relay releases, the ground is removed from the ring lead, the loop is closed to the CO, and the CO detects the loop closure. Dial tone is returned to the customer.

4.06 ▶***101C Only:*** When the customer goes off-hook to dial, a contact closure in the CPE across the CS and CG leads operates the K6 relay. K6 grounds the ring side of the CO trunk to seize the CO which returns ground on the tip side. This tip ground is sensed by the ground detector, causing K6 to release and K5 to operate, closing the loop to the CO. K2 operates on loop current, causing K4 to operate and the ground detector to be removed from the line. Dial tone is now returned to the customer.◀

4.07 When the customer dials, using dial pulse dialing, a normally closed dial pulsing contact between the CS and CG leads opens and closes. K5 relay releases and operates in unison with the dialing contacts. The K5 relay repeats the dial pulses to the CO by opening and closing the loop to the CO. Operation of K5 relay after each digit and after completion of dialing restores the transmission path to the CPE. With tone address signaling, the signals are passed directly over the CT and CR leads to the CO tip and ring and the CO receiver.

Toll Call Indication

4.08 If a battery reversal is returned from the CO on tip and ring to indicate that the outgoing call is a toll call, K3 relay will operate.

The K3 relay operated causes K6 relay to operate. K6 relay operated provides a contact closure on the CRV1 and CRV2 leads to the CPE to indicate the CO has reversed battery. When normal CO battery polarity is restored, the K3 and K6 relays release.

Disconnect

4.09 If the CPE disconnects first, the K5 relay releases and opens the loop to the CO, connecting the ground detector to the tip side of the line. With normal battery supervision, K5 relay released causes K2 relay to release. If reverse battery supervision is provided, K3 relay releases causing K6 relay to release and open the closure between leads CRV1 and CRV2. K2 or K3 relays releasing causes K4 relay to release in 500 ms, opening the contact closure on the CBS1 and CBS2 leads to the CPE and indicating disconnect. The CO trunk returns to idle condition when the open loop is detected.

4.10 If the CO end disconnects first and reverse battery supervision is applied, the loop is opened, causing K3 relay to release. K3 relay released causes K6 relay to release, opening the closure between leads CRV1 and CRV2. If the CO disconnects with normal battery supervision, K2 relay releases. K2 or K3 relay releasing causes K4 relay to release in 500 ms, opening the contact closure on the CBS1 and CBS2 leads to the CPE and indicating disconnect. When the CPE disconnects, K5 relay releases, opening the loop to the CO. The IU returns to idle condition.

> ***Note:*** 101A IU (Fig. 13) operates similarly to the 101B and C using different relays.

B. Power Failure Transfer (Delayed Restoral, Fig. 16)

4.11 Under normal conditions, CO tip and ring are connected through the operated contacts of the 229B KTU to the IU associated with the CPE. The 229B KTU is held operated through its own contact to local power supply. The telephone company-provided power failure station is inoperative at this time. Should local power fail, the 229B KTU releases. CO tip and ring are transferred to the Bell System station; this transfer is indicated by a lamp (if provided) powered independently. After power is restored, the 229B KTU will be reoperated by ground obtained through the line switch of the station only after the first time it goes on-hook, returning the circuit to normal. Calls in progress when local power is restored will not be interrupted.

4.12 Option Z (Fig. 16) provides visual indication only when the CO line is connected to the power failure telephone set, and an off-hook condition exists when local power resumes. The transfer indicator lamp is lighted through a contact of the 229B KTU. The lamp lights only when the 229B KTU is released by loss of power. It becomes inoperative with the operation of the 229B KTU.

4.13 Ground start operation is required, and when an off-hook condition exists at the power failure telephone set, depression of the start key applies ground to the ring side of the line to operate CO equipment which returns dial tone. The start key should be released when dial tone is returned. The call should then proceed in a normal manner.

C. Power Failure Transfer (Immediate Restoral, Fig. 17)

4.14 Under normal conditions, CO tip and ring are connected through the operated contacts of the 229B KTU and the IU associated with the CPE. The 229B KTU is held operated through battery and ground connected directly to the TR relay winding. The telephone company-provided power failure station is inoperative at this time. Should local power fail, the 229B KTU releases; CO tip and ring are transferred to the station. When power is restored, the 229B KTU will reoperate immediately returning the circuit to normal. Calls in progress when local power is restored will be interrupted. No visual indication is provided.

4.15 Ground start is required and when an off-hook condition exists at the power failure telephone set, depression of the start key applies ground to the ring side of the line to operate CO equipment which returns dial tone. The start key should be released when dial tone is returned. A start key must be provided at each telephone set associated with a CO line. The call then should proceed in a normal manner.

D. 75A Control Unit

4.16 The 75A control unit consists of six identical ALC circuits, each connected to the

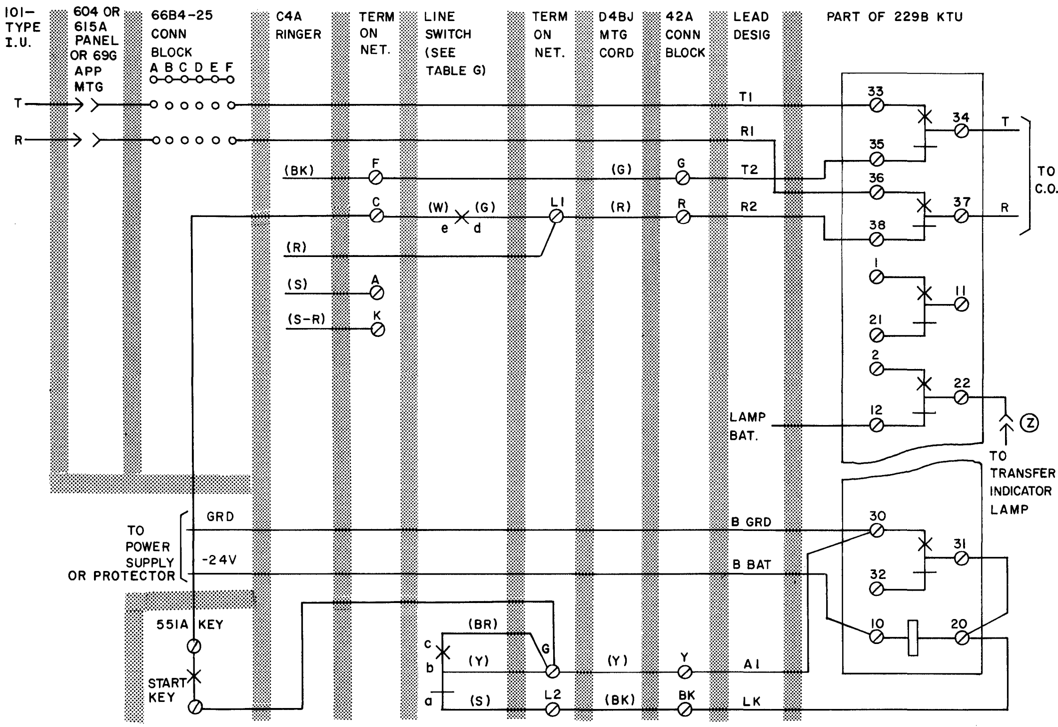


Fig. 16—Power Failure Transfer Circuit (Delayed Restoral)

transmission circuit (tip and ring) of an IU to protect Bell System equipment against excessive signal power. This protection is required when using voice-type IUs for data transmission. (See Section 463-300-112 for complete operational description.)

4.17 The ALC circuit monitors the CP data/voice voltages applied to tip and ring of the IU. If the power exceeds a preset level, the ALC circuit will present a resistance shunt across the input to the IU to linearly attenuate the signal to the preset value.

4.18 The level adjusting potentiometers R1 through R6 are set to limit the customer signals at a level determined by the amount of trunk loss and impedance.

E. KS-20944 Protector (Fig. 18)

4.19 When the CPE dc power supply is used to operate the Bell System equipment, overvoltage protection is required. The KS-20944 power protector is used to protect the Bell System personnel from hazardous voltages but may not protect the equipment from component failure. Separate fuses are required for the 101-type IUs. The breakers of the KS-20944 protector provide a switch to disconnect dc power when working on interconnecting circuits. (See Section 463-300-109 for complete operational description.)

4.20 The KS-20944 protector consists of a dc voltage-operated circuit breaker in series with a parallel resistor diode combination connected across the line and two dc current-operated circuit breakers connected in each side of the line. The contacts on each breaker are connected in series with the coil of that breaker and all three breakers are mechanically interlocked, externally by a tie bar and internally by a tripper bar. When any breaker is operated, all breakers will be opened. The circuit breakers are of the trip free type, so that the contacts cannot be closed by holding the lever to the ON position if the fault is still on the line.

4.21 The KS-20944, List 1 protector is designed to trip in 25 milliseconds (maximum) on dc overvoltage, current overload, reversed polarity, or ac greater than 18 volts, and on incorrect power supply ground.

5. MAINTENANCE

5.01 When trouble is reported, check for blown fuses and loose or broken connections, and check the CO pair. ♦If it is reported that calls from a non-SXS CO into the customer's equipment are not being answered, check for battery reversal on T and R leads. (Refer to 4.03 for explanation.)♦ If the fault is not found, perform a test of the 101-type IU.

A. Using 1013A Hand Test Set and 81A Test Set

5.02 Prepare the circuit under test as follows:

(a) Open the 10 leads to the circuit under test by removing the B bridging clips (or wire straps) at the 66M1-50 interface connecting block.

(b) Supply talk battery by connecting a 500-ohm resistor from the −24 volt supply to terminal CR and ground to terminal CT (make all connections on the telephone company side of the 66M1-50 interface connecting block). A 2A KTU or 31A KTU may be used for battery feed instead of the 500-ohm resistor; refer to Section 518-112-421 for KTU connections.

(c) Connect a 1013A (or equivalent) hand test set across terminals CT and CR. Prepare a strap to be used to connect terminal CS to CG as required.

(d) Connect an 81A or KS-16990, List 1 test set across terminals C1 and C2 to indicate continuity (ringing); connect another 81A or equivalent test set across terminals CBS1 and CBS2 to indicate continuity (CO supervision).

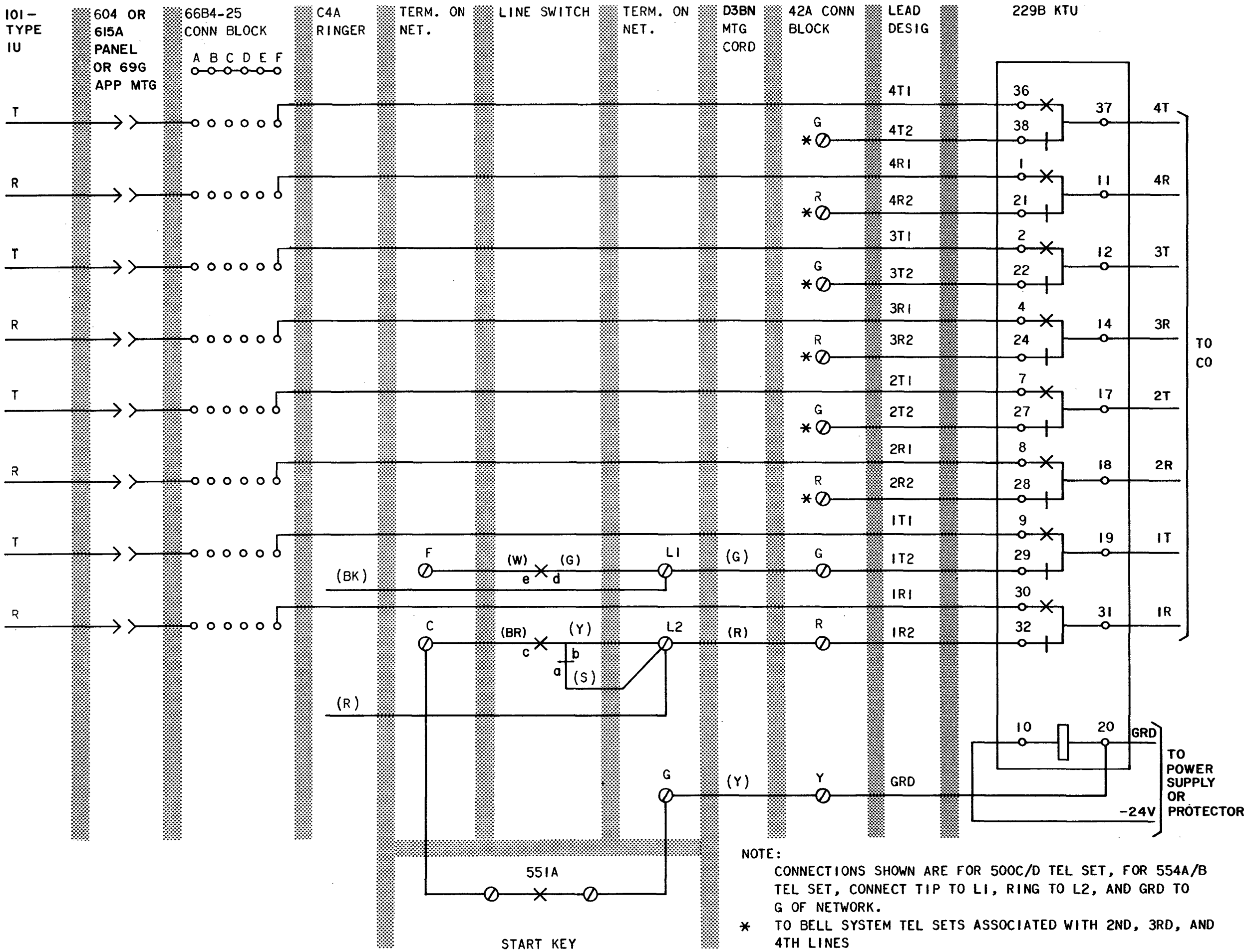
5.03 Perform the following tests:

(a) ***Incoming Call:*** Have the test desk call the number associated with the 101-type IU under test. The 81A (or equivalent) test set connected to terminals CBS1 and CBS2 will buzz steadily. The 81A (or equivalent) test set across terminals C1 and C2 will follow ringing. Answer the call by strapping terminal CS to CG and K5 relay should operate to establish a talk path. Have test desk disconnect; the 81A (or equivalent) test set across terminals CBS1 and CBS2 will indicate disconnect (open) within 0.5 second. Remove strap from terminals CS and CG and 81A (or equivalent) test set from terminals C1 and C2.

(b) ***Outgoing Call (Rotary Dial):*** Connect another 81A (or equivalent) test set across terminals CRV1 and CRV2. Connect the blue and green (or blue) leads of a 9C dial across terminals CS and CG for dialing. Dial tone will now be heard on the hand test set connected to terminals CT and CR, and the 81A test set connected to terminals CBS1 and CBS2 will buzz steadily until disconnect. Dial the test desk number using the 9C dial. If the office is arranged for toll diversion, have the test desk reverse battery and verify that the test set connected across terminals CRV1 and CRV2 indicates continuity for the duration of reversal. Disconnect by removing the 9C dial from terminals CS and CG; the 81A test set across terminals CBS1 and CBS2 will go silent indicating disconnect and the transmission path will open.

> ***Note:*** If the IU is a 101B, a ground hum may be heard in the hand test set during trunk seizure. This is a normal condition caused by the ground start placed on the ring passing through the coupling transformer.

(c) ***Outgoing Call (Tone Address Signaling):*** Connect another 81A (or equivalent) test set across terminals CRV1 and CRV2. Connect the mounting cord leads of a 2500D (or equivalent) station set using 161A adapters across terminals CT (green and yellow) and CR (red) for dialing. Connect a strap from terminal CS to CG. Dial tone will now be heard on the 2500D (or equivalent) station set, and the 81A test set connected to terminals CBS1 and CBS2 will buzz steadily until disconnect. Dial the test desk number; if the office is arranged for toll diversion, have the



NOTE:

CONNECTIONS SHOWN ARE FOR 500C/D TEL SET, FOR 554A/B TEL SET, CONNECT TIP TO L1, RING TO L2, AND GRD TO G OF NETWORK.

* TO BELL SYSTEM TEL SETS ASSOCIATED WITH 2ND, 3RD, AND 4TH LINES

Fig. 17—Power Failure Transfer Circuit (Immediate Restoral)

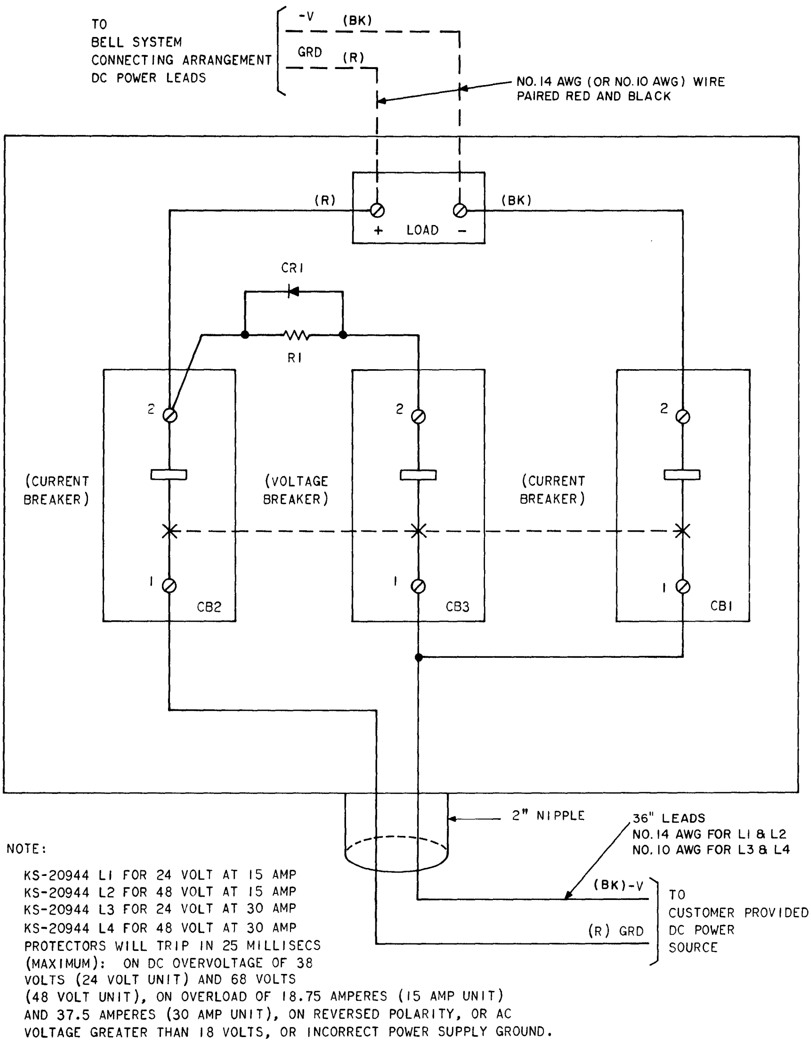


Fig. 18—Schematic—KS-20944 Protector

test desk reverse battery and verify that the 81A (or equivalent) test set connected across terminals CRV1 and CRV2 will indicate continuity for the duration of the reversal. Disconnect by removing the strap from terminals CS and CG; the 81A test set across terminals CBS1 and CBS2 will go silent indicating disconnect and the transmission path will open.

B. Using 142A Test Set (Fig. 19)

5.04 Prepare the circuit under test as follows:

(a) Disconnect the CPE by removing the B bridging clips or wire straps at the interface block.

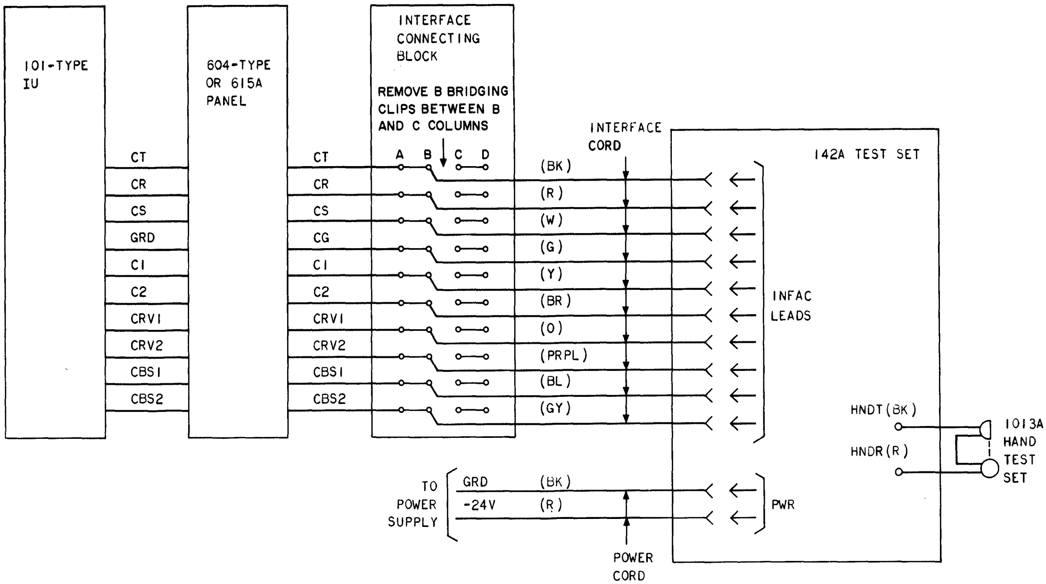


Fig. 19—Connections for Testing 101-Type IU With 142A Test Set

(b) ➧Select the proper interface cord from the three available 10-conductor cords and connect to the proper terminals on the telephone company side of the block.➧

(c) Connect the leads from the 2-conductor power cord to −24 volts and ground. This voltage should be obtained from the same source used to power the IU under test. The PWR lamp on the test set should light.

(d) Connect a 1013A hand test set to the HNDR and HNDT terminals of the test set with the MON-TALK switch in the MON position.

(e) Set the CS-CG loop switch in the 18-ohm position for a 101A IU or in the 100-ohm position for a 101B or C IU.

> ***Note:*** ➧This is a slide switch on current production; earlier models used a rotary switch.➧

5.05 After circuit preparation, proceed as follows:

(a) Operate switch on 1013A hand test set to the TALK position. The S relay in the 142A test set will operate, lighting the CS lamp and providing ground on the CS lead through the selected resistance on the CS-CG loop switch. Ground on the CS lead causes the IU to seize the CO trunk as indicated by the CBS- lamp lighting and dial tone being heard in the hand test set. If the IU is a 101B used on a ground start trunk, a ground hum may be heard in the hand test set during trunk seizure. This is a normal condition caused by the ground start placed on the ring passing through the coupling transformer.

> ***Note:*** If the IU fails to seize the CO trunk, move the CS-CG loop switch to a lower value. If the IU now operates properly, it is considered marginal. Circuits which operate only in the O position should be replaced.

(b) Dial the local test desk using the 1013A hand test set. The S relay and the CS lamp should follow the dial pulses. Request the test desk to call back on the trunk under test.

(c) Operate the hand test set to the MON position. The CS lamp should be extinguished indicating the S relay in the 142A test set has released removing the ground from the CS lead. The CBS- lamp should also be extinguished in approximately 1/2 second indicating the IU has released the CO trunk and the CO has disconnected.

(d) When the trunk is seized on the return call from the test desk, the CBS- lamp lights. When ringing is applied to the trunk, the C- lamp lights, following the ringing cycle.

(e) Reoperate the hand test set switch to TALK. The C- lamp should extinguish and the CS lamp lights indicating ringing has been tripped and the call answered. The trunk should now be cut through the IU and transmission quality judged using the hand test set.

(f) Instruct the test desk to reverse line polarity. The CRV- lamp should light and remain lit for the duration of the reversal.

(g) Have the test desk release the trunk and return hand test set switch to MON. The CBS- and CS lamps should be extinguished and the IU should be in the idle condition.

5.06 When all testing is complete, remove power and interface cords. Connect CPE by restoring B bridging clips or wire straps at interface connecting block.

5.07 When trouble is suspected in the 101-type IU, exchange it with another unit known to be functioning properly. Tag and place the defective IU in blister pack and return it for repair.

READ ***Do not attempt any tests or repairs to the customer-provided equipment.***

5.08 When trouble is suspected in the CPE, notify the Repair Service Bureau so that proper maintenance of service charge billing can be initiated as outlined in BSP 660-101-312 entitled Maintenance of Service Charge on Services With Customer-Provided Equipment (CPE).

6. CONNECTIONS

6.01 For connection information using the 69G apparatus mounting, refer to Fig. 11 and Table I.

6.02 For connection information using the 604A-type panel, refer to Fig. 6 and Tables B, C, D, E, F, and I.

6.03 For connection information using the 604B and 604C panels, refer to Fig. 3, 4, 5, and 12 and Tables B, C, D, E, F, and I.

6.04 For connection information using the 615A panel, refer to Fig. 2 and 12 and Tables G, H, and I.

6.05 For connection information using the power failure transfer circuit with delayed restoral, refer to Fig. 16 and Table J. For delayed restoral replace the D3BN mounting cord of 500C/D telephone set with a D4BJ cord.

6.06 For connection information using the power failure transfer circuit with immediate restoral, refer to Fig. 17 and make modifications and connections to telephone set as shown.

6.07 All necessary connections for data transmission are provided by the internal wiring of the 604B or 604C panel when a 75A control unit is plugged into position 13 or 14.

6.08 For connection information using the KS-20944 protector, refer to Fig. 18. For connections to multiple installations, refer to Section 463-300-109.

TABLE B

OPTIONAL CABLE ARRANGEMENTS TO PROVIDE CONNECTIONS FOR FOUR PLUGS ON 604-TYPE PANEL

CABLE DESIGNATION (NOTE)	MAXIMUM NO. OF CABLES REQUIRED		
	ARRANGEMENTS (SEE 3.03)		
	Arrangement 1	Arrangement 2	Arrangement 3
A25B	1	4	2
A50B			1
A75A	1		

Note: Arrangement of interconnecting units and local requirements will determine the size and maximum length of cable required. (Plug No. 5 of 604A (MD) panel not used in this application.)

TABLE C

CONNECTIONS FOR PLUG NO. 1—604-TYPE PANEL

TRUNK NO.	LEAD DESIG*	A25B CONN PIN NO.	A25B CONN CABLE COLOR	66B4-25 CONN BLK ROW NO.	POS. IN 604-TYPE PANEL
1	T	26	W-BL	1	1
	R	1	BL-W	2	
2	T	27	W-O	3	2
	R	2	O-W	4	
3	T	28	W-G	5	4
	R	3	G-W	6	
4	T	29	W-BR	7	5
	R	4	BR-W	8	
5	T	30	W-S	9	7
	R	5	S-W	10	
6	T	31	R-BL	11	8
	R	6	BL-R	12	
7	T	32	R-O	13	10
	R	7	O-R	14	
8	T	33	R-G	15	11
	R	8	G-R	16	
9†	T	34	R-BR	17	13
	R	9	BR-R	18	
10	T	35	R-S	19	3
	R	10	S-R	20	
11	T	36	BK-BL	21	6
	R	11	BL-BK	22	
12	T	37	BK-O	23	9
	R	12	O-BK	24	
13	T	38	BK-G	25	12
	R	13	G-BK	26	
14†	T	39	BK-BR	27	14
	R	14	BR-BK	28	
SPARE	SPARE	40	BK-S	29	
		15	S-BK	30	
		41	Y-BL	31	
		16	BL-Y	32	
		42	Y-O	33	
		17	O-Y	34	
		43	Y-G	35	
		18	G-Y	36	
		44	Y-BR	37	
		19	BR-Y	38	
		45	Y-S	39	
		20	S-Y	40	
		46	V-BL	41	
		21	BL-V	42	
		47	V-O	43	
		22	O-V	44	
		48	V-G	45	
		23	G-V	46	
		49	V-BR	47	
		24	BR-V	48	
		50	V-S	49	
		25	S-V	50	

* Stencil lead designations on fanning strip.

† Cannot be used if 75A control unit is used in position 13 or 14 of 604B panel.

TABLE D

CONNECTIONS FOR PLUG NO. 2—604-TYPE PANEL

TRUNK NO.	LEAD DESIG*	CONN PIN NO.	CONN CABLE COLOR	66M1-50 INTERFACE CONN BLK 1 ROW NO.	POS. IN 604-TYPE PANEL
1	CT	26	W-BL	1	1
	CR	1	BL-W	2	
	CS	27	W-O	3	
	CG	2	O-W	4	
	C1	28	W-G	5	
	C2	3	G-W	6	
	CRV1	29	W-BR	7	
	CRV2	4	BR-W	8	
	CBS1	30	W-S	9	
	CBS2	5	S-W	10	
2	CT	31	R-BL	11	2
	CR	6	BL-R	12	
	CS	32	R-O	13	
	CG	7	O-R	14	
	C1	33	R-G	15	
	C2	8	G-R	16	
	CRV1	34	R-BR	17	
	CRV2	9	BR-R	18	
	CBS1	35	R-S	19	
	CBS2	10	S-R	20	
3	CT	36	BK-BL	21	4
	CR	11	BL-BK	22	
	CS	37	BK-O	23	
	CG	12	O-BK	24	
	C1	38	BK-G	25	
	C2	13	G-BK	26	
	CRV1	39	BK-BR	27	
	CRV2	14	BR-BK	28	
	CBS1	40	BK-S	29	
	CBS2	15	S-BK	30	
4	CT	41	Y-BL	31	5
	CR	16	BL-Y	32	
	CS	42	Y-O	33	
	CG	17	O-Y	34	
	C1	43	Y-G	35	
	C2	18	G-Y	36	
	CRV1	44	Y-BR	37	
	CRV2	19	BR-Y	38	
	CBS1	45	Y-S	39	
	CBS2	20	S-Y	40	
5	CT	46	V-BL	41	7
	CR	21	BL-V	42	
	CS	47	V-O	43	
	CG	22	O-V	44	
	C1	48	V-G	45	
	C2	23	G-V	46	
	CRV1	49	V-BR	47	
	CRV2	24	BR-V	48	
	CBS1	50	V-S	49	
	CBS2	25	S-V	50	

* Stencil lead designations on fanning strip.

TABLE E

CONNECTIONS FOR PLUG NO. 3 — 604-TYPE PANEL

TRUNK NO.	LEAD DESIG*	CONN PIN NO.	CONN CABLE COLOR	66M1-50 INTERFACE CONN BLK 2 ROW NO.	POS. IN 604-TYPE PANEL
6	CT	26	W-BL	1	8
	CR	1	BL-W	2	
	CS	27	W-O	3	
	CG	2	O-W	4	
	C1	28	W-G	5	
	C2	3	G-W	6	
	CRV1	29	W-BR	7	
	CRV2	4	BR-W	8	
	CBS1	30	W-S	9	
	CBS2	5	S-W	10	
7	CT	31	R-BL	11	10
	CR	6	BL-R	12	
	CS	32	R-O	13	
	CG	7	O-R	14	
	C1	33	R-G	15	
	C2	8	G-R	16	
	CRV1	34	R-BR	17	
	CRV2	9	BR-R	18	
	CBS1	35	R-S	19	
	CBS2	10	S-R	20	
8	CT	36	BK-BL	21	11
	CR	11	BL-BK	22	
	CS	37	BK-0	23	
	CG	12	O-BK	24	
	C1	38	BK-G	25	
	C2	13	G-BK	26	
	CRV1	39	BK-BR	27	
	CRV2	14	BR-BK	28	
	CBS1	40	BK-S	29	
	CBS2	15	S-BK	30	
9‡	CT	41	Y-BL	31	13
	CR	16	BL-Y	32	
	CS	42	Y-O	33	
	CG	17	O-Y	34	
	C1	43	Y-G	35	
	C2	18	G-Y	36	
	CRV1	44	Y-BR	37	
	CRV2	19	BR-Y	38	
	CBS1	45	Y-S	39	
	CBS2	20	S-Y	40	
SPARE	SPARE	46	V-BL	41	
		21	BL-V	42	
		47	V-O	43	
		22	O-V	44	
		48	V-G	45	
		23	G-V	46	
—24V	FAL1†	49	V-BR	47	F2(FA)
GRD	G1†	24	BR-V	48	TS1(15)
—48V	FAL2†	50	V-S	49	F16(FA)
GRD	G2†	25	S-V	50	TS1(16)

* Stencil lead designations on fanning strip.

† Optional attendant alarm indicator on 604B or C panel only.

‡ Cannot be used if 75A control unit is used in position 13 of 604B or C panel.

TABLE F

CONNECTIONS FOR PLUG NO. 4—604-TYPE PANEL

TRUNK NO.	LEAD DESIG*	CONN PIN NO.	CONN CABLE COLOR	66M1-50 INTERFACE CONN BLK 3 ROW NO.	POS. IN 604-TYPE PANEL
10	CT	26	W-BL	1	3
	CR	1	BL-W	2	
	CS	27	W-O	3	
	CG	2	O-W	4	
	C1	28	W-G	5	
	C2	3	G-W	6	
	CRV1	29	W-BR	7	
	CRV2	4	BR-W	8	
	CBS1	30	W-S	9	
	CBS2	5	S-W	10	
11	CT	31	R-BL	11	6
	CR	6	BL-R	12	
	CS	32	R-O	13	
	CG	7	O-R	14	
	C1	33	R-G	15	
	C2	8	G-R	16	
	CRV1	34	R-BR	17	
	CRV2	9	BR-R	18	
	CBS1	35	R-S	19	
	CBS2	10	S-R	20	
12	CT	36	BK-BL	21	9
	CR	11	BL-BK	22	
	CS	37	BK-O	23	
	CG	12	O-BK	24	
	C1	38	BK-G	25	
	C2	13	G-BK	26	
	CRV1	39	BK-BR	27	
	CRV2	14	BR-BK	28	
	CBS1	40	BK-S	29	
	CBS2	15	S-BK	30	
13	CT	41	Y-BL	31	12
	CR	16	BL-Y	32	
	CS	42	Y-O	33	
	CG	17	O-Y	34	
	C1	43	Y-G	35	
	C2	18	G-Y	36	
	CRV1	44	Y-BR	37	
	CRV2	19	BR-Y	38	
	CBS1	45	Y-S	39	
	CBS2	20	S-Y	40	
14†	CT	46	V-BL	41	14
	CR	21	BL-V	42	
	CS	47	V-O	43	
	CG	22	O-V	44	
	C1	48	V-G	45	
	C2	23	G-V	46	
	CRV1	49	V-BR	47	
	CRV2	24	BR-V	48	
	CBS1	50	V-S	49	
	CBS2	25	S-V	50	

* Stencil lead designations on fanning strip.

† Cannot be used if 75A control unit is used in position 14 of 604B or C panel.

TABLE G

CONNECTIONS FOR CENTRAL OFFICE TRUNKS AT 615A PANEL

TRUNK NO.	LEAD DESIG	TERMINAL ON 66T1 CONN BLOCK	66B4-25 CONN BLOCK ROW NO.
1	T R	1A 2A	1 2
2	T R	3A 4A	3 4
3	T R	5A 6A	5 6

TABLE H

CONNECTIONS FROM PLUG P1 ON 615A PANEL TO INTERFACE CONNECTING BLOCK

TRUNK NO.	LEAD DESIG	P1 PIN NO.	A25B CONN CABLE	66M1-50 CONN BLOCK (TELCO SIDE) ROW NO.
1	CT	26	W-BL	1
	CR	1	BL-W	2
	CS	27	W-O	3
	CG	2	O-W	4
	C1	28	W-G	5
	C2	3	G-W	6
	CRV1	29	W-BR	7
	CRV2	4	BR-W	8
	CBS1	30	W-S	9
	CBS2	5	S-W	10
2	CT	31	R-BL	11
	CR	6	BL-R	12
	CS	32	R-O	13
	CG	7	O-R	14
	C1	33	R-G	15
	C2	8	G-R	16
	CRV1	34	R-BR	17
	CRV2	9	BR-R	18
	CBS1	35	R-S	19
	CBS2	10	S-R	20
3	CT	36	BK-BL	21
	CR	11	BL-BK	22
	CS	37	BK-O	23
	CG	12	B-BK	24
	C1	38	BK-G	25
	C2	13	G-BK	26
	CRV1	39	BK-BR	27
	CRV2	14	BR-BK	28
	CBS1	40	BK-S	29
	CBS2	15	S-BK	30

TABLE I

POWER CONNECTIONS

INPUT VOLTAGE	69G APP MTG (NOTE 1)	604B OR C PANEL (NOTE 2)	604A1 PANEL (NOTE 3)	615A PANEL (NOTE 4)
−24V	11	Input −24V	14	2D
−48V	—	Input −48V	—	—
GRD	4	Input GRD	13	4D

Notes:

1. Terminals on 66B4-25 connecting block. Connect as shown in Fig. 11.
2. Terminals on rear of panel stamped as shown. Position option straps for −24V or −48V.
3. Terminals on terminal strip TSA on rear of 604A1 panel.
4. Terminals on 66T1 connecting block.

TABLE J

MODIFICATION OF 500C/D OR 554A/B TELEPHONE SETS FOR POWER FAILURE TRANSFER WITH DELAYED RESTORAL ONLY

<table>
<tr><th colspan="2" rowspan="2">LEAD AND CONTACT DESIG</th><th rowspan="2">LEAD COLOR</th><th colspan="2">TERM. ON NET. (Note)</th></tr>
<tr><th>REMOVE FROM</th><th>CONNECT TO</th></tr>
<tr><td rowspan="4">D4BJ Mtg Cord</td><td>Tip</td><td>(G)</td><td>L1</td><td>F</td></tr>
<tr><td>Ring</td><td>(R)</td><td>L2</td><td>L1</td></tr>
<tr><td>LK</td><td>(BK)</td><td></td><td>L2</td></tr>
<tr><td>A1</td><td>(Y)</td><td></td><td>G</td></tr>
<tr><td colspan="2" rowspan="2">C4A Ringer</td><td>(R)</td><td>L2</td><td>L1</td></tr>
<tr><td>(BK)</td><td>G or L1</td><td>F</td></tr>
<tr><td rowspan="5">Line Switch</td><td>a</td><td>(S)</td><td></td><td>L2</td></tr>
<tr><td>b</td><td>(Y)</td><td>L2</td><td>G</td></tr>
<tr><td>c</td><td>(BR)</td><td>C</td><td>G</td></tr>
<tr><td>d</td><td>(G)</td><td></td><td>L1</td></tr>
<tr><td>e</td><td>(W)</td><td>F</td><td>C</td></tr>
</table>

Note: Connect 551A ground start key between C and G of network.

TABLE K

604A-TYPE PANEL FUSE ASSIGNMENT

FUSE NO.*	PANEL POSITION	VOLTAGE
F1	J1A	−24V
F2	J2A	
F3	J3A	
F4	J4A	
F5	J5A	
F6	J6A	
F7	J7A	
F8	J8A	
F9	J9A	
F10	J10A	
F11	J11A	
F12	J12A	
F13	J13A	
F14	J14A	
F15	J10B†	
F16	J11B†	
F17	J13B†	
F18	J14B†	

* Fuses are 70G 1/2-ampere.
† Plug No. 5 dedicated to one-way incoming trunks.

TABLE L

604B AND 604C PANEL FUSE ASSIGNMENT

FUSE NO.	PANEL POSITION	VOLTAGE
F1*	J1A thru J14A	Ringing Voltage (Note)
F2*	J1A	−24V
F3*	J2A	
F4*	J3A	
F5*	J4A	
F6*	J5A	
F7*	J6A	
F8*	J7A	
F9*	J8A	
F10*	J9A	
F11*	J10A	
F12*	J11A	
F13*	J12A	
F14†	J13A	
F15†	J14A	
F16†	J1A thru J5A	−48V (Note)
F17‡	J6A thru J10A	
F18‡	J11A thru J14A	

Note: Ringing voltage fuse and −48V fuses not used in this application.

* 70F fuse 1/4 ampere.
† 70G fuse 1/2 ampere.
‡ 70A fuse 1-1/3 ampere.

TABLE M

615A PANEL FUSE ASSIGNMENTS

VOLTAGE	FUSE NO.†	CONNECTOR
—24V	F1	J1A, B
	F2	J2A, B
	F3	J3A, B
—48V*	F4	J1A
	F5	J2A
	F6	J3A
±105V*	F7	J1A, J2A, J3A
	F8	SPARE

* Not used with PCA CDH.

† All fuses 24E, 1/2-ampere.

VOICE CONNECTING ARRANGEMENT CD6

1. GENERAL

1.01 This section provides identification, installation, operation, maintenance, and connection information for the 108A interconnecting unit (IU) and associated 604-type panel, or 615A panel when used in Voice Connecting Arrangement (VCA) CD6.

1.02 This section is reissued to:

- Add information on the 604C panel
- Include information on the 615A panel which replaces the 69G apparatus mounting
- Add use of the 142A test set.

1.03 Refer to Sections 463-300-101 and 463-300-102 for information on the 604A and 604B/604C panels. Refer to Section 463-300-104 for information on the 615A panel. Refer to Section 463-300-109 for information on the KS-20944 protector.

1.04 The size of the initial installation and the expected growth should be the determining factors in selecting the proper equipment. ➧For one to six IUs, use the 615A panel.➧ For 5 to 18 IUs, use the 604A-type panel. For 5 to 14 IUs, use the 604B/604C panels.

1.05 If the customer wants a copy of the Technical Reference which covers this interface specification, the customer should contact the local Telephone Company Business Office or the Marketing Representative.

1.06 This issue of the section is based on the following drawings:

SD-69611-01, Issue 3 (108A IU)

SD-1E200-01, Issue 2D (604A-Type Panel)

If this section is to be used with equipment or apparatus reflecting later issue(s) of the drawing(s), reference should be made to the SDs and CDs to determine the extent of the changes and the manner in which the section may be affected.

2. IDENTIFICATION

PURPOSE

- To provide an interface between the attendant position of a customer-provided (CP) PBX and Bell System 2-wire, one-way incoming only, loop start CO lines.
- To provide network control signaling functions.
- To limit excessive transmission signal levels from customer-provided equipment (CPE) and provide protection for telephone company personnel against hazardous voltages.
- ➧Insure longitudinal balance of facility between the customer premises and the CO.➧

APPLICATION

- VCA CD6 connects a one-way incoming exchange trunk line to a CP PBX.

ORDERING GUIDE

- Unit, Interconnecting, 108A (Fig. 1, 2, and 3, one per CO line)

Note: 108A IU replaces 433A KTU (MD).

Associated Apparatus (Order Separately)

Note: If a 23-inch relay rack is not provided on customer premises, provide a 16C apparatus mounting, or equivalent, for the ➧615A panel➧ or an ED-91180-72, Group 21 cabinet, or equivalent, for the 604-type panel.

- Panel, 604A1 (fuse panel only, no power unit; will mount up to eighteen 108A IUs)

or

- Panel, 604A2 (19C2 power unit and fuse panel, Fig. 1; will mount up to eighteen 108A IUs)

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INSTALLATION SEQUENCE OF 108A IUS

TRUNK NO.	POSITION NO.
1	1A
2	2A
3	4A
4	5A
5	7A
6	8A
7	10A
8	11A
9	13A
10	3A
11	6A
12	9A
13	12A
14	14A
15	10B
16	11B
17	13B
18	14B

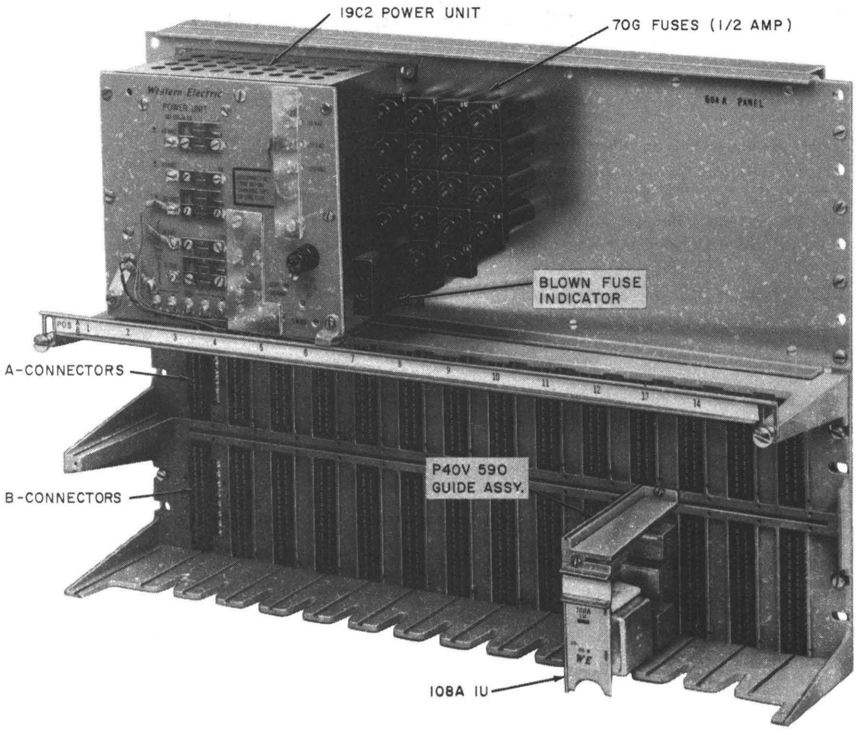


Fig. 1—108A Interconnecting Unit Mounted in 604A2 Panel

or

- Panel, 604B (fuse panel only, no power unit; will mount up to fourteen 108A IUs)

or

- ➧Panel, 604C (fuse panel only, no power unit; will mount up to fourteen 108A IUs)

or

- Unit, Apparatus, 21A (required with 604C panel when supply voltage is −48V)➧

or

- ➧Panel, 615A (fuse panel only, no power unit; will mount up to six 108A IUs)➧

- Guide, Assembly, P-40V590 (one per two 108A IUs)

- Bracket, 99B (one per three 615A panels)

- Cable, A25B (see Table A for 604-type panel, ➧one per 615A panel)➧

- Block, Connecting, 66M1-50 (as required, Fig. 4)

- Block, Connecting, 66B4-25 (as required)

Note: Other type blocks should not be used as they may not be compatible with **142A test** set.

- Clip, Bridging, B (as required, Fig. 4)

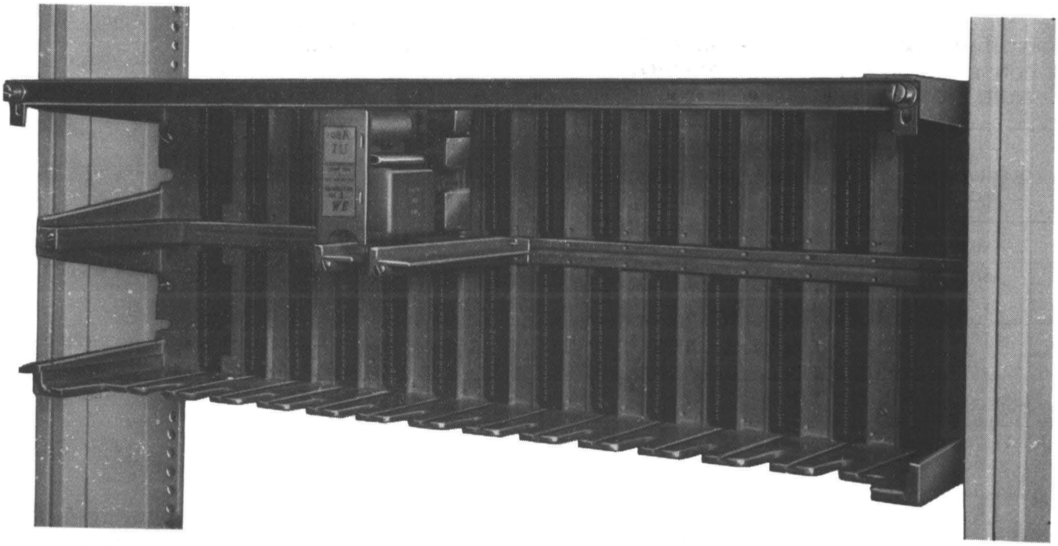


Fig. 2—108A Interconnecting Unit Mounted in 604B or 604C Panel

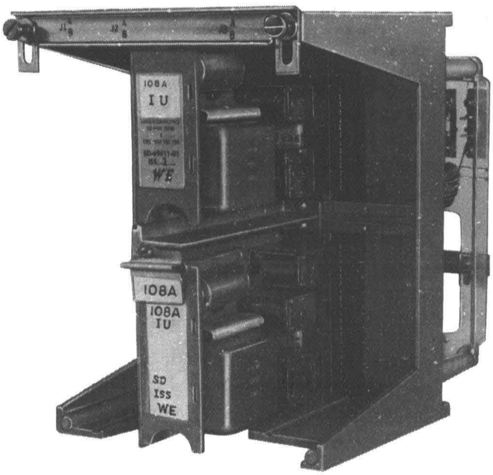


Fig. 3—108A Interconnecting Unit Mounted in 615A Panel

- Cable, D inside wiring or equivalent (where required for the 615A panel)
- Unit, Power, 19C2 or equivalent (for 604A1 or 604B/604C when existing KTS power supply is insufficient)
- Cord, Power (for 19C2 power unit)

  P-40J326 (1-1/2 ft)

  P-40J327 (2 ft)

  P-40J328 (4 ft)

  P-40J329 (6 ft)

  P-40J099 (12 ft)

TABLE A
OPTIONAL CABLE ARRANGEMENTS TO PROVIDE CONNECTIONS FOR FIVE PLUGS FOR 604A-TYPE PANEL OR FOUR PLUGS FOR 604B/604C PANEL

CABLE DESIGNATION (NOTE)	MAXIMUM NO. OF CABLES REQUIRED					
	ARRANGEMENTS (SEE 3.03)					
	604A	604B	604A	604B	604A	604B
A25B	1	1	1	2	2	4
A50B			2	1		
A75A		1			1	
A100C	1					

Note: Arrangement of interconnecting units and local requirements will determine the size and maximum length of cable required.

Overvoltage Protection (Optional)

- KS-20944, L1 Protector (required when a CP dc power supply is used).

Replaceable Components

604-Type Panel

- Unit, Power, 19C2 (or equivalent, for 604A2 or 604B/604C panel)
- Fuses, 70G (1/2-ampere, 18 per 604A-type panel)
- Fuses, 70A (1-1/3 amperes, 3 per 604B/604C panels)
- Fuses, 70F (1/4-ampere, 13 per 604B/604C panels)
- Fuses, 70G (1/2-ampere, 2 per 604B/604C panels)
- Indicator, 17C-49 (for optional fuse alarm if required, 604B/604C panel only).

615A Panel

- Fuses, 24E (1/2-ampere, 8 per panel)

DESIGN FEATURES

108A Interconnecting Unit

- Components mounted on a 4-inch, 40-pin epoxy glass board
- One-way incoming (loop-start) CO trunk voice connecting arrangement
- Provides voice frequency coupling to CPE
- Provides dc isolation to CPE
- Approximate dimensions: 3-3/4 inches by 5-1/2 inches
- Requires 0.030 ampere maximum at 26 volts dc.

3. INSTALLATION

69G Apparatus Mounting (Fig. 5 and 6)

3.01 The 69G apparatus mounting is not recommended for new installations. To provide additions to existing installations, refer to Fig. 5 and 6 for connections required. Separate fusing and −24 volt power are provided locally.

604-Type Panel (Fig. 7 and Tables B, C, D, E, F)

3.02 The 604-type panel will mount on a standard relay rack or in an ED-91180-72, 18-plate equipment cabinet. Connect a separate ground wire to relay rack or cabinet.

READ ***The 18-plate equipment cabinet will house two 604A-type or three 604-type panels or two 604-type panels with power unit when the drawing holder on the lower half of the equipment cabinet is removed.***

3.03 Electrical connection is made to the 604-type panel through connector cables. Arrangement of the Amphenol plugs on the panel restricts the first plug to an A25B connector cable (to CO lines). Plugs 2 through 4 (604B/604C) or 2 through 5 (604A-type) are arranged to adapt to a choice of cable sizes (to CPE; see Table A).

3.04 Terminate the stub end of connector cable No. 1 on a 66B4-25 connecting block for the CO lines.

3.05 Terminate the stub end of connector cables 2, 3, 4 (604B/604C) and 5 (604A-type) at

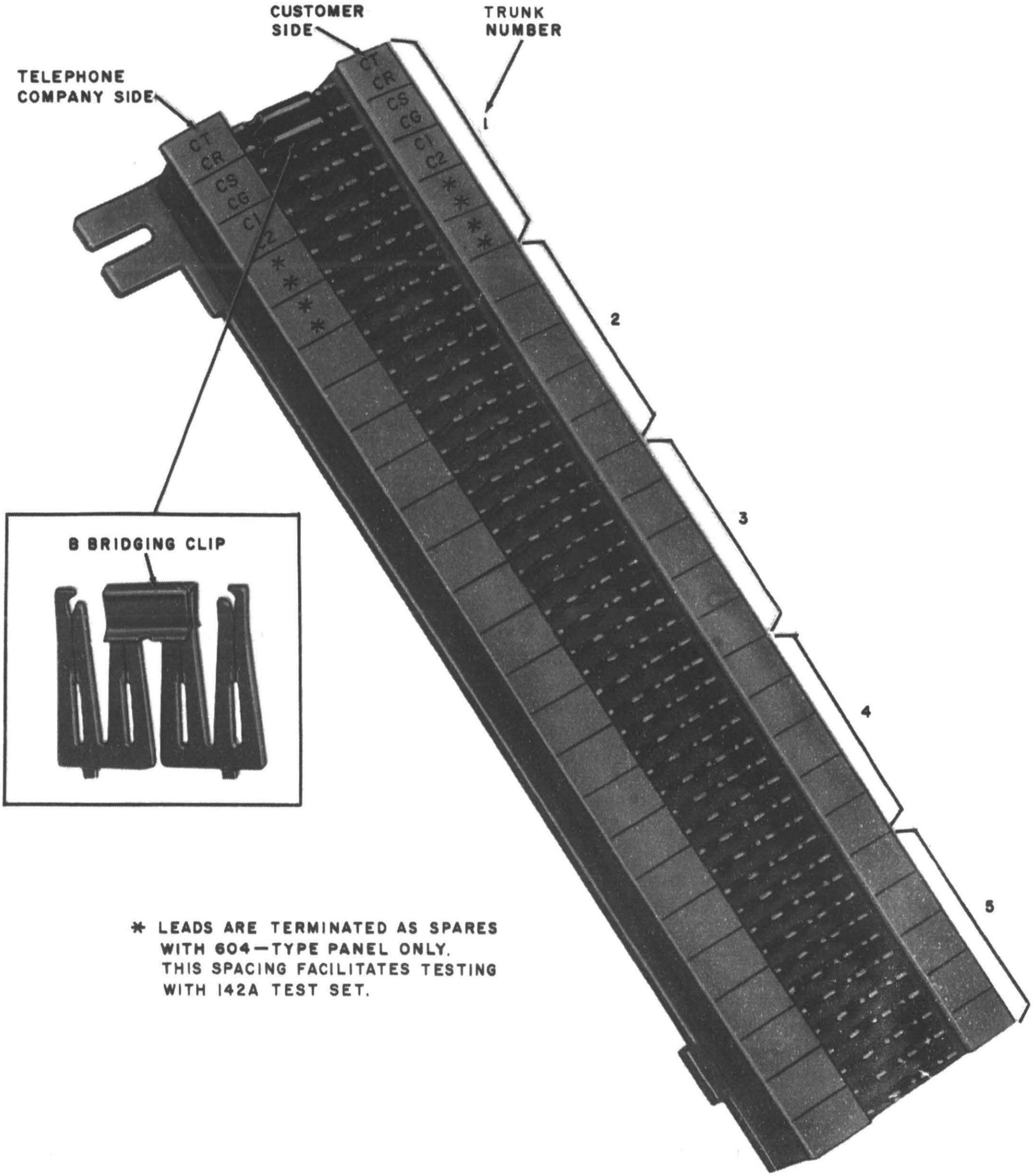


Fig. 4—➧66M1-50 Interface Connecting Block For Use With 604-Type Panel⬅

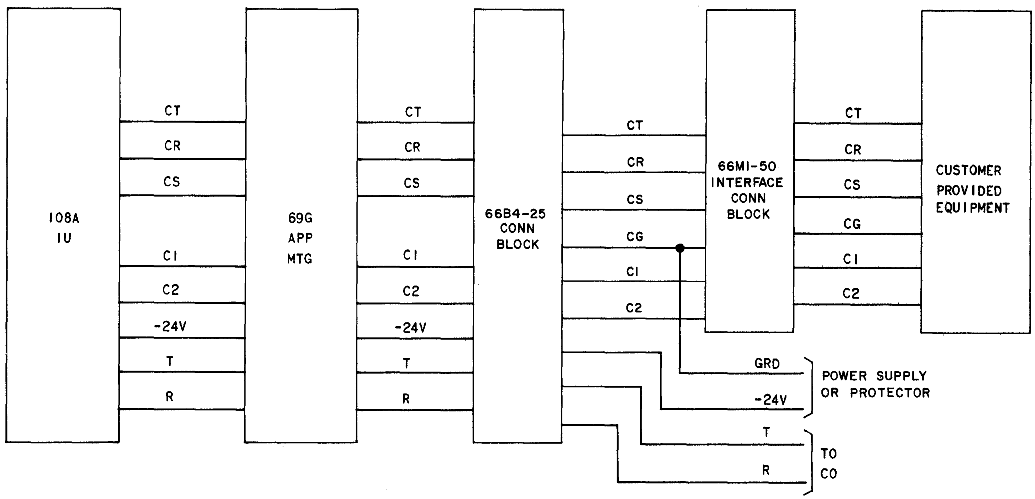


Fig. 5—Block Diagram—108A Interconnecting Unit With 69G Apparatus Mounting

the telephone company side on 66M1-50 interface connecting blocks following the wiring plan shown in Fig. 4 and Tables B, C, D, E, and F. (Stencil lead designations on fanning strip, Fig. 4.)

3.06 The customer must provide a separately fused 15-ampere, 105- to 130-volt, 60-Hz outlet for each panel within reach of available power cords (see Ordering Guide for cord lengths). The outlet should not be under control of a wall switch.

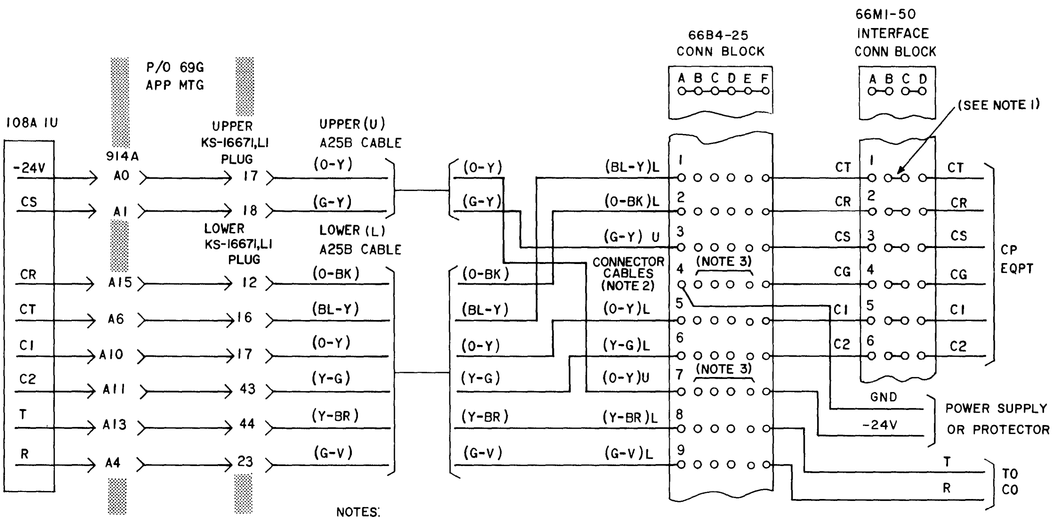
3.07 When using an external power supply (604A1 or 604B panel only) connect to fuse panel on rear of panel as shown in Fig. 7 and Table I (use 16-gauge or equivalent twisted pair). Refer to the appropriate section in Division 518 for proper grounding of power plants. Proper grounding of equipment and power unit is important to prevent damage from power line surges.

♦615A Panel (Fig. 8 and Tables G, H, and I)

3.08 Install the 615A panel on a 23-inch relay rack or in a 16C apparatus mounting using the 99B bracket. Remove the center mounting bar from the 16C apparatus mounting to avoid cover interference. The bracket holds up to three 615A panels. Each 615A panel holds up to six 108A IUs, three in the upper (A-position) connectors and three in the lower (B-position) connectors. When less than six 108A IUs are required, the sequence of installation of the required IUs should be in alphanumeric order of the card holding connectors (J1A, J2A, J3A, J1B, etc).

3.09 Connection of the CO lines is made to the 615A panel on the 66T1 connecting block as shown in Table G. 24-volt power and ground terminations are also made on the 66T1 block as shown in Table I.

3.10 Connection from the CPE is made to the 615A panel through a single A25B cable to an Amphenol plug on the panel as shown in Table H. Terminate the stub end of the A25B cable on the telephone company side of a 66M1-50 interface connecting block. Stencil lead designations on the fanning strip (Fig. 10).



NOTES:
1. B BRIDGING CLIP OR WIRE STRAPS.
2. INSULATE AND STORE SPARE LEADS
3. MULTIPLE TO OTHER CIRCUITS

Fig. 6—Connection Diagram for 69G Apparatus Mounting

3.11 Connect a frame ground wire to the 16C apparatus mounting on relay rack. Refer to the appropriate section in Division 518 for proper grounding. Proper grounding of equipment and power unit is important to prevent damage from power line surges.◀

108A Interconnecting Unit (Fig. 1 or 2)

To protect the electrical components of 108A IUs, remove fuses associated with that particular circuit before installing or replacing a unit. See Table J, K, or L.

3.12 When installing the 108A IU, position the board in the guide grooves of the P-40V590 guide assembly and the panel and slide the IU in until it is properly seated and electrically connected to the connector.

3.13 Make certain designation strip holder is properly positioned to hold the 108A IUs in place.

3.14 Refer to Fig. 1 for installation sequence of 108A IU in the 604-type panel. The suggested sequence is established to activate circuits in the order they appear at the customer interface. On current production of the 604B and the 604C panels, the ***trunk*** number is shown on the designation strip. On earlier production of the 604B, the ***position*** number is shown.

KS-20944 Protector

3.15 When power is supplied by a CP dc power source, protection is required. The KS-20944 protector must be mounted externally and wired to the fuse panel on rear of 604 panel (Fig. 7) or ▶615A panel (Fig. 8).◀

3.16 Connect as shown in Fig. 11 following local wiring instructions. The customer must connect his power supply to the red (GRD) and black (-V) 14-gauge wires extending from the unit.

Warning: Voltage is present on the number 1 terminal of the three circuit breakers.

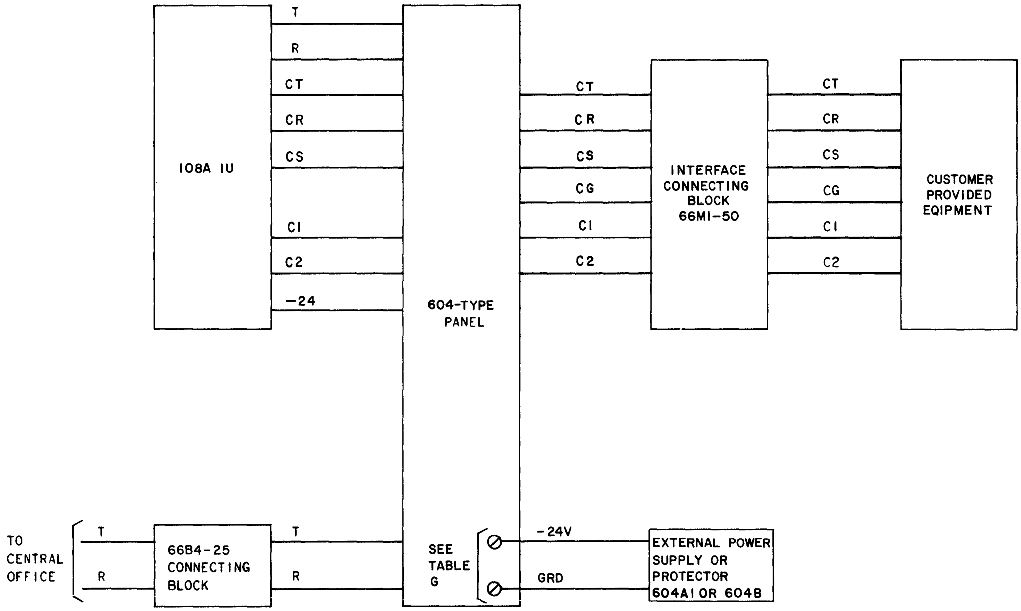


Fig. 7—Block Diagram—108A Interconnecting Unit With 604-Type Panel

Caution: Check for correct polarity and ground before closing switch.

4. OPERATION

A. 108A Interconnecting Unit (Fig. 9)

Incoming Call

4.01 When the CO seizes this circuit, ringing current supplied over the tip and ring operates relay R in the bridge ring detector circuit. The R relay operates and releases in unison with the ringing cycle and provides a contact closure on C1 and C2 leads to the CPE. When the customer answers, the CPE provides a contact closure between the CS, CG leads. The resulting ground on the CS lead causes S relay to operate. S relay operated trips the ringing, removes the ringing bridge, and establishes a talking path.

Disconnect

4.02 When the CPE goes to the on-hook condition, the closure is opened between CG and CS leads. This removes the ground on the CS lead releasing the slow release S relay. When S relay is released, the talking path to the CO is opened and the ringing bridge is placed across the tip and ring enabling the circuit to receive another incoming call.

B. KS-20944 Protector (Fig. 11)

4.03 When the CPE dc power supply is used to operate the Bell System equipment, power protection is required. The KS-20944 protector is used to protect telephone company personnel from hazardous voltages but will not protect the equipment from component failures (separate fuses are required for 108A IUs). The KS-20944 circuit breakers can be used as a switch to disconnect dc power when working on interconnecting circuits.

4.04 The KS-20944 protector consists of a dc voltage-operated circuit breaker in series with a parallel resistor-diode combination connected across the line and two dc current-operated circuit breakers connected in each side of the line. The contacts on the breakers are connected in series

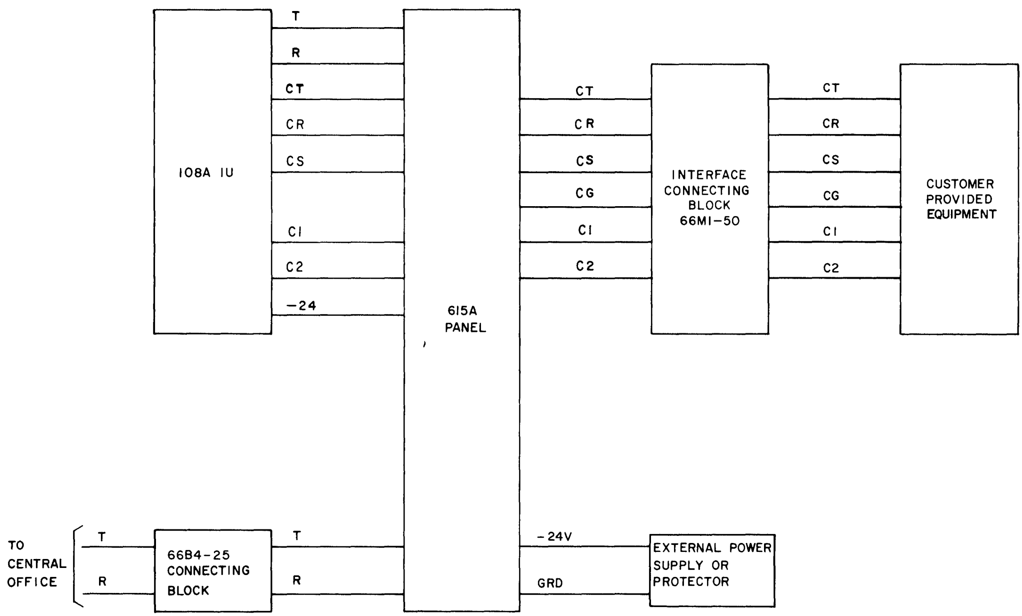


Fig. 8—Block Diagram—108A Interconnecting Unit With 615A Panel

with their own coil and their toggles are mechanically coupled together. When any breaker is operated, the line will be opened. The circuit breakers must be manually reset after tripping. The breakers will not reset if the fault persists.

4.05 The KS-20944, List 1 protector is designed to trip in 25 milliseconds (maximum) on 38 volts dc, on 18.75 amperes dc, on reversed polarity, or over 18V ac, and on incorrect power supply ground.

5. MAINTENANCE

5.01 When trouble is reported, check for blown fuses, loose or broken connections, and verify that the CO pair is good. Perform a test of the 108A IU.

A. Using 1013A Hand Test Set and 81A Test Set

5.02 Prepare the circuit under test as follows:

(a) Open the six leads to CPE by removing the B bridging clips (or wire straps) at the 66M1-50 interface block.

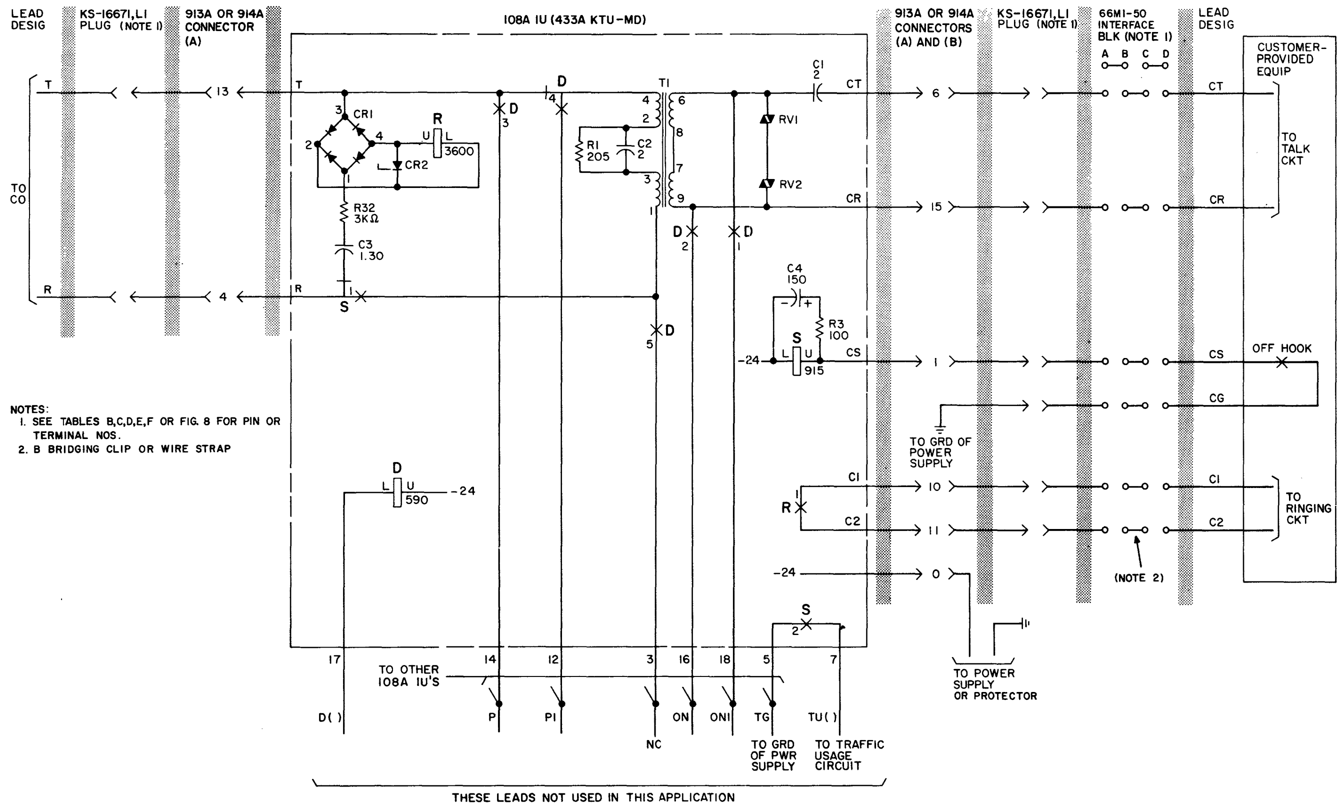
(b) Supply talk battery by connecting a 500-ohm resistor from the −24 volt supply to terminal CR and ground to terminal CT (make all connections on the telephone company side of the interface block). A 2A KTU or 31A KTU may be used for battery feed instead of the resistor. Refer to Section 518-112-421 for KTU connections.

(c) Connect a 1013A hand test set (or equivalent) across terminals CT and CR.

(d) Connect a strap to terminal CS (to be used later to strap CS and CG).

(e) Connect an 81A or KS-16990, List 1 test set across terminals C1 and C2.

5.03 ***Transmission and Ringing Test:*** Ask the test desk to ring the CO line associated with the 108A IU under test. The 81A (or equivalent) test set between terminals C1 and C2 should follow ringing. Answer the call by strapping terminals CS and CG and verify satisfactory transmission.



NOTES:
1. SEE TABLES B,C,D,E,F OR FIG. 8 FOR PIN OR TERMINAL NOS.
2. B BRIDGING CLIP OR WIRE STRAP

Fig. 9—Schematic Diagram—108A Interconnecting Unit

B. Using the 142A Test Set (Fig. 12)

5.04 Prepare the circuit under test as follows:

(a) Disconnect the CPE by removing the B bridging clips or wire straps at the interface block.

(b) Connect the test set interface cord to the terminals on the telephone company side of the block as shown in Fig. 12. The cord required is determined by the type of block provided to terminate the interface.

(c) Connect the leads from the 2-conductor power cord to −24 volts and ground as shown in Fig. 12. This voltage should be obtained from the same source used to power the IU under test. The PWR lamp on the test set should light.

(d) Connect a 1013A hand test set to the HNDST terminals on the test set. Set the MON-TALK switch on the hand test set to MON position.

(e) On the 142A test set, set the CS-CG LOOP switch to the 100-ohm position.

5.05 After circuit preparation, proceed as follows:

(1) Operate switch on 1013A hand test set to the TALK position. The S relay in the 142A test set will operate, lighting the CS lamp and providing a ground path on the CG lead through the 100-ohm resistor on the CS-CG LOOP switch. Ground on the CS lead causes the S relay in the IU to operate and seize the CO trunk. Since this is a one-way incoming service, dial tone should not be heard in the hand test set. Return the hand test set switch to MON position.

(2) Dial the local test desk using another line and request that an incoming call be placed on the trunk under test.

(3) When the trunk is seized by the incoming call from the test desk and ringing is applied to the trunk, the C- lamp lights and follows the ringing cycle.

(4) Operate the hand test set switch to TALK. The C- lamp should extinguish and the CS lamp light indicating ringing has been tripped and the call answered. The trunk should now be cut through the IU, and satisfactory transmission may be judged by using the hand test set. If the CS lamp lights but ringing is not tripped, change the CS-CG LOOP switch to the 18-ohm position. If ringing is now tripped, IU operation may be considered marginal or it may indicate the CS-CG loop is of too high resistance.

(5) Have the test desk release the trunk. Operate the hand test set switch to MON. The CS lamp should be extinguished and the IU should be in the idle condition.

5.06 When all testing is complete, remove power and interface cords. Connect the CPE by restoring B bridging clips or wire straps at interface connecting block.

READ ***Never replace an interconnecting unit without first removing the fuse for that particular circuit. See the applicable table in Part 6.***

5.07 When trouble is suspected in the 108A IU, exchange it with another unit known to be functioning properly. Tag and place the defective IU in blister pack and return it for repair.

READ ***Do not attempt any tests or repairs to the customer-provided equipment.***

5.08 When in the repairman's judgment the trouble is located in the CPE, the Repair Service Bureau should be notified so that proper Maintenance of Service Charge billing can be initiated as outlined in BSP 660-101-312 entitled Maintenance of Service Charge on Service With Customer-Provided Equipment (CPE).

6. CONNECTIONS

6.01 For connection information using the 69G apparatus mounting, refer to Fig. 5 and 6.

6.02 For connection information using the 604A-type panel, refer to Fig. 4, 7, and Tables B, C, D, E, F, and I.

6.03 For connection information using the 604B/604C panels, refer to Fig. 4, 7, and Tables B, C, D, E, and I.

6.04 ➧For connection information using 615A panel, refer to Fig. 8, 10, Tables G, H, and I.➧

6.05 For connection information using the KS-20944, List 1 protector, refer to Fig. 11.

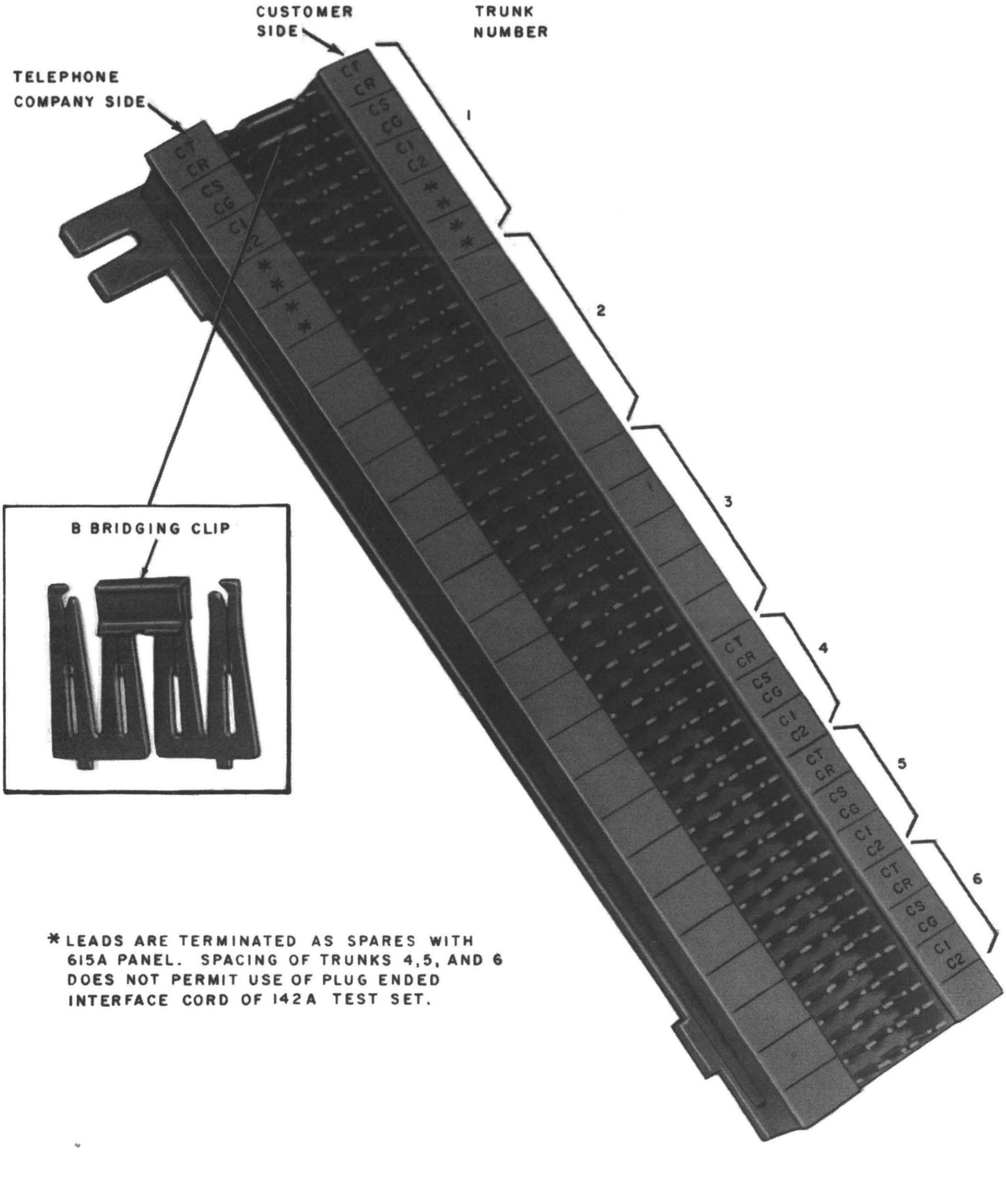


Fig. 10—66M1-50 Interface Connecting Block For Use With 615A Panel

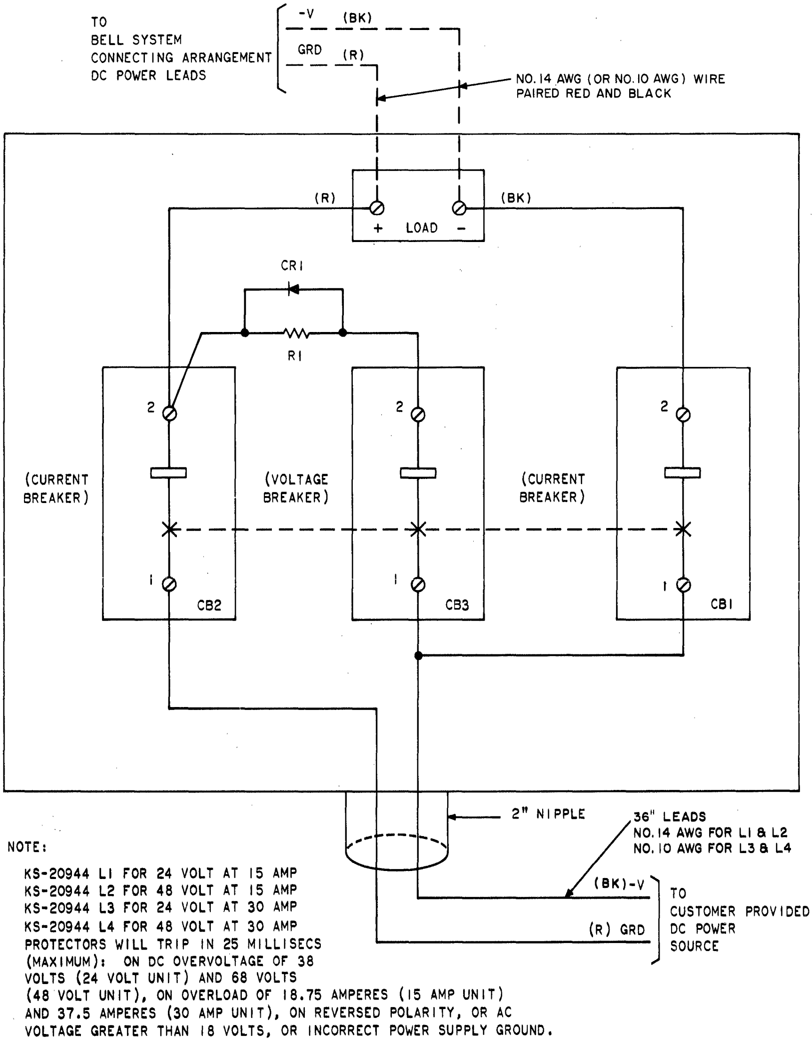


Fig. 11—Schematic Diagram—KS-20944 Protector

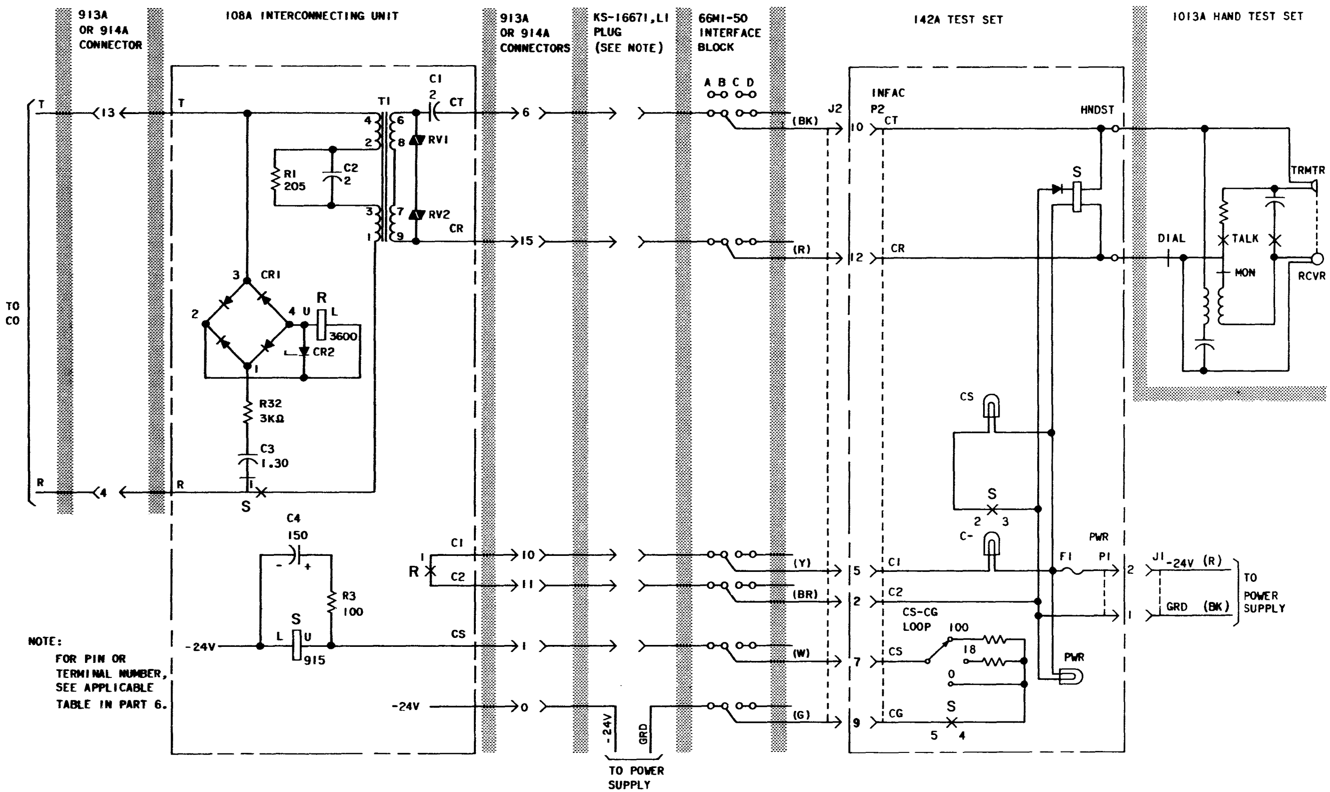


Fig. 12—Testing 108A Interconnecting Unit With 142A Test Set

TABLE B

CONNECTIONS FOR PLUG NO. 1—604-TYPE PANEL

TRUNK NO.	LEAD DESIG*	CONN PIN NO.	A25B CONN CABLE COLOR	66B4-25 CONN BLK ROW NO.	POS. IN 604-TYPE PANEL
1	T	26	W-BL	1	1A
	R	1	BL-W	2	
2	T	27	W-O	3	2A
	R	2	O-W	4	
3	T	28	W-G	5	4A
	R	3	G-W	6	
4	T	29	W-BR	7	5A
	R	4	BR-W	8	
5	T	30	W-S	9	7A
	R	5	S-W	10	
6	T	31	R-BL	11	8A
	R	6	BL-R	12	
7	T	32	R-O	13	10A
	R	7	O-R	14	
8	T	33	R-G	15	11A
	R	8	G-R	16	
9	T	34	R-BR	17	13A
	R	9	BR-R	18	
10	T	35	R-S	19	3A
	R	10	S-R	20	
11	T	36	BK-BL	21	6A
	R	11	BL-BK	22	
12	T	37	BK-O	23	9A
	R	12	O-BK	24	
13	T	38	BK-G	25	12A
	R	13	G-BK	26	
14	T	39	BK-BR	27	14A
	R	14	BR-BK	28	
15	T	40	BK-S	29	†10B
	R	15	S-BK	30	
16	T	41	Y-BL	31	†11B
	R	16	BL-Y	32	
17	T	42	Y-O	33	†12B
	R	17	O-Y	34	
18	T	43	Y-G	35	†14B
	R	18	G-Y	36	
SPARE	SPARE	44	Y-BR	37	
		19	BR-Y	38	
		45	Y-S	39	
		20	S-Y	40	
		46	V-BL	41	
		21	BL-V	42	
		47	V-O	43	
		22	O-V	44	
		48	V-G	45	
		23	G-V	46	
		49	V-BR	47	
		24	BR-V	48	
		50	V-S	49	
		25	S-V	50	

* Stencil lead designations on fanning strip.
† 604A-type only. Not on 604B and 604C.

TABLE C

CONNECTIONS FOR PLUG NO. 2—604-TYPE PANEL

TRUNK NO.	LEAD DESIG*	CONN PIN NO.	CONN CABLE COLOR	66M1-50 CONN BLK ROW NO.	POS. IN 604-TYPE PANEL
1	CT	26	W-BL	1	1 A
	CR	1	BL-W	2	
	CS	27	W-O	3	
	CG	2	O-W	4	
	C1	28	W-G	5	
	C2	3	G-W	6	
	SPARE	29	W-BR	7†	
	SPARE	4	BR-W	8†	
	SPARE	30	W-S	9†	
	SPARE	5	S-W	10†	
2	CT	31	R-BL	11	2 A
	CR	6	BL-R	12	
	CS	32	R-O	13	
	CG	7	O-R	14	
	C1	33	R-G	15	
	C2	8	G-R	16	
	SPARE	34	R-BR	17†	
	SPARE	9	BR-R	18†	
	SPARE	35	R-S	19†	
	SPARE	10	S-R	20†	
3	CT	36	BK-BL	21	4 A
	CR	11	BL-BK	22	
	CS	37	BK-O	23	
	CG	12	O-BK	24	
	C1	38	BK-G	25	
	C2	13	G-BK	26	
	SPARE	39	BK-BR	27†	
	SPARE	14	BR-BK	28†	
	SPARE	40	BK-S	29†	
	SPARE	15	S-BK	30†	
4	CT	41	Y-BL	31	5 A
	CR	16	BL-Y	32	
	CS	42	Y-O	33	
	CG	17	O-Y	34	
	C1	43	Y-G	35	
	C2	18	G-Y	36	
	SPARE	44	Y-BR	37†	
	SPARE	19	BR-Y	38†	
	SPARE	45	Y-S	39†	
	SPARE	20	S-Y	40†	
5	CT	46	V-BL	41	7 A
	CR	21	BL-V	42	
	CS	47	V-O	43	
	CG	22	O-V	44	
	C1	48	V-G	45	
	C2	23	G-V	46	
	SPARE	49	V-BR	47†	
	SPARE	24	BR-V	48†	
	SPARE	50	V-S	49†	
	SPARE	25	S-V	50†	

* Stencil lead designations on fanning strip.

† Stencil as spare. No customer-provided conductors should be terminated on these binding posts.

TABLE D

CONNECTIONS FOR PLUG NO. 3—604-TYPE PANEL

TRUNK NO.	LEAD DESIG*	CONN PIN NO.	CONN CABLE COLOR	66M1-50 CONN BLK ROW NO.	POS. IN 604-TYPE PANEL
	CT	26	W-BL	1	
	CR	1	BL-W	2	
	CS	27	W-O	3	
	CG	2	O-W	4	
6	C1	28	W-G	5	8 A
	C2	3	G-W	6	
	SPARE	29	W-BR	7†	
	SPARE	4	BR-W	8†	
	SPARE	30	W-S	9†	
	SPARE	5	S-W	10†	
	CT	31	R-BL	11	
	CR	6	BL-R	12	
	CS	32	R-O	13	
	CG	7	O-R	14	
7	C1	33	R-G	15	10 A
	C2	8	G-R	16	
	SPARE	34	R-BR	17†	
	SPARE	9	BR-R	18†	
	SPARE	35	R-S	18†	
	SPARE	10	S-R	20†	
	CT	36	BK-BL	21	
	CR	11	BL-BK	22	
	CS	37	BK-O	23	
	CG	12	O-BK	24	
8	C1	38	BK-G	25	11 A
	C2	13	G-BK	26	
	SPARE	39	BK-BR	27†	
	SPARE	14	BR-BK	28†	
	SPARE	40	BK-S	29†	
	SPARE	15	S-BK	30†	
	CT	41	Y-BL	31	
	CR	16	BL-Y	32	
	CS	42	Y-O	33	
	CG	17	O-Y	34	
9	C1	43	Y-G	35	13 A
	C2	18	G-Y	36	
	SPARE	44	Y-BR	37†	
	SPARE	19	BR-Y	38†	
	SPARE	45	Y-S	39†	
	SPARE	20	S-Y	40†	
	↑	46	V-BL	41	
		21	BL-V	42	
		47	V-O	43	
		22	O-V	44	
	SPARE	48	V-G	45	
	↓	23	G-V	46	
−24V	FAL1‡	49	V-BR	47	F2(FA)
GRD	G1‡	24	BR-V	48	TS1(15)
−48V	FAL2‡	50	V-S	49	F16(FA)
GRD	G2‡	25	S-V	50	TS1(16)

* Stencil lead designations on fanning strip.

† Stencil as spare. No customer-provided conductors should be terminated on these binding posts.

‡Optional attendant fuse alarm indicator on 604B panel only.

TABLE E

CONNECTIONS FOR PLUG NO. 4—604-TYPE PANEL

TRUNK NO.	LEAD DESIG*	CONN PIN NO.	CONN CABLE COLOR	66M1-50 CONN BLK ROW NO.	POS. IN 604-TYPE PANEL
10	CT	26	W-BL	1	3 A
	CR	1	BL-W	2	
	CS	27	W-O	3	
	CG	2	O-W	4	
	C1	28	W-G	5	
	C2	3	G-W	6	
	SPARE	29	W-BR	7†	
	SPARE	4	BR-W	8†	
	SPARE	30	W-S	9†	
	SPARE	5	S-W	10†	
11	CT	31	R-BL	11	6 A
	CR	6	BL-R	12	
	CS	32	R-O	13	
	CG	7	O-R	14	
	C1	33	R-G	15	
	C2	8	G-R	16	
	SPARE	34	R-BR	17†	
	SPARE	9	BR-R	18†	
	SPARE	35	R-S	19†	
	SPARE	10	S-R	20†	
12	CT	36	BK-BL	21	9 A
	CR	11	BL-BK	22	
	CS	37	BK-O	23	
	CG	12	O-BK	24	
	C1	38	BK-G	25	
	C2	13	G-BK	26	
	SPARE	39	BK-BR	27†	
	SPARE	14	BR-BK	28†	
	SPARE	40	BK-S	29†	
	SPARE	15	S-BK	30†	
13	CT	41	Y-BL	31	12 A
	CR	16	BL-Y	32	
	CS	42	Y-O	33	
	CG	17	O-Y	34	
	C1	43	Y-G	35	
	C2	18	G-Y	36	
	SPARE	44	Y-BR	37†	
	SPARE	19	BR-Y	38†	
	SPARE	45	Y-S	39†	
	SPARE	20	S-Y	40†	
14	CT	46	V-BL	41	14 A
	CR	21	BL-V	42	
	CS	47	V-O	43	
	CG	22	O-V	44	
	C1	48	V-G	45	
	C2	23	G-V	46	
	SPARE	49	V-BR	47†	
	SPARE	24	BR-V	48†	
	SPARE	50	V-S	49†	
	SPARE	25	S-V	50†	

* Stencil lead designations on fanning strip.

† Stencil as spare. No customer-provided conductors should be terminated on these binding posts.

TABLE F

CONNECTIONS FOR PLUG NO. 5—604A TYPE PANEL ONLY

TRUNK NO.	LEAD DESIG*	CONN PIN NO.	CONN CABLE COLOR	66M1-50 CONN BLK ROW NO.	POS. IN 604A PANEL
15	CT	26	W-BL	1	10 B
	CR	1	BL-W	2	
	CS	27	W-O	3	
	CG	2	O-W	4	
	C1	28	W-G	5	
	C2	3	G-W	6	
16	CT	29	W-BR	7	11 B
	CR	4	BR-W	8	
	CS	30	W-S	9	
	CG	5	S-W	10	
	C1	31	R-BL	11	
	C2	6	BL-R	12	
17	CT	32	R-O	13	13 B
	CR	7	O-R	14	
	CS	33	R-G	15	
	CG	8	G-R	16	
	C1	34	R-BR	17	
	C2	9	BR-R	18	
18	CT	35	R-S	19	14 B
	CR	10	S-R	20	
	CS	36	BK-BL	21	
	CG	11	BL-BK	22	
	C1	37	BK-O	23	
	C2	12	O-BK	24	

* Stencil lead designations on fanning strip.

→ TABLE G ←

CONNECTIONS FOR CENTRAL OFFICE TRUNKS — 615A PANEL

TRUNK NUMBER	LEAD DESIG.	66T1 CONN. BLOCK	TO 913 OR 914	
			CONN.	PIN
1	T	1A	J1A	13
	R	2A	J1A	4
2	T	3A	J2A	13
	R	4A	J2A	4
3	T	5A	J3A	13
	R	6A	J3A	4
4	T	7A	J1B	13
	R	8A	J1B	4
5	T	9A	J2B	13
	R	10A	J2B	4
6	T	11A	J3B	13
	R	12A	J3B	4
		13A	SPARE	
		14A	SPARE	

→ TABLE H ←

CONNECTIONS FOR PLUG P1 — 615A PANEL

LEAD DESIG.	PLUG P1 PIN NO.	LEAD COLOR	615A PANEL		
			JACK	PIN	66T1 BLK
CT	26	W-BL	J1A	6	1B
CR	1	BL-W		15	2B
CS	27	W-O		1	
CG	2	O-W			12C
C1	28	W-G		10	
C2	3	G-W		11	
SPARE	29	W-BR		14	
SPARE	4	BR-W		19	
SPARE	30	W-S		7	
SPARE	5	S-W		16	
CT	31	R-BL	J2A	6	3B
CR	6	BL-R		15	4B
CS	32	R-O		1	
CG	7	O-R			13C
C1	33	R-G		10	
C2	8	G-R		11	
SPARE	34	R-BR		14	
SPARE	9	BR-R		19	
SPARE	35	R-S		7	
SPARE	10	S-R		16	
CT	36	BK-BL	J3A	6	5B
CR	11	BL-BK		15	6B
CS	37	BK-O		1	
CG	12	O-BK			14C
C1	38	BK-G		10	
C2	13	G-BK		11	
SPARE	39	BK-BR		14	
SPARE	14	BR-BK		19	
SPARE	40	BK-S		7	
SPARE	15	S-BK		16	

→ TABLE H (Cont) ←

LEAD DESIG.	PLUG P1 PIN NO.	LEAD COLOR	615A PANEL		
			JACK	PIN	66T1 BLK
CT	41	Y-BL	J1B	6	7B
CR	16	BL-Y		15	8B
CS	42	Y-O		1	
CG	17	O-Y			12D
C1	43	Y-G		10	
C2	18	G-Y		11	
CT	44	Y-BR	J2B	6	9B
CR	19	BR-Y		15	10B
CS	45	Y-S		1	
CG	20	S-Y			13D
C1	46	V-BL		10	
C2	21	BL-V		11	
CT	47	V-O	J3B	6	11B
CR	22	O-V		15	12B
CS	48	V-G		1	
CG	23	G-V			14D
C1	49	V-BR		10	
C2	24	BR-V		11	
SPARE SPARE	50 25	V-S S-V			

→ TABLE I ←

POWER CONNECTIONS

INPUT VOLTAGE	69G APP MTG (NOTE 1)	604A1 PANEL (NOTE 2)	604B/604C PANEL (NOTE 3)	615A PANEL (NOTE 4)
−24V	7	14	Input −24V	D2
−48V	—	—	Input −48V	—
GRD	4	13	Input −GRD	D4

Notes:

1. Terminals on 66B4-25 connecting block, connect as shown in Fig. 7.
2. Terminals on terminal strip TSA on rear of 604A1 panel.
3. Terminals on rear of 604B/604C panel are stamped as shown. Position option straps for −24V or −48V.
4. Terminals on 66T1 connecting block. Use 20 gauge wire, strip leads before putting into 66-type terminals. Power may be distributed to subsequent panels by multipling succeeding panels from terminals C2 and C4 (multiple a maximum of three panels).

▶ TABLE J ◀

604A-TYPE PANEL FUSE ASSIGNMENT

VOLTAGE	FUSE NO.*	PANEL POSITION
−24V	F1	J1A
	F2	J2A
	F3	J3A
	F4	J4A
	F5	J5A
	F6	J6A
	F7	J7A
	F8	J8A
	F9	J9A
	F10	J10A
	F11	J11A
	F12	J12A
	F13	J13A
	F14	J14A
	F15	J10B
	F16	J11B
	F17	J13B
	F18	J14B

* Fuses are 70G 1/2-ampere.

TABLE K
604B OR 604C PANEL FUSE ASSIGNMENT

TABLE

VOLTAGE	FUSE NO.	PANEL POSITION
±105V (Note)	F1*	J1A thru J14A
–24V	F2*	J1A
	F3*	J2A
	F4*	J3A
	F5*	J4A
	F6*	J5A
	F7*	J6A
	F8*	J7A
	F9*	J8A
	F10*	J9A
	F11*	J10A
	F12*	J11A
	F13*	J12A
	F14†	J13A
	F15†	J14A
–48V (Note)	F16‡	J1A thru J5A
	F17‡	J6A thru J10A
	F18‡	J11A thru J14A

Note: ±105V and –48V not used in this application.

* 70F Fuse 1/4 Ampere.
† 70G Fuse 1/2 Ampere.
‡ 70A Fuse 1-1/3 Ampere.

→ TABLE L ←

615A PANEL FUSE ASSIGNMENT

VOLTAGE	FUSE NO.*	PANEL POSITION
–24V	F1	J1A
	F2	J2A
	F3	J3A
–48V†	F4	J1B
	F5	J2B
	F6	J3B
±105V†	F7	J1A, J2A, J3A
SPARE	F8	

* 24E Fuse 1/2 Ampere.
† Not used in this application.

PROTECTIVE CONNECTION ARRANGEMENTS CD9, CD8, CD7 AND CONNECTING ARRANGEMENT CBF

1. GENERAL

1.01 This section provides identification, installation, operation, maintenance, and connection information for the 102-type interconnecting unit (IU) and associated 604-type, ➧or 615A➧ panel when used for Protective Connecting Arrangements (PCA) CD9, CD8, or CD7. ➧It also covers the 75A control unit used for Connecting Arrangement (CA) CBF, the KS-20944 protector used for CA VCP, and Uniform Service Order Codes CA PFB and PFC.➧

1.02 This section is reissued to:

- Add 604C panel
- Add 615A panel
- Show use of the 142A test set
- Clarify use of options (Fig. 14)
- Remove information on use of 69G apparatus mounting in new installations.

1.03 For detailed maintenance and connection information of specified components, refer to:

604A Panel—463-300-101

604B and 604C Panels—463-300-102

➧615A Panel—463-300-104

142A Test Set—463-300-113➧

75A Control Unit—463-300-112

KS-20944 Protector—463-300-109.

1.04 The 102B IU is an improved version of the 102A (MD) IU for use with PCAs CD9, CD8, and CD7 and offers the following advantages:

- Line impedance matching
- Increases range limitation of supervisory and dial pulsing leads (CS and CG) from 18 ohms to 100 ohms maximum (see Note)
- Maximum allowable external loop resistance to central office (CO) of 2500 ohms
- Arranged for data application
- New transformer with higher breakdown insulation.

Note: If a problem is encountered in an existing installation with these limitations using a 102A IU, replace with a 102B. In existing installations using pulse correction, the 103A (MD) pulse corrector must be removed when replacing the 102A IU with a 102B IU.

1.05 The 604B and ➧604C➧ panels are improved versions of the 604A (MD) panel and offer the following advantages:

- Arranged for data application (with 75A control unit)
- 24V operation (604B and 604C panels)
- 48V operation (604B and 604C panels with 21A apparatus mounting)
- Require only 8 inches of the vertical mounting space
- Connections for remote fuse alarm indicator.

1.06 ➧The 615A panel provides mounting facilities for three 102-type IUs. It is designed to

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be used instead of the 69G apparatus mounting in new installations.◀

> *Note:* The 604B, ▶604C and 615A◀ panels require the use of an external power supply.

1.07 The size of the initial installation and the expected growth should be the determining factors in selecting the proper mounting equipment. For one to three IUs use the ▶615A panel.◀ If growth is expected to be 4 to 14 IUs, use the 604-type panel.

1.08 For data application (CA CBF), the 75A control unit is used with the 102B IU to provide an alternate voice/data capability. The 75A control unit can only be provided with the 604B ▶or 604C◀ panel.

1.09 These arrangements are used to provide the following services from a local or foreign exchange CO to a customer-provided (CP) communications system:

- 2-way loop-start manual service, attendant handled (CD9)
- One-way outgoing automatic service, machine handled (CD8)
- One-way outgoing manual service, attendant handled (CD7).

1.10 If the customer wants a copy of the Technical Reference which covers this interface specification, the customer should contact the local Telephone Company Business Office or the Marketing Representative.

1.11 This issue of the section is based on the following drawings:

SD-1E202-01, Issue 3A (102A IU)

SD-1E238-01, Issue 2A (102B IU)

SD-1E246-01, Issue 2A (75A CU)

SD-1E200-01, Issue 2D (604A Panel)

SD-69631-01, Issue 3D (Power Failure Transfer)

If this section is to be used with equipment or apparatus reflecting later issue(s) of the drawing(s), reference should be made to the SDs and CDs to determine the extent of the changes and the manner in which the section may be affected.

2. IDENTIFICATION

PURPOSE

(a) ***PCA CD7, CD8, and CD9***

- To provide interfaces between loop-start CO trunks and a CP PBX
- To provide voiceband transmission
- To limit excessive voice signal power levels from customer-provided equipment (CPE) and to provide protection for telephone company personnel against hazardous voltages
- To transmit network control signaling function.

(b) ***CA CBF***

- To limit excessive data and voice signal levels from CPE.

(c) ***PFB, PFC***

- To provide telephone service during commercial power failure.

(d) ***CA VCP***

- To provide an interface between CP power supply and the PCA
- To provide protection for telephone company personnel against hazardous voltages.

ORDERING GUIDE

(a) ***For PCA CD7, CD8, and CD9***

- Unit, Interconnecting, 102B (one per CO trunk, Fig. 1).

Associated Apparatus (Order Separately)

> *Note:* If a 23-inch relay rack is not provided on customer premises, provide a 16C apparatus mounting for the ▶615A panel◀ or an ED-91180-72,

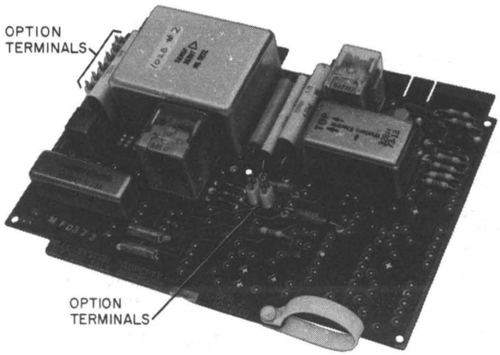


Fig. 1—102B Interconnecting Unit

Group 21 cabinet for the 604-type panel, or their local equivalent.

- Panel, 604A1 (MD) (fuse panel only, no power unit; mounts fourteen 102-type IUs)

  or

- Panel, 604A2 (MD) (includes 19C2 power unit and fuse panel; mounts fourteen 102-type IUs, Fig. 2)

  or

- Panel, 604B (fuse panel only, no power unit; mounts fourteen 102-type IUs, ➧or twelve 102B IUs and two 75A control units, Fig. 3 and 4) (24V or 48V operation)➦

  or

- Panel, 604C (fuse panel only, no power unit; mounts fourteen (102-type IUs, ➧or twelve 102B IUs and two 75A control units, Fig. 3 and 4) (24V operation)➦

  or

- Panel, 615A (fuse panel only, no power unit; mounts three 102-type IUs, Fig. 5)—supply voltage must be −24V

  or

- Unit, Apparatus, 21A—required with 604C panel when supply voltage is −48V

- Bracket, 99B ➧(one per three 615A panels)➦

- Cable, A25B (➧one per 615A panel,➦ or four per 604-type panel; see Table A)

- ➧Cable, A50B (one per 604-type panel) (Table A)

- Cable, A75B (one per 604-type panel) (Table A)➦

- Block, Connecting, 66M1-50 (as required, Fig. 6)

Note: Other type blocks should not be used as they may not be compatible for testing with the 142A test set.

- Block, Connecting 66B4-25 (as required)

- Clip, Bridging, B (25 per pkg., as required, Fig. 6)

- Cable, D Inside Wiring, or equivalent ➧(where required for the 615A panel)➦

- Unit, Power, 19C2, or equivalent (for 615A, 604A1, 604B or 604C)

- Unit, Power, 29C1, or equivalent (for 604B or 604C with 75A control units)

- Cord, Power (for 19C2 or 29C1 power unit)

  P40J326 (1-1/2 ft)

  P40J327 (2 ft)

  P40J328 (4 ft)

  P40J329 (6 ft)

  P40J099 (12 ft)

(b) ***For Power Failure Transfer (CA PFB or PFC)***

- Set, Telephone, 500C/D or 554A/B* (one per arrangement)

INSTALLATION SEQUENCE OF 102B INTERCONNECTING UNITS

TRUNK NO.	POSITION NO.
1	1
2	2
3	4
4	5
5	7
6	8
7	10
8	11
9	13
10	3
11	6
12	9
13	12
14	14

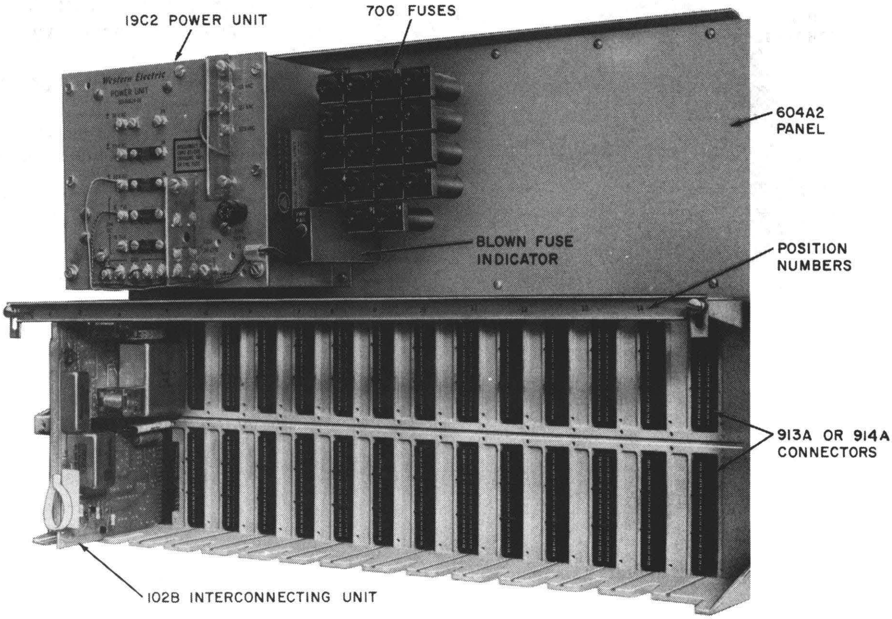


Fig. 2—102B Interconnecting Unit Mounted in 604A2 (MD) Panel

- Unit, Key Telephone, 229B (one per four arrangements if immediate restoral is used, PFB; one per arrangement if delayed restoral is used, PFC)
- Indicator, Lamp, 15-Type, or equivalent (delayed restoral only when option Z provided in 229B KTU, PFC)
- Cord, Mounting, D4BJ (for 500C/D telephone set if delayed restoral required, PFC)*

*Add color suffix.

(c) ***For Data Transmission (CA CBF)***

- Unit, Control, 75A (one per six 102B IUs in 604B or 604C panel, Fig. 7).

(d) ***For Power Protection Unit (CA VCP)***

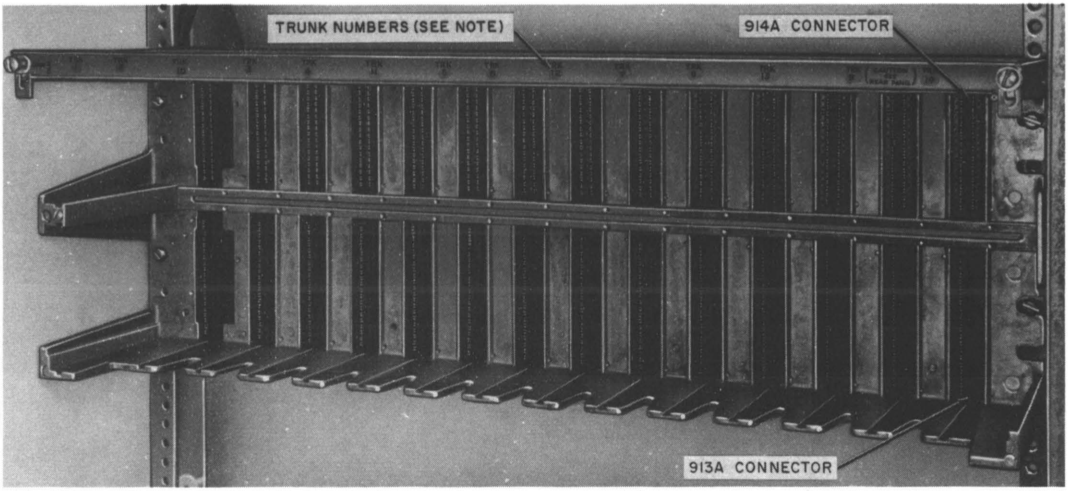
- Protector, KS-20944 (Fig. 8, select list number from Fig. 17) (must be provided when a CP dc power supply is used).

Replaceable Components

- Unit, Power, 19C2 (for 604A2 panel)
- ♦Fuse, 24E, 1/2 Ampere (eight per 615A panel)♦
- Fuse, 70G, 1/2 Ampere (18 per 604A-type panel)
- Fuse, 70F, 1/4 Ampere (13 per 604B or 604C panel)
- Fuse, 70G, 1/2 Ampere (two per 604B or 604C panel)
- Fuse, 70A, 1-1/3 Amperes (three per 604B or 604C panel)
- Unit, Apparatus, 21A.

DESIGN FEATURES

102-Type Interconnecting Unit



NOTE: ON OLDER 604B PANELS, POSITION NUMBERS APPEAR INSTEAD OF TRUNK NUMBERS.

INSTALLATION SEQUENCE OF 102-TYPE INTERCONNECTING UNITS

TRUNK NO.	1	2	10	3	4	11	5	6	12	7	8	13	9	14
POSITION NO.	1	2	3	4	5	6	7	8	9	10	11	12	13	14

Fig. 3—➧604B or 604C Panel, Front View⬅

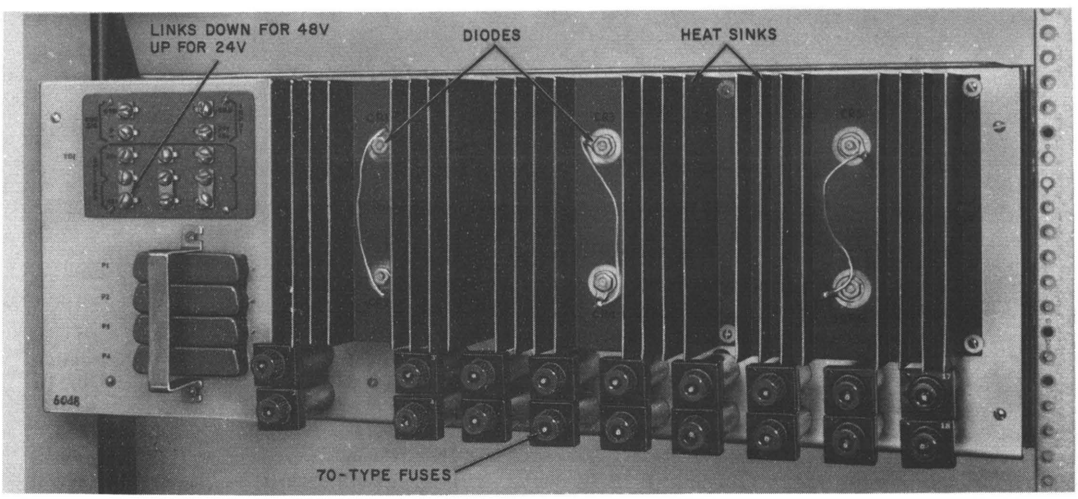


Fig. 4—604B Panel, Rear View

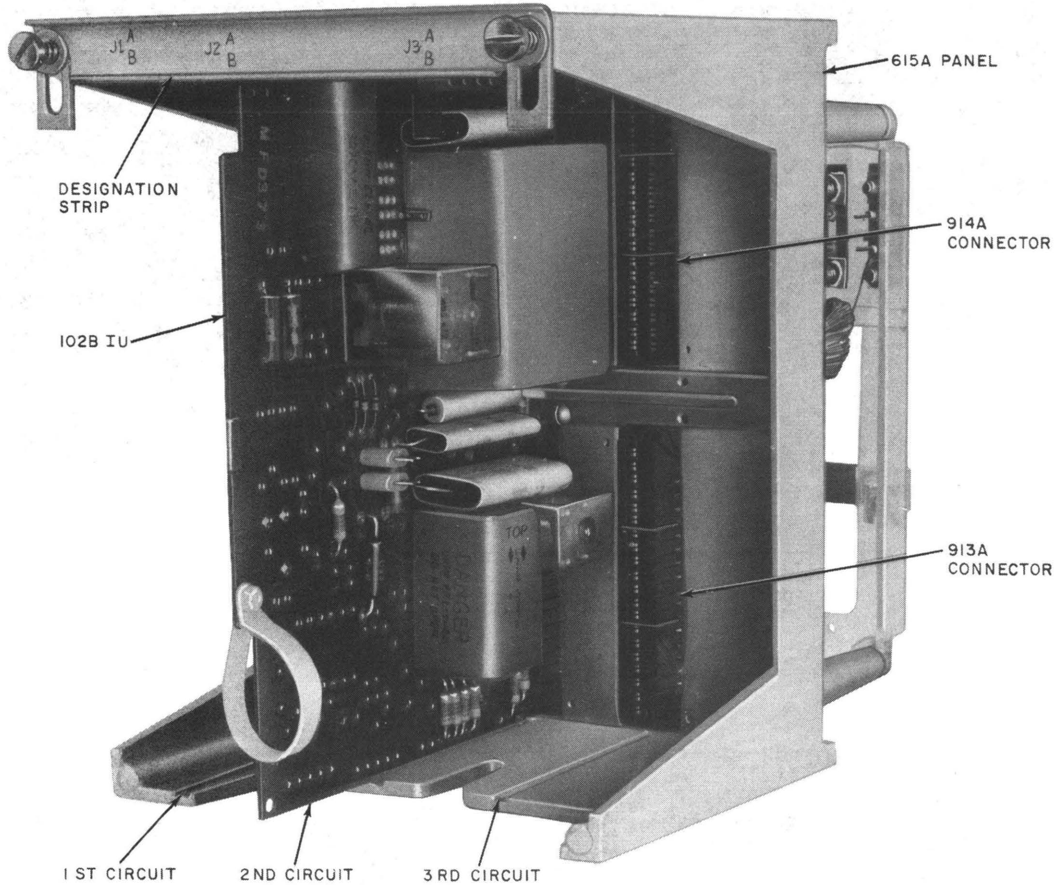


Fig. 5—►102B Interconnecting Unit Mounted in 615A Panel◄

- Components mounted on epoxy coated 8-inch 80-pin board.
- Features loop-start operation.
- Option terminals (Fig. 1).
- Features line impedance matching (102B IU only).
- Provides dc isolation to CPE.
- 102B IU requires 0.090 ampere (maximum) at 26 volts dc; 102A IU requires 0.110 ampere maximum at 26 volts dc.
- Data transmission capability (102B only when used in 604B or 604C panel with 75A control unit).

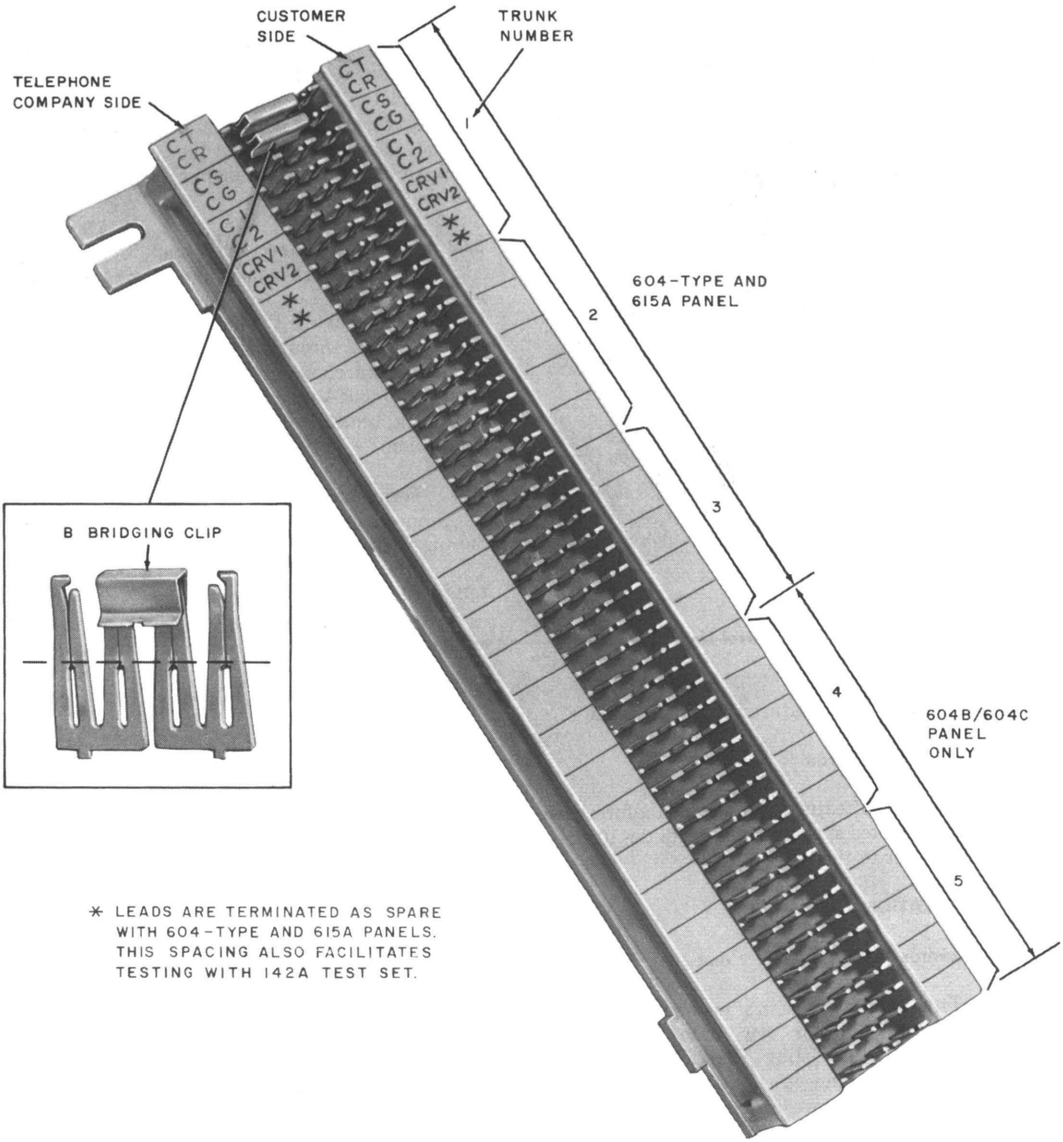


Fig. 6—66M1-50 Interface Connecting Block

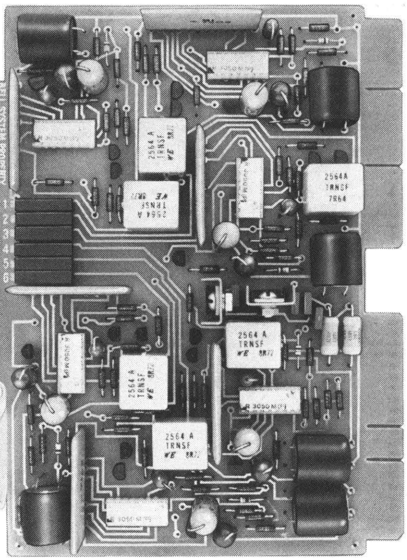


Fig. 7—75A Control Unit

- Operating temperature range 0°F to 120°F.

Associated Apparatus

- ▶For design features and detailed information on associated apparatus used with the 102-type IU, refer to the sections shown in 1.03.◀

3. INSTALLATION

69G Apparatus Mounting (Fig. 9 and 10)

3.01 ▶The 69G apparatus mounting is not recommended for new installations. To provide additions to existing installations, refer to Fig. 9 and 10 for connections required. Separate fusing and −24 volt power are provided locally.◀

604-Type Panel (Fig. 11, and Tables B, C, D, E, H, I, and J)

3.02 Mount the 604-type panel on a standard relay rack or in an ED-91180-72, Group 21, 18-plate equipment cabinet. Locate the panel within 18 ohms loop resistance (200 ft) of the CPE for the 102A IU and within 100 ohms loop resistance for the 102B IU. This cabinet will hold two 604A-type panels, three 604B or 604C panels, or two 604B or 604C panels with power units when the drawing holder on the lower half of the cover is removed. The relay rack or equipment cabinet should be grounded separately. Mount the 66M1-50 connecting block so as to facilitate testing between the block and the 604-type panel.

3.03 Electrical connection is made to the 604-type panel through connector cables. Arrangement of the KS-16671, List 1 plugs on the panel restricts the first plug for the CO lines to an A25B connector cable. Plugs 2 through 4 for the CPE are arranged to adapt to a choice of cable sizes (see Table A). Plug No. 5 (604A-type only) is dedicated to one-way incoming trunks only and is not used in this application.

3.04 Terminate connector cable No. 1 on a 66B4-25 intermediate connecting block for connecting the CO lines.

3.05 Terminate connector cables 2, 3, and 4 at customer end on the telephone company side of the 66M1-50 interface connecting blocks located within 25 feet of panel (stencil lead designation on fanning strip, Fig. 6).

> ***Note:*** C1 and C2 leads are required for PCA CD9 only. CRV1 and CRV2 leads are used with PCA CD8 when the customer orders toll diversion service on a trunk. It is recommended that space be reserved for these leads even though they may not be required for this particular installation.

3.06 When using separate power units, the customer must provide a separately fused (15 ampere) 105- to 130-volt 60-Hz outlet for each panel within reach of the power cords (see ORDERING GUIDE for cord lengths). The outlet should not be under control of a wall switch.

3.07 Connect power, either telephone company-provided power or CP dc power supplied through the KS-20944 protector, to rear of 604A1, 604B, or 604C panel as shown in Fig. 11 and Table H. Refer to appropriate section in Division 518 for proper grounding of power plants. Proper grounding of equipment and power unit is important to prevent damage from power line surges.

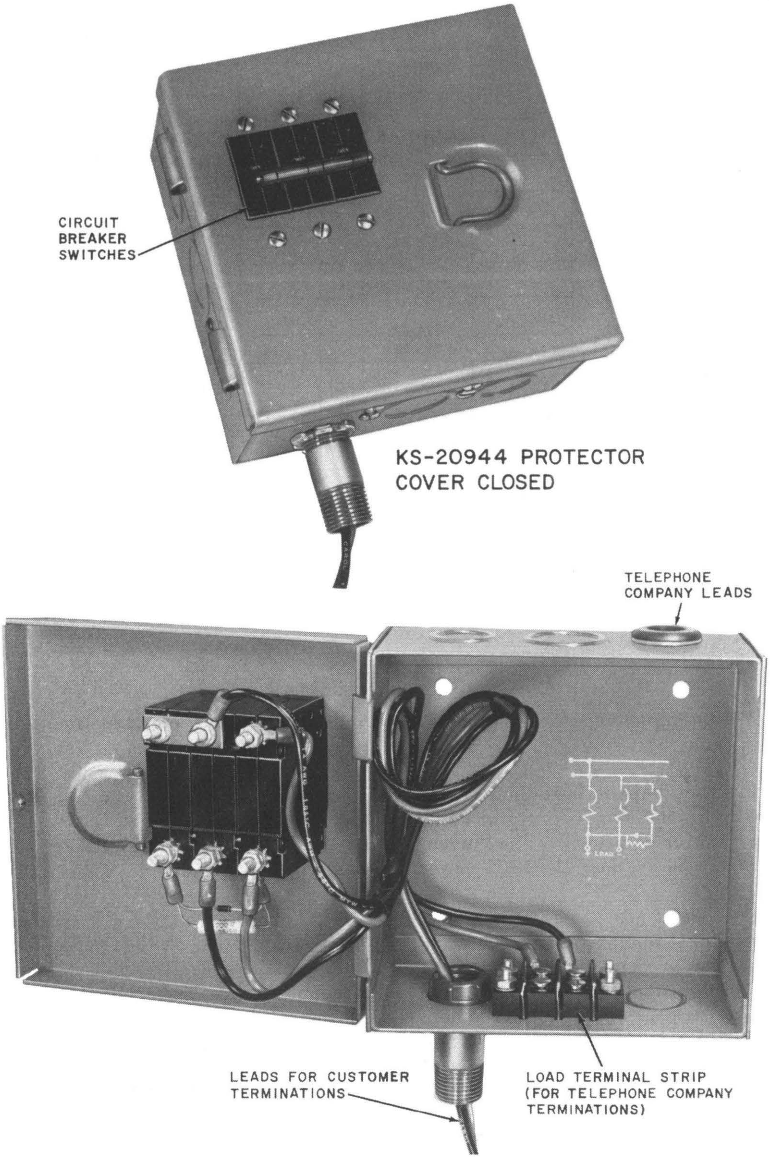


Fig. 8—KS-20944 Protector

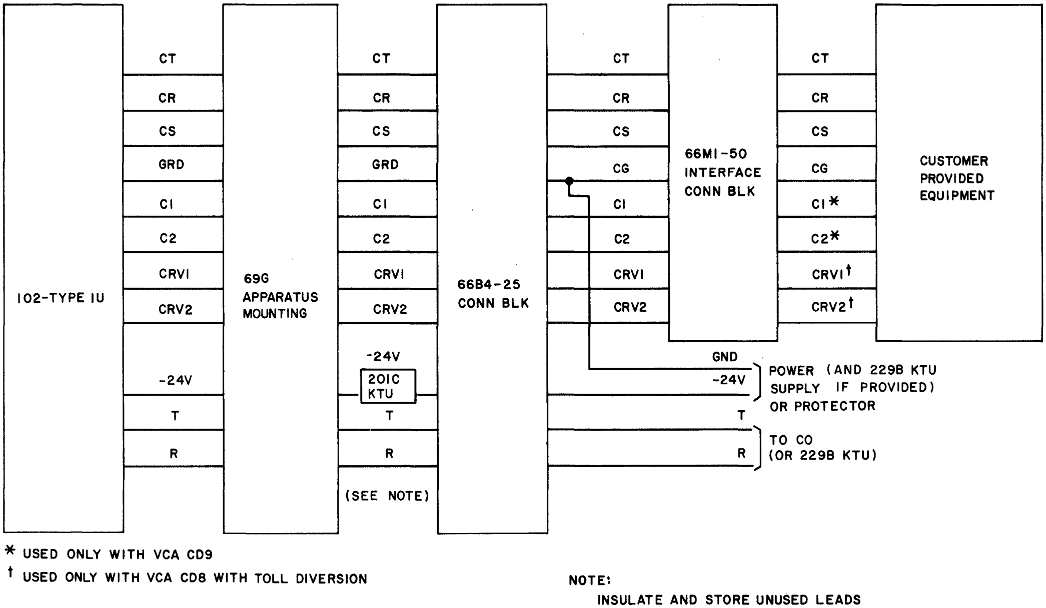


Fig. 9—Block Diagram—69G Apparatus Mounting With 102-Type Interconnecting Unit

3.08 When using the 604B or 604C panel with twelve 102B IUs and two 75A control units, use a 29C1 power unit or equivalent. The current drawn by these units will overload the 19C2 power unit.

3.09 ➧Position option straps on rear of 604B and 604C panels for proper supply voltage. If a 604C panel has been installed and supply voltage is −48V, a 21A apparatus unit must be added. Connect any of the R-BK leads to any of the −24V terminals. Connect any of the R leads to any of the −48V terminals.➧

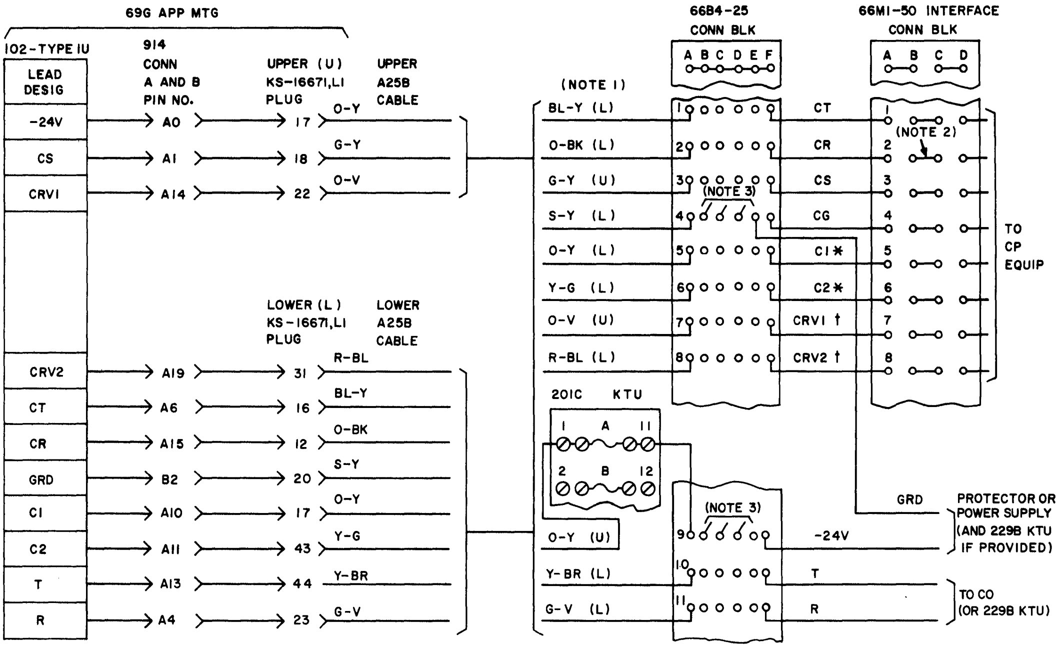
➧615A Panel (Fig. 12, and Tables F, G, H, and K)

3.10 Install the 615A panel on a 23-inch relay rack or in a 16C apparatus mounting using the 99B bracket. Remove the center mounting bar from the 16C apparatus mounting to avoid cover interference. The bracket holds up to three 615A panels. Each 615A panel holds three 102-type IUs. When less than three IUs are required, the sequence of installation of the required IUs should be the same as the designation assigned to the connectors (J1, J2, J3).

3.11 Connection of the CO lines is made to the 615A panel on a 66T1 connecting block as shown in Table F. The 24-volt power and ground terminations are also made on the 66T1 block as shown in Table H.

3.12 All other connections to the CPE are made to the 615A panel through a single A25B cable to an Amphenol plug on the panel as shown in Table G. Terminate the stub end of the A25B cable on the telephone company side of a 66M1-50 interface connecting block. Stencil lead designations on the fanning strip (Fig. 6).

3.13 Connect a frame ground wire to the 16C apparatus mounting on relay rack. Refer to the appropriate section in Division 518 for proper



NOTES:
1. INSULATE AND STORE SPARE LEADS
2. B BRIDGING CLIPS OR WIRE STRAPS
3. MULTIPLE TO OTHER CIRCUITS.

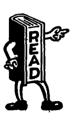
* USED ONLY WITH VCA CD9
† USED ONLY WITH VCA CD8 FOR TOLL DENIAL WHEN SERVING CO CAN PROVIDE

Fig. 10—Connection Diagram—69G Apparatus Mounting With 102-Type Interconnecting Unit

grounding. Proper grounding of equipment and power unit is important to prevent damage from power line surges.◀

102-Type Interconnecting Unit (Fig. 1, 13, or 14)

▶Caution: Do not use 102A IU in position 13 if 102B IU is used in position 1 or 4. Do not use 102A IU in position 14 if 102B IU is used in position 7 or 10.◀



To protect transistors and other electrical components of 102-type interconnecting units, remove fuses associated with that particular circuit before installing or replacing a unit. (See Table I, J, or K.)

3.14 Place proper option straps using 24-gauge bare wire for options W, Y, or Z from Fig. 13 or 14 for local conditions. Always use option Z for the 102A IU.

3.15 ▶For the 102B IU, provide option Y or Z as required. Option Y provides 600-ohm CPE to 600-ohm CO impedance matching. This option is factory provided on current production of 102B IUs. Option Z provides 600-ohm CPE to 900-ohm CO impedance matching. Option Z is required only when PBX-CO trunk facility is designed with terminating sets or 837-type impedance compensators that have 900-ohm input impedance.◀ ***Provide option W for CO loops greater than 800 ohms including CO resistance only.***

Note: The option designations are different for the 102A and 102B IUs.

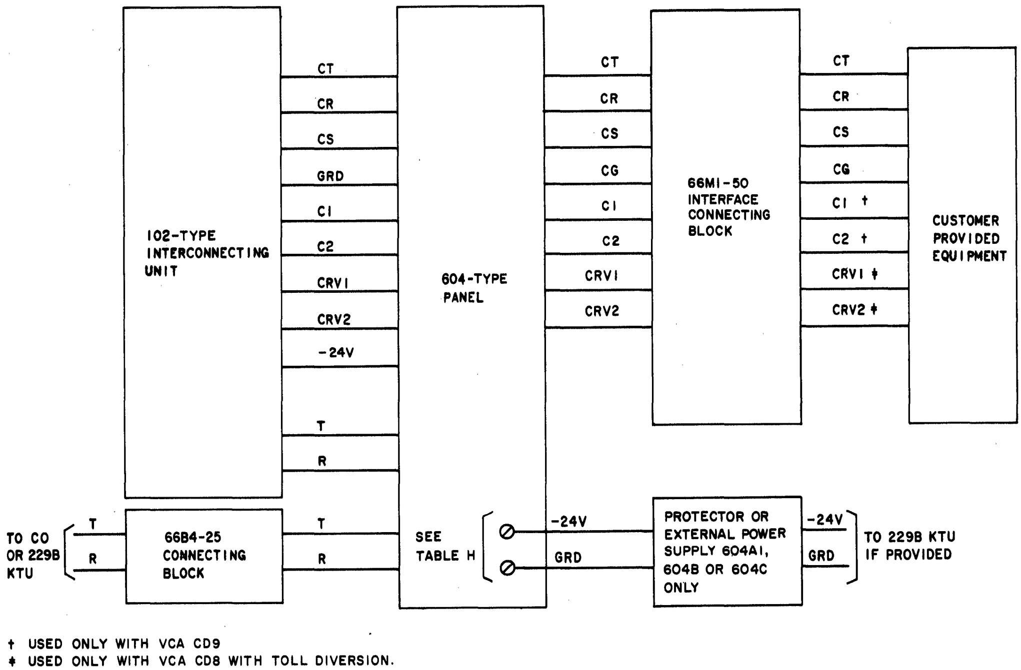


Fig. 11—Block Diagram—604-Type Panel With 102-Type Interconnecting Unit

Check that all option straps have been installed and check continuity of straps after installation.

3.16 When installing the 102-type IU, position the board in the guide grooves of the 69G apparatus mounting, 604-type or 615A panel, and slide in until the unit is properly seated in the connectors. The guide grooves prevent improper insertion of the 102-type IU.

> *Note:* The connectors in the 604-type and 615A panels are equipped with index clips to match the code slots in the 102B IU. When using 102A IUs, it will be necessary to pull out the clips between contacts 9 and 10 in the B connectors of 604-type panels.

3.17 Make certain card retainer or designation strip holder is properly positioned to hold the 102-type IUs in place.

3.18 Refer to Fig. 2 or 3 for installation sequence of 102-type IUs in the 604-type panel. On earlier production of the 604B panel, the position numbers were stamped on the designation strip. On current production of the 604B and on the 604C panel, the trunk number appears on the strip.

This suggested sequence is required to correspond to the KS-16671, List 1 plug wiring arrangement.

3.19 Perform tests shown in Part 5 after installation.

Power Failure Transfer (Fig. 15 or 16)

3.20 When power failure transfer with delayed restoral is required, the 229B KTU must be mounted externally and wired to the 69G apparatus mounting, 604-type or 615A panel, and selected telephone set as shown in Fig. 15 and Table L. Replace the D3BN mounting cord with a D4BJ

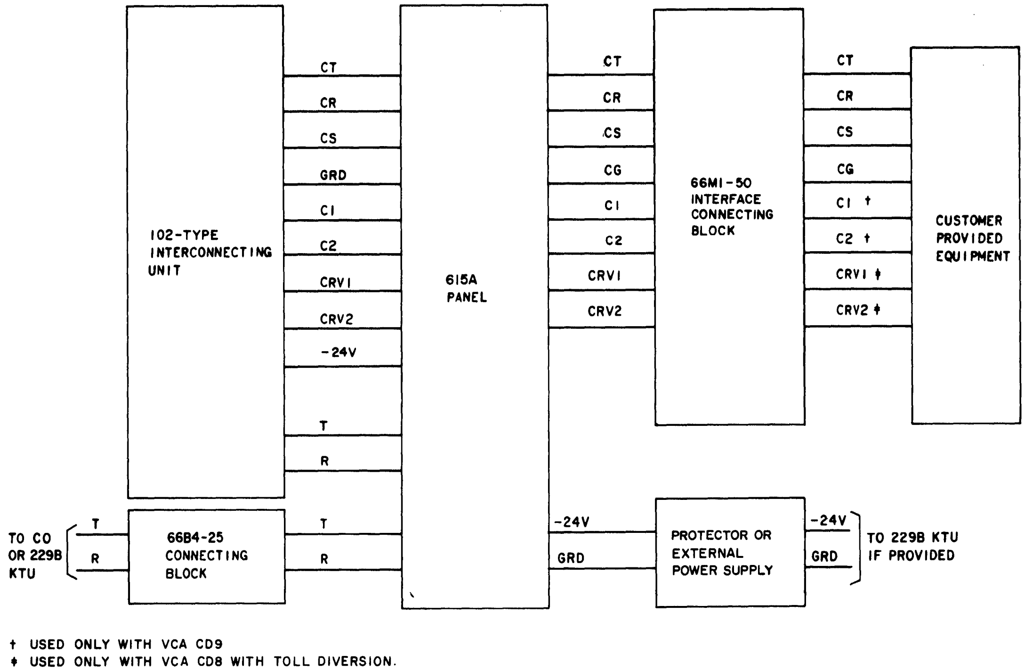


Fig. 12—♦Block Diagram—615A Panel With 102-Type Interconnecting Unit♦

mounting cord. If Z option (indicator lamp) is required, install per local practices.

3.21 When power failure transfer with immediate restoral is required, the 229B KTU must be mounted externally and wired to the 604-type or 615A panel and selected telephone set as shown in Fig. 16. No telephone set modification is required.

75A Control Unit

3.22 The 75A control unit is plugged into position 13 of the 604B or 604C panel to furnish ALC to IUs in position 1 through 6 or plugged into position 14 to furnish ALC for positions 7 through 12. Since the 604B and 604C panels are prewired for the 75A, all connections are made when it is plugged into the panel.

The electrical design of the 75A control unit protects it from voltage surges and it may be installed or removed without disturbing service to the associated IUs.

3.23 After installation, adjust the limiting level threshold by setting the six-level control potentiometers as shown in 5.04 of Section 463-300-112.

KS-20944 Protector (Fig. 17)

3.24 When voltage protection is required, the KS-20944 protector must be mounted externally and wired to the power supply terminals of the 69G apparatus mounting (Fig. 10), 604-type panel (Fig. 11), or 615A panel (Fig. 12). Refer to Section 463-300-109 for connections to multiple installations.

3.25 Connect as shown in Fig. 17 following local wiring instructions. The customer must connect his power supply to the red (GRD) and black (-V) 14-gauge (or 10-gauge) wires extending from the unit.

Warning: Voltage will be present on the number 1 (upper) terminals of circuit breakers when customer power is connected.

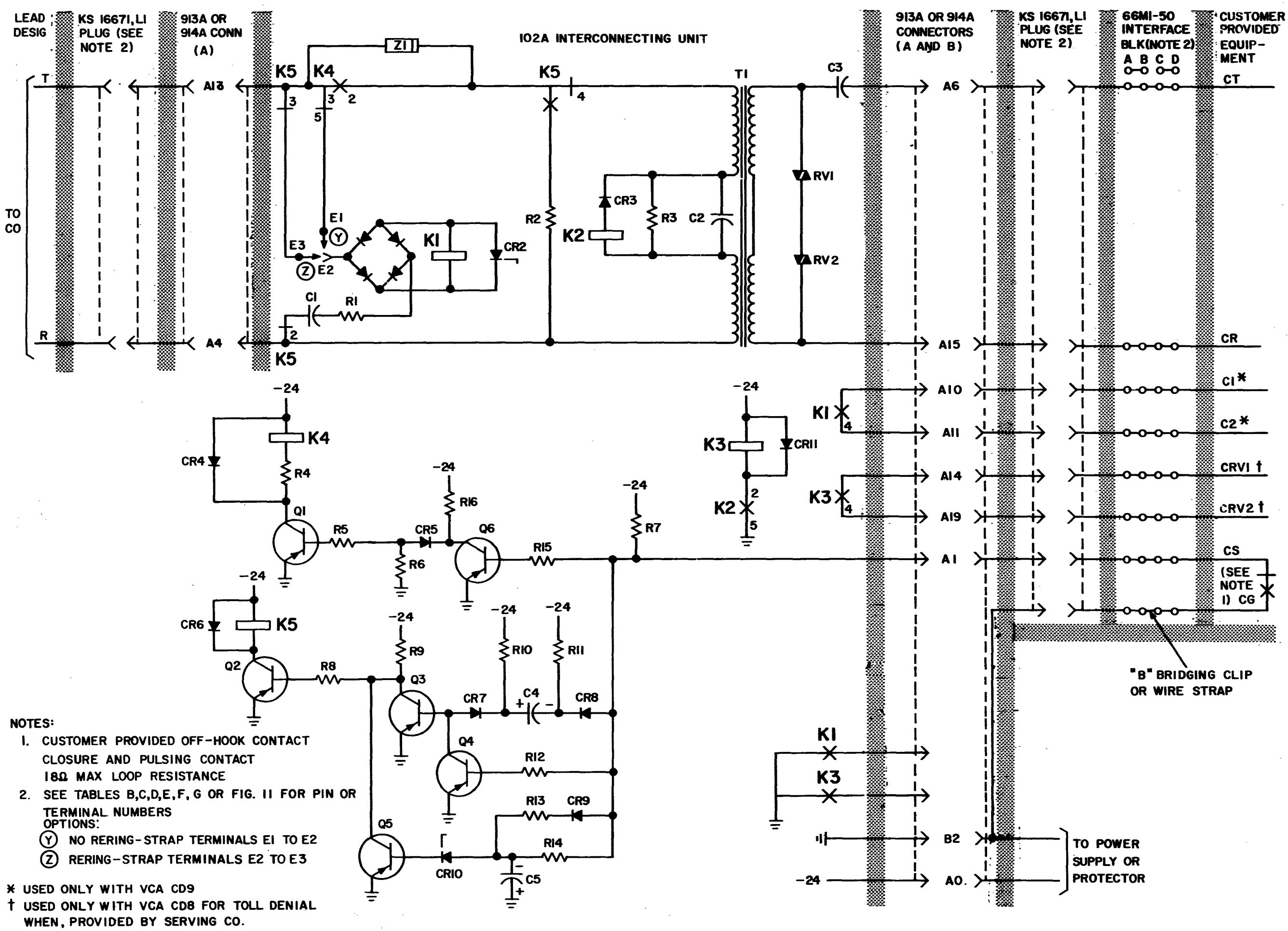
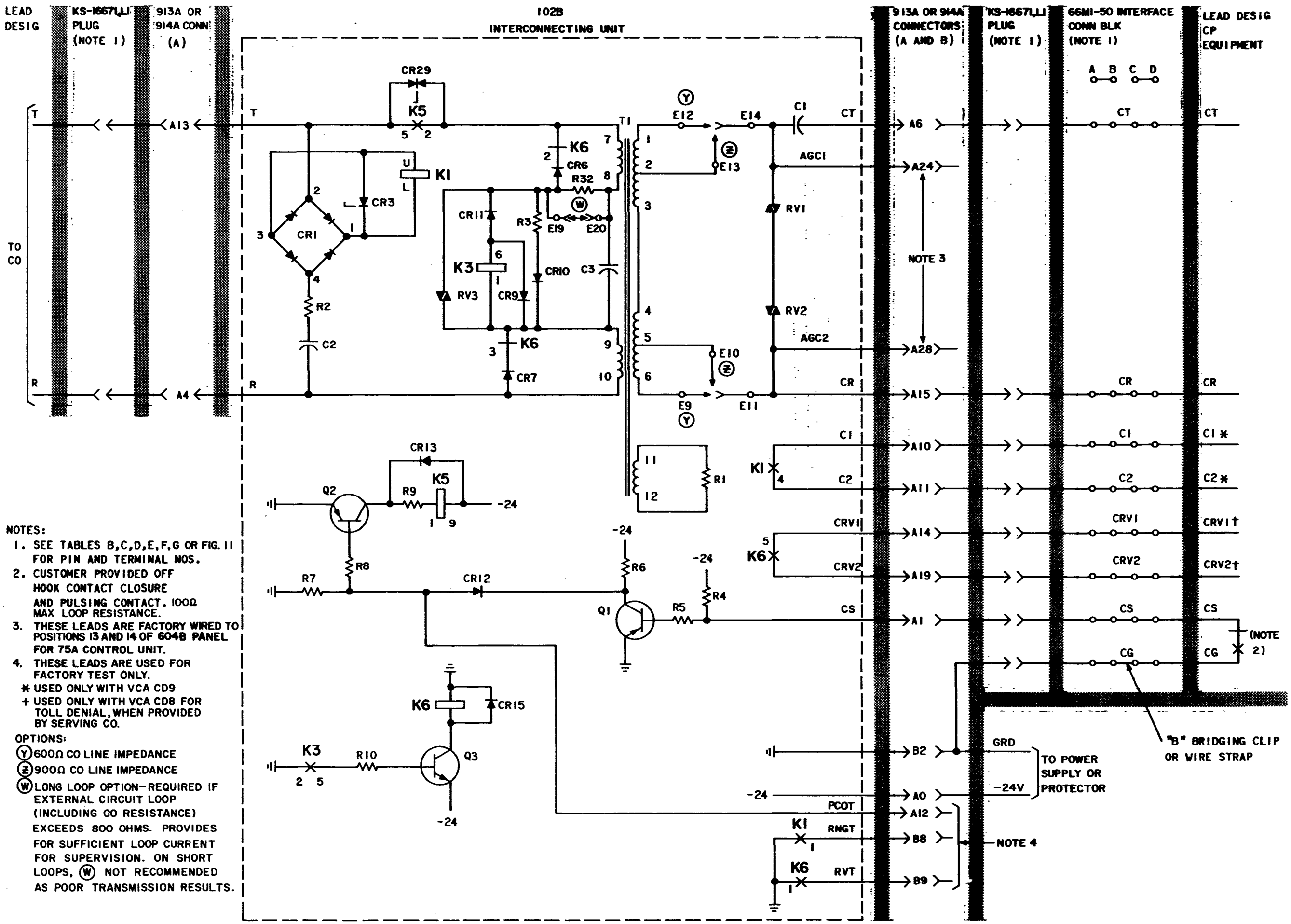


Fig. 13—Schematic—102A (MD) Interconnecting Unit



NOTES:
1. SEE TABLES B,C,D,E,F,G OR FIG. 11 FOR PIN AND TERMINAL NOS.
2. CUSTOMER PROVIDED OFF HOOK CONTACT CLOSURE AND PULSING CONTACT. 100Ω MAX LOOP RESISTANCE.
3. THESE LEADS ARE FACTORY WIRED TO POSITIONS 13 AND 14 OF 604B PANEL FOR 75A CONTROL UNIT.
4. THESE LEADS ARE USED FOR FACTORY TEST ONLY.

* USED ONLY WITH VCA CD9
† USED ONLY WITH VCA CD8 FOR TOLL DENIAL, WHEN PROVIDED BY SERVING CO.

OPTIONS:
(Y) 600Ω CO LINE IMPEDANCE
(Z) 900Ω CO LINE IMPEDANCE
(W) LONG LOOP OPTION—REQUIRED IF EXTERNAL CIRCUIT LOOP (INCLUDING CO RESISTANCE) EXCEEDS 800 OHMS. PROVIDES FOR SUFFICIENT LOOP CURRENT FOR SUPERVISION. ON SHORT LOOPS, (W) NOT RECOMMENDED AS POOR TRANSMISSION RESULTS.

Fig. 14—Schematic—102B Interconnecting Unit

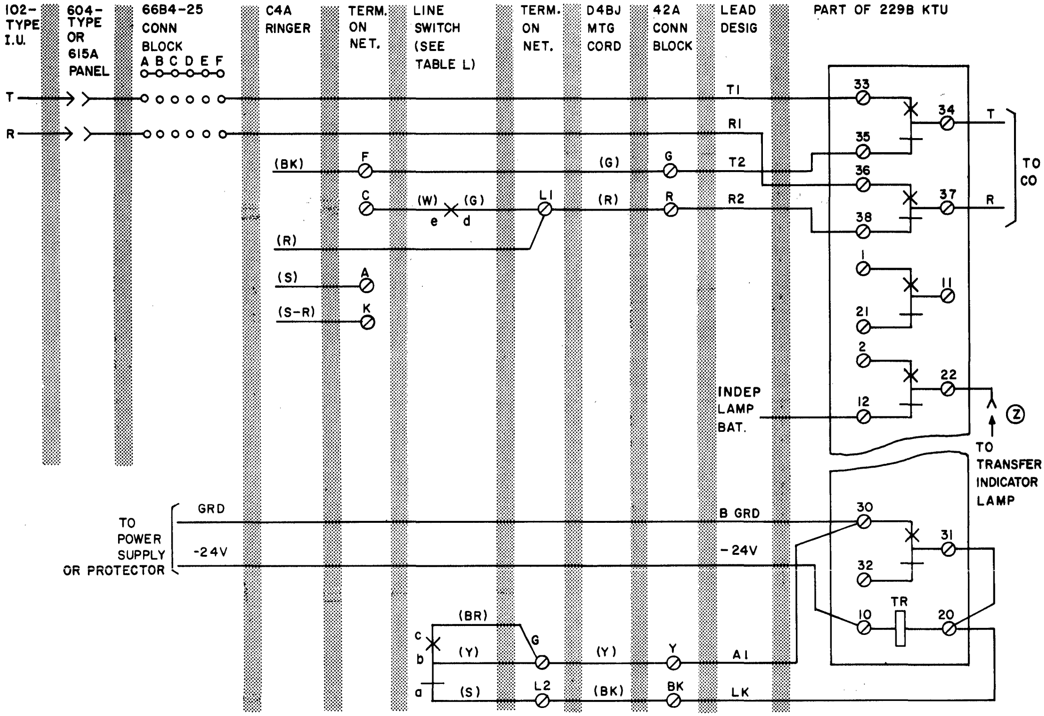
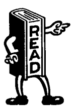


Fig. 15—Power Failure Transfer Circuit (Delayed Restoral)



Check for correct polarity and ground before closing circuit breaker.

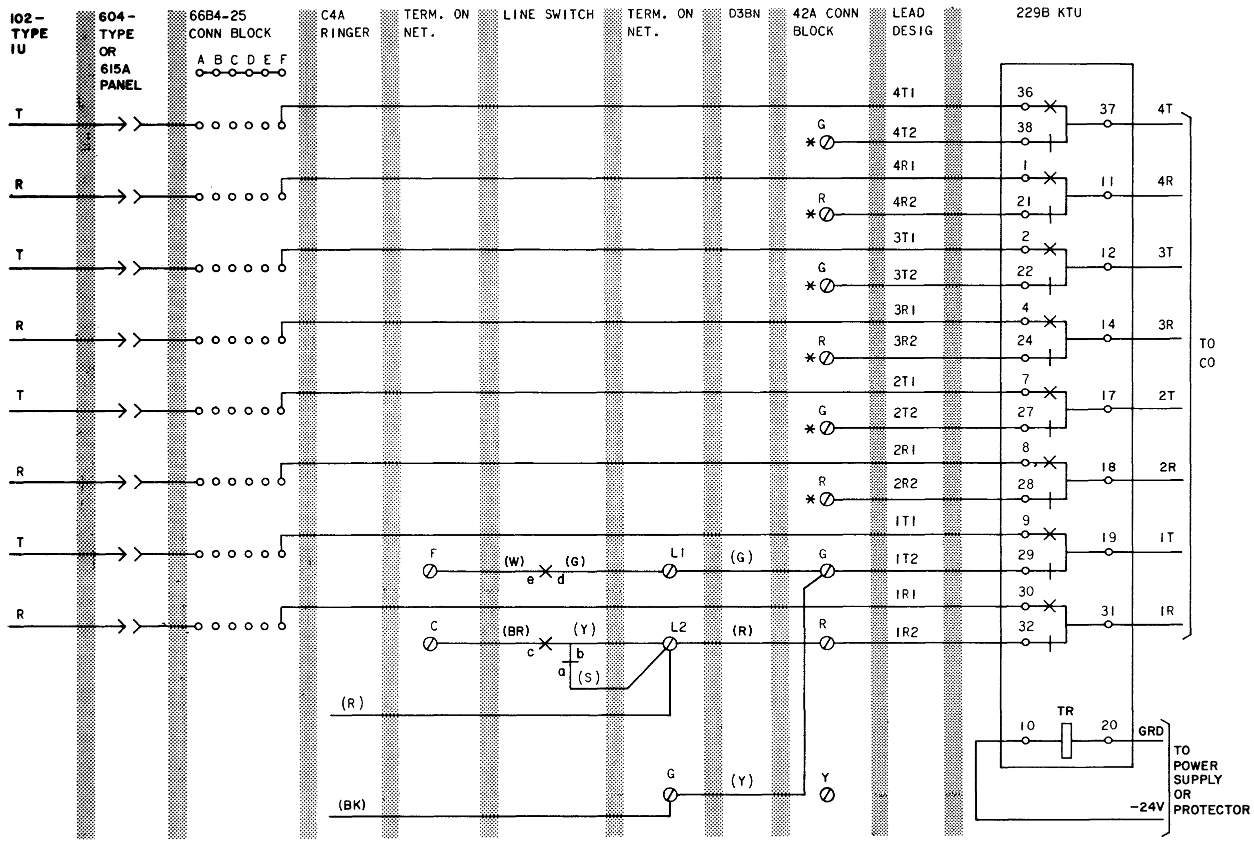
4. OPERATION

A. 102A Interconnecting Unit (Fig. 13)

4.01 *Incoming Call (CD9 only):* When the CO seizes this circuit on an incoming call, ringing current is applied across the tip and ring. K1 relay in the ringing bridge operates and provides a contact closure on the C1 and C2 leads to the CPE which opens and closes in unison with the ringing cycle. When the customer answers, the CPE provides a contact closure to ground the CS lead operating K4 relay. Operated K4 relay trips the CO ringing and establishes a talking path.

4.02 *Outgoing Call (CD7, CD8 and CD9):* When the CPE provides a contact closure to leads CS and CG, K4 relay operates. Operated K4 relay closes the loop toward the CO (and removes the ringing bridge in 2-way loop manual service). The CO recognizes the loop closure and returns dial tone to the CPE. When the customer dials, ground on the CS lead is interrupted. The first time the dial contacts break, K5 relay operates and opens the talking path. K4 relay repeats the dial pulses to the CO. K5 relay releases after each digit and, after completion of dialing, restores the talking path.

4.03 *Toll Denial:* If a battery reversal is returned from the CO on the tip and ring, K2 relay will operate, operating K3 relay. Operated K3 relay provides a contact closure on leads CRV1



NOTE:

CONNECTIONS SHOWN ARE FOR 500C/D TEL SET, FOR 554A/B TEL SET, CONNECT TIP TO L1, RING TO L2, OF NETWORK. (Y) LEAD NOT NEEDED.

* TO BELL SYSTEM TEL SETS ASSOCIATED WITH 2ND, 3RD, AND 4TH LINES

Fig. 16—Power Failure Transfer Circuit (Immediate Restoral)

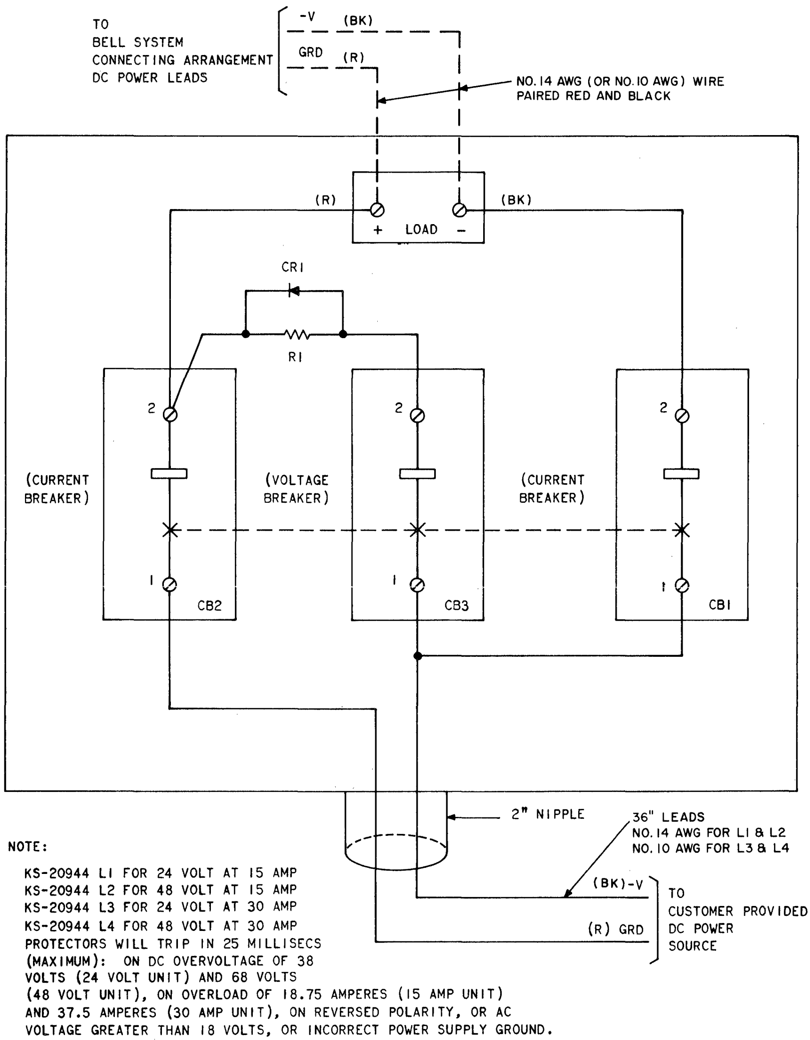


Fig. 17—Schematic—KS-20944 Protector

and CRV2 (normally used for toll diverting, if provided in the CO and ordered by the customer).

4.04 ***Disconnect:*** When the CPE goes on-hook, ground is removed from the CS lead releasing K4 relay. When K4 relay releases, it opens the loop toward the CO (and reconnects the ringing bridge across the tip and ring in the 2-way loop manual service).

B. 102B Interconnecting Unit (Fig. 14)

4.05 ***Incoming Call (CD9 only):*** When the CO seizes this circuit on an incoming call, ringing current is applied across the tip and ring. K1 relay in the ringing bridge operates and provides a contact closure on the C1 and C2 leads to the CPE which closes during ringing and opens during silent period in unison with the ringing cycle. When the customer goes off-hook to answer the call, the CPE provides a contact closure across CS and CG leads to ground the CS lead operating K5 relay. K5 relay operated closes the loop to the CO to trip the CO ringing and cut through the transmission path to the CT and CR leads.

4.06 ***Outgoing Call (CD7, CD8, and CD9):*** When this circuit is seized for an outgoing call, the CPE provides a contact closure across leads CS and CG causing K5 relay to operate. K5 relay operated closes the loop toward the CO and cuts through the transmission path. The CO recognizes the loop closure and returns dial tone to the CPE. When the customer rotary dials, the CS and CG leads are opened and closed to release and operate the K5 relay which repeats the dial pulses to the CO. When the customer uses ***tone address signaling,*** the CPE provides a contact closure across CS and CG. K5 relay operates and dial tone is returned to CT and CR, and the customer may dial over the CT and CR leads.

4.07 ***Toll Denial:*** If a battery reversal is returned from the CO on the tip and ring to indicate that the outgoing call is a toll call, K3 relay will operate, operating K6 relay. K6 relay operated provides a contact closure on leads CRV1 and CRV2 to indicate that the CO has reversed battery. When normal battery supervision is restored, the K3 and K6 relays release.

4.08 ***Disconnect:*** When the CPE goes on-hook, leads CS and CG are opened removing ground from the CS lead releasing K5 relay. When K5 relay releases, it opens the loop toward the CO and opens the transmission path. In approximately 500 milliseconds after the closure is removed from the CS and CG leads, the circuit can be reseized. The exact reseizure time depends on the CO.

C. Power Failure Transfer (Delayed Restoral, Fig. 15)

4.09 Under normal conditions, CO tip and ring are connected through the operated contacts of the 229B KTU to the IU associated with the CPE. The 229B KTU is held operated through its own contact to local power supply. The telephone company-provided power failure station is inoperative at this time. Should local power fail, the 229B KTU releases, and CO tip and ring are transferred to the station. This transfer is indicated by a lamp (if desired) powered independently. After power is restored, the 229B KTU will be reoperated by ground obtained through the line switch of the station, only after the station is on-hook or the first time it goes on-hook, returning the circuit to normal. Calls in progress when local power is restored will not be interrupted as there is no operate path for the 229B KTU when the station is off-hook.

4.10 Z option provides a visual indication only when the CO line is connected to the power failure telephone set and an off-hook condition exists when local power is restored. The power failure indicator lamp is lighted through the break contact of the power failure transfer (TR) relay. The lamp functions only when the TR relay is released and power is restored. It becomes inoperative with the operation of the TR relay.

D. Power Failure Transfer (Immediate Restoral, Fig. 16)

4.11 Under normal conditions, CO tip and ring are connected through the operated contacts of the 229B KTU to the 102-type IU associated with the CPE. The 229B KTU is held operated through battery and ground connected directly to the winding of the TR relay. The telephone company-provided power failure station is inoperative at this time. Should local power fail, the 229B KTU releases, and CO tip and ring are transferred to the station. Calls in progress will be interrupted, but new calls can be placed or answered in the normal manner. When power is restored, the 229B KTU will reoperate, returning the circuit to normal immediately. Calls in progress will be interrupted when power is restored. No visual indication is provided.

E. 75A Control Unit

4.12 The 75A control unit consists of six identical ALC circuits, each connected to the transmission circuitry of an IU to protect telephone company equipment against excessive signal power. This protection is required when using voice-type IUs for data transmission. (See Section 463-300-112 for a complete description.)

4.13 The ALC circuit monitors the CP data/voice voltages applied to tip and ring of the IU. If the power exceeds a preset level, the ALC circuit will present a resistance shunt across the input to the IU to linearly attenuate the signal to the preset value.

4.14 The level adjusting potentiometers R1 through R6 are set as described in Section 463-300-312 to limit the customer signals at a level determined by the amount of trunk loss and impedance.

F. KS-20944 Protector (Fig. 17)

4.15 When the CPE dc power supply is used to operate the telephone company equipment, power protection is required. The KS-20944 protector is used to protect the telephone company personnel from hazardous voltages but may not protect equipment from component failures. Separate fuses are required for the 102-type IUs. The breakers of the KS-20944 protector provide a switch to disconnect CP dc power when working on interconnecting circuits. (See Section 463-300-109 for a complete description.)

4.16 The KS-20944 protector consists of a dc voltage-operated circuit breaker in series with a parallel resistor-diode combination connected across the line and two dc current-operated circuit breakers connected in each side of the line. The contacts on each breaker are connected in series with the coil of that breaker, and all three breakers are mechanically interlocked externally by a tie bar and internally by a tripper bar. When any breaker is operated, all breakers will open. The circuit breakers must be manually reset by the customer after tripping. The breakers are of the trip free type so that the contacts cannot be closed by holding the lever to the ON position if the fault is still on the line.

4.17 The KS-20944 protector is designed to trip in 25 milliseconds (maximum) on dc overvoltage, current overload, reversed polarity, or ac greater than 18 volts, and on incorrect power supply ground.

5. MAINTENANCE

5.01 When trouble is reported, check for blown fuses, loose or broken connections and check the CO lines. Perform a test of the 102-type IU.

A. Using 1013A Hand Test Set and 81A Test Set

5.02 Prepare the circuit under test as follows:

(a) Open the eight leads to the circuit under test by removing B bridging clips (or wire straps) at the 66M1-50 interface connecting block.

(b) Supply talk battery by connecting a 500-ohm resistor from the −24 volt supply to terminal CR and connect a ground strap from CG to terminal CT. (Make all connections on the telephone company side of the interface connecting block.) A 2A KTU or 31A KTU may be used for battery feed instead of the 500-ohm resistor. Refer to Section 518-112-421 for connections to KTUs.

(c) Connect a 1013A (or equivalent) hand test set across terminals CT and CR. Prepare a strap to be used to connect terminals CS and CG when required.

(d) Connect an 81A or KS-16990, List 1 test set across terminals C1 and C2 to indicate continuity (ringing).

5.03 Perform the following tests:

(a) ***Incoming Call (CD9 only):*** Have the test desk call the number associated with the 102-type IU under test. When ringing is indicated by the test set across terminals C1 and C2, answer the call by strapping terminals CS and CG together. K5 relay should operate cutting through the transmission path. Verify transmission and remove the strap from terminals CS and CG and disconnect the test set from terminals C1 and C2.

(b) ***Outgoing Call—Rotary Dial (CD9, CD8, CD7):*** Connect the blue and green (or blue) leads of a 9C or 9CA dial across terminals CS and CG for dialing. Dial tone will be heard on the hand test set connected to terminals CT and CR. Connect the 81A or KS-16990, List 1 test set across terminals CRV1 and CRV2 (if used) to indicate continuity (battery reversal). Dial the test desk number using the 9C or 9CA dial connected across terminals CS and CG. If the office is arranged for toll diversion, have the test desk reverse battery. The test set connected across terminals CRV1 and CRV2 will show continuity for the duration of the reversal.

Disconnect by removing the 9C or 9CA dial from terminals CS and CG. The transmission path to leads CT and CR will open.

(c) ***Outgoing Call—Tone Address Signaling (if office is arranged for TOUCH-TONE® dialing) (CD9, CD8, CD7):*** Connect the 81A (or equivalent) test set across terminals CRV1 and CRV2. Connect the mounting cord leads of a 2500D (or equivalent) station set using 161A adapters across terminals CT (green and yellow) and CR (red) for dialing. Connect a strap from terminals CS to CG. Dial tone will now be heard on the 2500D (or equivalent) station set. Dial the test desk number using the 2500D; if the office is arranged for toll diversion, have the test desk reverse battery and verify that the 81A (or equivalent) test set connected across terminals CRV1 and CRV2 will show continuity for the duration of the reversal. Disconnect by removing the strap from terminals CS and CG. The transmission path to CT and CR will open.

B. ➧Using the 142A Test Set (Fig. 18)

5.04 Prepare the circuit under test as follows:

(a) Disconnect the CPE by removing the B bridging clips or wire straps at the interface block.

(b) Connect the test set interface cord to the terminals on the telephone company side of the block. The cord required is determined by the type of block provided to terminate the interface.

(c) Connect the leads from the 2-conductor power cord to −24 volts and ground. This voltage should be obtained from the same source used to power the IU under test. The PWR lamp on the test set should light.

(d) Connect a 1013A hand test set to the HNDST terminals on the test set. Set the MON-TALK switch on the hand test set to MON position.

(e) On the 142A test set, set the CS-CG LOOP switch to the 100-ohm position.

5.05 Perform the following tests:

PCA CD7, CD8, or CD9

(1) Operate switch on 1013A hand test set to the TALK position. The S relay in the 142A test set will operate lighting the CS lamp and providing a ground path on the CG lead through the 100-ohm resistor on the CS-CG LOOP switch. Ground on the CS lead causes relay K5 in the IU to operate and seize the CO trunk as indicated by dial tone being heard in the hand test set.

> ***Note:*** If the IU fails to seize the CO trunk, move the CS-CG LOOP switch to the 18 position. If the IU now operates properly, it is considered marginal. The IU circuits that operate only on the 0 position should be replaced.

(2) Dial the local test desk using the 1013A hand test set. The S relay and the CS lamp of the test set should follow the dial pulses. When the test desk answers, the trunk should be cut through and satisfactory transmission may be judged using the hand test set.

CD7 Only

(3) Have the test desk release the trunk under test.

CD8 Only

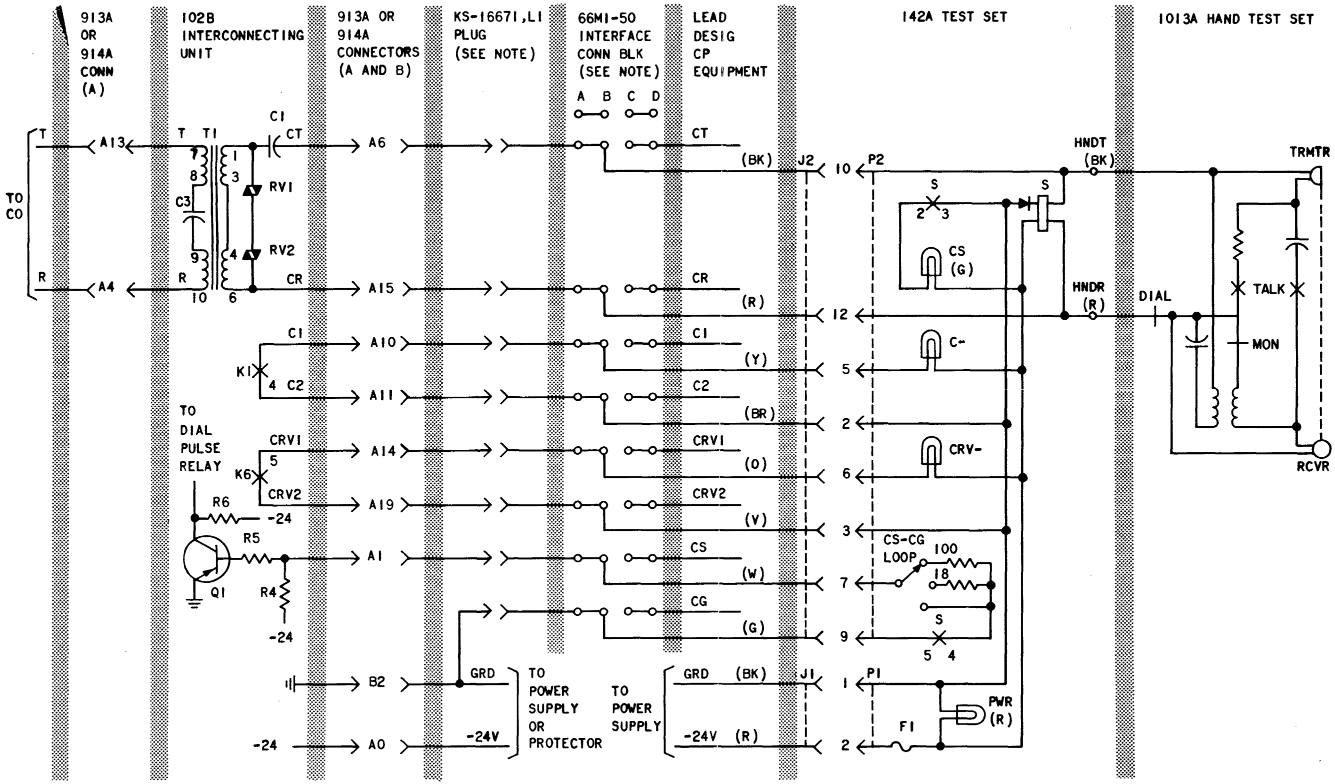
(4) If toll denial is provided, have the test desk reverse line polarity. The CRV- lamp should light and remain lighted for the duration of the reversal.

(5) Have the test desk release the trunk under test.

CD9 Only

(6) Request the test desk to call back on the trunk under test.

(7) Operate the hand test set switch to MON position. The CS lamp should be extinguished indicating the S relay in the 142A test set has released. The S relay in the IU should also release causing the IU to release the CO trunk.



NOTE:
FOR PIN OR TERMINAL NUMBER,
SEE APPLICABLE TABLE IN PART 6.

Fig. 18—Testing 102B Interconnecting Unit With 142A Test Set

(8) When the trunk is seized on the return call from the test desk and ringing is applied to the trunk, the C- lamp lights and follows the ringing cycle.

(9) Operate the hand test set switch to TALK. The C- lamp should extinguish and the CS lamp light indicating ringing has been tripped and the call answered. The trunk should now be cut through the IU and satisfactory transmission may be judged by using the hand test set.

(10) Have the test desk release the trunk.

5.06 When all testing is complete, remove power and interface cords. Connect the CPE by restoring B bridging clips or wire straps at interface connecting block.

Never replace an interconnecting unit without first removing the fuse for that particular circuit. See the applicable table in Part 6.

5.07 When trouble is suspected in the 102-type IU, exchange it with another unit known to be functioning properly. Tag and place the defective IU in blister pack and return it for repair.◆

Do not attempt any tests or repairs to the customer-provided equipment.

5.08 When in the repairman's judgment the trouble is located in the CPE, the Repair Service Bureau should be notified so that proper maintenance of service charge billing can be initiated as outlined in BSP 660-101-312 entitled Maintenance of Service Charge on Service With Customer-Provided Equipment (CPE).

6. CONNECTIONS

6.01 For connection information using the 69G apparatus mounting, refer to Fig. 9 and 10.

6.02 For connection information using the 604A-type panel, refer to Fig. 2, 6, and 11, and Tables A, B, C, D, E, and H.

6.03 For connection information using the 604B or 604C panel, refer to Fig. 3, 4, 6, and 11, and Tables A, B, C, D, E, and H.

6.04 ◆For connection information using the 615A panel, refer to Fig. 5, 6, and 12, and Tables F, G, and H.◆

6.05 For connection information using the power failure transfer circuit with delayed restoral, refer to Fig. 15 and Table L. Replace the D3BN mounting cord of the 500C/D telephone set with a D4BJ cord.

6.06 For connection information using the power failure transfer circuit with immediate restoral, refer to Fig. 16.

6.07 All necessary connections are provided by the internal wiring of the 604B and 604C panels when a 75A control unit is plugged into position 13 or 14.

6.08 For connection information using the KS-20944 protector, refer to Fig. 17. For connections to multiple installations, refer to Section 463-300-109.

TABLE A

OPTIONAL CABLE ARRANGEMENTS TO PROVIDE CONNECTIONS FOR FOUR PLUGS ON 604-TYPE PANEL

CABLE DESIGNATION (NOTE)	MAXIMUM NO. OF CABLES REQUIRED		
	ARRANGEMENTS (SEE 3.03)		
	Arrangement 1	Arrangement 2	Arrangement 3
A25B	1	4	2
A50B			1
A75A	1		

Note: Arrangement of interconnecting units and local requirements will determine the size and maximum length of cable required. Plug No. 5 on 604A-type panel not used in this application.

TABLE B

CONNECTIONS FOR PLUG NO. 1 – 604-TYPE PANEL

TRUNK NO.	LEAD DESIG*	CONN PIN NO.	A25B CONN CABLE COLOR	66B4-25 CONN BLK ROW NO.	POS. IN 604-TYPE PANEL
1	T	26	W-BL	1	1
	R	1	BL-W	2	
2	T	27	W-O	3	2
	R	2	O-W	4	
3	T	28	W-G	5	4
	R	3	G-W	6	
4	T	29	W-BR	7	5
	R	4	BR-W	8	
5	T	30	W-S	9	7
	R	5	S-W	10	
6	T	31	R-BL	11	8
	R	6	BL-R	12	
7	T	32	R-O	13	10
	R	7	O-R	14	
8	T	33	R-G	15	11
	R	8	G-R	16	
9	T	34	R-BR	17	13†
	R	9	BR-R	18	
10	T	35	R-S	19	3
	R	10	S-R	20	
11	T	36	BK-BL	21	6
	R	11	BL-BK	22	
12	T	37	BK-O	23	9
	R	12	O-BK	24	
13	T	38	BK-G	25	12
	R	13	G-BK	26	
14	T	39	BK-BR	27	14†
	R	14	BR-BK	28	
SPARE	SPARE	40	BK-S	29	
		15	S-BK	30	
		41	Y-BL	31	
		16	BL-Y	32	
		42	Y-O	33	
		17	O-Y	34	
		43	Y-G	35	
		18	G-Y	36	
		44	Y-BR	37	
		19	BR-Y	38	
		45	Y-S	39	
		20	S-Y	40	
		46	V-BL	41	
		21	BL-V	42	
		47	V-O	43	
		22	O-V	44	
		48	V-G	45	
		23	G-V	46	
		49	V-BR	47	
		24	BR-V	48	
		50	V-S	49	
		25	S-V	50	

* Stencil lead designations on fanning strip.

† Cannot be used if position is occupied by 75A control unit.

TABLE C

CONNECTIONS FOR PLUG NO. 2 – 604-TYPE PANEL

TRUNK NO.	LEAD DESIG*	CONN PIN NO.	CONN CABLE COLOR	66M1-50 INTERFACE CONN BLK 1 ROW NO.	POS. IN 604-TYPE PANEL
1	CT	26	W-BL	1	1§
	CR	1	BL-W	2	
	CS	27	W-O	3	
	CG	2	O-W	4	
	C1†	28	W-G	5	
	C2†	3	G-W	6	
	CRV1‡	29	W-BR	7	
	CRV2‡	4	BR-W	8	
		30	W-S	9	
		5	S-W	10	
2	CT	31	R-BL	11	2§
	CR	6	BL-R	12	
	CS	32	R-O	13	
	CG	7	O-R	14	
	C1†	33	R-G	15	
	C2†	8	G-R	16	
	CRV1‡	34	R-BR	17	
	CRV2‡	9	BR-R	18	
		35	R-S	19	
		10	S-R	20	
3	CT	36	BK-BL	21	4§
	CR	11	BL-BK	22	
	CS	37	BK-O	23	
	CG	12	O-BK	24	
	C1†	38	BK-G	25	
	C2†	13	G-BK	26	
	CRV1‡	39	BK-BR	27	
	CRV2‡	14	BR-BK	28	
		40	BK-S	29	
		15	S-BK	30	
4	CT	41	Y-BL	31	5§
	CR	16	BL-Y	32	
	CS	42	Y-O	33	
	CG	17	O-Y	34	
	C1†	43	Y-G	35	
	C2†	18	G-Y	36	
	CRV1‡	44	Y-BR	37	
	CRV2‡	19	BR-Y	38	
		45	Y-S	39	
		20	S-Y	40	
5	CT	46	V-BL	41	7¶
	CR	21	BL-V	42	
	CS	47	V-O	43	
	CG	22	O-V	44	
	C1†	48	V-G	45	
	C2†	23	G-V	46	
	CRV1‡	49	V-BR	47	
	CRV2‡	24	BR-V	48	
		50	V-S	49	
		25	S-V	50	

* Stencil lead designations on fanning strip.
† Used only with VCA CD9.
‡ Used only with VCA CD8 for toll denial when provided by serving CO.
§ Associated with 75A control unit in position 13.
¶ Associated with 75A control unit in position 14.

TABLE D

CONNECTIONS FOR PLUG NO. 3 – 604-TYPE PANEL

TRUNK NO.	LEAD DESIG*	CONN PIN NO.	CONN CABLE COLOR	66M1-50 INTERFACE CONN BLK 2 ROW NO.	POS. IN 604-TYPE PANEL
6	CT	26	W-BL	1	8**
	CR	1	BL-W	2	
	CS	27	W-O	3	
	CG	2	O-W	4	
	C1†	28	W-G	5	
	C2†	3	G-W	6	
	CRV1‡	29	W-BR	7	
	CRV2‡	4	BR-W	8	
		30	W-S	9	
		5	S-W	10	
7	CT	31	R-BL	11	10**
	CR	6	BL-R	12	
	CS	32	R-O	13	
	CG	7	O-R	14	
	C1†	33	R-G	15	
	C2†	8	G-R	16	
	CRV1‡	34	R-BR	17	
	CRV2‡	9	BR-R	18	
		35	R-S	19	
		10	S-R	20	
8	CT	36	BK-BL	21	11**
	CR	11	BL-BK	22	
	CS	37	BK-0	23	
	CG	12	O-BK	24	
	C1†	38	BK-G	25	
	C2†	13	G-BK	26	
	CRV1‡	39	BK-BR	27	
	CRV2‡	14	BR-BK	28	
		40	BK-S	29	
		15	S-BK	30	
9¶	CT	41	Y-BL	31	13
	CR	16	BL-Y	32	
	CS	42	Y-O	33	
	CG	17	O-Y	34	
	C1†	43	Y-G	35	
	C2†	18	G-Y	36	
	CRV1‡	44	Y-BR	37	
	CRV2‡	19	BR-Y	38	
		45	Y-S	39	
		20	S-Y	40	
SPARE	SPARE	46	V-BL	41	
		21	BL-V	42	
		47	V-O	43	
		22	O-V	44	
		48	V-G	45	
		23	G-V	46	
–24V	FAL1§	49	V-BR	47	F2(FA)
GRD	G1§	24	BR-V	48	TS1(15)
–48V	FAL2§	50	V-S	49	F16(FA)
GRD	G2§	25	S-V	50	TS1(16)

* Stencil lead designations on fanning strip.
† Used only with VCA CD9.
‡ Used only with VCA CD8 for toll denial when provided by serving CO.
§ Optional attendant alarm indicator on 604B panel only.
¶ Cannot be used if position is occupied by 75A control unit.
** Associated with 75A control unit in position 14.

TABLE E

CONNECTIONS FOR PLUG NO. 4 – 604-TYPE PANEL

TRUNK NO.	LEAD DESIG*	CONN PIN NO.	CONN CABLE COLOR	66M1-50 INTERFACE CONN BLK 3 ROW NO.	POS. IN 604-TYPE PANEL
10	CT	26	W-BL	1	3¶
	CR	1	BL-W	2	
	CS	27	W-O	3	
	CG	2	O-W	4	
	C1†	28	W-G	5	
	C2†	3	G-W	6	
	CRV1‡	29	W-BR	7	
	CRV2‡	4	BR-W	8	
		30	W-S	9	
		5	S-W	10	
11	CT	31	R-BL	11	6¶
	CR	6	BL-R	12	
	CS	32	R-O	13	
	CG	7	O-R	14	
	C1†	33	R-G	15	
	C2†	8	G-R	16	
	CRV1‡	34	R-BR	17	
	CRV2‡	9	BR-R	18	
		35	R-S	19	
		10	S-R	20	
12	CT	36	BK-BL	21	9**
	CR	11	BL-BK	22	
	CS	37	BK-O	23	
	CG	12	O-BK	24	
	C1†	38	BK-G	25	
	C2†	13	G-BK	26	
	CRV1‡	39	BK-BR	27	
	CRV2‡	14	BR-BK	28	
		40	BK-S	29	
		15	S-BK	30	
13	CT	41	Y-BL	31	12**
	CR	16	BL-Y	32	
	CS	42	Y-O	33	
	CG	17	O-Y	34	
	C1†	43	Y-G	35	
	C2†	18	G-Y	36	
	CRV1‡	44	Y-BR	37	
	CRV2‡	19	BR-Y	38	
		45	Y-S	39	
		20	S-Y	40	
14§	CT	46	V-BL	41	14
	CR	21	BL-V	42	
	CS	47	V-O	43	
	CG	22	O-V	44	
	C1†	48	V-G	45	
	C2†	23	G-V	46	
	CRV1‡	49	V-BR	47	
	CRV2‡	24	BR-V	48	
		50	V-S	49	
		25	S-V	50	

* Stencil lead designations on fanning strip.
† Used only with VCA CD9.
‡ Used only with VCA CD8 for toll denial when provided by serving CO.
§ Cannot be used if position is occupied by 75A control unit.
¶ Associated with 75A in position 13.
** Associated with 75A in position 14.

➧TABLE F⬅

CONNECTIONS FOR CO TRUNKS – 615A PANEL

TRUNK NUMBER	LEAD DESIG	66T1 CONN. BLOCK	TO 913 OR 914	
			CONN.	PIN
1	T	A1	J1A	13
	R	A2	J1A	4
2	T	A3	J2A	13
	R	A4	J2A	4
3	T	A5	J3A	13
	R	A6	J3A	4

TABLE G

CONNECTIONS FOR PLUG P1 — 615A PANEL

LEAD DESIG	PLUG P1 PIN NO.	LEAD COLOR	615A PANEL		
			JACK	PIN	66T1 BLK
CT	26	W-BL	J1	A6	C12
CR	1	BL-W		A15	
CS	27	W-O		A1	
CG	2	O-W			
C1	28	W-G		A10	
C2	3	G-W		A11	
CRV1	29	W-BR		A14	
CRV2	4	BR-W		A19	
SPARE	30	W-S		A7	
SPARE	5	S-W		A16	
CT	31	R-BL	J2	A6	C13
CR	6	BL-R		A15	
CS	32	R-O		A1	
CG	7	O-R			
C1	33	R-G		A10	
C2	8	G-R		A11	
CRV1	34	R-BR		A14	
CRV2	9	BR-R		A19	
SPARE	35	R-S		A7	
SPARE	10	S-R		A16	
CT	36	BK-BL	J3	A6	C14
CR	11	BL-BK		A15	
CS	37	BK-O		A1	
CG	12	O-BK			
C1	38	BK-G		A10	
C2	13	G-BK		A11	
CRV1	39	BK-BR		A14	
CRV2	14	BR-BK		A19	
SPARE	40	BK-S		A7	
SPARE	15	S-BK		A16	

▶TABLE H◀

POWER CONNECTIONS

INPUT VOLTAGE	69G APP MTG (NOTE 1)	604A1 PANEL (NOTE 2)	604B OR 604C PANEL (NOTE 3)	615A PANEL (NOTE 4)
−24V	9	T14	Input −24V	D2
−48V	—	—	Input −48V	—
GRD	4	T13	Input −GRD	D4

Notes:

1. Terminals on 66B4-25 connecting block, connect as shown in Fig. 10.
2. Terminals on terminal strip TSA on rear of 604A1 Panel.
3. Terminals on rear of 604B Panel are stamped as shown. Position option straps for −24V or −48V.
4. Terminals on 66T1 connecting block. Use 20-gauge wire; strip leads before putting into 66-type terminals. Power may be distributed to subsequent panels by multipling succeeding panels from terminal C2 and C4 (multiple a maximum of three panels).

TABLE I

604A-TYPE PANEL—FUSE ASSIGNMENT

FUSE NO.*	PANEL POSITION	VOLTAGE
F1	J1A	−24V
F2	J2A	
F3	J3A	
F4	J4A	
F5	J5A	
F6	J6A	
F7	J7A	
F8	J8A	
F9	J9A	
F10	J10A	
F11	J11A	
F12	J12A	
F13	J13A	
F14	J14A	
F15	J10B	
F16	J11B	
F17	J13B	
F18	J14B	

* Fuses are 70G 1/2-ampere.

TABLE J

604B AND 604C PANELS—FUSE ASSIGNMENT

FUSE NO.	PANEL POSITION	VOLTAGE
F1*	J1A thru J14A	+105V (Note)
F2*	J1A	−24V
F3*	J2A	
F4*	J3A	
F5*	J4A	
F6*	J5A	
F7*	J6A	
F8*	J7A	
F9*	J8A	
F10*	J9A	
F11*	J10A	
F12*	J11A	
F13*	J12A	
F14†	J13A	
F15†	J14A	
F16‡	J1A thru J5A	−48V (Note)
F17‡	J6A thru J10A	
F18‡	J11A thru J14A	

Note: +105V and −48V not used in this application.

* 70F fuse 1/4 ampere.
† 70G fuse 1/2 ampere.
‡ 70A fuse 1-1/3 ampere.

➧TABLE K➧

615A PANEL—FUSE ASSIGNMENT

VOLTAGE	FUSE NO. *	PANEL POSITION
−24V	F1	J1A
	F2	J2A
	F3	J3A
−48V	F4†	J1B
	F5†	J2B
	F6†	J3B
±105V	F7†	J1A, J2A, J3A
SPARE	F8	

* 24E fuse 1/2 ampere.

† Not used in this application.

TABLE L

MODIFICATION OF 500C/D OR 554A/B TELEPHONE SETS FOR POWER FAILURE TRANSFER (DELAYED RESTORAL ONLY)

LEAD AND CONTACT DESIG		LEAD COLOR	TERM. ON NET. (Note)	
			REMOVE FROM	CONNECT TO
Mtg Cord	Tip	(G)	L1	F
	Ring	(R)	L2	L1
	LK	(BK)		L2
	A1	(Y)		G
C4A Ringer		(R)	L2	L1
		(BK)	G or L1	F
Line Switch (Note)	a	(S)		L2
	b	(Y)	L2	G
	c	(BR)	C	G
	d	(G)		L1
	e	(W)	F	C

Note: 500C/D and 554A/B telephone sets having 425B networks cannot be used to control power failure transfer relay as some line switch leads are soldered on the network.

PROTECTIVE CONNECTING ARRANGEMENT CED

1. GENERAL

1.01 This section provides identification, installation, operation, maintenance, and connection information for the 101-type interconnecting unit (IU) and associated 69G apparatus mounting, 604-type panel, or 615A panel when used for Protective Connecting Arrangement (PCA) CED. It also covers the KS-20944 protector used for PCA VCP, which can be associated with PCA CED.

1.02 This section is reissued to:

- Include information on the 101C IU which replaces the 101B (MD)
- Rate the 604B panel MD
- Replace the term Voice Connecting Arrangement (VCA) with Protective Connecting Arrangement (PCA)
- Add comcode numbers to piecepart numbers
- Add new Table A.

1.03 For detailed information on associated apparatus, refer to the following sections:

463-300-101—604A Panel

463-300-102—604B and 604C Panels; 21A Apparatus Unit

463-300-104—615A Panel

463-300-109—KS-20944 Protector

463-300-113—142A Test Set

1.04 ◆The 101C IU (Fig. 1) is an improved version of the 101B (MD) (Fig. 2) and is the preferred unit for new installations and replacements. Existing installations with 101A (MD) and 101B (MD) IUs may be encountered in the field; do not replace these units unless they are defective. Furthermore, existing stock of these MD IUs should be used if possible. Refer to Table A for a summary of the applications and limitations of the three 101-type IUs.◆

> *Note:* In existing installations using pulse correction, the 103A (MD) pulse corrector must be removed when replacing a 101A with a 101B or C.

1.05 The 604B panel (Fig. 3 and 5) is now rated MD but may be used when available; an installed 604B should be replaced with a 604C (Fig. 3 and 4) only when defective. These conditions also apply to the MD rated 604A-type panel (Fig. 6).

> ***Caution: When 101A and 101B/C IUs are installed in the same 604B or C panel, do not use a 101A for trunk 9 (position 13) if 101B/Cs are used for trunks 1 or 3 (positions 1 or 4), and do not use a 101A for trunk 14 (position 14) if 101B/Cs are used for trunks 5 or 7 (positions 7 or 10). If these rules are violated, the AGC leads of the 101B/Cs will be shorted.***

1.06 For mounting one to six 101-type IUs, use 615A panels. For over six circuits, use a 604-type panel. Consider both the size of the initial installation and the expected future growth in selecting the proper mounting equipment.

Do not use the 69G apparatus mounting for any new installations. Information is supplied in this practice only for servicing existing installations of the 69G.

1.07 The customer should contact the local Telephone Company Business Office or the Marketing Representative to obtain a copy of the Technical Reference covering this interface specification.

1.08 This issue is based on the following drawings:

SD-1E201-01, Issue 5B (101A IU)

NOTICE
Not for use or disclosure outside the
Bell System except under written agreement

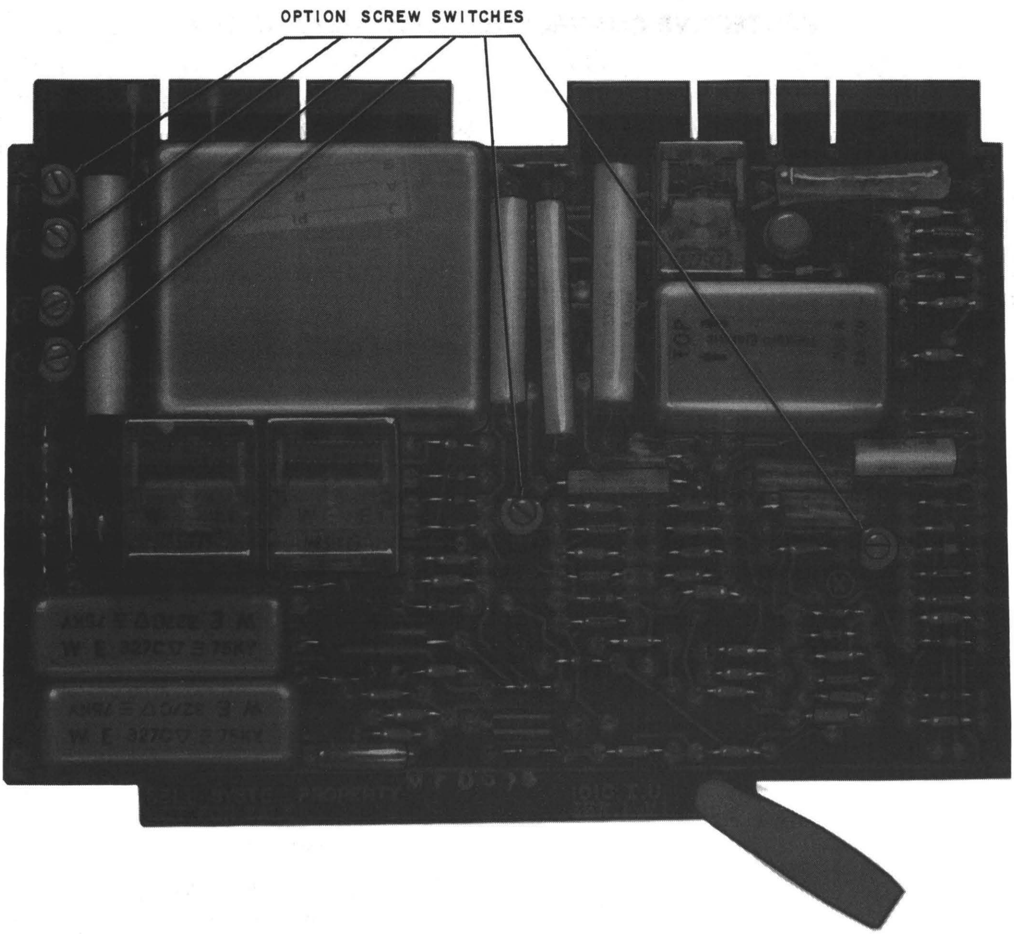


Fig. 1—➧101C IU⬅

➧SD-1E238-01, Issue 6B (101B IU)

SD-1E294-01, Issue 2D (101C IU)⬅

SD-1E200-01, Issue 2D (604A Panel)

SD-69599-01, Issue 2A (69G Apparatus Mounting)

If this section is to be used with equipment or apparatus reflecting later issue(s) of the drawing(s), reference should be made to the SDs and CDs to determine the extent of the changes and the manner in which the section may be affected.

2. IDENTIFICATION

PURPOSE

(a) ***PCA CED***

- To provide a means to automatically connect, on a ground start basis, the dial switching equipment of a customer-provided (CP) PBX to a Bell System toll operator for toll terminal service with ringback

- To limit excessive transmission signal levels from customer-provided equipment (CPE) and to provide protection for telephone company personnel against hazardous voltages

- To provide network control signaling functions.

(b) ***PCA VCP***

- To provide an interface between CP power supply and PCA CED

- To provide protection for telephone company personnel against hazardous voltages.

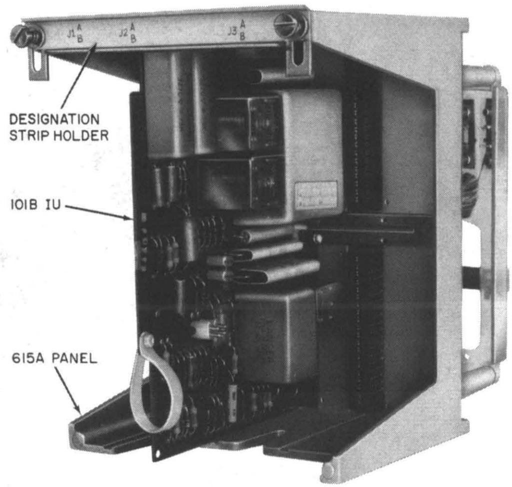


Fig. 2—101B (MD) IU Mounted in 615A Panel

TABLE A

APPLICATIONS OF 101-TYPE IUs

IU	APPLICATIONS/LIMITATIONS
101C	• All applications. • No limitations.
101B (MD)	• Not recommended for use with panel COs. • Not recommended for use with CPE equipped with electronic toll restriction circuitry.
101A (MD)	• Not recommended for use with panel COs. • Cannot be used in conjunction with 75A control units (PCA CBF).

APPLICATION

- PCA CED is intended for use with CP Hotel-Motel dial PBX systems.

ORDERING GUIDE

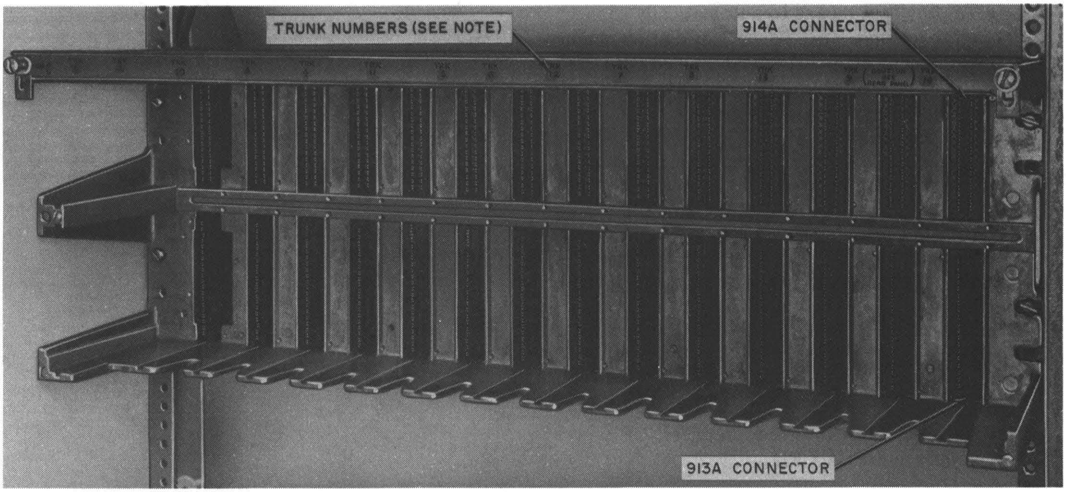
(a) ***For PCA CED***

- Unit, Interconnecting, 101C (one per toll operator access trunk) (Fig. 1).

(b) ***Associated Apparatus (Order Separately)***

Note: If a 23-inch relay rack is not provided on customer premises, provide a 16C apparatus mounting or equivalent for the 615A panel or an ED-91180-72 Group 21 cabinet for the 604-type panel, or their local equivalent.

- Panel, 615A (includes fuse panel only, no power unit; mounts up to three 101-type IUs) (Fig. 2)



NOTE: ON OLDER 604B PANELS, POSITION NUMBERS APPEAR INSTEAD OF TRUNK NUMBERS.

INSTALLATION SEQUENCE OF 101-TYPE INTERCONNECTING UNITS

TRUNK NO.	1	2	10	3	4	11	5	6	12	7	8	13	9	14
POSITION NO.	1	2	3	4	5	6	7	8	9	10	11	12	13	14

Fig. 3—604B (MD) or 604C Panel, Front View

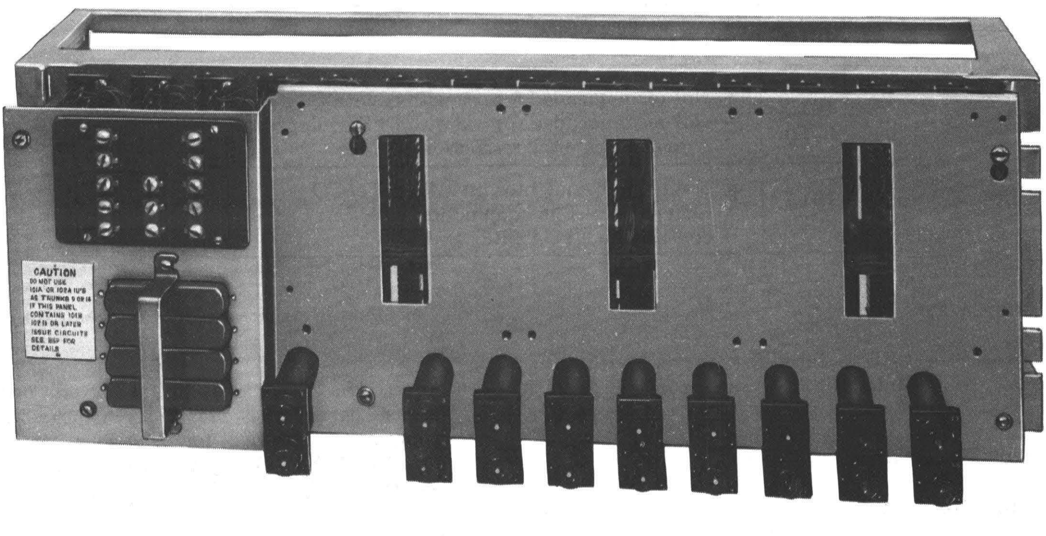


Fig. 4—604C Panel, Rear View (21A Apparatus Unit Not Installed)

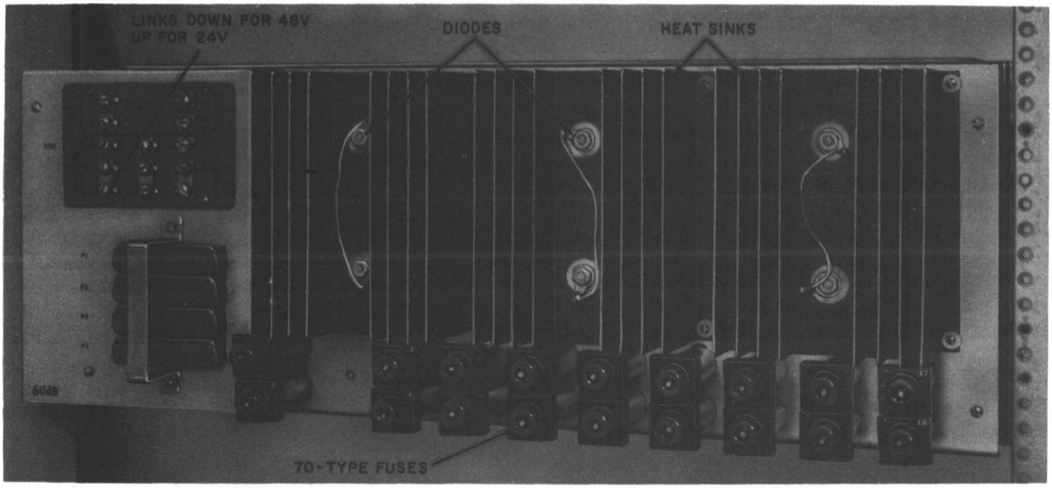


Fig. 5—604B (MD) Panel, Rear View

INSTALLATION SEQUENCE OF 101 INTERCONNECTING UNITS

TRUNK NO.	POSITION NO.
1	1
2	2
3	4
4	5
5	7
6	8
7	10
8	11
9	13
10	3
11	6
12	9
13	12
14	14

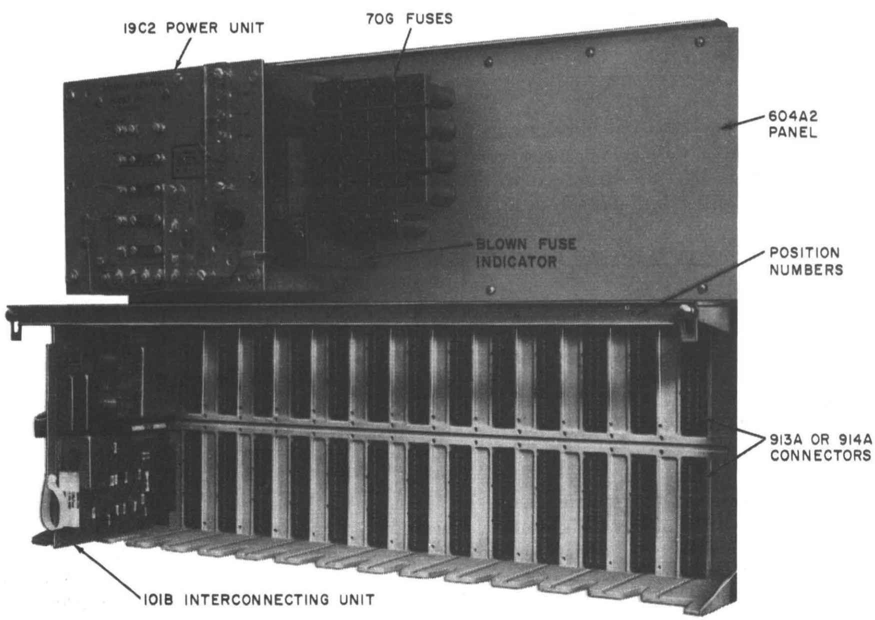


Fig. 6—101B IU Mounted in 604A2 (MD) Panel

- Bracket, 99B (one per one, two, or three 615A panels when mounted in 16C or in relay rack)

- ➧Adapter, 262A (one per 19C2 power unit mounted in 16C)➧

  or

- Panel, 604C (24V operation; includes fuse panel only, no power unit; mounts up to fourteen 101-type IUs) (Fig. 3 and 5)

- Unit, Apparatus, 21A (converts 604C panel to 48V operation)

- Cable, A25B (one per 615A panel or one, two, or four per 604-type panel) (Table B)

- Cable, A50B (one per 604-type panel) (Table B)

- Cable, 475A (one per 604-type panel) (Table B)

- Block, Connecting, 66M1-50 (as required) (Fig. 7, 10, and 11)

- Block, Connecting, 66B4-25 (as required) (Fig. 10 and 11)

Note: Other types of blocks may be used when specified by local engineering. (66M1-50 should be used for interface with CPE to facilitate testing with 142A test set.)

- Clip, Bridging, B (25 per pack, as required) (Fig. 7)

- Cable, D Inside Wiring, or equivalent (for connecting 615A panel to connecting block for CO terminations)

- Wire, 20-gauge (for connecting external power supplies to 604-type or 615A panels)

- Unit, Power, 19C2 or equivalent (for 615A, 604A1, 604B or 604C panels locally engineered and installed when existing PBX power supply is insufficient)

- Cord, Power (for 19C2 power unit)

  ➧824013262 (P40J326) (1-1/2 feet)

  824013270 (P40J327) (2 feet)

  824013288 (P40J328) (4 feet)

  824013296 (P40J329) (6 feet)

  824010995 (P40J099) (12 feet)➧

(c) ***For Power Protection Unit (PCA VCP)***

- KS-20944, L1 Protector (must be provided when a CP dc power supply is used) (Fig. 8).

(d) ***Replaceable Components (For 604-Type or 615A Panel)***

- Unit, Power, 19C2 (for 604A2 panel)

- Fuses, 70G (1/2 ampere, 18 per 604A-type panel)

- Fuses, 70F (1/4 ampere, 13 per 604B or 604C panel)

- Fuses, 70G (1/2 ampere, two per 604B or 604C panel)

- Fuses, 70A (1-1/3 ampere, three per 604B or 604C panel)

- Fuses, 24E (1/2 ampere, eight per 615A panel)

- Indicator, 17C-49 (for optional fuse alarm, if required; 604B or 604C panel only).

DESIGN FEATURES

101-Type Interconnecting Unit

- Components mounted on epoxy coated 8-inch 80-pin board

- Ambient operating temperature range 0°F to 120°F

- Approximate dimensions: 7-1/2 inches by 5-1/2 inches

- Options connected by straps on 101A and 101B; by screw switches on 101C (Fig. 1)

- Features line impedance matching (101B and C only)

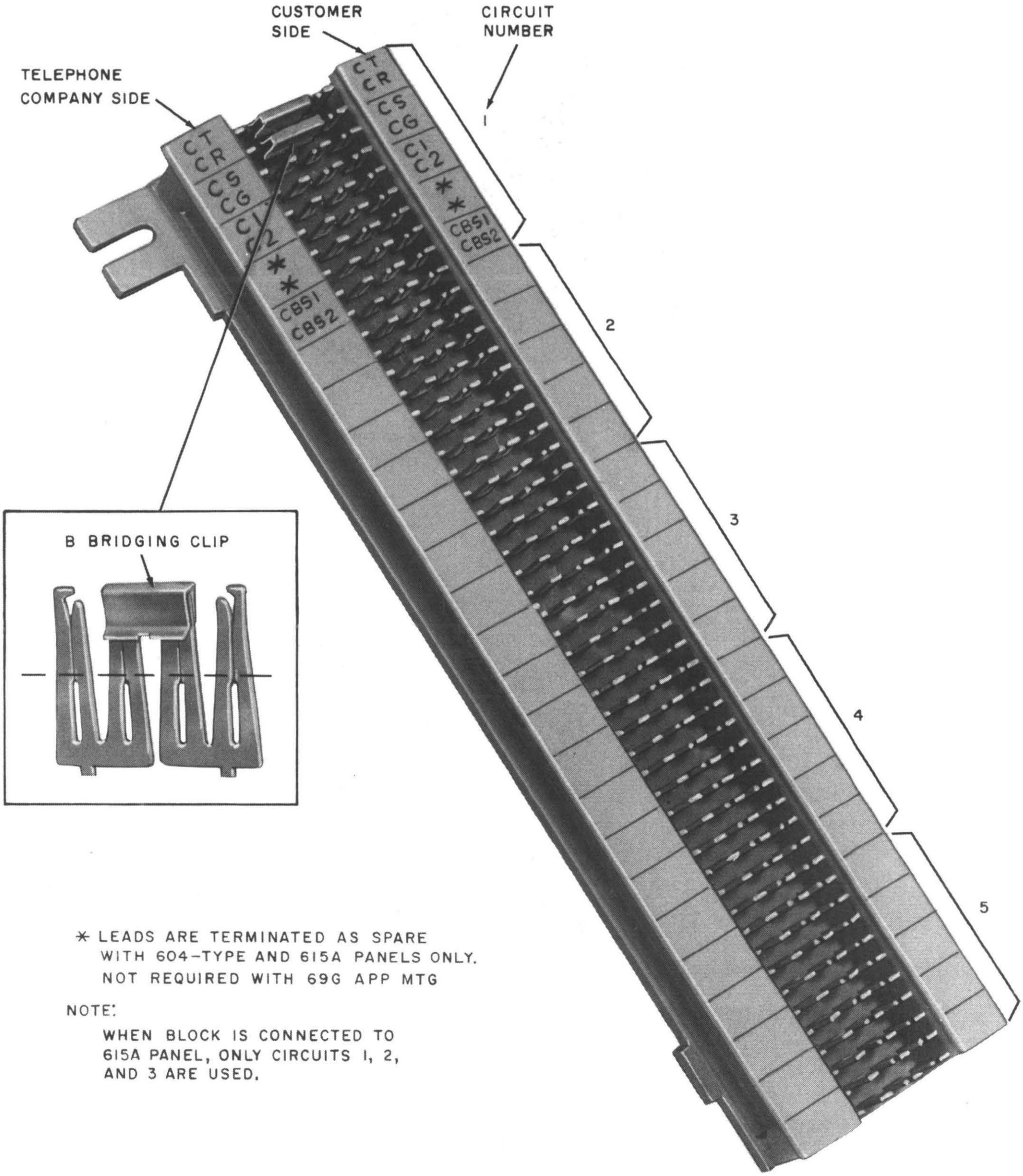


Fig. 7—66M1-50 Interface Connecting Block

Fig. 8—KS-20944 Protector

- Features ground start operation with rering capability

- Maximum current requirement at 26 volts dc: 0.160 ampere (101A); 0.126 ampere (101B); ➧0.143 ampere (101C).➧

3. INSTALLATION

69G Apparatus Mounting (Fig. 9 and 10)

3.01 The 69G apparatus mounting should not be used for new installations of PCA CED. Refer to Fig. 10 for connections used in existing installations.

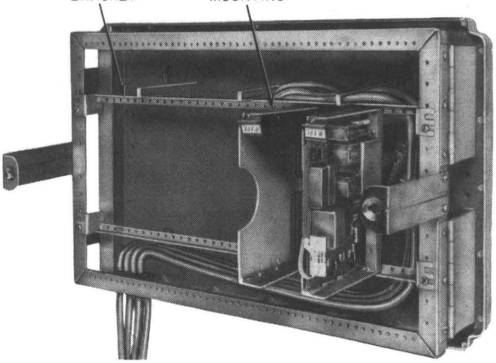


Fig. 9—69G Apparatus Mounting With 101B IU Mounted in 16C Apparatus Mounting

604-Type Panel (Fig. 11 and Tables C, D, E, F, I, J, and K)

3.02 Mount the 604-type panel on a standard relay rack or in an ED-91180-72, Group 21, 18-plate equipment cabinet. Locate the panel within 200 feet (18 ohms loop resistance) of the CPE for the 101A IU or within 1000 feet (100 ohms) for the 101B or C. Connect a separate ground wire to relay rack or cabinet. The ED-91180-72 cabinet will hold a maximum of two 604A-type panels or three 604B or C panels and a power unit when the drawing holder on the lower half of its cover is removed. Mount the 66M1-50 interface connecting block within 25 feet of the panel and in a position which will facilitate testing between the block and the panel.

3.03 Make connection to the 604-type panel with connector cables. Arrangement of the plugs on the panel restricts plug P1 (CO lines) to an A25B connector cable. Plugs 2 through 4 (CPE connections) are arranged to accept a choice of cable sizes (see Table B). For example, in the first arrangement, an A25B can be used for plug 1 and single A75A for plugs 2 through 4; or a separate A25B can be used for each plug. Plug 5 (604A panel only) is not used with PCA CED.

3.04 Terminate the stub end of the connector cable from P1 on a 66B4-25 connecting block for CO lines (Table C).

3.05 Terminate the stub end of the connector cable from P2, P3, and P4 on the telephone company side of 66M1-50 interface connecting blocks located within 25 feet of the panel (Tables D, E, and F). Stencil lead designations on fanning strips and use B bridging clips to connect columns B and C together on the connecting block (Fig. 7).

3.06 The 604A1, 604B, and 604C panels operate on externally supplied −24 volts. The 604B can be adapted to −48 volt operation by putting the option straps in the down position (Fig. 5). The 604C can be adapted to −48 volt operation by adding a 21A apparatus unit and putting the option straps in the down position. Attach the 21A to the rear of the 604C using the four 8-32 by 3/16-inch screws supplied with the apparatus unit as a loose item. Electrical connection to the 604C is made by attaching each red wire to a 48-volt terminal and each red-black wire to a 24-volt option terminal.

3.07 When a telephone company power unit is used, the customer must provide a separately fused 105- to 130-volt, 60-Hz outlet within reach of available power cords (see ORDERING GUIDE for cord lengths) and not under control of a wall switch. Mount the power unit in the same rack or cabinet with the 604-type panel it supplies, if possible, or in a nearby location. If CP power is used, it must be supplied through a KS-20944 protector (see 3.19).

3.08 Connect external power to terminals on rear of 604-type panel as shown in Table I. Refer to the appropriate section in Division 518 for proper grounding of power plants which is

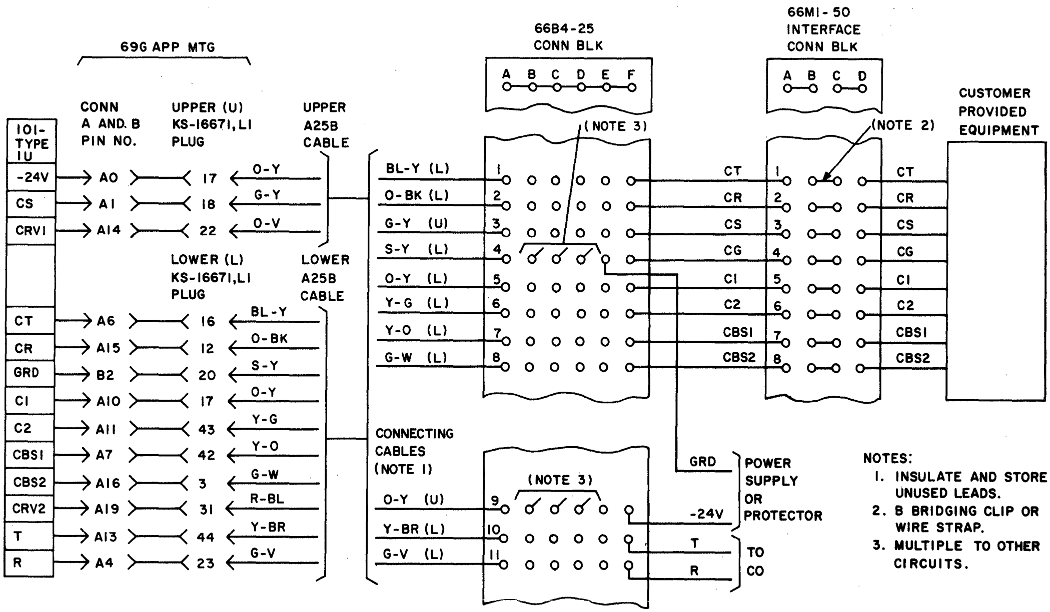


Fig. 10—Connection Diagram—69G Apparatus Mounting With 101-Type IU

important to prevent damage from power line surges.

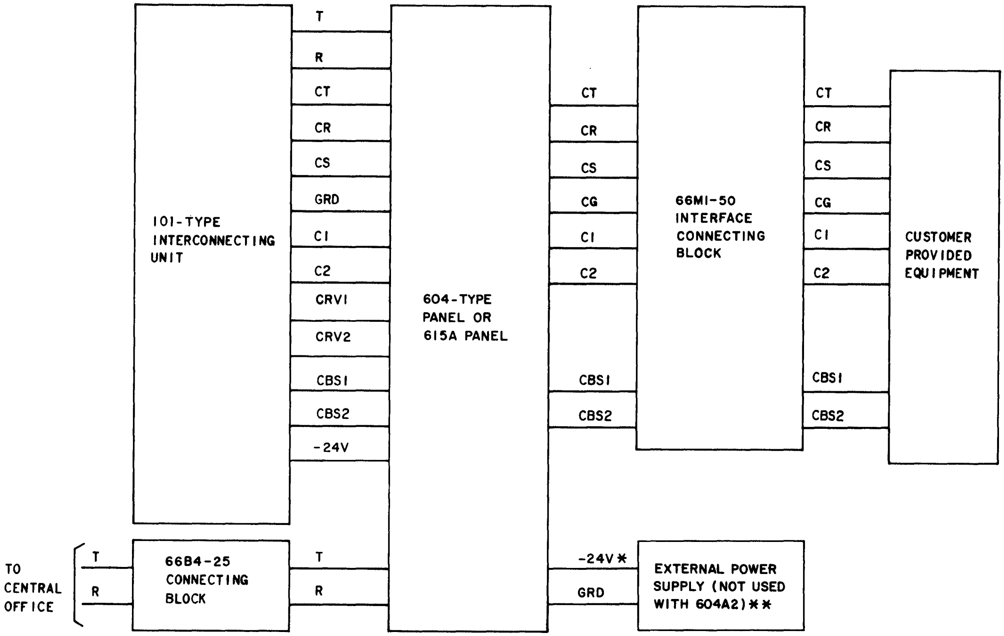
615A Panel (Fig. 11 and Tables G, H, I, and L)

3.09 Mount the 615A panel on a standard relay rack or on a 16C apparatus mounting using a 99B bracket. Remove the center mounting bar from the 16C to allow the 615A to fit on the 99B bracket. The bracket holds up to three 615A panels ▶or two 615A panels and a 19C2 power unit mounted with a 262A adapter;◀ up to three 101-type IUs can be installed in each panel. Locate the panel within 200 feet (18 ohms loop resistance) of the CPE for the 101A IU or within 1000 feet (100 ohms) for the 101B or 101C. Connect a separate ground wire to relay rack or apparatus mounting.

3.10 Use D station wire or D inside wiring cable to run T and R leads for the 66T1 block on the 615A panel to a 66B4-25 connecting block where CO lines are terminated (Table G).

3.11 Use an A25B connector cable to connect the 615A panel to a 66M1-50 interface connecting block located within 25 feet of the panel. Connect the plug end of the cable to P1 on the 615A panel and terminate the stub end on the telephone company side of the connecting block (Table H). Stencil lead designations on fanning strips and use B bridging clips to connect columns B and C together on the connecting block (Fig. 7).

3.12 When used with PCA CED, the 615A panel operates on −24 volts supplied from associated equipment, a separate telephone company power unit, or from the customer's power supply. When a telephone company unit such as the recommended 19C2 is used, the customer must provide a 105- to 130-volt, 60-Hz outlet within reach of available power cords (see ORDERING GUIDE for cord lengths) and not under the control of a wall switch. Mount the power unit in the same rack or apparatus mounting with the 615A panel it supplies, if possible, or in a nearby location. If CP power is used, it must be supplied through a KS-20944 protector (see 3.19).



* 604B AND C CAN OPERATE ON -48V.
** CP POWER MUST COME THROUGH PROTECTOR.

Fig. 11—Block Diagram—PCA CED Using 604-Type or 615A Panel

3.13 Use 20-gauge wire to connect external power to the 66T1 connecting block on the rear of 615A panel as shown in Table I. Strip insulation from wire before placing in terminals. Refer to appropriate section in Division 518 for proper grounding of power plants, which is important to prevent damage from power line surges.

101-Type Interconnecting Unit (Fig. 1, 12, 13, and 14)

3.14 *Options—101A IU:* Install proper option straps with 24-gauge bare wire (see Fig. 12):

- Option W: Required when CO is step-by-step.
- Option Y: Always required.
- Option Z: Install when CO loop resistance (including resistance of CO) is greater than 500 ohms.

Be sure all option straps have been installed and check continuity of straps after they are in place.

3.15 *Options—101B or C IU:* Install proper option straps on 101B with 24-gauge bare wire, or by screwing down screw switches on 101C (see Fig. 13 or 14):

- Option W: Install when CO loop resistance (including resistance of CO) is greater than 800 ohms.
- Option X: Required when CO is step-by-step.
- Option Y: Normally required; factory installed. Provides impedance ratio of 600 ohms to 600 ohms between CPE and CO lines.

- Option Z: Provides impedance ratio of 600 ohms to 900 ohms between CPE and CO lines, respectively. Required only when PBX-CO trunk facility is designed with terminating sets or 837-type impedance compensators that have 900 ohms input impedance.

The sequence of installing 101-type IUs in the panels is important. Refer to the table in Fig. 3 for the correct sequence for the 604B or C panels and the table in Fig. 6 for the 604A panel. Note that the trunk number does not necessarily correspond to the position number in the panel. For example, the IU for trunk 3 must be installed in position 4. (The designation strip holders on the 604C panel and on some newer 604B panels show the trunk number associated with each position. The 604A and older 604Bs have only the position number.) In the 615A panel, install the IUs for trunks 1, 2, and 3 in J1, J2, and J3 respectively.

3.16 ***Refer to CAUTION preceding 1.06 before installing 101A and 101B IUs in the same 604B or 604C panel.*** When installing the 101-type IU, raise the designation strip holder on the panel, position the board in the guide grooves of the 615A or 604-type panel, and slide the 101-type IU until it is properly seated and electrically connected to the 913A or 914A connectors. The guide grooves prevent improper insertion of the 101-type IUs.

> ***Note:*** The connectors in the 604B and C panels are equipped with index clips to match the code slots in the 101B and C IUs. When using the 101A IUs, pull out the clips between contacts 9 and 10 in the B connectors.

3.17 Make certain designation strip holder is properly positioned to hold the IUs in place.

3.18 Perform tests shown in Part 5 after installation.

KS-20944 Protector (Fig. 15)

3.19 When voltage protection is required, the KS-20944 protector must be mounted externally and wired to the power supply terminals of the 615A or 604-type panel (Fig. 11). Refer to Section 463-300-109 for connections to multiple installations.

3.20 Set circuit breaker switch lever to OFF and connect as shown in Fig. 15 following local wiring instructions. The customer must connect his power supply to the red (GRD) and black (−V) wires extending from the unit.

> ***Warning: Voltage will be present on upper terminals of circuit breakers as soon as customer power is connected.***

Check for correct polarity and ground before closing circuit breakers.

4. OPERATION

A. 101B or C Interconnecting Unit (Fig. 13 or 14):

4.01 ***Outgoing Call:*** When the user of the CP station dials the trunk level associated with PCA CED, the CPE initiates a contact closure between the CS and CG leads. The resulting ground on the CS lead operates the K6 relay of the 101C IU (or relays K5 and K6 of the 101B). Operation of K6 relay grounds the ring side of the trunk circuit to the CO which causes a signal to appear at the toll board. The toll operator plugs the rear cord of a cord pair into the jack associated with the signal and operates the DIAL and TALK key. Ground is returned on the tip and battery on the ring of the trunk circuit. This operates the K4 relay of the 101B IU (or relays K4 and K5 of the 101C) and releases K6 relay. Operation of K4 relay closes a set of supervisory contacts to the CPE over the CBS1 and CBS2 leads and removes the ground detector. With K6 released and K5 operated, ground is removed from ring, and a talking path is established between the toll operator and the CPE. The toll operator requests dialing information and, using the front cord of the same cord pair, dials the requested number and restores the DIAL and TALK key.

4.02 ***Disconnect and Operate Ringback:*** When the CP station goes on-hook, the closure between the CS and CG leads is opened and the K5 relay releases opening the loop to the toll operator. If this loop is opened or if the toll connection is opened, the toll operator receives a disconnect signal and may then ring toward the

CP PBX to provide time and charge information to the PBX attendant. Ring relay K1 in the ring detector circuit operates and closes a set of contacts to the CPE over the C1 and C2 leads. The PBX attendant answers the ringing by a contact closure on the CS and CG leads, which operates the K5 relay. K5 relay operated removes the ground detector circuit, trips ringing, and establishes the talking path. When the CP PBX attendant and the toll operator disconnect, the K4 and K5 relays release and the circuit returns to the idle condition.

> ***Note:*** 101A IU (Fig. 12) operates similarly to the 101B and C IU using different relays.

B. KS-20944 Protector (Fig. 15)

4.03 When the CPE dc power supply is used to operate the telephone company equipment, overcurrent and overvoltage protection is required. The KS-20944 power protector is used to protect the telephone company personnel from hazardous voltages but may not protect equipment from component failures. The KS-20944 protector provides a switch to disconnect dc power when working on interconnecting circuits.

4.04 The KS-20944 protector consists of a dc voltage-operated circuit breaker in series with a parallel resistor-diode combination connected across the line and a dc current-operated circuit breaker connected in each side of the line. The contacts on the breaker are connected in series with the coil of the breaker, and they are mechanically coupled together. When any breaker is operated, the line will be opened. The circuit breakers must be manually reset after tripping. They cannot be reset if the fault persists.

4.05 The KS-20944, List 1 protector is designed to trip in 25 milliseconds (maximum) on 38 volts dc, on 18.75 amperes dc, on reversed polarity (or ac) greater than 18 volts, or on incorrect power supply ground.

5. MAINTENANCE

5.01 When trouble is reported, check the CO pair and check for blown fuses and loose or broken connections. If the fault is not found, perform a test of the 101-type IU.

A. Using 1013A Hand Test Set and 81A Test Set

5.02 Prepare the circuit under test as follows:

(1) Open the eight leads to CPE by removing the B bridging clips (or wire straps) at the 66M1-50 interface block.

(2) Supply talk battery by connecting a 500-ohm resistor from the −24 volt supply to terminal CR and ground to terminal CT (make all connections on the telephone company side of the interface block). A 2A KTU or 31A KTU may be used for battery feed instead of the resistor. Refer to Section 518-112-421 for KTU connections.

(3) Connect a 1013A hand test set (or equivalent) across terminals CT and CR.

(4) Connect an 81A or KS-16990, List 1 test set across terminals CBS1 and CBS2 with the switch in C position.

5.03 Perform the following tests:

(a) ***Transmission Path:*** Connect a strap across the CS and CG terminals. When the toll operator answers the call, there should be continuity across the CBS1 and CBS2 terminals as indicated by the 81A test set. Remove the test set from the CBS1 and CBS2 terminals.

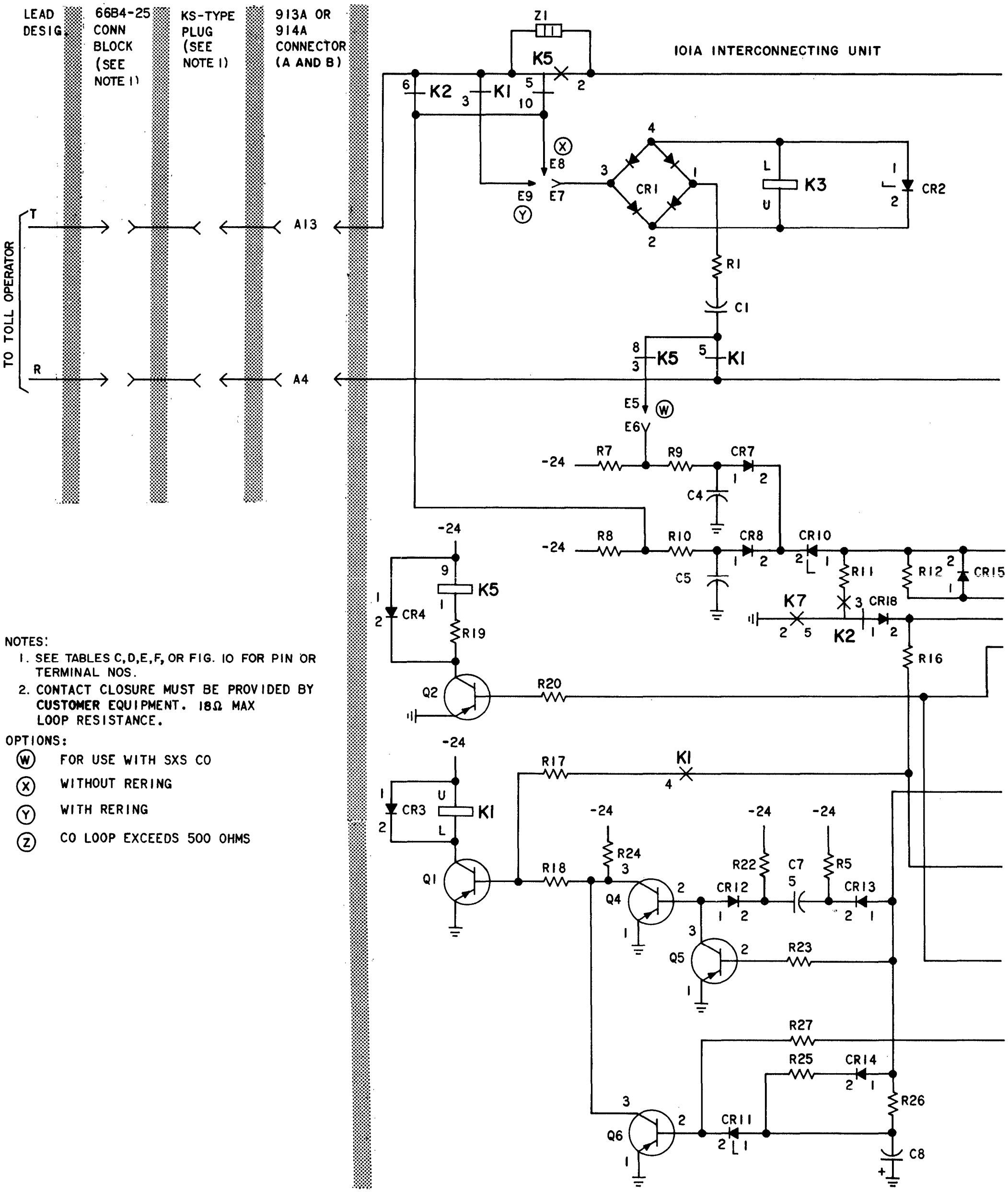
(b) ***Disconnect and Operator Ringback:*** Connect the 81A (or KS-16990, List 1) test set across the C1 and C2 terminals. Remove the strap across the CS and CG terminals. The toll operator will receive a disconnect signal and may ring back causing a contact closure across the C1 and C2 terminals. Answer the call by strapping the CS and CG terminals. Remove the strap and the circuit returns to idle.

B. Using 142A Test Set (Fig. 16)

5.04 Prepare the circuit under test as follows:

(1) Disconnect the CPE by removing the B bridging clips or wire straps at the interface block.

(2) ➧Select the proper interface cord from the three available 10-conductor cords and connect to the proper terminals on the telephone company side of the block.➧



NOTES:

1. SEE TABLES C, D, E, F, OR FIG. 10 FOR PIN OR TERMINAL NOS.
2. CONTACT CLOSURE MUST BE PROVIDED BY CUSTOMER EQUIPMENT. 18Ω MAX LOOP RESISTANCE.

OPTIONS:

- (W) FOR USE WITH SXS CO
- (X) WITHOUT RERING
- (Y) WITH RERING
- (Z) CO LOOP EXCEEDS 500 OHMS

Fig. 12—Schematic—101A (MD) IU (Sheet 1)

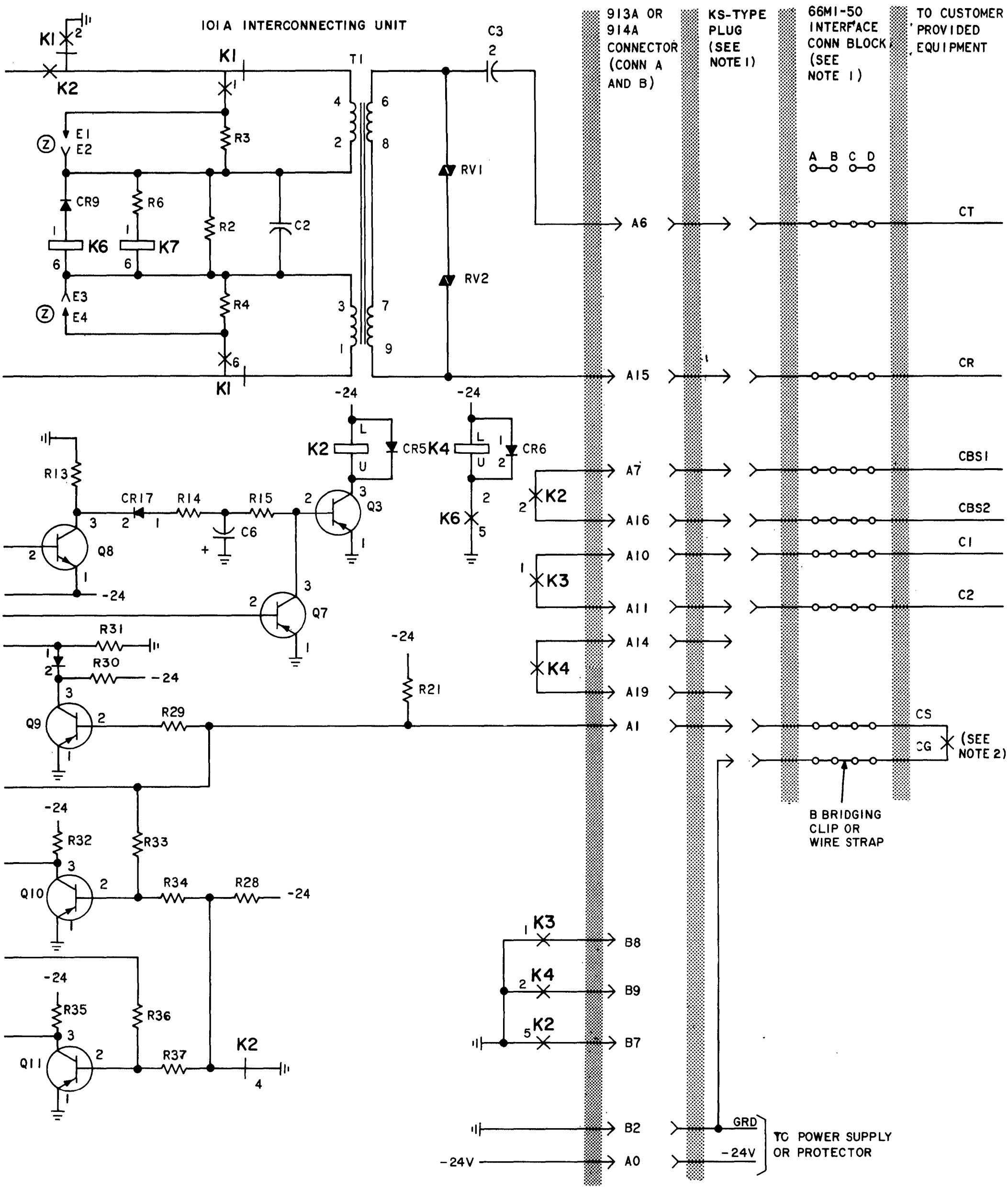
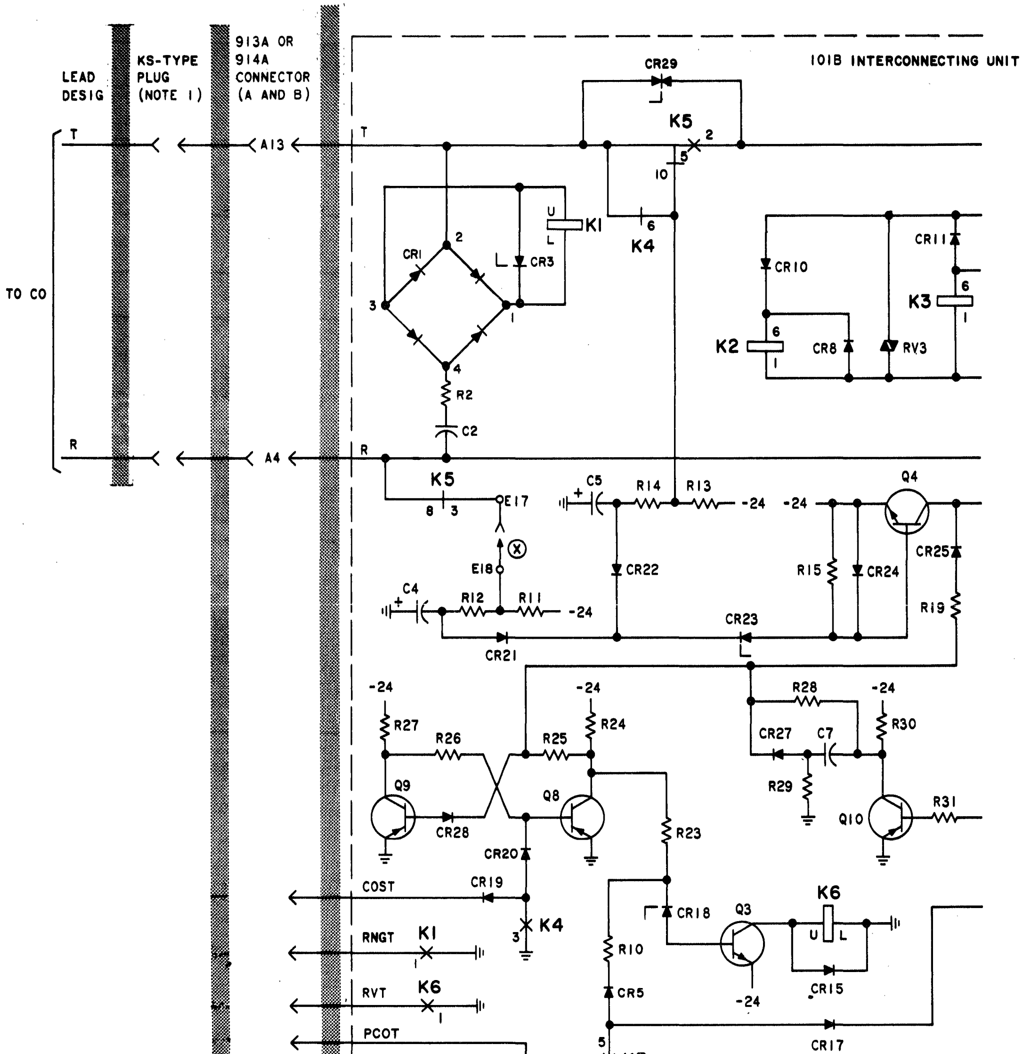


Fig. 12—Schematic—101A (MD) IU (Sheet 2)



NOTES:

1. SEE TABLES C,D,E,F, OR FIG. 10 FOR PIN OR TERMINAL NO.
2. CUSTOMER PROVIDED OFF-HOOK CONTACT CLOSURE AND PULSING CONTACT. 100Ω MAX. LOOP RESISTANCE.

OPTIONS:

Y 600Ω CO LINE IMPEDANCE. FACTORY INSTALLED.
Z 900Ω CO LINE IMPEDANCE.
X FOR USE WITH SXS CO.
W EXTERNAL CIRCUIT LOOP GREATER THAN 800Ω.(INCLUDING CO RESISTANCE)

Fig. 13—Schematic—101B (MD) IU (Sheet 1)

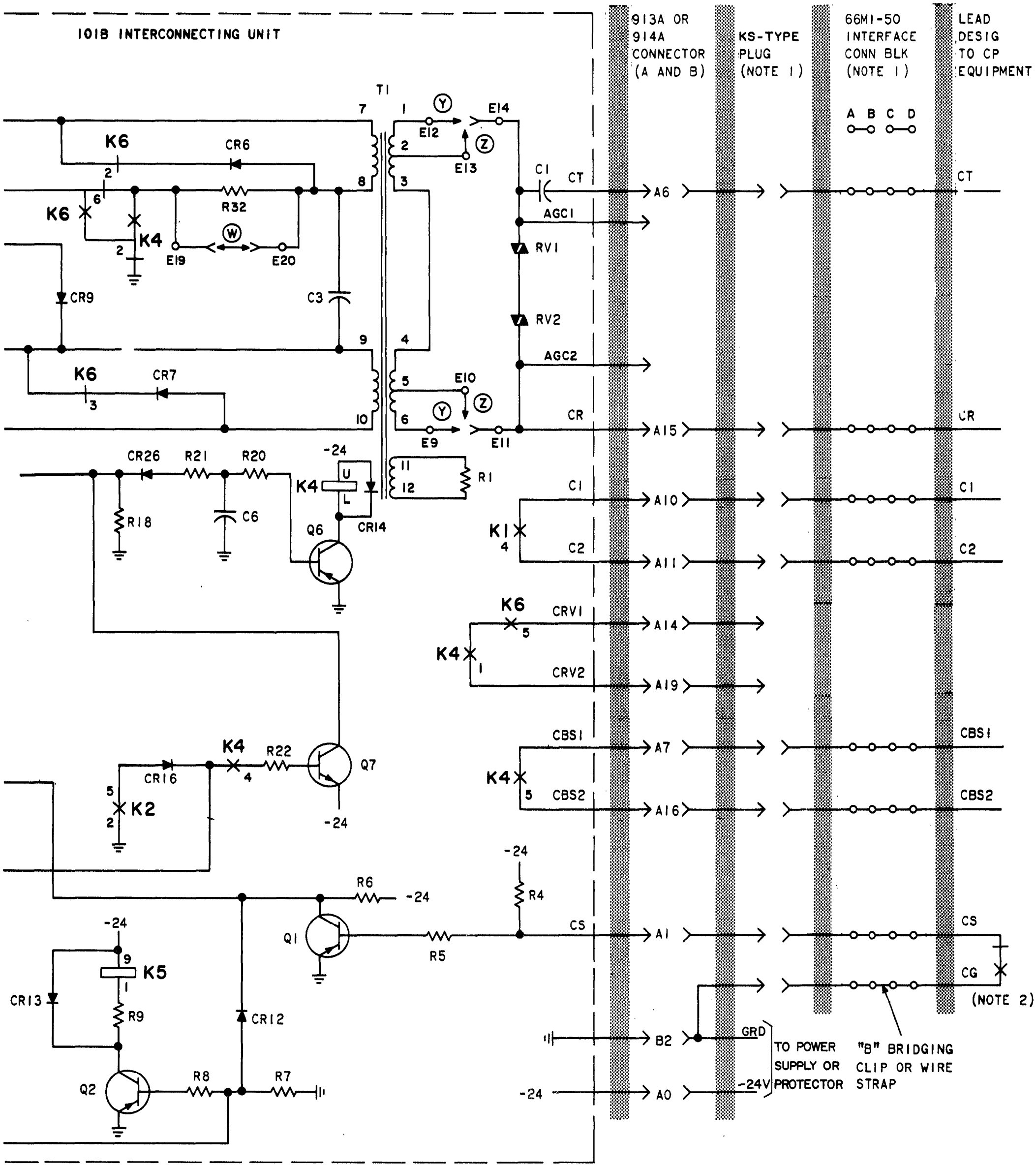
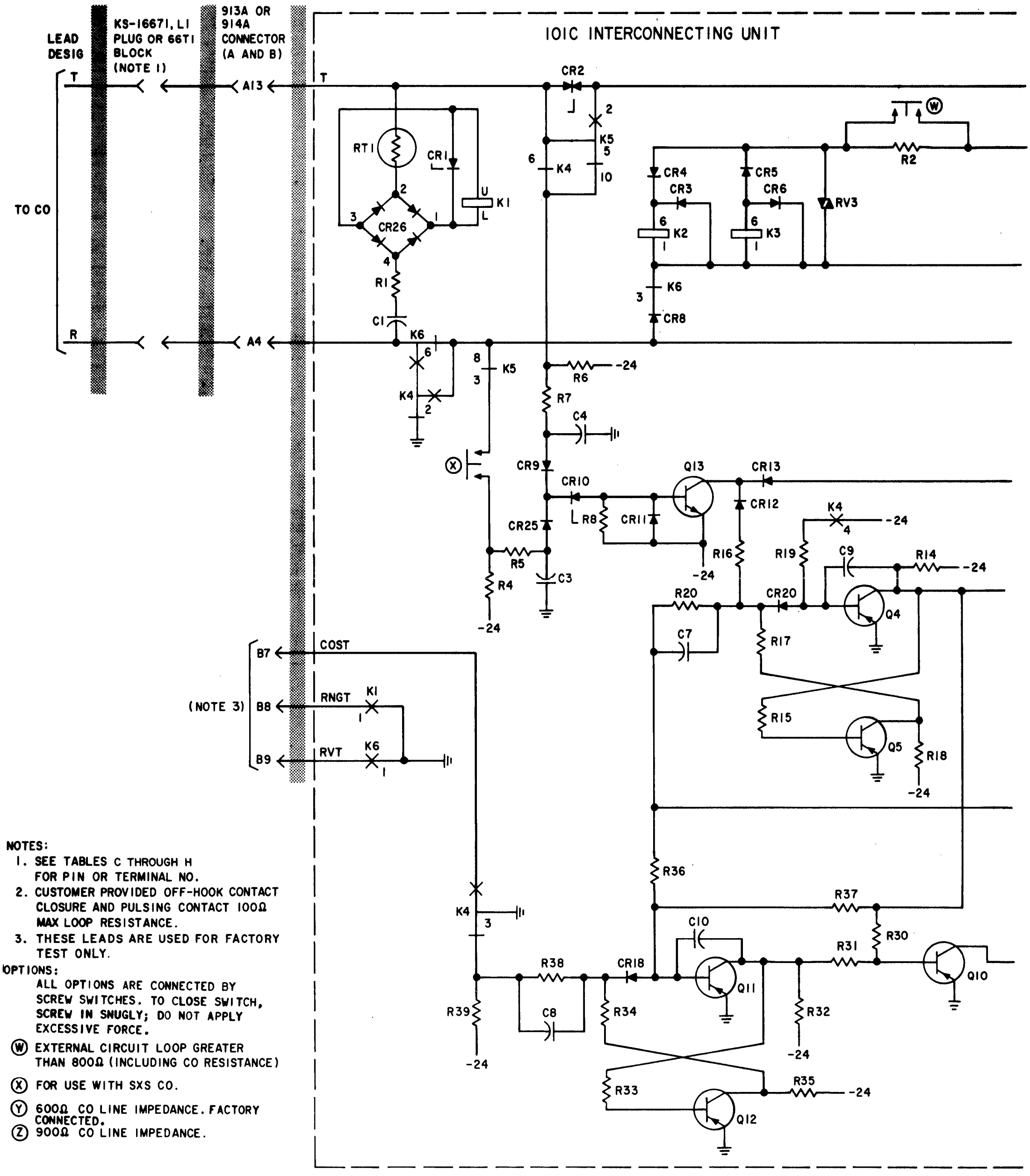


Fig. 13—Schematic—101B (MD) IU (Sheet 2)



NOTES:
1. SEE TABLES C THROUGH H FOR PIN OR TERMINAL NO.
2. CUSTOMER PROVIDED OFF-HOOK CONTACT CLOSURE AND PULSING CONTACT 100Ω MAX LOOP RESISTANCE.
3. THESE LEADS ARE USED FOR FACTORY TEST ONLY.

OPTIONS:
ALL OPTIONS ARE CONNECTED BY SCREW SWITCHES. TO CLOSE SWITCH, SCREW IN SNUGLY; DO NOT APPLY EXCESSIVE FORCE.

Ⓦ EXTERNAL CIRCUIT LOOP GREATER THAN 800Ω (INCLUDING CO RESISTANCE)

Ⓧ FOR USE WITH SXS CO.

Ⓨ 600Ω CO LINE IMPEDANCE. FACTORY CONNECTED.

Ⓩ 900Ω CO LINE IMPEDANCE.

Fig. 14—Schematic—101C IU (Sheet 1)

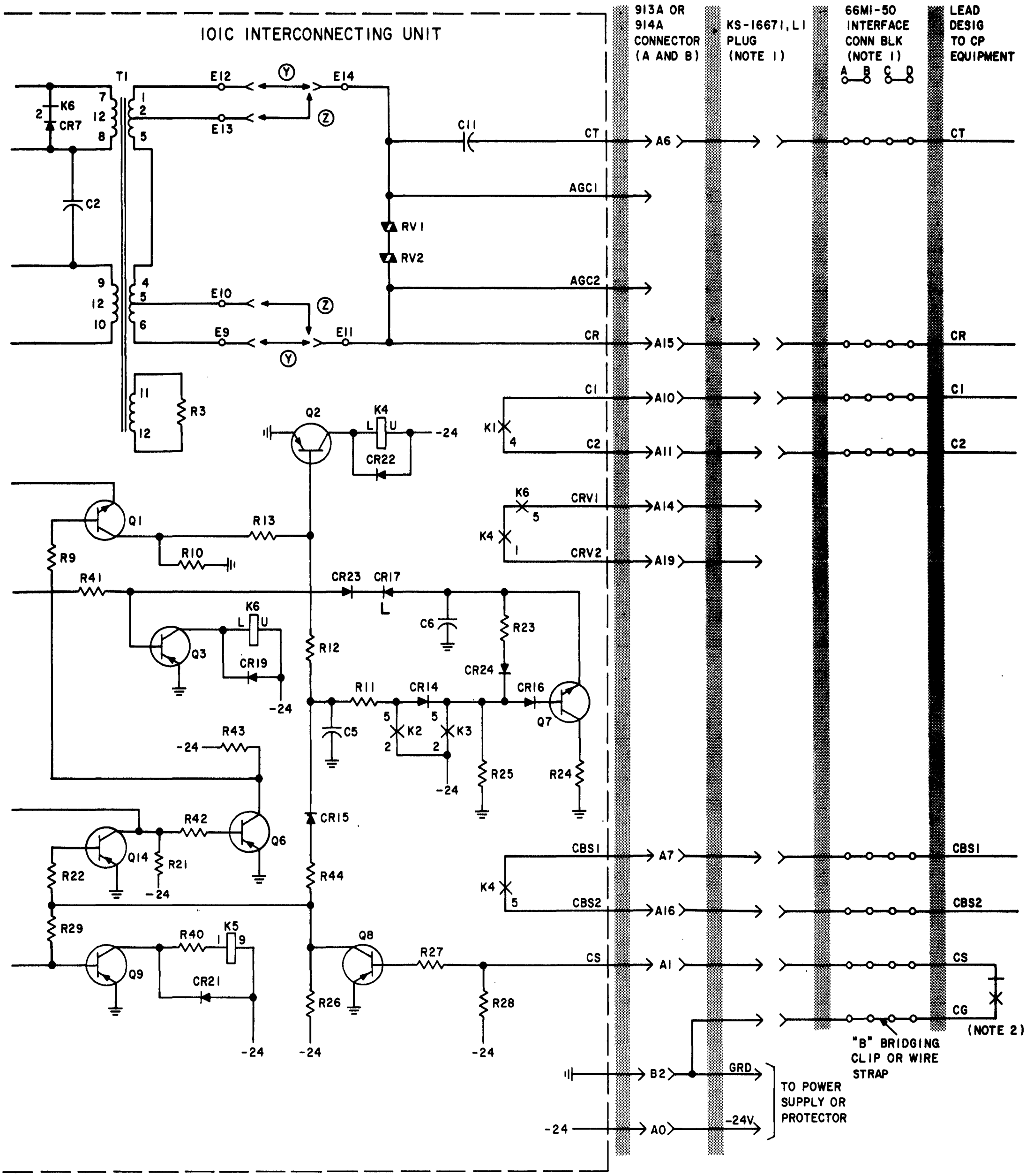


Fig. 14—Schematic—101C IU (Sheet 2)

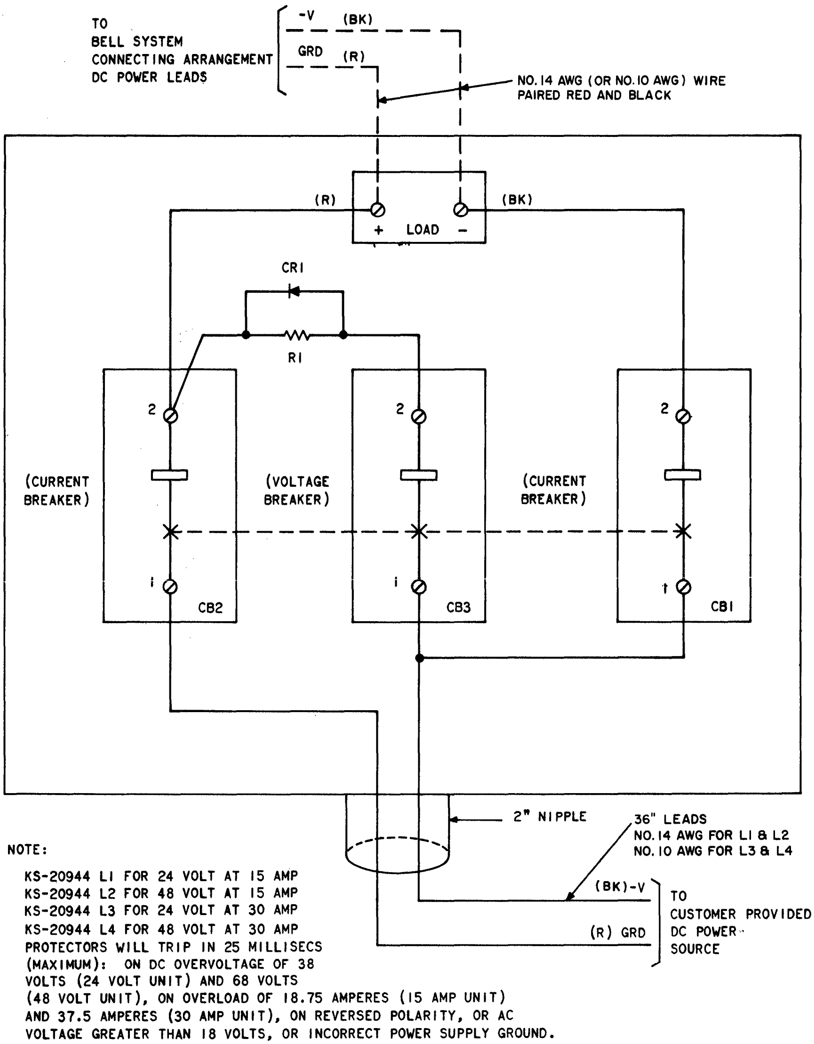


Fig. 15—Schematic—KS-20944 Protector

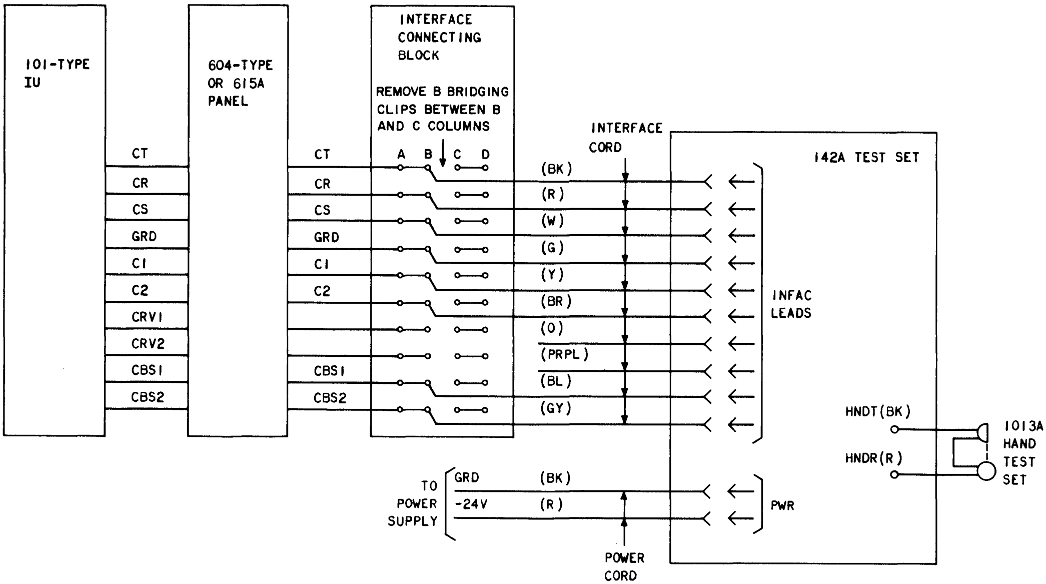


Fig. 16—Connections for Testing 101-Type IU With 142A Test Set

(3) Connect the leads from the 2-conductor power cord to −24 volts and ground. This voltage should be obtained from the same source used to power the IU under test. The PWR lamp on the test set should light.

(4) Connect a 1013A hand test set to the HNDR and HNDT terminals on the test set with the MON-TALK switch in the MON position.

(5) Set the CS-CG loop switch in the 18-ohm position for a 101A IU or in the 100-ohm position for a 101B or C IU.

Note: This is a slide switch on current production; earlier models used a rotary switch.

5.05 After circuit preparation, proceed as follows:

(1) Operate switch on 1013A hand test set to the TALK position. The S relay in the 142A test set will operate, lighting the CS lamp and providing signal ground on the CS lead through the selected resistance on the CS-CG loop switch. Ground on the CS lead causes the IU to ground the ring of the trunk and signal the toll operator. A ground hum may be heard in the hand test set during this period. This is a normal condition caused by the ground placed on the ring passing through the coupling transformer.

Note: If the IU fails to seize the CO trunk, move the CS-CG loop switch to a lower value. If the IU now operates properly, it is considered marginal. Circuits which operate only in the 0 position should be replaced.

(2) When the toll operator answers, battery and ground are placed on the ring and tip to the IU, which provides a closure on CBS1 and CBS2 which lights the CBS- lamp. Conversation with the operator should now be possible.

(3) Request operator to observe for a disconnect and then rering. Operate hand test set switch to MON. CS lamp should be extinguished.

(4) When operator rerings, the IU should function to provide a contact closure on C1 and C2 to light the C- lamp.

(5) Operate switch to TALK. The C- lamp should be extinguished; the CS lamp relights, and transmission is reestablished.

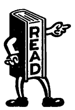
(6) Have operator release trunk. Operate switch to MON. The CS and CBS- lamps should be extinguished and IU should be in the idle condition.

5.06 When all testing is complete, remove power and interface cords. Connect CPE by restoring B bridging clips or wire straps at interface connecting block.

5.07 When trouble is suspected in the IU, exchange it with another unit known to be functioning properly.

5.08 If the above tests are satisfactory, remove all connections to restore the circuit to normal and replace the B bridging clips (or wire straps) on the 66M1-50 interface connecting block.

5.09 When trouble is suspected in the CPE, notify the Repair Service Bureau so that proper maintenance of service charge billing can be initiated as outlined in BSP 660-101-312 entitled Maintenance of Service Charge on Services With Customer-Provided Equipment (CPE).



Do not attempt any tests or repairs to the CPE.

6. CONNECTIONS

6.01 For connection information using the 69G apparatus mounting, refer to Fig. 10.

6.02 For connection information using the 604A-type panel, refer to Fig. 6 and 11 and Tables B, C, D, E, F, I, and J.

6.03 For connection information using the 604B and 604C panels, refer to Fig. 3, 4, 5 and 11 and Tables B, C, D, E, F, I, and K.

6.04 For connection information using the 615A panel, refer to Fig. 2 and 11 and Tables G, H, I, and L.

6.05 For connection information using the KS-20944 protector, refer to Fig. 15.

TABLE B

OPTIONAL CABLE ARRANGEMENTS TO PROVIDE CONNECTIONS FOR FOUR PLUGS ON 604-TYPE PANEL

CABLE DESIG-NATION (NOTE)	MAXIMUM NO. OF CABLES REQUIRED ARRANGEMENTS (SEE 3.03)		
	Arrangement 1	Arrangement 2	Arrangement 3
A25B	1	4	2
A50B			1
A75A	1		

Note: Arrangement of interconnecting units and local requirements will determine the size and maximum length of cable required.

TABLE C

CONNECTIONS FOR PLUG NO.1 – 604-TYPE PANEL

TRUNK NO.	LEAD DESIG*	CONN PIN NO.	A25B CONN CABLE COLOR	66B4-25 CONN BLK ROW NO.	POS. IN 604-TYPE PANEL
1	T	26	W-BL	1	1
	R	1	BL-W	2	
2	T	27	W-O	3	2
	R	2	O-W	4	
3	T	28	W-G	5	4
	R	3	G-W	6	
4	T	29	W-BR	7	5
	R	4	BR-W	8	
5	T	30	W-S	9	7
	R	5	S-W	10	
6	T	31	R-BL	11	8
	R	6	BL-R	12	
7	T	32	R-O	13	10
	R	7	O-R	14	
8	T	33	R-G	15	11
	R	8	G-R	16	
9	T	34	R-BR	17	13
	R	9	BR-R	18	
10	T	35	R-S	19	3
	R	10	S-R	20	
11	T	36	BK-BL	21	6
	R	11	BL-BK	22	
12	T	37	BK-O	23	9
	R	12	O-BK	24	
13	T	38	BK-G	25	12
	R	13	G-BK	26	
14	T	39	BK-BR	27	14
	R	14	BR-BK	28	
SPARE	SPARE	40	BK-S	29	
		15	S-BK	30	
		41	Y-BL	31	
		16	BL-Y	32	
		42	Y-O	33	
		17	O-Y	34	
		43	Y-G	35	
		18	G-Y	36	
		44	Y-BR	37	
		19	BR-Y	38	
		45	Y-S	39	
		20	S-Y	40	
		46	V-BL	41	
		21	BL-V	42	
		47	V-O	43	
		22	O-V	44	
		48	V-G	45	
		23	G-V	46	
		49	V-BR	47	
		24	BR-V	48	
		50	V-S	49	
		25	S-V	50	

* Stencil lead designations on fanning strip.

TABLE D

CONNECTIONS FOR PLUG NO.2 – 604-TYPE PANEL

TRUNK NO.	LEAD DESIG*	CONN PIN NO.	CONN CABLE COLOR	66M1-50 INTERFACE CONN BLK ROW NO.	POS. IN 604-TYPE PANEL
1	CT	26	W-BL	1	1
	CR	1	BL-W	2	
	CS	27	W-O	3	
	CG	2	O-W	4	
	C1	28	W-G	5	
	C2	3	G-W	6	
	SPARE	29	W-BR	7	
	SPARE	4	BR-W	8	
	CBS1	30	W-S	9	
	CBS2	5	S-W	10	
2	CT	31	R-BL	11	2
	CR	6	BL-R	12	
	CS	32	R-O	13	
	CG	7	O-R	14	
	C1	33	R-G	15	
	C2	8	G-R	16	
	SPARE	34	R-BR	17	
	SPARE	9	BR-R	18	
	CBS1	35	R-S	19	
	CBS2	10	S-R	20	
3	CT	36	BK-BL	21	4
	CR	11	BL-BK	22	
	CS	37	BK-O	23	
	CG	12	O-BK	24	
	C1	38	BK-G	25	
	C2	13	G-BK	26	
	SPARE	39	BK-BR	27	
	SPARE	14	BR-BK	28	
	CBS1	40	BK-S	29	
	CBS2	15	S-BK	30	
4	CT	41	Y-BL	31	5
	CR	16	BL-Y	32	
	CS	42	Y-O	33	
	CG	17	O-Y	34	
	C1	43	Y-G	35	
	C2	18	G-Y	36	
	SPARE	44	Y-BR	37	
	SPARE	19	BR-Y	38	
	CBS1	45	Y-S	39	
	CBS2	20	S-Y	40	
5	CT	46	V-BL	41	7
	CR	21	BL-V	42	
	CS	47	V-O	43	
	CG	22	O-V	44	
	C1	48	V-G	45	
	C2	23	G-V	46	
	SPARE	49	V-BR	47	
	SPARE	24	BR-V	48	
	CBS1	50	V-S	49	
	CBS2	25	S-V	50	

* Stencil lead designations on fanning strip.

TABLE E
CONNECTIONS FOR PLUG NO.3 – 604-TYPE PANEL

TRUNK NO.	LEAD DESIG*	CONN PIN NO.	CONN CABLE COLOR	66M1-50 INTERFACE CONN BLK ROW NO.	POS. IN 604-TYPE PANEL
6	CT	26	W-BL	1	8
	CR	1	BL-W	2	
	CS	27	W-O	3	
	CG	2	O-W	4	
	C1	28	W-G	5	
	C2	3	G-W	6	
	SPARE	29	W-BR	7	
	SPARE	4	BR-W	8	
	CBS1	30	W-S	9	
	CBS2	5	S-W	10	
7	CT	31	R-BL	11	10
	CR	6	BL-R	12	
	CS	32	R-O	13	
	CG	7	O-R	14	
	C1	33	R-G	15	
	C2	8	G-R	16	
	SPARE	34	R-BR	17	
	SPARE	9	BR-R	18	
	CBS1	35	R-S	19	
	CBS2	10	S-R	20	
8	CT	36	BK-BL	21	11
	CR	11	BL-BK	22	
	CS	37	BK-O	23	
	CG	12	O-BK	24	
	C1	38	BK-G	25	
	C2	13	G-BK	26	
	SPARE	39	BK-BR	27	
	SPARE	14	BR-BK	28	
	CBS1	40	BK-S	29	
	CBS2	15	S-BK	30	
9	CT	41	Y-BL	31	13
	CR	16	BL-Y	32	
	CS	42	Y-O	33	
	CG	17	O-Y	34	
	C1	43	Y-G	35	
	C2	18	G-Y	36	
	SPARE	44	Y-BR	37	
	SPARE	19	BR-Y	38	
	CBS1	45	Y-S	39	
	CBS2	20	S-Y	40	
SPARE	SPARE	46	V-BL	41	
		21	BL-V	42	
		47	V-O	43	
		22	O-V	44	
		48	V-G	45	
		23	G-V	46	
–24V	FAL1 †	49	V-BR	47	F2
GRD	G1 †	24	BR-V	48	TS1-15
–48V	FAL2 †	50	V-S	49	F16
GRD	G2 †	25	S-V	50	TS1-16

* Stencil lead designations on fanning strip.

† Optional attendant alarm indicator on 604B or 604C panel only.

TABLE F

CONNECTIONS FOR PLUG NO. 4 – 604-TYPE PANEL

TRUNK NO.	LEAD DESIG*	CONN PIN NO.	CONN CABLE COLOR	66M1-50 INTERFACE CONN BLK ROW NO.	POS. IN 604-TYPE PANEL
10	CT	26	W-BL	1	3
	CR	1	BL-W	2	
	CS	27	W-O	3	
	CG	2	O-W	4	
	C1	28	W-G	5	
	C2	3	G-W	6	
	SPARE	29	W-BR	7	
	SPARE	4	BR-W	8	
	CBS1	30	W-S	9	
	CBS2	5	S-W	10	
11	CT	31	R-BL	11	6
	CR	6	BL-R	12	
	CS	32	R-O	13	
	CG	7	O-R	14	
	C1	33	R-G	15	
	C2	8	G-R	16	
	SPARE	34	R-BR	17	
	SPARE	9	BR-R	18	
	CBS1	35	R-S	19	
	CBS2	10	S-R	20	
12	CT	36	BK-BL	21	9
	CR	11	BL-BK	22	
	CS	37	BK-O	23	
	CG	12	O-BK	24	
	C1	38	BK-G	25	
	C2	13	G-BK	26	
	SPARE	39	BK-BR	27	
	SPARE	14	BR-BK	28	
	CBS1	40	BK-S	29	
	CBS2	15	S-BK	30	
13	CT	41	Y-BL	31	12
	CR	16	BL-Y	32	
	CS	42	Y-O	33	
	CG	17	O-Y	34	
	C1	43	Y-G	35	
	C2	18	G-Y	36	
	SPARE	44	Y-BR	37	
	SPARE	19	BR-Y	38	
	CBS1	45	Y-S	39	
	CBS2	20	S-Y	40	
14	CT	46	V-BL	41	14
	CR	21	BL-V	42	
	CS	47	V-O	43	
	CG	22	O-V	44	
	C1	48	V-G	45	
	C2	23	G-V	46	
	SPARE	49	V-BR	47	
	SPARE	24	BR-V	48	
	CBS1	50	V-S	49	
	CBS2	25	S-V	50	

* Stencil lead designations on fanning strip.

TABLE G

CONNECTIONS FOR CENTRAL OFFICE TRUNKS AT 615A PANEL

TRUNK NO.	LEAD DESIG	TERMINAL ON 66T1 CONN BLOCK	66B4-25 CONN BLOCK ROW NO.
1	T R	1A 2A	1 2
2	T R	3A 4A	3 4
3	T R	5A 6A	5 6

◆ TABLE H ◆

CONNECTIONS FROM PLUG P1 ON 615A PANEL TO INTERFACE CONNECTING BLOCK

TRUNK NO.	LEAD DESIG	P1 PIN NO.	A25B CONN CABLE	66M1-50 CONN BLOCK (TELCO SIDE) ROW NO.
1	CT	26	W-BL	1
	CR	1	BL-W	2
	CS	27	W-O	3
	CG	2	O-W	4
	C1	28	W-G	5
	C2	3	G-W	6
	Spare	29	W-BR	7
	Spare	4	BR-W	8
	CBS1	30	W-S	9
	CBS2	5	S-W	10
2	CT	31	R-BL	11
	CR	6	BL-R	12
	CS	32	R-O	13
	CG	7	O-R	14
	C1	33	R-G	15
	C2	8	G-R	16
	Spare	34	R-BR	17
	Spare	9	BR-R	18
	CBS1	35	R-S	19
	CBS2	10	S-R	20
3	CT	36	BK-BL	21
	CR	11	BL-BK	22
	CS	37	BK-O	23
	CG	12	B-BK	24
	C1	38	BK-G	25
	C2	13	G-BK	26
	Spare	39	BK-BR	27
	Spare	14	BR-BK	28
	CBS1	40	BK-S	29
	CBS2	15	S-BK	30

TABLE I

POWER CONNECTIONS

INPUT VOLTAGE	69G APP MTG (NOTE 1)	604B OR C PANEL (NOTE 2)	604A1 PANEL (NOTE 3)	615A PANEL (NOTE 4)
−24V	9	INPUT −24V	14	2D
−48V	—	INPUT −48V	—	—
GRD	4	INPUT GRD	13	4D

Notes:

1. Terminals on 66B4-25 connecting block. Connect as shown in Fig. 10.
2. Terminals on rear of panel stamped as shown. Position option straps for −24V or −48V.
3. Terminals on terminal strip TSA on rear of panel.
4. Terminals on 66T1 connecting block on rear of panel.

TABLE J

604A-TYPE PANEL FUSE ASSIGNMENT

VOLTAGE	FUSE NO.*	PANEL POSITION
−24V	F1	J1A
	F2	J2A
	F3	J3A
	F4	J4A
	F5	J5A
	F6	J6A
	F7	J7A
	F8	J8A
	F9	J9A
	F10	J10A
	F11	J11A
	F12	J12A
	F13	J13A
	F14	J14A
	F15	J10B†
	F16	J11B†
	F17	J13B†
	F18	J14B†

* Fuses are 70G 1/2-ampere.

† Plug. No. 5 dedicated to one-way incoming trunks not used in this application.

TABLE K

604B AND 604C PANELS FUSE ASSIGNMENT

VOLTAGE	FUSE NO.	PANEL POSITION
±105V (Note)	F1*	J1A thru J14A
−24V	F2*	J1A
	F3*	J2A
	F4*	J3A
	F5*	J4A
	F6*	J5A
	F7*	J6A
	F8*	J7A
	F9*	J8A
	F10*	J9A
	F11*	J10A
	F12*	J11A
	F13*	J12A
	F14†	J13A
	F15†	J14A
−48V (Note)	F16‡	J1A thru J5A
	F17‡	J6A thru J10A
	F18‡	J11A thru J14A

Note: ±105V and −48V not used in this application.

* 70F Fuse 1/4 Ampere.

† 70G Fuse 1/2 Ampere.

‡ 70A Fuse 1-1/3 Ampere.

TABLE L

615A PANEL FUSE ASSIGNMENTS

VOLTAGE	FUSE NO.†	CONNECTOR
−24V	F1 F2 F3	J1A,B J2A,B J3A,B
−48V*	F4 F5 F6	J1A J2A J3A
±105V*	F7	J1A,J2A,J3A
	F8	SPARE

* Not used with PCA CED.

† All fuses 24E, 1/2 ampere.

VOICE CONNECTING ARRANGEMENT CET

1. GENERAL

1.01 This section provides identification, installation operation, maintenance and connection information for the 102-type interconnecting unit (IU) and associated 604-type panel, or 615A panel when used in Voice Connecting Arrangement CET.

1.02 This section is reissued to:

- Include information on the 615A panel which replaces the 69G apparatus mounting
- Add information on the 604C panel and 21A apparatus unit
- Include information on the 142A test set
- Add note on option W to 1.03
- Show 604A panel rated MD and replaced by 604B panel
- Show 102A IU rated MD and replaced by 102B IU.

1.03 The 102B IU is an improved version of the 102A (MD) IU and offers the following advantages:

- Line impedance matching terminals (option Y or Z) for 600-ohm or 900-ohm CO line
- Increases range limitation of dial pulsing and supervisory leads (CS and CG) from 18 ohms to 100 ohms maximum

Note: If a problem is encountered in existing installations with the 18-ohm range limitation using a 102A IU, replace with a 102B IU. In existing installations using pulse correction, the 103A pulse corrector must be removed when replacing the 102A IU with a 102B IU.

- Maximum allowable external loop resistance to CO of 2500 ohms with option W

Note: ➧Option W is required when the external circuit loop exceeds 800 ohms (including central office [CO] resistance) to provide sufficient dc loop current for supervision. Option W is not recommended for short loops as high line current may cause poor transmission.➧

- Arranged for data application (covered in other BSPs)
- New transformer with higher breakdown insulation.

1.04 The 604B and ➧604C➧ panels are improved versions of the 604A(MD)-type panels using less mounting space and featuring 24-volt or 48-volt operation with connections for ringing voltage and optional fuse alarm indicator.

1.05 ➧The 604C panel should be used if the supply voltage is −24V but can be used with −48V with the addition of a 21A apparatus unit.➧

1.06 For one to three IUs use the 615A panel. For 4 to 14 IUs use the 604-type panel. The size of the initial installation and the expected growth should be the determining factor in selecting the proper mounting equipment. ➧The 69G apparatus mounting is no longer recommended for use now that the 615A panel is available. The 69G apparatus mounting has the undesirable feature of splitting tip and ring.➧

1.07 ➧The 142A test set (Fig. 12) is designed to provide a quick field operational test for the 101- and 102-type IUs. The 142A test set uses signal lamps to indicate the correct operation of the IU by simulating the inputs from the customer-provided equipment (CPE).➧

1.08 ➧For more detailed information on the associated equipment, refer to the following sections:

- 463-300-101—604A-Type Panels
- 463-300-102—604B and 604C Panels
- 463-300-104—615A Panel
- 463-300-109—KS-20944 Protector

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- 463-300-102—604C Panel and 21A Apparatus Unit
- 463-300-113—142A Test Set◀

1.09 If the customer wants a copy of the Technical Reference which covers this interface specification, the customer should contact the local Telephone Company Business Office or the Marketing Representative.

1.10 This issue of the section is based on the following drawings:

SD-1E238-01, Issue 3A (102B IU)

SD-1E202-01, Issue 3A (102A IU)

SD-69599-01, Issue 2A (69G Apparatus Mounting)

SD-1E200-01, Issue 2D (604-Type Panel)

SD-1E258-01, Issue 1 (142A Test Set)

If this section is to be used with equipment or apparatus reflecting later issue(s) of the drawing(s), reference should be made to the SDs and CDs to determine the extent of the changes and the manner in which the section may be affected.

2. IDENTIFICATION

PURPOSE

- To provide a means to automatically connect, on a loop-start basis, the dial switching equipment of a customer-provided (CP) PBX to a telephone company toll operator for toll terminal service without ringback (has ringback capability but is not used in this application).
- To limit excessive voice levels from CPE and to provide protection for telephone company personnel against hazardous voltages.
- To transmit network control signaling functions.
- ▶To ensure impedance matching between the cable pair and ground.◀

APPLICATION

- Customer-provided dial Hotel-Motel PBX systems.

ORDERING GUIDE

- Unit, Interconnecting, 102B (one per toll operator access trunk, Fig. 1).

Note: If 102A IUs are used in position 13 or 14 of a 604B or 604C panel, 102A IUs must also be used in positions 1, 4, 7, and 10.

Associated Apparatus (Order Separately)

Note: If a 23-inch relay rack is not provided on customer premises, provide a 16C apparatus mounting for the 69G or ▶615A panel◀ or an ED-91180-72, Group 21 cabinet for the 604-type panel.

- Panel, 604A1 (MD) (fuse panel only, no power unit; mounts up to fourteen 102-type IUs)

or

- Panel 604A2 (MD) (includes 19C2 power unit and fuse panel; mounts up to fourteen 102-type IUs)

or

- Panels, 604B and ▶604C◀ (fuse panel only, no power unit; mounts up to fourteen 102-type IUs, Fig. 2 and 3)
- Unit, Apparatus, 21A (one per 604C when supply voltage is −48V)

or

- ▶Panel, 615A (fuse panel only, no power unit; mounts three 102-type IUs, Fig. 4)◀
- Bracket, 99B (one per twelve 69G; ▶one per three 615As◀)
- Cable, Connector, A25B

  (a) ▶one per 615A panel

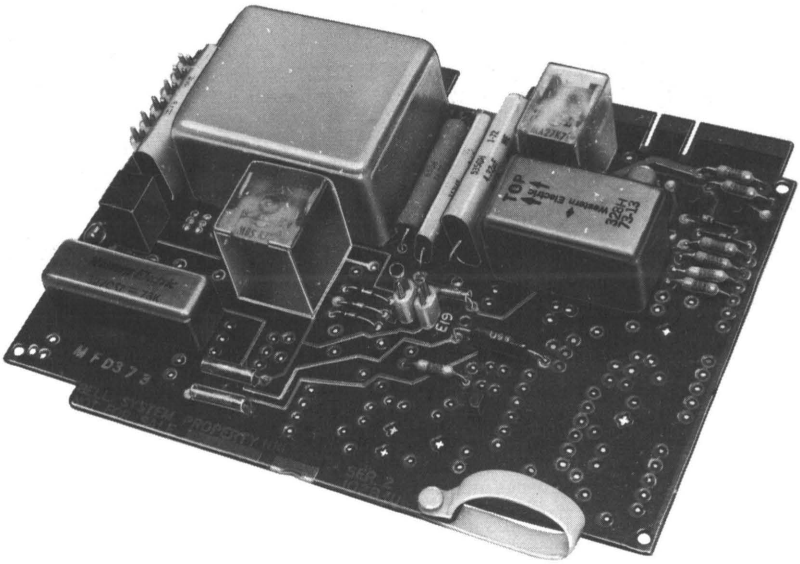


Fig. 1—➧102B Interconnecting Unit➧

(b) four per 604-type panel or see Table A➧

- Block, Connecting, 66M1-50 (as required, Fig. 5)
- Block, Connecting, 66B4-25 (as required)
- Clip, Bridging, B (as required, 25 per pkg., Fig. 5)

Note: ➧Other type blocks should not be used for the customer interface due to their incompatibility with the 142A test set connections.➧

- Cable, D Inside Wiring (or equivalent), for cabling from the 66B4-25 intermediate connecting block to 66M1-50 interface connecting block (69G only) ➧or for cabling from 615A panel to CO lines➧
- Unit, Power, for 604A1 (MD), 604B and ➧604C➧ (locally engineered and installed when existing PBX power supply is insufficient). (A 19C2 will power one panel; a 29C1 will power two panels.)
- Unit, Telephone, Key 201C (if required for fusing 69G) (See 3.01.)
- Cord, Power, for 19C2 power unit
- ➧Unit, Power, 19C2 (for 615A panel)➧

P40J326 (1-1/2 ft)

P40J327 (2 ft)

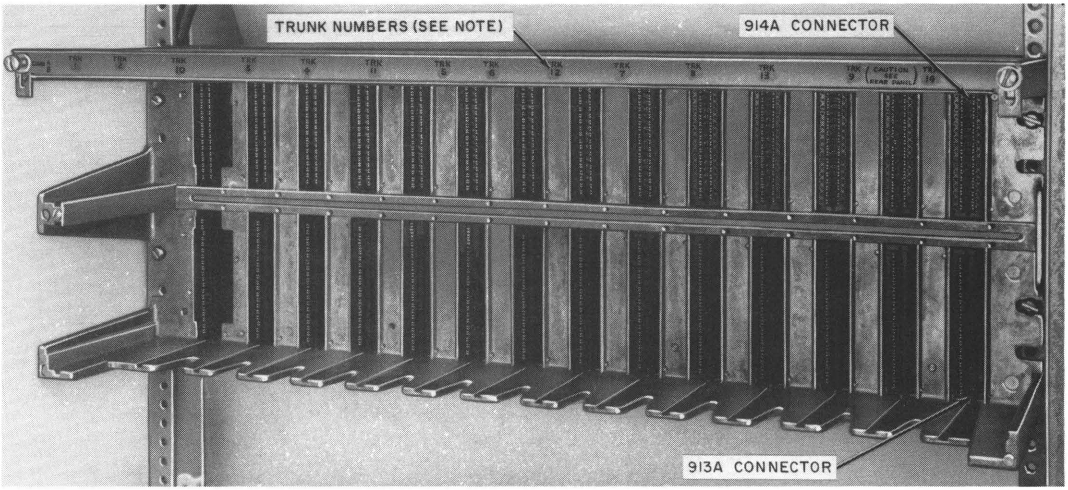
P40J328 (4 ft)

P40J329 (6 ft)

P40J099 (12 ft)

For Power Protection Unit (Optional)

- KS-20944, L1 ➧or L2➧ Protector (Fig. 6). ➧Use the List 1 protector for −24 volts and the List 2 for −48 volts.➧



NOTE: ON OLDER 604B PANELS, POSITION NUMBERS APPEAR INSTEAD OF TRUNK NUMBERS.

INSTALLATION SEQUENCE OF 102-TYPE INTERCONNECTING UNITS

TRUNK NO.	1	2	10	3	4	11	5	6	12	7	8	13	9	14
POSITION NO.	1	2	3	4	5	6	7	8	9	10	11	12	13	14

Fig. 2—604B and 604C Panels, Front View

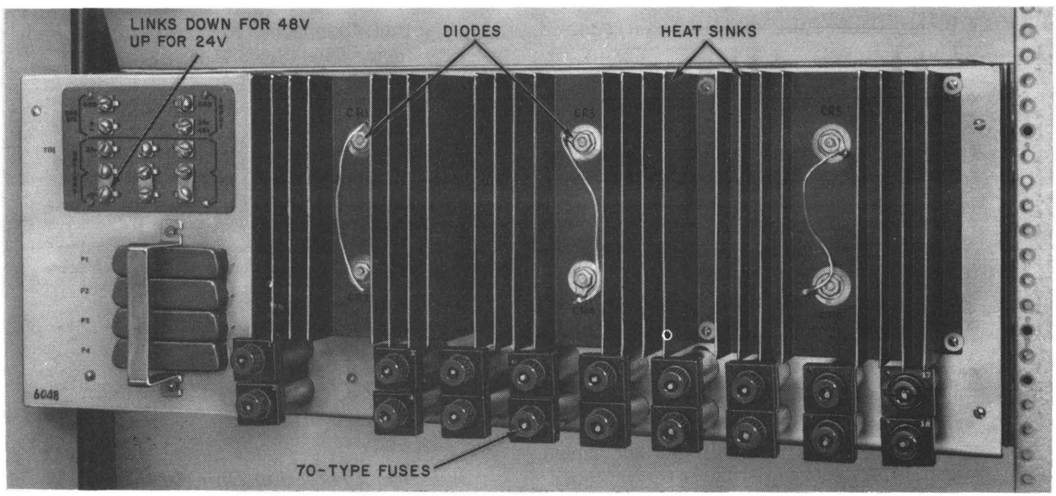


Fig. 3—604B Panel, Rear View

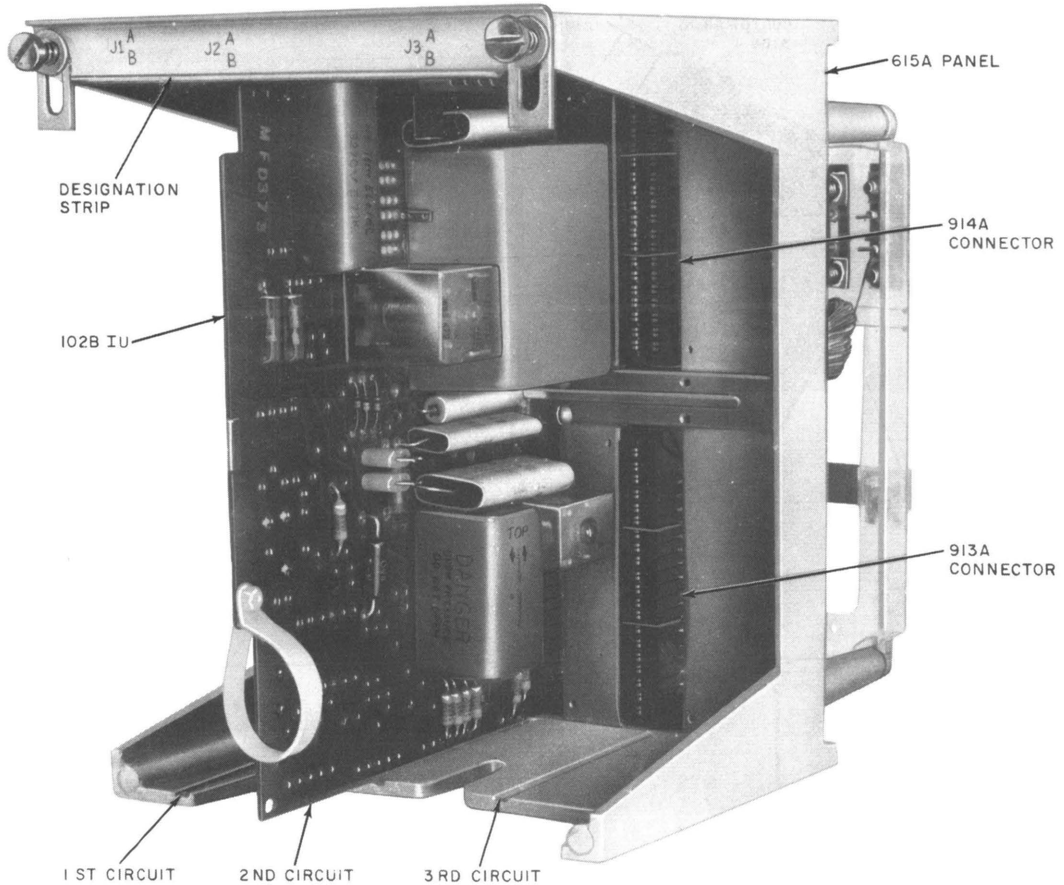


Fig. 4—102B Interconnecting Unit Mounted in 615A Panel

Replaceable Components

604-Type Panel

- Unit, Power, 19C2 (for 604A2)

- Fuse, 70G, 1/2 ampere (18 per 604A-type panel)

- Fuse, 70F, 1/4 ampere (13 per 604B and ➧604C➧ panels)

- Fuse, 70G, 1/2 ampere (two per 604B and ➧604C➧ panels)

- Fuse, 70A, 1-1/3 ampere (three per 604B and ➧604C➧ panels)

- Indicator, 17C-49 for optional fuse alarm (604B and ➧604C➧ panels only).

➧615A Panel

- Fuse, 24E, 1/2 ampere (8 per panel, Fig. 4).➧

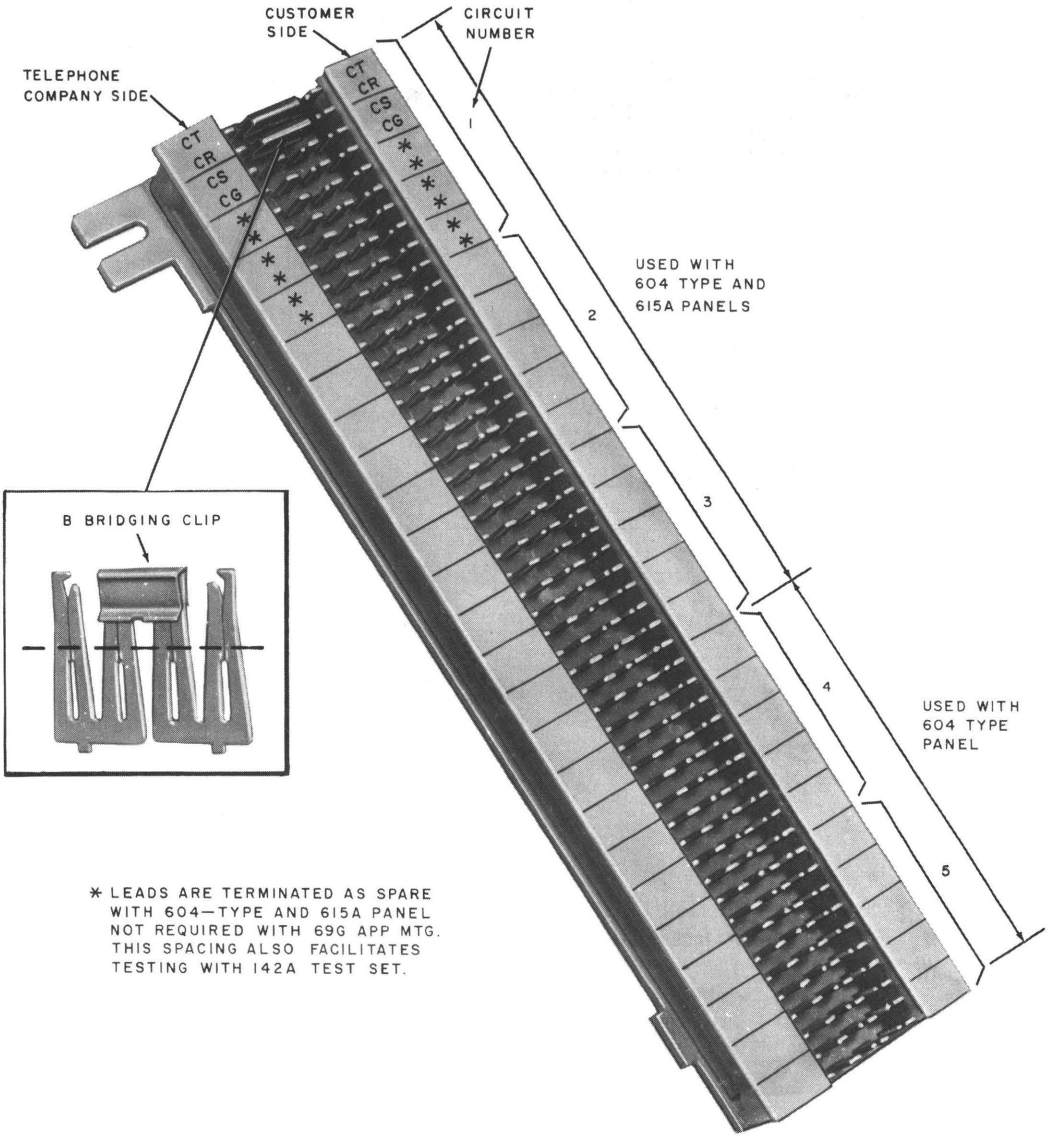


Fig. 5—66M1-50 Interface Connecting Block

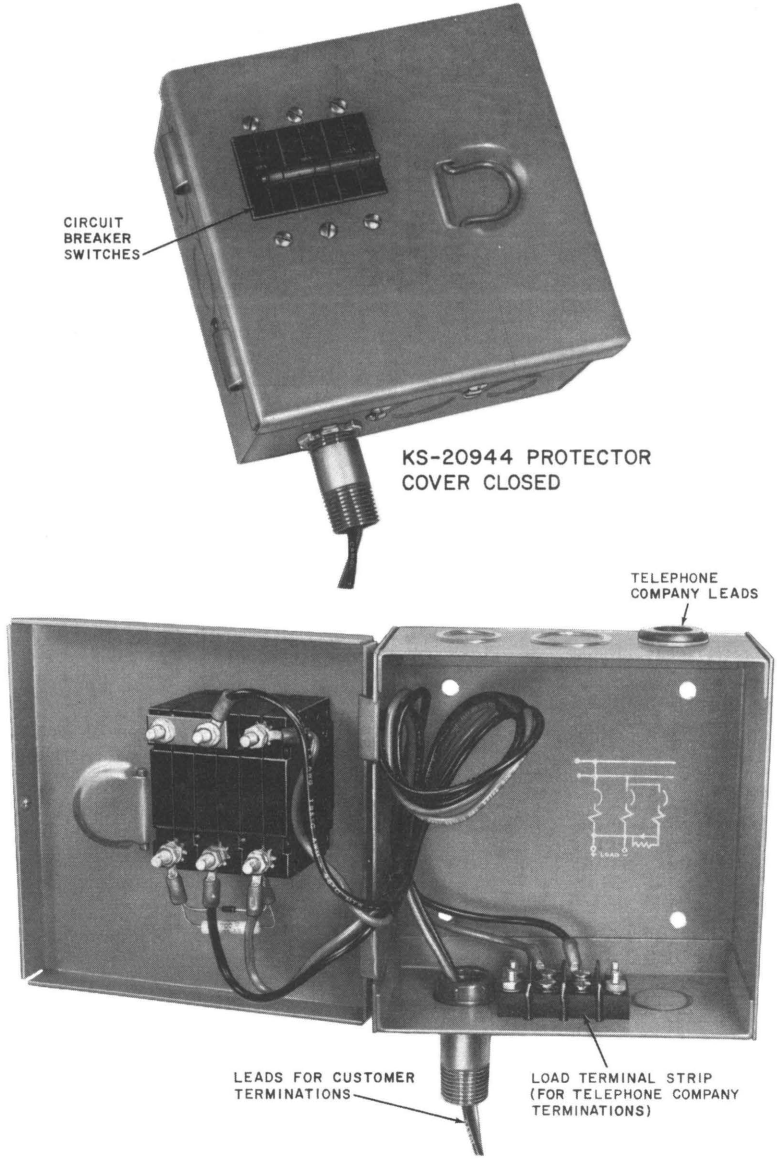


Fig. 6—KS-20944 Protector

DESIGN FEATURES

102-Type Interconnecting Unit

- Approximate dimensions: 7-1/2 inches by 5-1/2 inches
- Components mounted on epoxy coated 8-inch, 80-pin board
- Features loop-start operation with rering capability
- Option terminals
- Features line impedance matching (102B IU only)
- ➧Provides long-loop operation (102B IU only)➧
- Provides voice frequency coupling to CPE
- Provides dc isolation to CPE
- Provides indication of CO battery reversal
- Limits excessive voice signals
- Provides connection between CPE and loop-start CO trunk
- Permits tone address signaling from behind the CP PBX.

Associated Apparatus

- For design features of the apparatus used with the 102-type IU, refer to the sections listed in 1.08.

604-Type Panel

- Approximate dimensions: 604A (MD) panel is 16 inches high, 23 inches wide, and 8-1/2 inches deep; 604B and ➧604C➧ panels are 8 inches high by 23 inches wide and 10 inches deep.
- Equipped with 20-pin 913A and 40-pin 914A connectors which are factory-wired to ➧four KS-16671, L1 plugs➧ and five KS-16671, List 1 plugs.
- The arrangement of 913A and 914A connectors provides for two vertical connectors to accommodate an 8-inch, 80-pin board.
- All 14 positions will accommodate 102-type IUs.

Caution: ➧102A and 102B IUs will not fit in certain slots. Do not force into slots.➧

- Fused power protection is provided to all fourteen 102-type IUs.
- Fused power protection is provided for 48-volt talk battery and ring supply (604B and ➧604C➧ only—not used in this application).
- Option terminals to change connections for 24- or 48-volt operation (604B and ➧604C➧ only).
- Mounts on a standard relay rack or in an equipment cabinet.

➧615A Panel

- Approximate dimensions: 8 inches high by 6 inches wide by 9-1/4 inches deep.
- Equipped with three 20-pin 913A and three 40-pin 914A connectors, which are factory-wired to one KS-16671, List 1 plug.
- The arrangement of the 913A and 914A connectors provides for two vertical connectors to accommodate an 8-inch, 80-pin board.
- Mounts three 102-type IUs.
- Fused power protection is provided to each 102-type IU.
- Mounts on a standard relay rack or in a 16C apparatus mounting, using 99B brackets.➧

KS-20944 Protector (Fig. 6)

- Approximate dimensions: 8 inches high, 6-3/8 inches wide, and 3-3/4 inches deep
- Provides protection against excessive dc voltage and dc current, reversed polarity, over 18 volts ac, or incorrect ground from CP power supply

- Provides dc interface to CPE
- Equipped with a 3-pole magnetic circuit breaker mounted on a hinged cover
- Provides disconnect switch for power supply voltage
- Equipped with two leads for connection to the CP power supply and a 2-terminal connecting block for connection to the connecting arrangement dc power leads.
- ▶List 1 for 24 volts at 15 amps; List 2 for 48 volts at 15 amps; List 3 for 24 volts at 30 amps; List 4 for 48 volts at 30 amps.◀

3. INSTALLATION

69G Apparatus Mounting (Fig. 7)

Note: ▶The 69G apparatus mounting is not recommended for new installations. It has been replaced by the 615A panel. The following paragraphs are intended for use as an Additions and Maintenance (A&M) basis only.◀

3.01 Electrical connection is made to the 69G apparatus mounting through two A25B connector cables. Terminate the stub ends of the two cables on the 66B4-25 intermediate connecting block following the wiring plan shown in Fig. 7. Insulate and store all spare conductors. The CO lines and power supply are also connected to this block.

3.02 Use the "D" inside wiring cable to extend the four interface leads from the 66B4-25 intermediate connecting block to the 66M1-50 interface connecting block for access to the CPE. Stencil lead designations on the designation strip as shown in Fig. 5.

3.03 Connect the −24 volt power supply leads from a telephone company-provided power supply, or CP dc power supplied through the KS-20944 protector, to the 66B4-25 connecting block as shown in Fig. 7 and Table H. Multiple through separate fuses to each 102-type IU (201C KTU fuse unit with 24E 1/2-ampere fuses, or equivalent).

3.04 The relay rack or apparatus mounting should be grounded separately. When a separate power unit is used, refer to the appropriate section in Division 518 for proper grounding of power units. Proper grounding of equipment and power unit is important to prevent damage from power line surges.

604-Type Panel (Fig. 8 and Tables B, C, D, E, H, I, and J)

3.05 The 604-type panel will mount on a standard relay rack, or in an ED-91180-72, 18-plate equipment cabinet. The relay rack or equipment cabinet should be grounded separately.

The 18-plate equipment cabinet will house two 604A-type panels, three 604B and ▶604C◀ panels, or two 604B and ▶604C◀ panels with a 29C1 power unit, when the drawing holder (P423968 clips) on the lower half of the equipment cabinet cover is removed (to allow clearance for IUs in lower panel).

Mount the 66M1-50 interface connecting block within 200 feet of the 604-type panel for the 102A; for the 102B, the range may be longer.

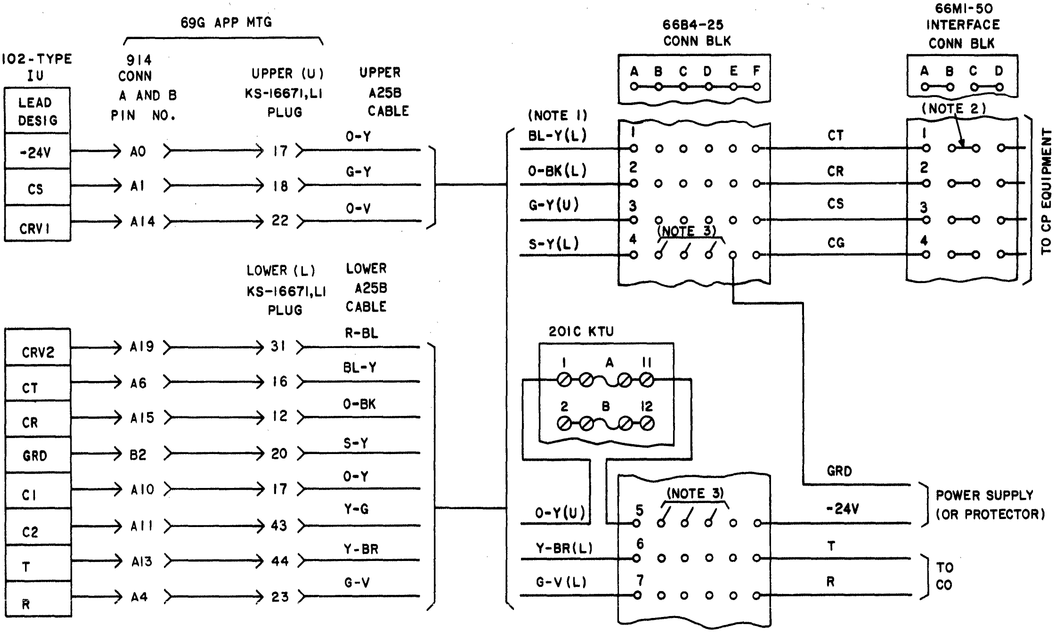
3.06 Electrical connection is made to the 604-type panel through connector cables. Arrangement of the plugs on the panel restricts the first plug to an A25B connector cable (to CO lines). Plugs 2 through 4 are arranged to adapt to a choice of cable sizes (see Table A). Plug 5 (604A-type only) is used only for one-way incoming trunks and is not used in this voice connecting arrangement.

3.07 Terminate the stub end of connector cable 1 on the 66B4-25 connecting block for CO lines.

3.08 Terminate the stub end of connector cables 2, 3, and 4 at the customer end on 66M1-50 interface connecting blocks (stencil lead designations on designation strip, Fig. 5).

3.09 The customer must provide a 105- to 130-volt, 60-Hz outlet within reach of available power cords (see ORDERING GUIDE for cord lengths). This outlet should ***not*** be under control of a wall switch.

3.10 When using an external telephone company-provided power supply (604A1, 604B or 604C only) or CP dc power supplied through the KS-20944 protector, connect to fuse panel on



NOTES:
1. INSULATE AND STORE SPARE LEADS.
2. B BRIDGING CLIPS OR WIRE STRAPS.
3. MULTIPLE TO OTHER CIRCUITS.

Fig. 7—Connection Diagram—102-Type Interconnecting Unit With 69G Apparatus Mounting

rear of panel as shown in Table H (use 16-gauge or equivalent twisted pair). Maximum current drain per 102B IU is 0.090 ampere, and 102A (MD) IU is 0.110 ampere. Refer to the appropriate section in Division 518 for proper grounding of power plants. Proper grounding of equipment and power unit is important to prevent damage from power line surges.

▶615A Panel (Fig. 8 and Tables F, G, and H)

3.11 Install the 615A panel on a 23-inch relay rack or in a 16C apparatus mounting using the 99B bracket. Remove the center mounting bar from the 16C apparatus mounting to avoid cover interference. The 99B bracket will hold three 615A panels. Each 615A panel mounts three 102-type IUs. Mount the 66M1-50 connecting block within 25 feet of the 615A panel (for an A25B connector cable).

3.12 Mount a 66B4-25 connecting block, if required, for connecting the CO lines to the 615A panel. Where conditions permit, the CO lines can be terminated directly on the 66T1 connecting block on the rear of the panel (Table F).

3.13 Connections to the CPE are made to the 615A panel through an A25B connector cable. Terminate the stub end of the A25B connector cable at the customer end on the 66M1-50 interface connecting block. Stencil lead designations on the designation strip as shown in Fig. 5.

3.14 Connect the −24 volt power leads from a separate telephone company-provided power unit, or CP dc power supplied through the KS-20944, List 1 protector, to the 66T1 connecting block on the rear of the 615A panel as shown in Fig. 8 and Table H. Connect a separate ground wire to the rack or 16C apparatus mounting. Refer to the appropriate section in Division 518 for proper grounding of power plants. Proper grounding of equipment and power unit is important to prevent damage from power line surges.◀

102-Type Interconnecting Unit (Fig. 1, 9, or 10)

To protect transistors and other electrical components of 102-type interconnecting units, remove fuses associated with that particular circuit before installing or replacing a unit. See Table I, J, or K for fuse location.

3.15 Provide proper option straps using 24-gauge ***bare wire*** for options W, Y, and Z from Fig. 9 or 10 for local conditions. Always use option Z for the 102A IU. The toll operator should be instructed not to rering on these PBX lines. For the 102B IU, provide option Y or Z for proper line impedance matching; and ▶when the external loop exceeds 800 ohms (including CO resistance), provide option W.◀ Check straps for continuity after placing.

3.16 When installing the 102-type IU, raise and secure the card retainer (69G) or designation strip holder (604 and 615A panel) and then position the board in the guide grooves of the 69G apparatus mounting, 604-type panel or 615A panel, and slide the IU in until it is properly seated and electrically connected to the 913A or 914A connectors.

The connectors in the 604B and ▶604C◀ panels are equipped with index clips to match the code slots in the 102B IU. When using 102A IUs it will be necessary to remove the clips between contacts 9 and 10 in the panel B connectors.

3.17 Make certain the card retainer or designation strip holder is properly positioned and locked down to hold the 102-type IUs in place.

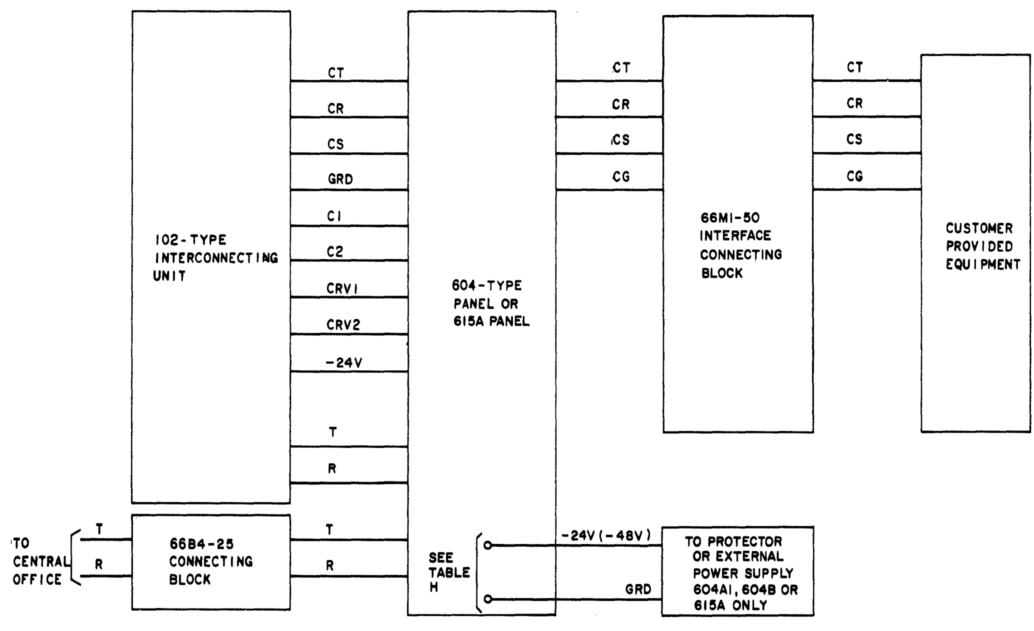
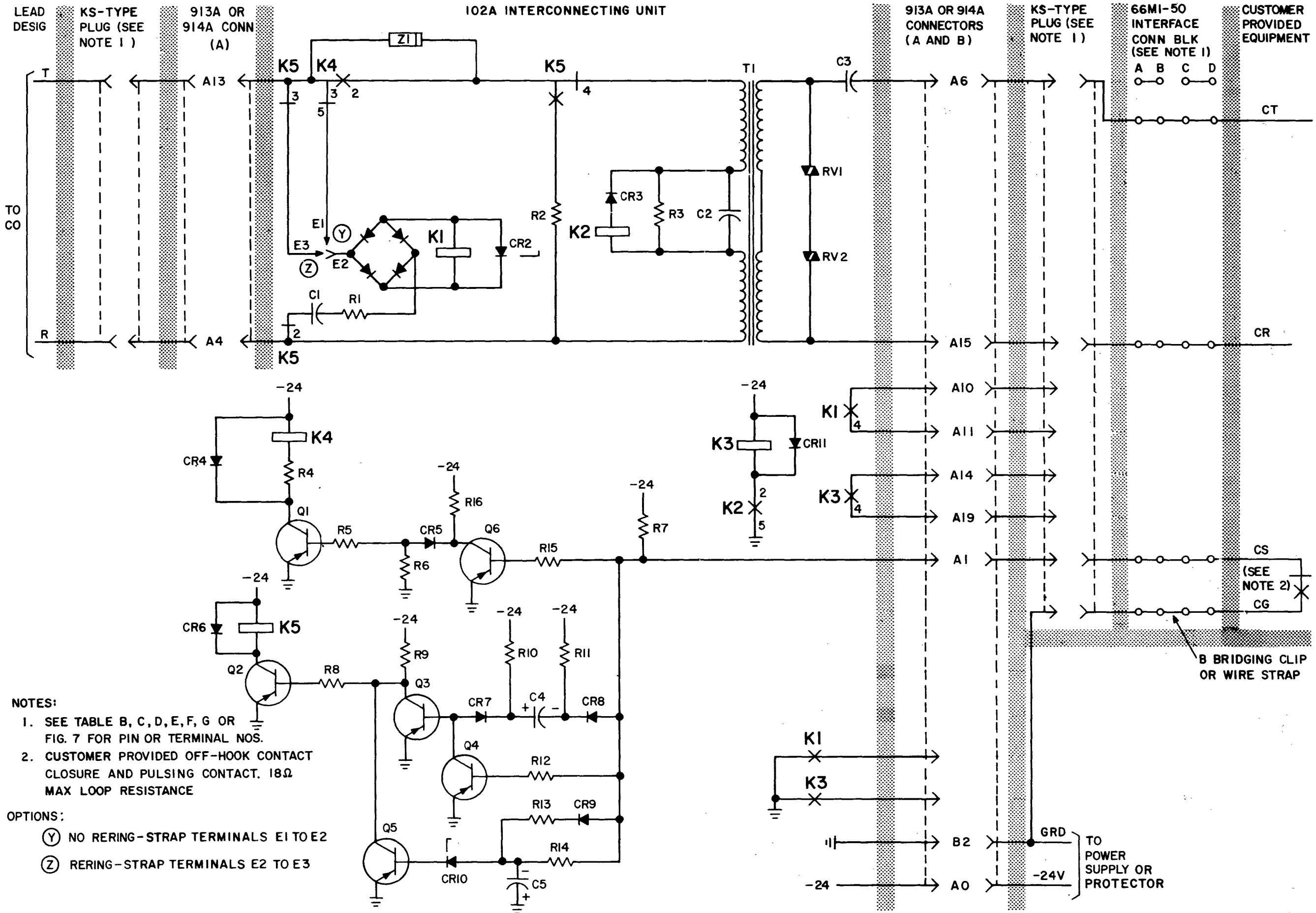


Fig. 8—Block Diagram—102-Type Interconnecting Unit With 604-Type or 615A Panel



NOTES:

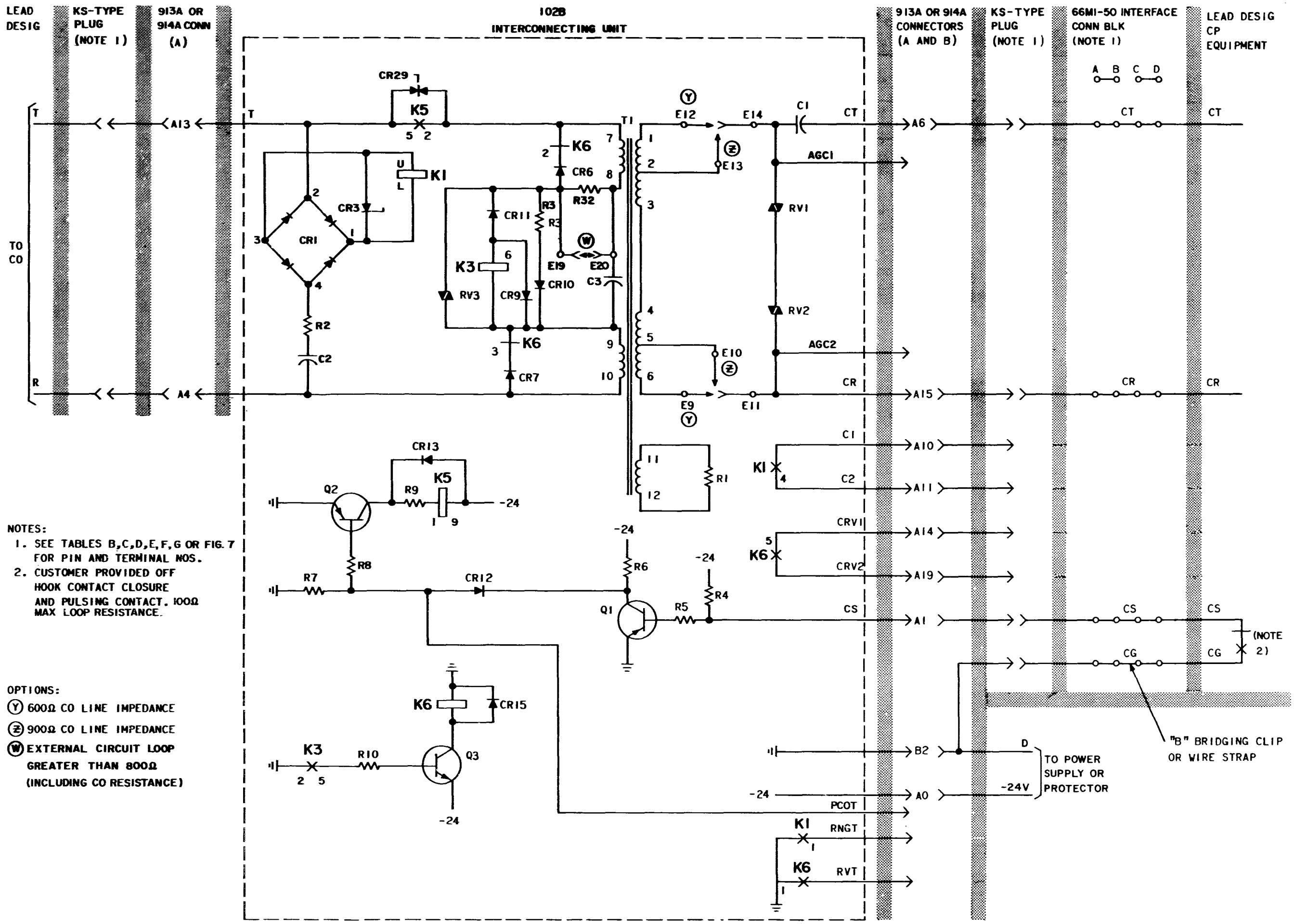
1. SEE TABLE B, C, D, E, F, G OR FIG. 7 FOR PIN OR TERMINAL NOS.
2. CUSTOMER PROVIDED OFF-HOOK CONTACT CLOSURE AND PULSING CONTACT. 18Ω MAX LOOP RESISTANCE

OPTIONS:

(Y) NO RERING-STRAP TERMINALS E1 TO E2

(Z) RERING-STRAP TERMINALS E2 TO E3

Fig. 9—Schematic—102A Interconnecting Unit



NOTES:

1. SEE TABLES B, C, D, E, F, G OR FIG. 7 FOR PIN AND TERMINAL NOS.
2. CUSTOMER PROVIDED OFF HOOK CONTACT CLOSURE AND PULSING CONTACT. 100Ω MAX LOOP RESISTANCE.

OPTIONS:

(Y) 600Ω CO LINE IMPEDANCE

(Z) 900Ω CO LINE IMPEDANCE

(W) EXTERNAL CIRCUIT LOOP GREATER THAN 800Ω (INCLUDING CO RESISTANCE)

Fig. 10—Schematic—102B Interconnecting Unit

3.18 The CO trunks are not wired to the IU positions in numerical order in the 604-type panels. On earlier production of the 604B panel, the ***position*** number is shown on the designation strip. On current production of the 604B and 604C, the ***trunk*** number is shown. Refer to Fig. 2 for installation sequence of 102-type IUs. This suggested sequence is established to correspond to the plug wiring arrangement. The installation sequence for the 615A panel is in the same numerical order as the connectors (J1, J2, J3) from left to right.

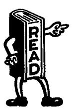
3.19 Perform the tests shown in Part 5 after installation.

KS-20944 Protector (Fig. 11)

3.20 When voltage protection is required, the KS-20944 protector must be mounted externally and wired to the power supply terminals of the 69G apparatus mounting (Fig. 7) or the 604-type and 615A panel (Fig. 8).

3.21 Connect as shown in Fig. 11 following local wiring instructions. The customer must connect his power supply to the red (GRD) and black (−V) 14-gauge leads extending from the unit.

CAUTION: Voltage will be present on (upper) terminals 1 of circuit breakers.



Check for correct polarity and ground before closing switch.

4. OPERATION

A. 102B Interconnecting Unit (Fig. 10)

4.01 ***Outgoing Call:*** When the user of the CP PBX station dials the trunk level associated with Voice Connecting Arrangement CET, the CPE closes a contact which connects the CS lead to the CG lead which operates K5 relay of the 102B IU. K5 relay operated closes the loop to the toll switchboard and cuts through the transmission path over CT and CR leads to the CPE. The toll subscriber line circuit associated with the line lights a lamp at the switchboard jack assigned to the line. An audible ringing signal is not returned to the calling party. The toll operator plugs the rear cord of a cord pair into the jack associated with the signal and operates the DIAL and TALK key establishing a talk path between the toll operator and CP station. The toll operator requests dialing information and, using the front cord of the same pair, dials the requested number and restores the DIAL and TALK key.

4.02 ***Disconnect:*** When the CP station goes on-hook, the closure is removed from across the CS and CG leads, releasing the K5 relay and opening the loop toward the CO. If the CP station goes on-hook or if the toll connection is opened, the toll operator receives a disconnect signal by cord lamp supervision and removes the cord. Time and charge information is passed on to the customer over another circuit, eg, calling the listed directory number or via teletype.

Note: The 102A IU (Fig. 9) operates similarly to the 102B IU but uses different relays.

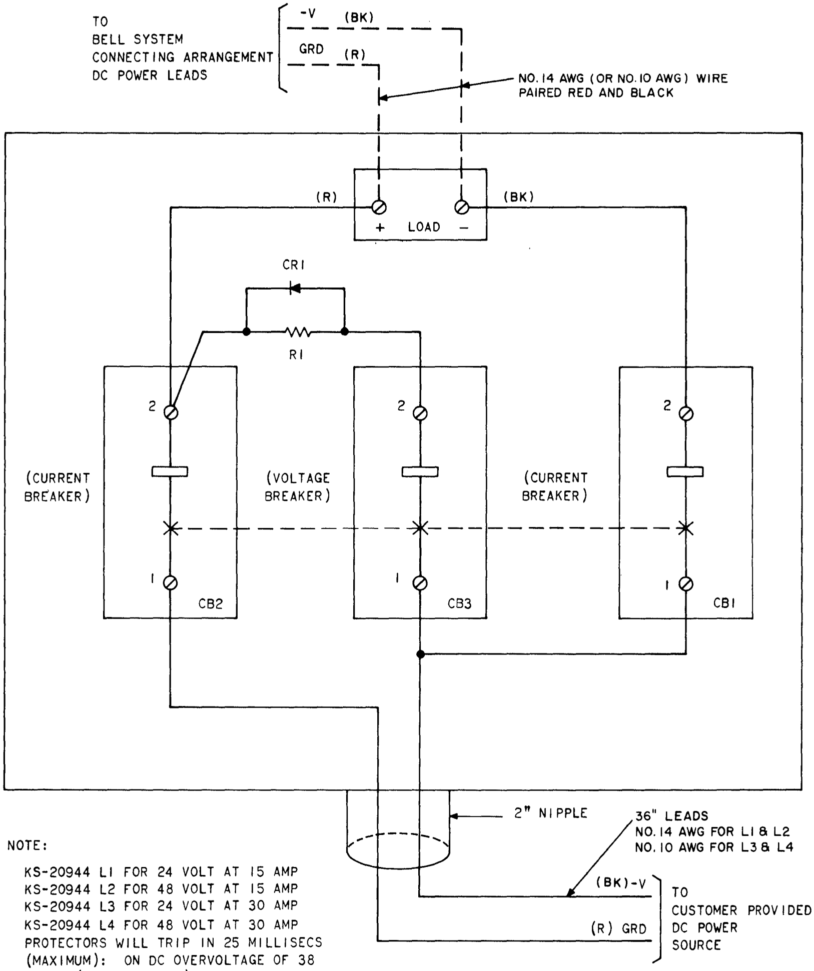
B. KS-20944 Protector (Fig. 11)

4.03 The KS-20944 protector is used to protect the telephone company personnel from hazardous voltages but may not protect equipment from component failures. The KS-20944 protector provides a switch to disconnect dc power when working on interconnecting circuits.

4.04 The KS-20944 protector consists of a dc voltage-operated circuit breaker in series with a parallel resistor-diode combination connected across the line and two dc current-operated circuit breakers connected in each side of the line. The contacts on the breakers are connected in series with their own coil and mechanically coupled together. When any breaker is operated, the line will be opened. The circuit breakers must be manually reset by the customer after tripping. They cannot be reset if the fault persists.

4.05 The KS-20944, List 1 and List 2 protectors are designed to trip in 25 milliseconds (maximum):

- 24 volts dc (List 1) or 48 volts dc (List 2)
- 15 amps dc (List 1) or 15 amps (List 2)
- Reversed polarity or ac greater than 18 volts
- Incorrect power supply ground.



NOTE:

KS-20944 L1 FOR 24 VOLT AT 15 AMP
KS-20944 L2 FOR 48 VOLT AT 15 AMP
KS-20944 L3 FOR 24 VOLT AT 30 AMP
KS-20944 L4 FOR 48 VOLT AT 30 AMP
PROTECTORS WILL TRIP IN 25 MILLISECS (MAXIMUM): ON DC OVERVOLTAGE OF 38 VOLTS (24 VOLT UNIT) AND 68 VOLTS (48 VOLT UNIT), ON OVERLOAD OF 18.75 AMPERES (15 AMP UNIT) AND 37.5 AMPERES (30 AMP UNIT), ON REVERSED POLARITY, OR AC VOLTAGE GREATER THAN 18 VOLTS, OR INCORRECT POWER SUPPLY GROUND.

Fig. 11—Schematic—KS-20944 Protector

5. MAINTENANCE

5.01 When trouble is reported, check the CO pair, check for blown fuses, loose or broken connections, and the power supply.

5.02 Open the four leads to the circuit under test by removing the B bridging clips (or wire straps) at the 66M1-50 interface connecting block and verify in which direction trouble exists by performing the following tests:

A. Without 142A Test Set

Transmission Path

(1) Supply talk battery by connecting a 500-ohm resistor from the −24V supply to terminal CR and strap terminal CT to ground. (Make all connections on the telephone company side of the interface connecting block, Fig. 8.) A 2A KTU or 31A KTU may be used for battery feed instead of the 500-ohm resistor. Refer to Section 518-112-421 for connections. Connect a 1013A (or equivalent) hand test set to terminals CT and CR.

(2) Connect a wire strap across terminals CS and CG. K5 relay will operate completing the talk path, and the toll operator will answer the call. Verify satisfactory transmission.

B. With 142A Test Set (Fig. 12)

(1) Connect the power cord of the 142A test set to the −24V power supply (same supply as for IU) as follows:

- Black lead to ground
- Red lead to −24V
- PWR lamp should light.

(2) Connect the interface cord of the 142A test set to the telephone company side of the interface block as follows:

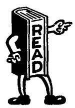
- Black lead to terminal CT
- Red lead to terminal CR
- White lead to terminal CS
- Green lead to terminal CG.

(3) Connect a 1013A (or equivalent) hand test set to the HNDR and HNDT terminals of the 142A test set with the MON-TALK switch in the MON position. Set the CS-CG LOOP switch to the 18-ohm position for a 102A IU or the 100-ohm position for the 102B IU.

(4) Operate the switch on the hand set to the TALK position. CS lamp on 142A test set should light and toll operator answer. Check for satisfactory transmission.

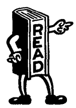
Note: If IU does not seize the trunk, move CS-CG loop switch to lower value. If IU now operates properly, it is marginal. Circuits which only operate on the 0 position should be replaced.

5.03 When trouble is suspected in the 102-type IU, exchange it with another unit known to be operating properly.



Never replace an interconnecting unit in apparatus mounting or panel without first removing the fuse for that circuit. See Table I, J, or K for fuse location.

5.04 Remove all test connections and replace the B bridging clips (or wire straps) on the 66MI-50 interface connecting block.



Do not attempt any tests or repairs to the CPE.

5.05 When in the repairman's judgment the trouble is located in the CPE, the Repair Service Bureau should be notified so that proper maintenance of service charge billing can be initiated as outlined in BSP 660-101-312 entitled Maintenance of Service Charge on Services With Customer-Provided Equipment (CPE).

6. CONNECTIONS

6.01 For connection information using the 69G apparatus mounting, refer to Fig. 5, 6 and 7.

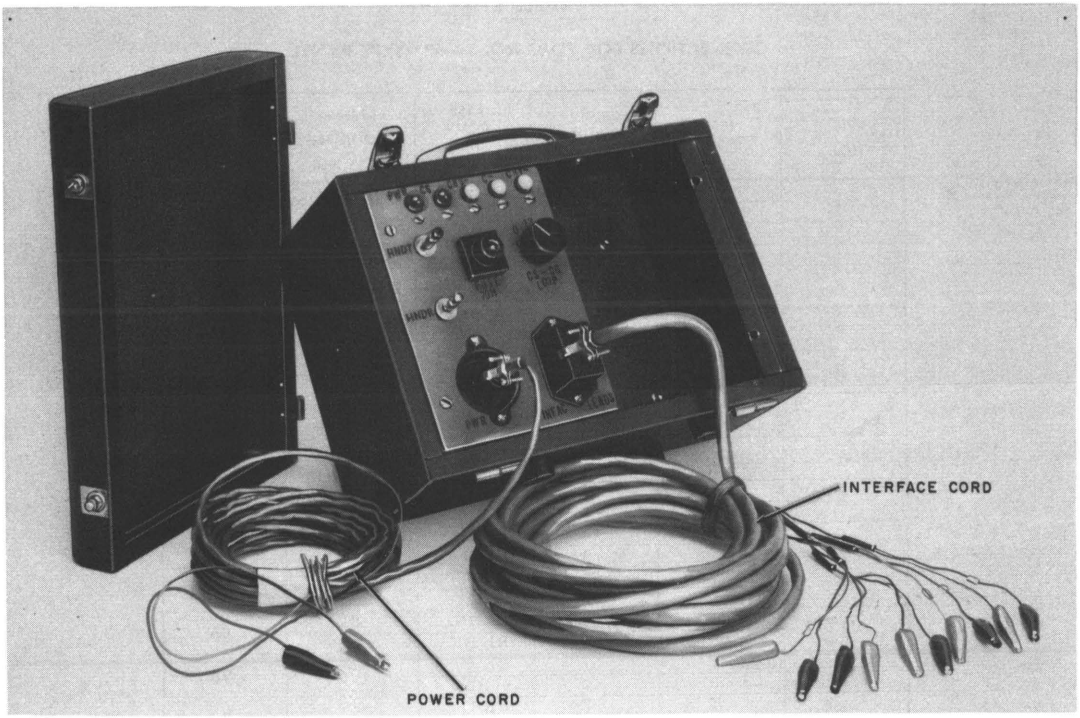


Fig. 12—➧142A Test Set⧏

6.02 For connection information using the 604A-type panel, refer to Fig. 5 and 8 and Tables A, B, C, D, E, H and I.

6.03 For connection information using the 604B and ➧604C⧏ panels, refer to Fig. 5 and 8 and Tables A, B, C, D, E, H and J.

6.04 ➧For connection information using the 615A panel, refer to Fig. 5 and 8 and Tables F, G and H.⧏

6.05 For connection information using the KS-20944 protector, refer to Fig. 11.

TABLE A

OPTIONAL CABLE ARRANGEMENTS TO PROVIDE CONNECTIONS FOR FOUR PLUGS ON 604-TYPE PANEL

CABLE DESIG-NATION (NOTE)	MAXIMUM NO. OF CABLES REQUIRED ARRANGEMENTS (SEE 3.06)		
	Arrangement 1	Arrangement 2	Arrangement 3
A25B	1	4	2
A50B			1
A75A	1		

Note: Arrangement of interconnecting units and local requirements will determine the size and maximum length of cable required.

TABLE B

CONNECTIONS FOR PLUG NO. 1—604-TYPE PANEL

LINE NO.	LEAD DESIG*	CONN PIN NO.	A25B CONN CABLE COLOR	66B4-25 CONN BLK ROW NO.	POS. IN 604-TYPE PANEL
1	T	26	W-BL	1	1A
	R	1	BL-W	2	
2	T	27	W-O	3	2A
	R	2	O-W	4	
3	T	28	W-G	5	4A
	R	3	G-W	6	
4	T	29	W-BR	7	5A
	R	4	BR-W	8	
5	T	30	W-S	9	7A
	R	5	S-W	10	
6	T	31	R-BL	11	8A
	R	6	BL-R	12	
7	T	32	R-O	13	10A
	R	7	O-R	14	
8	T	33	R-G	15	11A
	R	8	G-R	16	
9	T	34	R-BR	17	13A
	R	9	BR-R	18	
10	T	35	R-S	19	3A
	R	10	S-R	20	
11	T	36	BK-BL	21	6A
	R	11	BL-BK	22	
12	T	37	BK-O	23	9A
	R	12	O-BK	24	
13	T	38	BK-G	25	12A
	R	13	G-BK	26	
14	T	39	BK-BR	27	14A
	R	14	BR-BK	28	
†	†	40	BK-S	29	10B‡
		15	S-BK	30	
		41	Y-BL	31	11B‡
		16	BL-Y	32	
		42	Y-O	33	13B‡
		17	O-Y	34	
		43	Y-G	35	14B‡
		18	G-Y	36	
SPARE	SPARE	44	Y-BR	37	
		19	BR-Y	38	
		45	Y-S	39	
		20	S-Y	40	
		46	V-BL	41	
		21	BL-V	42	
		47	V-O	43	
		22	O-V	44	
		48	V-G	45	
		23	G-V	46	
		49	V-BR	47	
		24	BR-V	48	
		50	V-S	49	
		25	S-V	50	

* Stencil lead designations on fanning strip.

† Dedicated to 1-way incoming trunks. (See BSP 463-350-105 for connecting arrangement CD6.)

‡ 604A-type only.

TABLE C
CONNECTIONS FOR PLUG NO. 2 – 604-TYPE PANEL

CIRCUIT NO.	LEAD DESIG*	CONN PIN NO.	CONN CABLE COLOR	66M1-50 INTERFACE CONN BLK ROW NO.	POS. IN 604-TYPE PANEL
1	CT	26	W-BL	1	1
	CR	1	BL-W	2	
	CS	27	W-O	3	
	CG	2	O-W	4	
	SPARE	28	W-G	5	
		3	G-W	6	
		29	W-BR	7	
		4	BR-W	8	
		30	W-S	9	
		5	S-W	10	
2	CT	31	R-BL	11	2
	CR	6	BL-R	12	
	CS	32	R-O	13	
	CG	7	O-R	14	
	SPARE	33	R-G	15	
		8	G-R	16	
		34	R-BR	17	
		9	BR-R	18	
		35	R-S	19	
		10	S-R	20	
3	CT	36	BK-BL	21	4
	CR	11	BL-BK	22	
	CS	37	BK-O	23	
	CG	12	O-BK	24	
	SPARE	38	BK-G	25	
		13	G-BK	26	
		39	BK-BR	27	
		14	BR-BK	28	
		40	BK-S	29	
		15	S-BK	30	
4	CT	41	Y-BL	31	5
	CR	16	BL-Y	32	
	CS	42	Y-O	33	
	CG	17	O-Y	34	
	SPARE	43	Y-G	35	
		18	G-Y	36	
		44	Y-BR	37	
		19	BR-Y	38	
		45	Y-S	39	
		20	S-Y	40	
5	CT	46	V-BL	41	7
	CR	21	BL-V	42	
	CS	47	V-O	43	
	CG	22	O-V	44	
	SPARE	48	V-G	45	
		23	G-V	46	
		49	V-BR	47	
		24	BR-V	48	
		50	V-S	49	
		25	S-V	50	

* Stencil lead designations on fanning strip.

TABLE D
CONNECTIONS FOR PLUG NO. 3 — 604-TYPE PANEL

CIRCUIT NO.	LEAD DESIG*	CONN PIN NO.	CONN CABLE COLOR	66M1-50 INTERFACE CONN BLK ROW NO.	POS. IN 604-TYPE PANEL
6	CT	26	W-BL	1	8
	CR	1	BL-W	2	
	CS	27	W-O	3	
	CG	2	O-W	4	
	SPARE	28	W-G	5	
		3	G-W	6	
		29	W-BR	7	
		4	BR-W	8	
		30	W-S	9	
		5	S-W	10	
7	CT	31	R-BL	11	10
	CR	6	BL-R	12	
	CS	32	R-O	13	
	CG	7	O-R	14	
	SPARE	33	R-G	15	
		8	G-R	16	
		34	R-BR	17	
		9	BR-R	18	
		35	R-S	19	
		10	S-R	20	
8	CT	36	BK-BL	21	11
	CR	11	BL-BK	22	
	CS	37	BK-O	23	
	CG	12	O-BK	24	
	SPARE	38	BK-G	25	
		13	G-BK	26	
		39	BK-BR	27	
		14	BR-BK	28	
		40	BK-S	29	
		15	S-BK	30	
9	CT	41	Y-BL	31	13
	CR	16	BL-Y	32	
	CS	42	Y-O	33	
	CG	17	O-Y	34	
	SPARE	43	Y-G	35	
		18	G-Y	36	
		44	Y-BR	37	
		19	BR-Y	38	
		45	Y-S	39	
		20	S-Y	40	
	SPARE	46	V-BL	41	
		21	BL-V	42	
		47	V-O	43	
		22	O-V	44	
		48	V-G	45	
		23	G-V	46	
-24V	FAL1 †	49	V-BR	47	F2(FA)
GRD	G1 †	24	BR-V	48	TS1(15)
-48V	FAL2 †	50	V-S	49	F16(FA)
GRD	G2 †	25	S-V	50	TS1(16)

* Stencil lead designations on fanning strip.

† Optional attendant alarm indicator on 604B panel only.

TABLE E
CONNECTIONS FOR PLUG NO. 4 – 604-TYPE PANEL

CIRCUIT NO.	LEAD DESIG*	CONN PIN NO.	CONN CABLE COLOR	66M1-50 INTERFACE CONN BLK ROW NO.	POS. IN 604-TYPE PANEL
10	CT	26	W-BL	1	3
	CR	1	BL-W	2	
	CS	27	W-O	3	
	CG	2	O-W	4	
	SPARE	28	W-G	5	
		3	G-W	6	
		29	W-BR	7	
		4	BR-W	8	
		30	W-S	9	
		5	S-W	10	
11	CT	31	R-BL	11	6
	CR	6	BL-R	12	
	CS	32	R-O	13	
	CG	7	O-R	14	
	SPARE	33	R-G	15	
		8	G-R	16	
		34	R-BR	17	
		9	BR-R	18	
		35	R-S	19	
		10	S-R	20	
12	CT	36	BK-BL	21	9
	CR	11	BL-BK	22	
	CS	37	BK-O	23	
	CG	12	O-BK	24	
	SPARE	38	BK-G	25	
		13	G-BK	26	
		39	BK-BR	27	
		14	BR-BK	28	
		40	BK-S	29	
		15	S-BK	30	
13	CT	41	Y-BL	31	12
	CR	16	BL-Y	32	
	CS	42	Y-O	33	
	CG	17	O-Y	34	
	SPARE	43	Y-G	35	
		18	G-Y	36	
		44	Y-BR	37	
		19	BR-Y	38	
		45	Y-S	39	
		20	S-Y	40	
14	CT	46	V-BL	41	14
	CR	21	BL-V	42	
	CS	47	V-O	43	
	CG	22	O-V	44	
	SPARE	48	V-G	45	
		23	G-V	46	
		49	V-BR	47	
		24	BR-V	48	
		50	V-S	49	
		25	S-V	50	

*Stencil lead designations on fanning strip.

TABLE F

CONNECTIONS FOR CO LINES – 615A PANEL

LINE NO.	LEAD DESIG	914A CONN PIN NO.	66T1 CONN BLOCK	66B4-25 CONN BLK ROW NO.
1	T	J1A (13)	A1	1
	R	J1A (4)	A2	2
2	T	J2A (13)	A3	3
	R	J2A (4)	A4	4
3	T	J3A (13)	A5	5
	R	J3A (4)	A6	6

TABLE G

CONNECTIONS FOR PLUG P1 – 615A PANEL

CIRCUIT NO.	LEAD* DESIG	CONN PIN NO.	CONN CABLE COLOR	66M1-50 CONN BLK ROW NO.	POS. IN 615A PANEL
1	CT	26	W-BL	1	J1
	CR	1	BL-W	2	
	CS	27	W-O	3	
	CG	2	O-W	4	
	SPARE	28	W-G	5	
		3	G-W	6	
		29	W-BR	7	
		4	BR-W	8	
		30	W-S	9	
		5	S-W	10	
2	CT	31	R-BL	11	J2
	CR	6	BL-R	12	
	CS	32	R-O	13	
	CG	7	O-R	14	
	SPARE	33	R-G	15	
		8	G-R	16	
		34	R-BR	17	
		9	BR-R	18	
		35	R-S	19	
		10	S-R	20	
3	CT	36	BK-BL	21	J3
	CR	11	BL-BK	22	
	CS	37	BK-O	23	
	CG	12	O-BK	24	
	SPARE	38	BK-G	25	
		13	G-BK	26	
		39	BK-BR	27	
		14	BR-BK	28	
		40	BK-S	29	
		15	S-BK	30	

TABLE G (Cont)

CIRCUIT NO.	LEAD* DESIG	CONN PIN NO.	CONN CABLE COLOR	66M1-50 CONN BLK ROW NO.	POS. IN 615A PANEL
	SPARE	41	Y-BL	31	
		16	BL-Y	32	
		42	Y-O	33	
		17	O-Y	34	
		43	Y-G	35	
		18	G-Y	36	
		44	Y-BR	37	
		19	BR-Y	38	
		45	Y-S	39	
		20	S-Y	40	
	SPARE	46	V-BL	41	
		21	BL-V	42	
		47	V-O	43	
		22	O-V	44	
		48	V-G	45	
		23	G-V	46	
		49	V-BR	47	
		24	BR-V	48	
		50	V-S	49	
		25	S-V	50	

* Stencil lead designations on designation strip.

TABLE H

POWER CONNECTIONS

INPUT VOLTAGE*	69G APP MTG (NOTE 1)	604B PANEL (NOTE 2)	615A PANEL (NOTE 3)
−24V	5	INPUT −24V	D2
−48V	—	INPUT −48V	—
GRD	4	INPUT GRD	D4

Notes:

1. Terminals on 66B4-25 connecting block.
2. Terminals on rear of panel stamped as shown. Position option straps for −24V or −48V.
3. Terminals on 66T1 connecting block on rear of panel.

* 48 volts not used with 102 IUs.

TABLE I

604A-TYPE PANEL FUSE ASSIGNMENT

VOLTAGE	FUSE NO.*	PANEL POSITION
−24V	F1	J1A
	F2	J2A
	F3	J3A
	F4	J4A
	F5	J5A
	F6	J6A
	F7	J7A
	F8	J8A
	F9	J9A
	F10	J10A
	F11	J11A
	F12	J12A
	F13	J13A
	F14	J14A
	F15	J10B†
	F16	J11B†
	F17	J13B†
	F18	J14B†

* Fuses are 70G 1/2-ampere.

† Plug. No. 5 dedicated to one-way incoming trunks not used in this application.

TABLE J

604B OR 604C PANEL FUSE ASSIGNMENT

VOLTAGE	FUSE NO.	PANEL POSITION
±105V (Note)	F1*	J1A thru J14A
−24V	F2*	J1A
	F3*	J2A
	F4*	J3A
	F5*	J4A
	F6*	J5A
	F7*	J6A
	F8*	J7A
	F9*	J8A
	F10*	J9A
	F11*	J10A
	F12*	J11A
	F13*	J12A
	F14†	J13A
	F15†	J14A
−48V (Note)	F16‡	J1A thru J5A
	F17‡	J6A thru J10A
	F18‡	J11A thru J14A

Note: ±105V and −48V not used in this application.

* 70F Fuse 1/4 Ampere.
† 70G Fuse 1/2 Ampere.
‡ 70A Fuse 1-1/3 Ampere.

TABLE K

615A PANEL FUSE ASSIGNMENT

VOLTAGE	FUSE NO.*	PANEL POSITION
−24V	F1	J1A, J1B
	F2	J2A, J2B
	F3	J3A, J3B
−48V	F4†	J1A
	F5†	J2A
	F6†	J3A
±105V	F7†	J1A, J2A, J3A
SPARE	F8	SPARE

* Fuses are 24E 1/2-ampere.
† Not used in this application.

VOICE CONNECTING ARRANGEMENT C22

112A INTERCONNECTING UNIT

607A PANEL

1. GENERAL

1.01 This section provides identification, installation, operation, maintenance, and connection information for the 112A interconnecting unit (IU) and 607A mounting panel when used to provide Voice Connecting Arrangement (VCA) C22. This arrangement is used to interface a central office (CO) arranged for direct inward dialing (DID) to a customer-provided (CP) PBX.

1.02 This section is reissued to:

- Add information on the KS-20944 protector
- Change the 66M1-50 intermediate connecting block to 66B4-25
- Revise illustrations.

1.03 Voice Connecting Arrangement C22 requires one 112A IU per CO trunk for connection to the CP equipment. The 607A panel will accommodate fourteen 112A IUs.

1.04 If the customer wants a copy of the Technical Reference which covers this interface specification, the customer should contact the local Telephone Company Business Office or the Marketing Representative.

1.05 This issue of the section is based on the following drawings:

SD- and CD-1E240-01, Issue 1, 112A IU

If this section is to be used with equipment or apparatus reflecting later issue(s) of the drawing(s), reference should be made to the SDs and CDs to determine the extent of the changes and the manner in which the section may be affected.

2. IDENTIFICATION

PURPOSE

- To provide one-way direct inward dialing into a CP PBX on a dial pulse basis
- To limit excessive transmission signal levels from CP equipment and to provide protection for personnel against hazardous voltages
- To provide network control signaling functions.

ORDERING GUIDE

- Unit, Interconnecting, 112A (one per CO trunk, Fig. 1).

Associated Apparatus (Order Separately)

Note: If a 23-inch relay rack is not provided on customer premises, provide an ED-91180-72, Group 21 equipment cabinet, or equivalent.

- 607A Panel (includes fuse panel, Fig. 2 and 3)
- Unit, Power 19C2 (24-volt, 1.5-ampere supply) or equivalent (furnished locally, if required)
- Unit, Power, KS-15620, L14 (48-volt, 2-ampere supply) or equivalent (furnished locally, if required)
- Blocks, Connecting, 66M1-50 (as required, Fig. 4)
- ♦Blocks, Connecting, 66B4-25 (as required, see Table A)♦
- Cable, A25B (three per panel)
- Clip, Bridging, B (Fig. 4)

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Note: Other type blocks may be used when specified by local engineering.

Replaceable Components (for 607A Panel)

- Fuses, 24E (1/2-ampere, 10 per panel)

➧Overvoltage Protection Circuit (Optional)

- KS-20944, L1, Protector (Fig. 5)
- KS-20944,L2, Protector (Fig. 5)➧

DESIGN FEATURES

112A Interconnecting Unit

- Approximate dimensions: 7-1/2 inches by 5-1/2 inches (called an 8-inch board)
- Components mounted on epoxy coated 80-pin board
- Provides impedance matching cross-connections
- Provides voice frequency coupling to CP equipment
- Provides dc isolation to CP equipment
- Limits excessive signals
- Requires 0.125 ampere at 26 volts dc and 0.100 ampere at 48 volts dc.

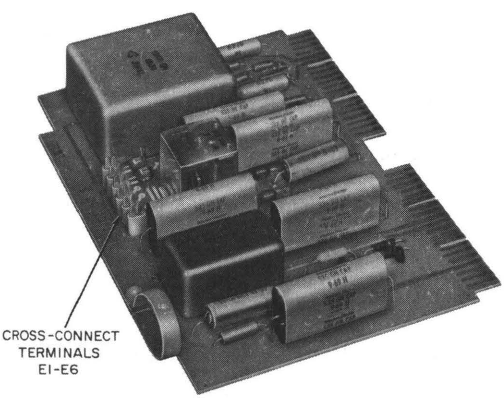


Fig. 1—112A Interconnecting Unit

607A Panel

- Approximate dimensions: 8 inches high, 23 inches long, and 10 inches deep.
- Equipped with twenty-eight 40-pin 914A connectors which are factory-wired to Amphenol plugs.
- The arrangement of the 914A connectors provides two vertical connectors for each 8-inch 80-pin board.
- All 14 positions will accommodate 112A IUs.
- Is not equipped with a power supply.
- Fuse protection is provided to all IUs.

➧KS-20944 Protector

- Approximate dimensions: 6 inches high, 6 inches wide, and 3 inches deep
- Provides protection against excessive voltage and current from CP power supply
- Provides dc interface to CP equipment
- Equipped with a three-pole magnetic circuit breaker
- Provides disconnect switch for power supply voltage
- Equipped with leads for line connection and a two terminal connecting block for load connection.➧

3. INSTALLATION

607A Panel (Fig. 6 and 7, Tables A, B, C, D)

3.01 The 607A panel will mount on a standard relay rack or in an ED-91180-72, Group 21 equipment cabinet. The cabinet will hold four 607A panels when the drawing holder on the lower half of the cover is removed. (Ground relay rack or equipment cabinet separately.)

3.02 Electrical connection is made to the 607A panel through A25B connector cables to three Amphenol plugs (P1, P2, and P3, Fig. 3).

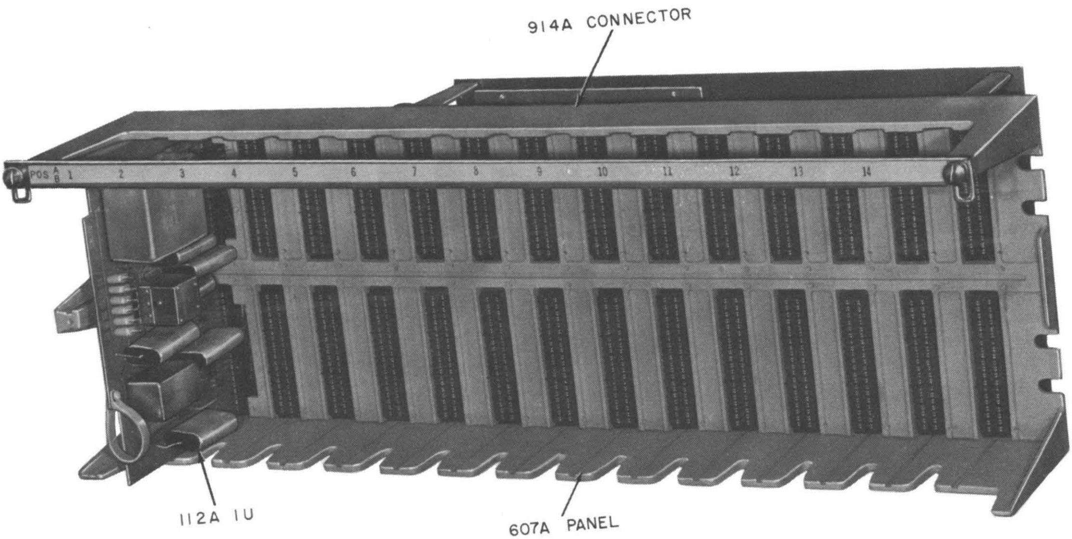


Fig. 2—607A Panel With 112A Interconnecting Unit

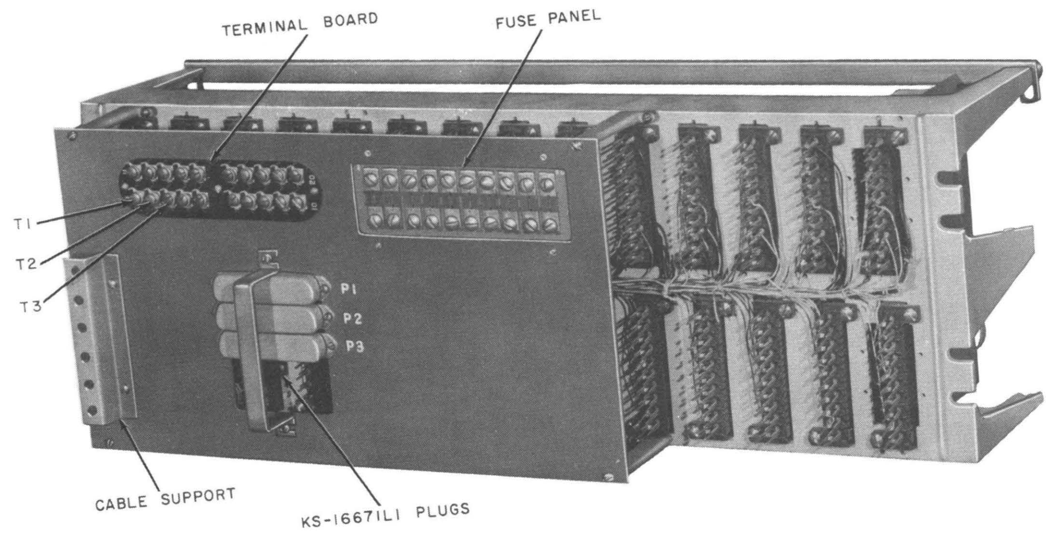


Fig. 3—607A Panel-Rear View

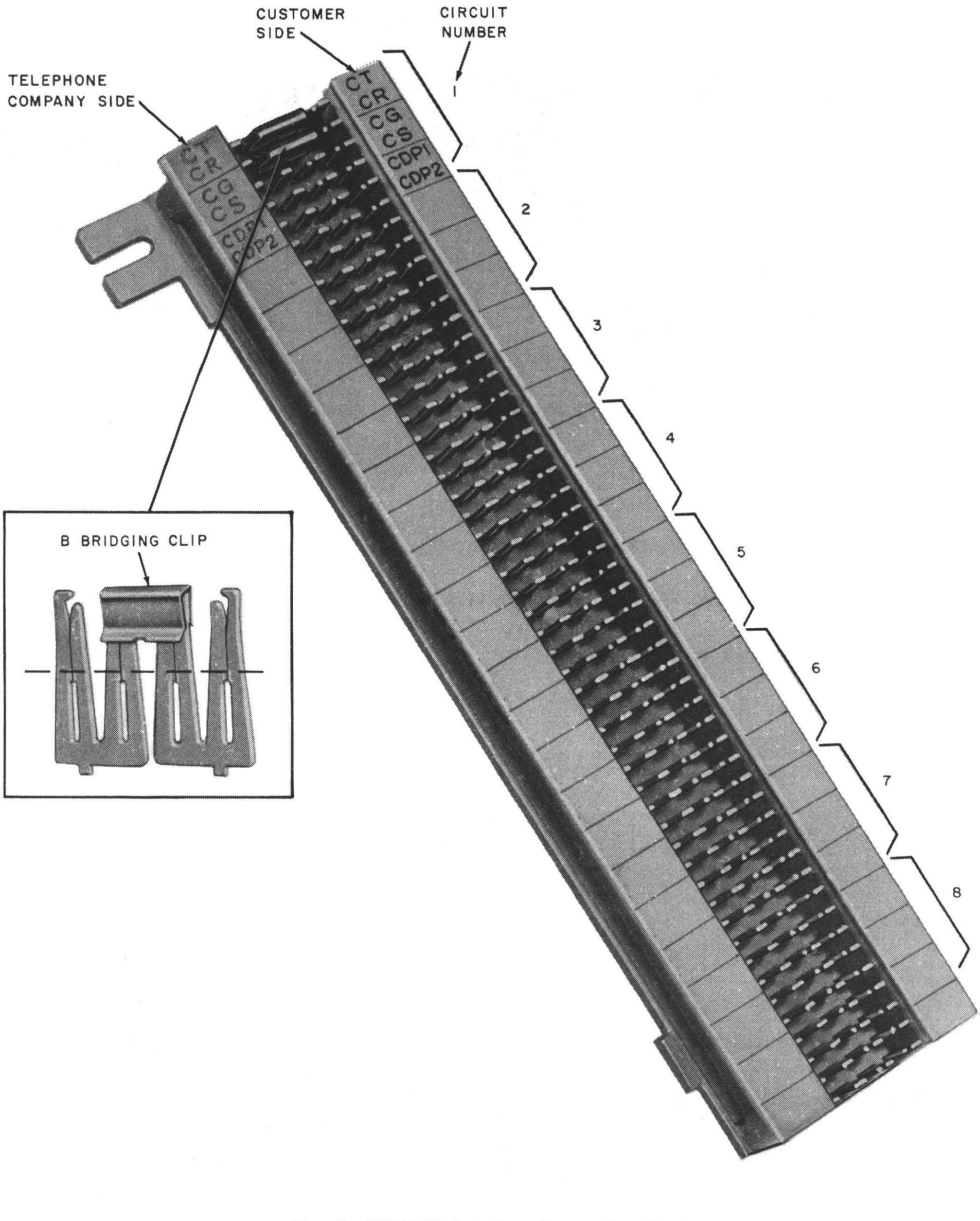
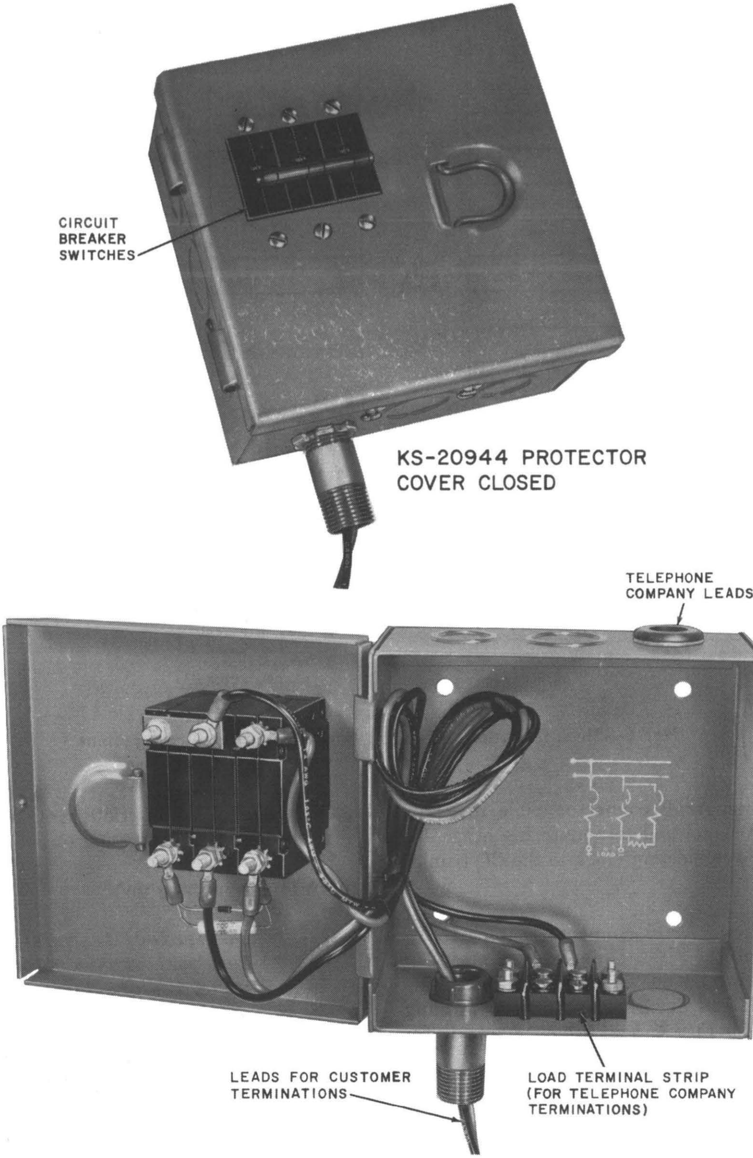


Fig. 4—66M1-50 Interface Connecting Block



KS-20944 PROTECTOR
COVER CLOSED

KS-20944 PROTECTOR COVER OPEN

Fig. 5—➧KS-20944 Protector⬅

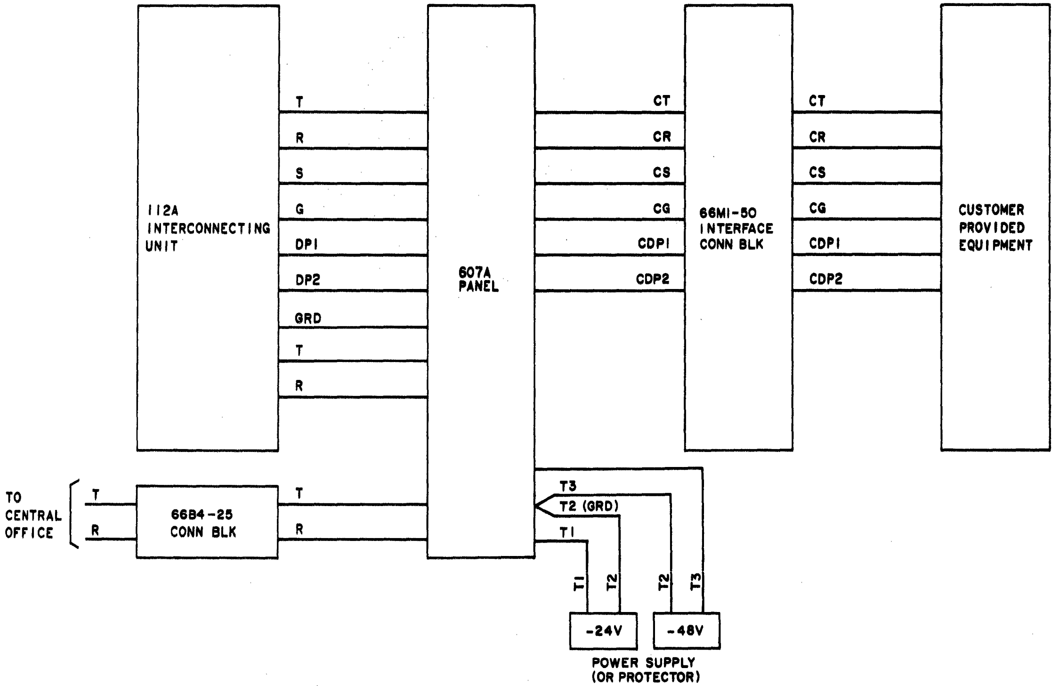


Fig. 6—Block Diagram of Typical Voice Connecting Arrangement

3.03 Connect an A25B connector cable to P1 on the 607A panel and terminate the other end on the 66B4-25 connecting block to the CO trunks. (See Table A.)

3.04 Connect two A25B connector cables to P2 and P3 on the 607A panel and terminate at the customer end on the 66M1-50 interface connecting block. (Stencil lead designations on the fanning strip as shown in Fig. 4; see Tables B and C for connections.)

3.05 Connect power supply to terminals on rear of 607A panel as shown in Table D and Fig. 3.

3.06 When separate power supplies are used, the customer must provide a 105- to 130-volt, 60-Hz outlet within reach of available power cords (locally furnished). This electrical outlet should not be under control of a wall switch.

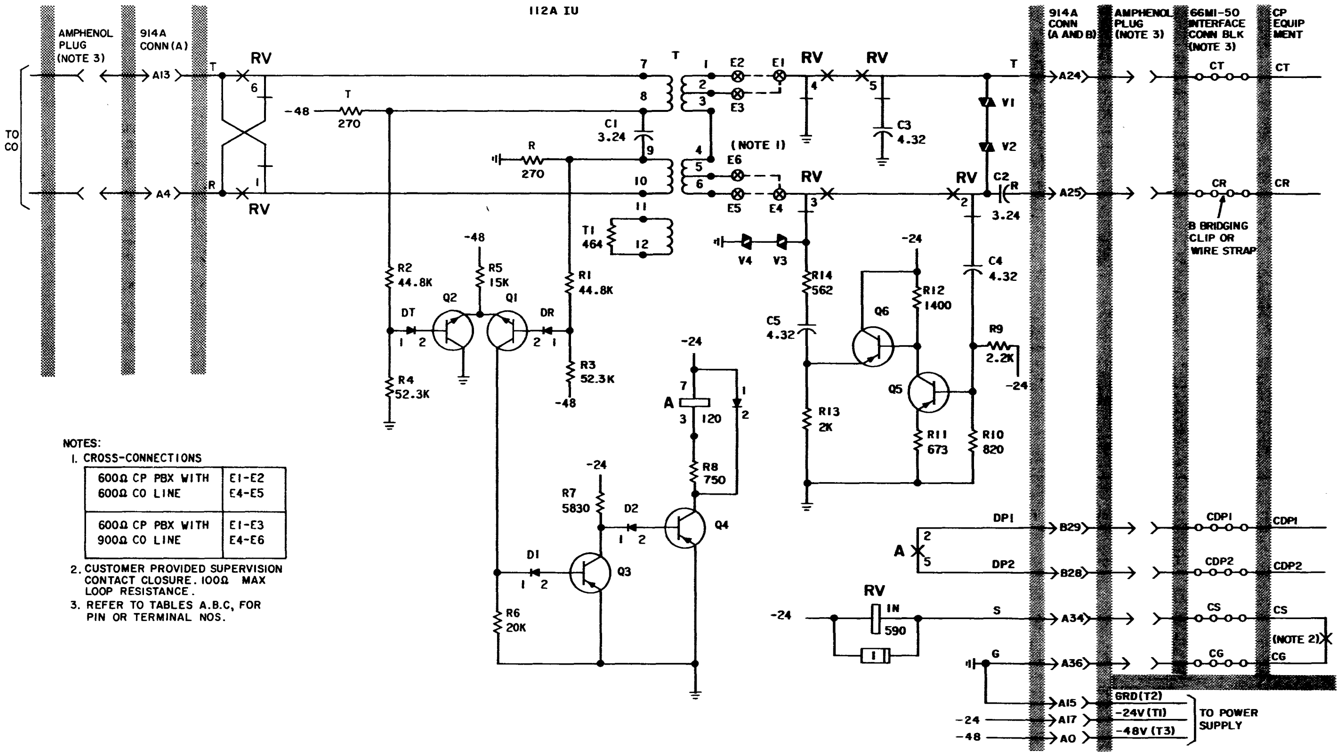
3.07 Refer to appropriate section in Division 167 for proper grounding of power plants.

112A Interconnecting Unit

READ ***To protect transistors and other electrical components of interconnecting units, remove fuses before installing or replacing a unit.***

3.08 If the incoming CO trunk is 600 ohms, strap E1 to E2 and E4 to E5. If the incoming CO trunk is 900 ohms, strap E1 to E3 and E4 to E6 (Fig. 1 and 7). Check connections for continuity after strapping to make sure terminals cut through insulation.

3.09 When installing the 112A IU, position the board in the guide grooves of the 607A panel and slide the unit in until it is properly seated in the mating 914A connectors. The designation strip



NOTES:

1. CROSS-CONNECTIONS

600Ω CP PBX WITH 600Ω CO LINE	E1-E2 E4-E5
600Ω CP PBX WITH 900Ω CO LINE	E1-E3 E4-E6

2. CUSTOMER PROVIDED SUPERVISION CONTACT CLOSURE. 100Ω MAX LOOP RESISTANCE.
3. REFER TO TABLES A.B.C, FOR PIN OR TERMINAL NOS.

Fig. 7—Schematic of 112A Interconnecting Unit

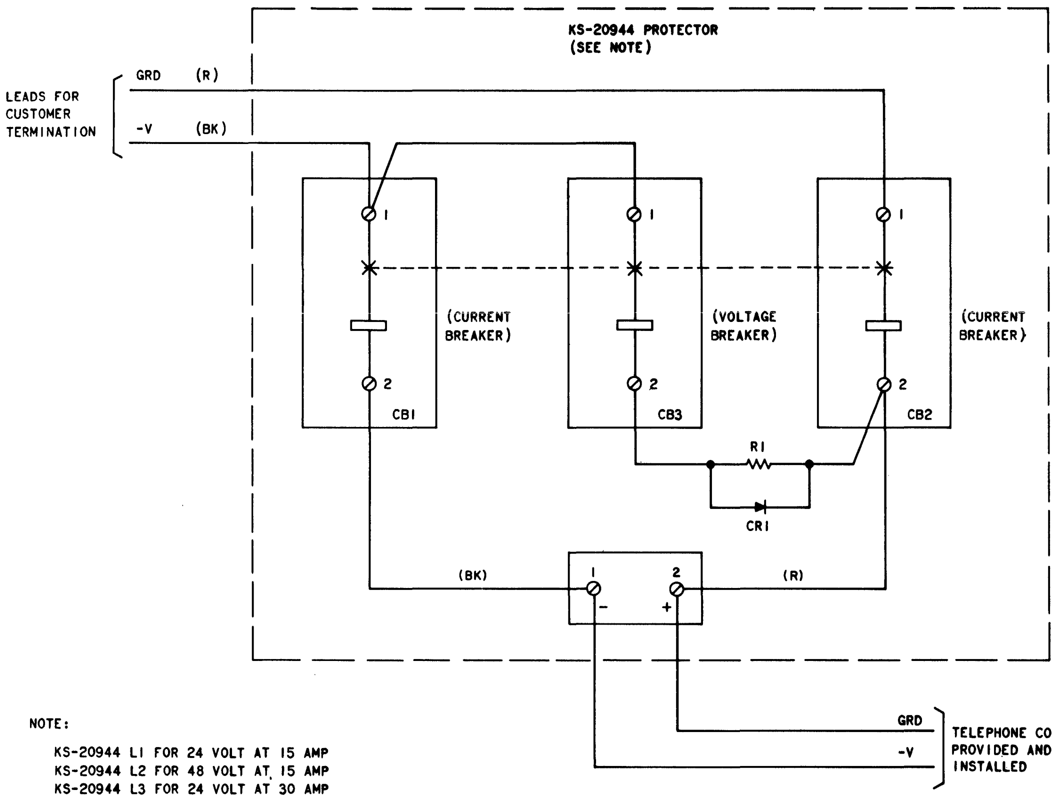
locking bar, when lowered, will hold the IU in place.

♦KS-20944 Protector (Fig. 8)

3.10 When overvoltage protection is required, the KS-20944 protector must be mounted externally and wired to the power supply terminals of the 607A panel (Fig. 3).

3.11 Connect as shown in Fig. 8 following local wiring instructions. The customer must connect his power supply to the red (+) and black (−) 16-gauge leads extending from the unit.

Check for correct polarity and ground before closing switch. ♦



NOTE:

KS-20944 L1 FOR 24 VOLT AT 15 AMP
KS-20944 L2 FOR 48 VOLT AT 15 AMP
KS-20944 L3 FOR 24 VOLT AT 30 AMP
K2-20944 L4 FOR 48 VOLT AT 30 AMP
PROTECTORS WILL TRIP IN 25 MILLISECS (MAXIMUM):
ON OVERVOLTAGE OF 38 VOLTS (24 VOLT UNIT) AND 68 VOLTS (48 VOLT UNIT), ON OVERLOAD OF 18 AMPERES (15 AMP UNIT) AND 36 AMPERES (30 AMP UNIT), ON REVERSED POLARITY, OR AC VOLTAGE GREATER THAN 18 VOLTS, OR INCORRECT GRD.

Fig. 8—♦Schematic of KS-20944 Protector♦

4. OPERATION

A. 112A Interconnecting Unit (Fig. 7)

Incoming Call

4.01 When the CO seizes this circuit by a loop closure, voltage level changes at resistors R and T in the 112A IU are detected by transistors Q1 and Q2 resulting in the operation of supervisory *A* relay. The *A* relay operated provides a contact closure between leads CDP1 and CDP2 indicating seizure to the CP PBX.

4.02 The dc pulses are received from the CO over tip and ring leads. The maximum external loop resistance to the CO should not exceed 2500 ohms.

4.03 The pulses are repeated to the CP PBX by the *A* relay over leads CDP1 and CDP2. This is a fast mercury relay and will not distort the pulses. Current in leads CDP1 and CDP2 should not exceed 0.5 ampere maximum.

4.04 Only one-way voice transmission (toward the CO) is provided until an answer signal is received from the CP PBX. When the CP PBX station answers, a CP contact between leads CS and CG closes and operates RV relay. RV relay operated sends answer supervision by causing a local battery-ground reversal on leads T and R toward the CO, removes the amplifier and establishes 2-way transmission between the CO and CP PBX. The maximum allowable external loop resistance between leads CS and CG is 100 ohms.

4.05 The CO indicates disconnection by causing the *A* relay to release which opens the contact closure between leads CDP1 and CDP2. The CP PBX indicates disconnection by opening the contact closure between leads CS and CG.

4.06 The CS, CG loop should be open when the unit is idle. To prevent incoming calls on this unit, the associated trunk at the CO should be made busy.

4.07 Some step-by-step COs will not wait for a signal to start outpulsing; in this case, the CP PBX must be prepared to receive dial pulses within 65 milliseconds after seizure. A by-link path may be required in the CP PBX.

4.08 With "wink start" signaling, the CP PBX should provide a momentary closure on leads CS, CG as an indication that it is ready to receive dial pulses. This closure should last 200 milliseconds nominal (140 milliseconds minimum).

4.09 With delay dial signaling, the CP PBX must provide a contact closure on leads CS, CG immediately upon seizure and must open when ready to receive dial pulses.

4.10 Under wink start and delay dial signaling, the CDP1 and CDP2 leads may open momentarily. If this occurs, the open is not expected to exceed 5 milliseconds and shall be ignored by the CP PBX.

4.11 Call progress tones (audible ringing, busy and reorder) and recorder announcements are applied to leads CT and CR for transmission to the CO.

4.12 The 112A IU is provided with option strapping to properly match the PBX impedance (600 ohms) to the CO line impedance.

B. ➧KS-20944 Protector (Fig. 8)

4.13 The KS-20944 protector is used to protect the Bell System personnel from hazardous voltages but may not protect equipment from component failures. The KS-20944 protector provides a switch to disconnect dc voltage when working on interconnecting circuits.

4.14 The KS-20944 protector consists of a dc voltage-operated circuit breaker in series with a parallel resistor diode combination connected across the line and two dc current-operated circuit breakers connected in each side of the line. The contacts on both breakers are connected in series with their own coil and mechanically coupled together. When either breaker is operated, the line will be opened. The circuit breakers must be manually reset after tripping.

4.15 The KS-20944, List 1 and List 2 protectors are designed to trip in 25 milliseconds (maximum) on 38 volts dc (List 1) and 68 volts dc (List 2), on 18 amperes dc (List 1), and 18 amperes dc (List 2), on reversed polarity (or ac) greater than 18 volts, and on incorrect ground. The diode and resistor combination are selected to adjust the tripping voltage of the voltage-operated circuit breaker.➧

5. MAINTENANCE (Fig. 7)

5.01 When trouble is reported, check for blown fuses, loose or broken connections, and verify that the CO pair is good.

5.02 Open all six leads on circuit under test by removing B bridging clips or wire straps at the 66M1-50 connecting block. To verify in which direction the trouble exists, perform the following tests:

(a) Connect a 1013A (or equivalent) test set to the CT and CR leads on the Telephone Company side of the 66M1-50 connecting block. Set the TALK-MON switch of the test set to the TALK position. To furnish talk battery, connect a 5000-ohm resistor from CT to ground and −24 volt to CR. Connect an 81A or KS-16990, List 1 test set to the CDP1 and CDP2 terminals (set test set to continuity position). Connect a short strap to the CS terminal (to be connected to CG later).

(b) Request the test desk to dial the CO line connected to the interconnecting circuit under test. When the CO seizes the trunk, the 81A or KS-16990, List 1 test set will follow dial pulses (81A may not follow dial pulses if batteries are weak) remaining on steadily after dialing. Hold the transmitter of the 1013A test set near the buzzer long enough for the test desk to hear it; this tests operation of the one-way amplifier.

(c) Connect terminal CS to terminal CG to answer the call. The one-way amplifier is removed and talk path cut through.

5.03 When trouble is suspected in the 112A IU, exchange it with another unit known to be functioning satisfactorily.

READ ***Never replace an IU in the 607A panel without first removing the fuse for this particular unit.***

5.04 If the above tests are satisfactory, remove all test connections to restore circuit to normal and replace the B bridging clips (or wire straps) at the 66M1-50 interface connecting block.

READ ***Do not attempt any tests or repairs to the CP equipment.***

6. CONNECTIONS

6.01 For connection information, refer to Tables A, B, C, and D and Fig. 4, 6, and 7.

6.02 Connect the 24-volt power supply to terminals T1 (−24 volts) and T2 (GRD) and the 48-volt power supply to terminals T2 (GRD) and T3 (−48 volts) on the 607A fuse panel. (See Table D.)

6.03 ➧If overvoltage circuit protection is used with a CP power source, connect the KS-20944, List 1 protector to terminals T1 (−24 volts) and T2 (GRD) and the KS-20944, List 2 protector to terminals T2 (GRD) and T3 (−48 volts) on the 607A fuse panel. (See Table D.)➧

TABLE A

CONNECTIONS FOR AMPHENOL CONNECTOR NO. 1

TRUNK NO.	LEAD DESIG*	AMPHENOL CONN PIN NO.	A25B CONN CABLE COLOR	66B4-25 CONN BLK TERM.	POS. IN 607A PANEL
1	T	26	W-BL	1	J1A
	R	1	BL-W	2	
2	T	27	W-O	3	J2A
	R	2	O-W	4	
3	T	28	W-G	5	J3A
	R	3	G-W	6	
4	T	29	W-BR	7	J4A
	R	4	BR-W	8	
5	T	30	W-S	9	J5A
	R	5	S-W	10	
6	T	31	R-BL	11	J6A
	R	6	BL-R	12	
7	T	32	R-O	13	J7A
	R	7	O-R	14	
8	T	33	R-G	15	J8A
	R	8	G-R	16	
9	T	34	R-BR	17	J9A
	R	9	BR-R	18	
10	T	35	R-S	19	J10A
	R	10	S-R	20	
11	T	36	BK-BL	21	J11A
	R	11	BL-BK	22	
12	T	37	BK-O	23	J12A
	R	12	O-BK	24	
13	T	38	BK-G	25	J13A
	R	13	G-BK	26	
14	T	39	BK-BR	27	J14A
	R	14	BR-BK	28	
SPARE	SPARE	40	BK-S	29	
		15	S-BK	30	
		41	Y-BL	31	
		16	BL-Y	32	
		42	Y-O	33	
		17	O-Y	34	
		43	Y-G	35	
		18	G-Y	36	
		44	Y-BR	37	
		19	BR-Y	38	
		45	Y-S	39	
		20	S-Y	40	
		46	V-BL	41	
		21	BL-V	42	
		47	V-O	43	
		22	O-V	44	
		48	V-G	45	
		23	G-V	46	
		49	V-BR	47	
		24	BR-V	48	
		50	V-S	49	
		25	S-V	50	

* Stencil lead designations on fanning strip.

TABLE B

CONNECTIONS FOR AMPHENOL CONNECTOR NO. 2

CIRCUIT NO.	LEAD DESIG*	AMPHENOL CONN PIN NO.	CONN CABLE COLOR	66M1-50 CONN BLK	POS. IN 607A PANEL
1	CT	26	W-BL	1	J1
	CR	1	BL-W	2	
	CG	27	W-O	3	
	CS	2	O-W	4	
	CDP1	28	W-G	5	
	CDP2	3	G-W	6	
2	CT	29	W-BR	7	J2
	CR	4	BR-W	8	
	CG	30	W-S	9	
	CS	5	S-W	10	
	CDP1	31	R-BL	11	
	CDP2	6	BL-R	12	
3	CT	32	R-O	13	J3
	CR	7	O-R	14	
	CG	33	R-G	15	
	CS	8	G-R	16	
	CDP1	34	R-BR	17	
	CDP2	9	BR-R	18	
4	CT	35	R-S	19	J4
	CR	10	S-R	20	
	CG	36	BK-BL	21	
	CS	11	BL-BK	22	
	CDP1	37	BK-O	23	
	CDP2	12	O-BK	24	
5	CT	38	BK-G	25	J5
	CR	13	G-BK	26	
	CG	39	BK-BR	27	
	CS	14	BR-BK	28	
	CDP1	40	BK-S	29	
	CDP2	15	S-BK	30	
6	CT	41	Y-BL	31	J6
	CR	16	BL-Y	32	
	CG	42	Y-O	33	
	CS	17	O-Y	34	
	CDP1	43	Y-G	35	
	CDP2	18	G-Y	36	
7	CT	44	Y-BR	37	J7
	CR	19	BR-Y	38	
	CG	45	Y-S	39	
	CS	20	S-Y	40	
	CDP1	46	V-BL	41	
	CDP2	21	BL-V	42	
8	CT	47	V-O	43	J8
	CR	22	O-V	44	
	CG	48	V-G	45	
	CS	23	G-V	46	
	CDP1	49	V-BR	47	
	CDP2	24	BR-V	48	
	SPARE	50	V-S	49	
	SPARE	25	S-V	50	

* Stencil lead designations on fanning strip.

TABLE C

CONNECTIONS FOR AMPHENOL CONNECTOR NO. 3

CIRCUIT NO.	LEAD DESIG*	AMPHENOL CONN PIN NO.	CONN CABLE COLOR	66M1-50 CONN BLK	POS. IN 607A PANEL
9	CT	26	W-BL	1	J9
	CR	1	BL-W	2	
	CG	27	W-O	3	
	CS	2	O-W	4	
	CDP1	28	W-G	5	
	CDP2	3	G-W	6	
10	CT	29	W-BR	7	J10
	CR	4	BR-W	8	
	CG	30	W-S	9	
	CS	5	S-W	10	
	CDP1	31	R-BL	11	
	CDP2	6	BL-R	12	
11	CT	32	R-O	13	J11
	CR	7	O-R	14	
	CG	33	R-G	15	
	CS	8	G-R	16	
	CDP1	34	R-BR	17	
	CDP2	9	BR-R	18	
12	CT	35	R-S	19	J12
	CR	10	S-R	20	
	CG	36	BK-BL	21	
	CS	11	BL-BK	22	
	CDP1	37	BK-O	23	
	CDP2	12	O-BK	24	
13	CT	38	BK-G	25	J13
	CR	13	G-BK	26	
	CG	39	BK-BR	27	
	CS	14	BR-BK	28	
	CDP1	40	BK-S	29	
	CDP2	15	S-BK	30	
14	CT	41	Y-BL	31	J14
	CR	16	BL-Y	32	
	CG	42	Y-O	33	
	CS	17	O-Y	34	
	CDP1	43	Y-G	35	
	SDP2	18	G-Y	36	
	SPARE	44	Y-BR	37	
		19	BR-Y	38	
		45	Y-S	39	
		20	S-Y	40	
		46	V-BL	41	
		21	BL-V	42	
		47	V-O	43	
		22	O-V	44	
		48	V-G	45	
		23	G-V	46	
		49	V-BR	47	
		24	BR-V	48	
		50	V-S	49	
		25	S-V	50	

* Stencil lead designations on fanning strip.

TABLE D

CONNECTIONS FOR POWER SUPPLY

TERMINAL	VOLTAGE	FUSE*	PANEL POSITION
T1	—24 Volts	F1	1-2-3
		F2	4-5-6
		F3	7-8-9
		F4	10-11-12
		F5	13-14
T2	GRD		Multipled
T3	—48 Volts	F6	1-2-3
		F7	4-5-6
		F8	7-8-9
		F9	10-11-12
		F10	13-14

* Type 24E (1/2-amp)

PROTECTIVE CONNECTING ARRANGEMENT TAS

1. GENERAL

1.01 This section provides identification, installation, operation, maintenance, and connection information for the J53050J-2, List 1 interconnecting unit (IU) and associated equipment when used in Protective Connecting Arrangement (PCA) TAS.

1.02 This section is reissued to:

- Include information on the J53050J-2, List 1 IU which replaces the J53050J-1, List 1 IU now rated MD
- Add the use of the 142A test set.

1.03 The J53050J-2 IU provides exactly the same circuit functions as the J53050J-1 in an improved mechanical design. Installation, connections, and maintenance are unchanged. Available stock of the MD unit should be used.

1.04 The J53050J-2, List 1 IU (Fig. 1) provides a means for connecting up to ten secretarial lines from a telephone company central office (CO) to customer-provided equipment (CPE), typically a telephone answering service bureau.

1.05 When a customer-provided (CP) dc power supply is used with PCA TAS, refer to Section 463-300-109 entitled Connecting Arrangement VCP, Customer-Provided Power, KS-20944 Protector.

1.06 If the customer wants a copy of the Technical Reference which covers this interface unit, he should contact the local Telephone Company Business Office or the Marketing Representative.

1.07 This issue of the section is based on the following drawing:

SD-1E257-01, Issue 2 (J53050J IU)

If this section is to be used with equipment or apparatus reflecting a later issue of the drawing, reference should be made to the SD to determine the extent of the changes and the manner in which the section may be affected.

2. IDENTIFICATION

PURPOSE

- Provides an interface between a CO secretarial line and a one-way line circuit associated with the CPE

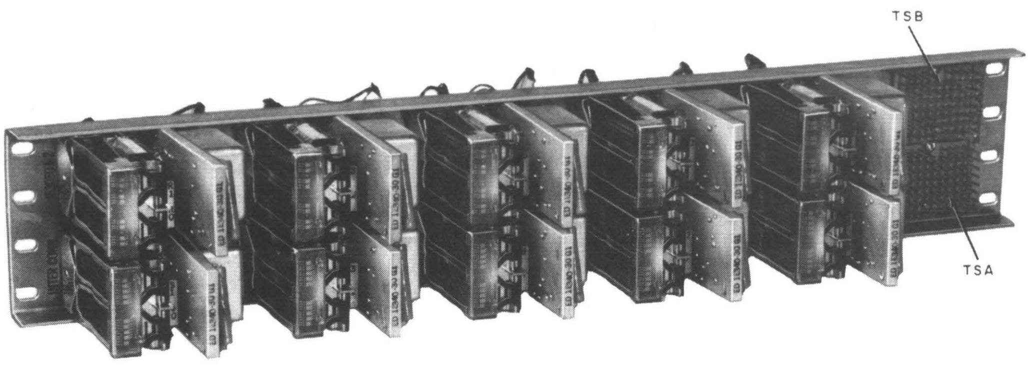


Fig. 1—J53050J-2, List 1 Interconnecting Unit

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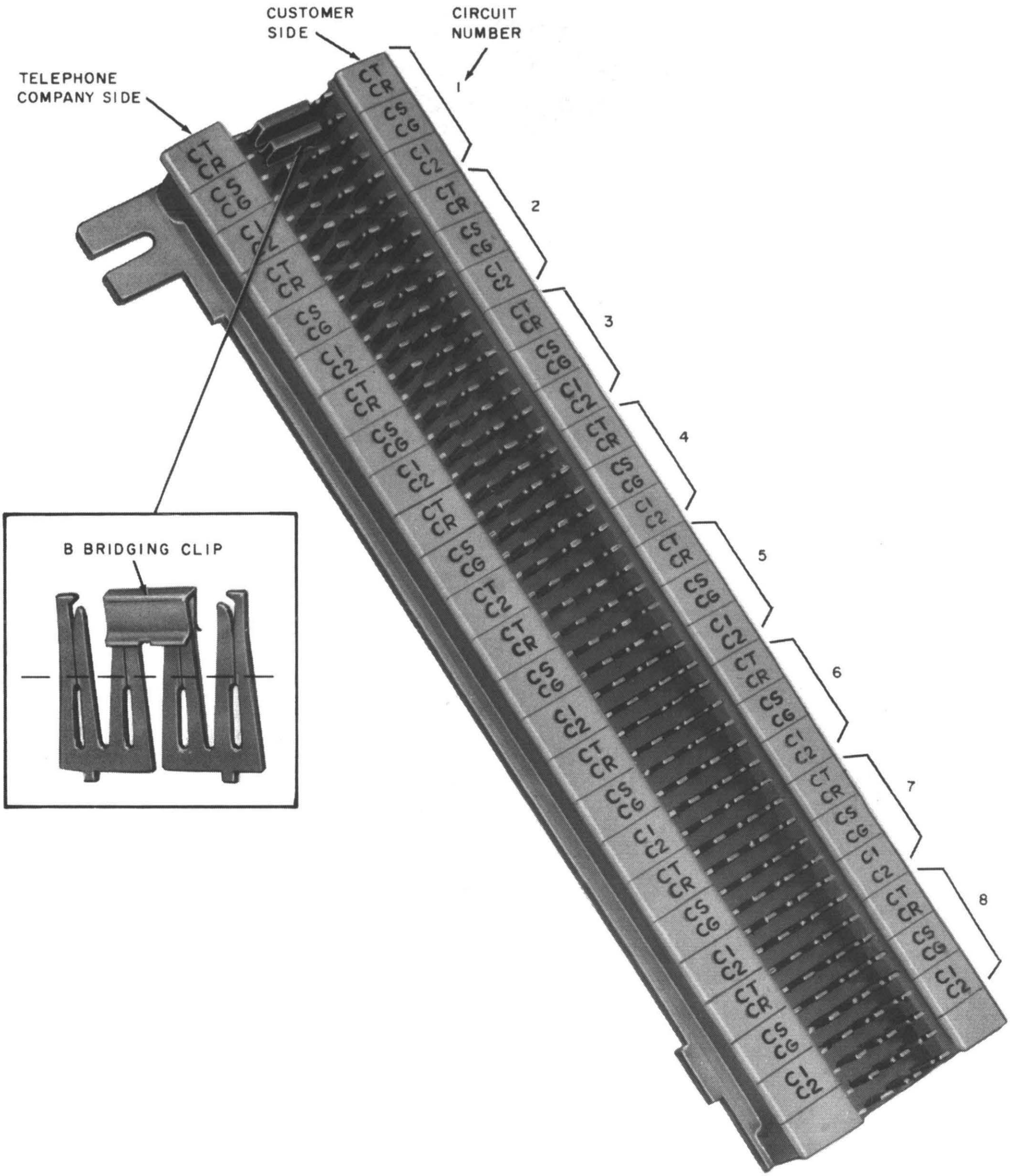


Fig. 2—66M1-50 Interface Connecting Block

Fig. 3—KS-20944, List 2 Protector

- Each circuit provides a 2-wire voiceband transmission path to and from the CPE.
- The maximum dc current drain for each of the ten circuits is 0.080 ampere at 52 volts.
- The typical dc current drain for each of the ten circuits is 0.070 ampere at 48 volts.
- Provides dc isolation and hazardous voltage protection between CPE and telephone company equipment.

3. INSTALLATION (Fig. 4 and 5)

3.01 Locate the J53050J-2 IU in an area free of dampness and excessive dust with adequate room for access to front and rear of equipment.

3.02 Mount the 66M1-50 connecting block close to the IU and near the termination of the CO lines. Select a location convenient for cross-connecting to the CO lines. Mount the two 66M1-50 interface connecting blocks in a location near the IU and convenient for customer access. The maximum dc loop resistance of the CS and CG leads is 700 ohms.

3.03 Use the 16-pair "D" inside wiring cable, or equivalent, to terminate the leads to the CO lines and traffic usage (TU) circuits (if used) on the 66M1-50 connecting block. Follow the wiring plan shown in Fig. 4 and 5 and refer to Table A for connections. Use wire-wrap tools to connect to 342A terminal strips. Stencil line number and lead designations on designation strip.

3.04 Use the 25-pair "D" inside wiring cable, or equivalent, to terminate the leads associated with the CPE on the two 66M1-50 interface connecting blocks. Refer to Tables B and C for connections. Stencil lead designations on interface connecting block designation strips as shown in Fig. 2.

3.05 If power is telephone company supplied, use adapters to mount the KS-15620 rectifier on the 23-inch rack close to the J53050J-2 IU. Use D station wire, or equivalent, to connect the rectifier dc output terminals to the IU. Connect −48V to terminal 81 of TSA and connect GRD to terminal 101 of TSA.

3.06 The customer must provide a 117V 60-Hz power outlet within power cord length of the customer-designated mounting location of the rectifier. (See ORDERING GUIDE for cord lengths.) The power outlet must not be under control of a switch and should be fused separately to prevent accidental loss of ac line voltage. Where local instructions permit, secure the power cord plug to the outlet with a power cord plug retainer assembly. Refer to the appropriate section in Division 518 for proper grounding of power plants. Proper grounding of equipment and power unit is important to prevent damage from power line surges.

3.07 When dc power is provided by the customer, a KS-20944, List 2 protector must be used as an interface between the CP power supply and the IU. Mount the protector close to the IU and in a location convenient to the customer for connecting his power supply. Use the 14-gauge wire, or equivalent, to make connections from the protector to the 66C1-16 connecting block (see Fig. 7). Terminate one end of the red and black pair on the screw terminals (term. − and +) of the load terminal strip on the protector (see Fig. 6). Solder the other end of the red and black pair to the terminal in column D of the 66C1-16 connecting block as shown in Fig. 7. Strap to as many terminals in column D as required to supply the required number of multiples. Use 18-gauge wire, or equivalent, to make connections from the quick-connect terminals in columns A, B, and C of the connecting block to the −48V (TSA 81) and GRD (TSA 101) terminals on the J53050J-2 IU.

3.08 Perform tests shown in Part 5 after installation is completed.

4. OPERATION (Fig. 5)

Incoming Call

4.01 When the CO seizes one of the circuits on an incoming call and applies ringing voltage between the T and R leads, the R relay in the ring detector operates. Relay R operated closes the C contact across the C1 and C2 leads. During the silent interval, R relay releases opening the C contact. C contact opening and closing indicates ringing to the customer. The customer answers the call by providing a contact closure across the CS and CG leads to operate relay S. S relay operated removes the ring detector from the CO line and connects transformer T1 across the CO

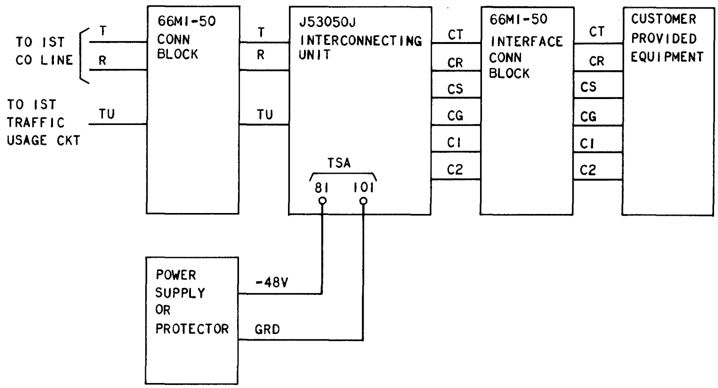


Fig. 4—Block Diagram—PCA TAS

line. The f contact of S relay closes to indicate a call to the traffic usage circuit. The T1 transformer terminated on the CO line trips ringing and provides a voice transmission path to the CPE over the CT and CR leads. Relay R released opens the C1 and C2 leads. Condenser C1 blocks dc from the CPE, and varistors RV1 and RV2 serve to limit excessive voice signals from the CPE.

Disconnect

4.02 When the attendant goes on-hook, the CPE opens the contact closure on the CS and CG leads. The S relay releases and the circuit returns to the idle condition.

5. MAINTENANCE (Fig. 5)

5.01 Precautions should be taken when performing tests to avoid adversely affecting service to the customer. Follow local instructions with reference to notifying customer before performing tests.

5.02 When trouble is reported, check for blown fuses, loose or broken connections, and verify that the CO pair is good.

A. Circuit Test Using the 1013A Hand Test Set and the 81A Test Set

5.03 Prepare the circuit under test as follows:

Warning: The CS lead will carry a maximum potential of −52V dc through a 680-ohm relay.

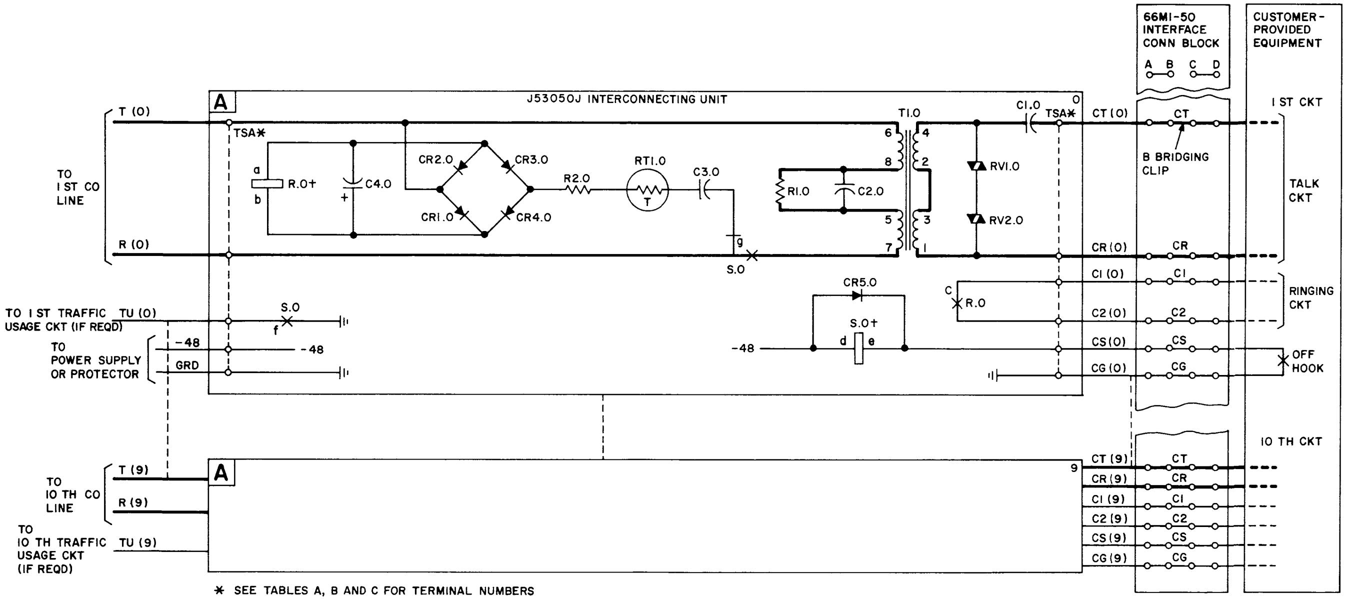
(a) Open the six leads to the CPE by removing the B bridging clips (or wire straps) at the 66M1-50 interface connecting block.

(b) Supply talk battery by connecting a 500-ohm resistor from the −48V supply to terminal CR and connect ground to terminal CT (make all connections on the telephone company side of the 66M1-50 interface connecting block). A 2A KTU or 31A KTU may be used for battery feed instead of the resistor. Refer to Section 518-112-421 for KTU connections.

(c) Connect a 1013A hand test set, or equivalent, across terminals CT and CR.

(d) Connect a strap to terminal CG (to be used later to strap CS to CG).

(e) Connect an 81A or KS-16990, List 1 test set across terminals C1 and C2 to indicate ringing (switch in C position).



* SEE TABLES A, B AND C FOR TERMINAL NUMBERS
† SEE RELAY DESIGNATION TABLE BELOW

RELAY DESIGNATIONS

RELAY SUFIX	CONTACT NUMBER						
	R RELAY			S RELAY			
	a	b	c	d	e	f	g
.0, .2, .4, .6, .8	1L	2L	4	2L	1L	5	2
.1, .3, .5, .7, .9	1U	2U	8	2U	1U	8	11

Fig. 5—Simplified Schematic—PCA TAS

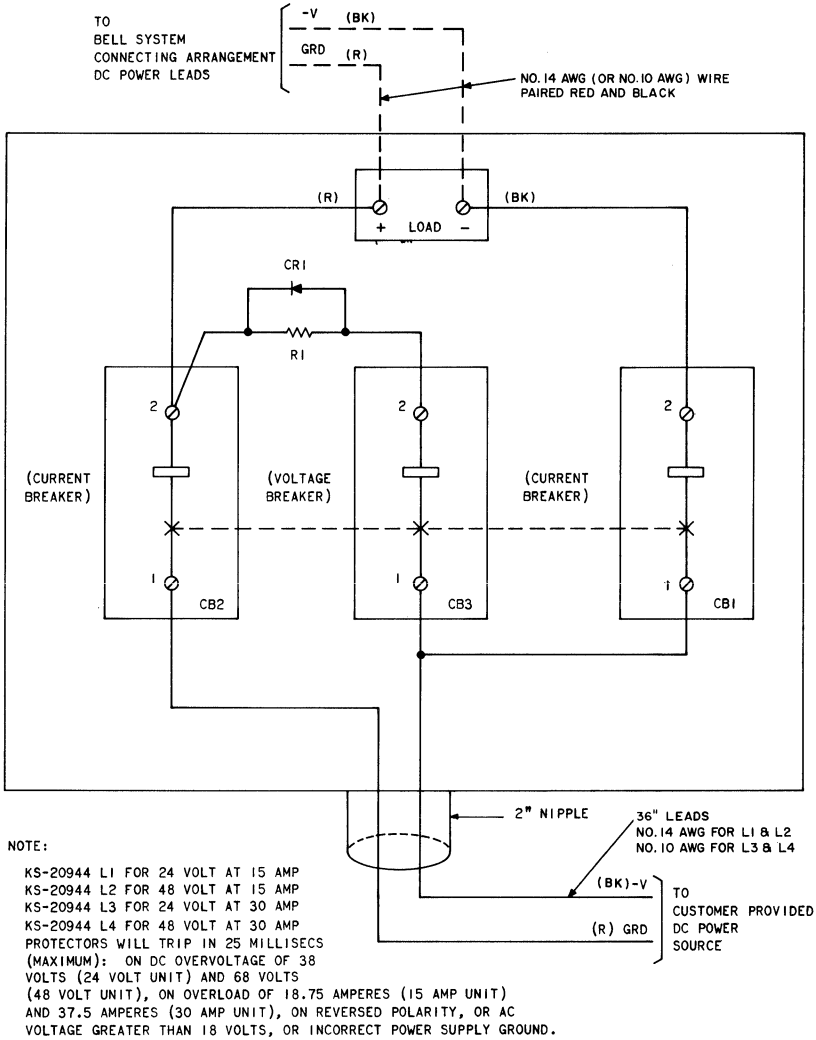


Fig. 6—Schematic—KS-20944 Protector

Transmission and Ringing Test

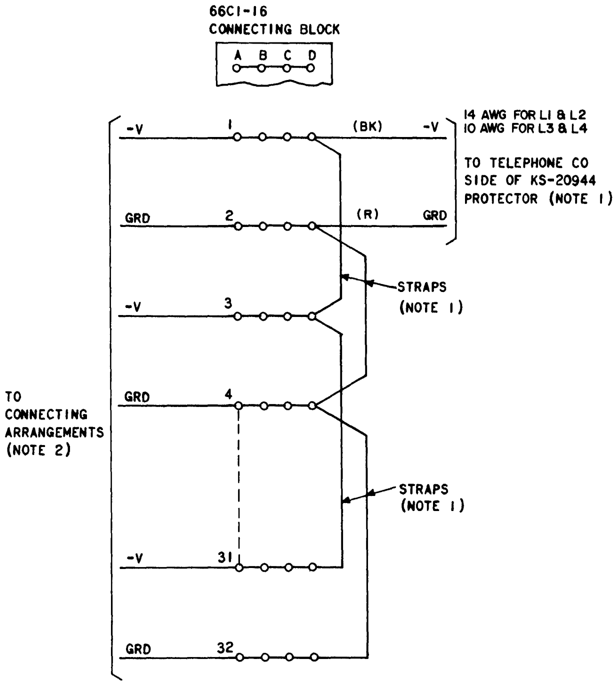
5.04 Perform test as follows:

(1) Have the local test desk call the line under test. At this time quality of transmission can be judged using hand test set.

(2) Operate switch to MON.

(3) When ringing is applied to line, buzzer in 81A test set should follow ringing cycle.

(4) Answer call by operating hand test set switch to TALK and strapping CS and CG. Ringing should be tripped and transmission satisfactory.



NOTES:

1. USE 14-GAUGE (OR 10-GAUGE) WIRE TO CONNECT FROM KS-20944 PROTECTOR TO CONNECTING BLOCK; PROVIDE MULTIPLE STRAPS AS DETERMINED BY NUMBER OF CONNECTING ARRANGEMENTS TO BE CONNECTED TO. USE SOLDER TO MAKE THE CONNECTION OF THE 14-GAUGE (OR 10-GAUGE) WIRE AND STRAPS TO THE CONNECTING BLOCK.
2. USE 18-GAUGE WIRE OR EQUIVALENT TO MAKE CONNECTIONS FROM CONNECTING BLOCK TO CONNECTING ARRANGEMENTS. EACH CONNECTING BLOCK PROVIDES MEANS FOR CONNECTING TO 16 CIRCUITS, HOWEVER, DO NOT EXCEED THE MAXIMUM CURRENT RATING OF THE KS-20944 PROTECTOR.

Fig. 7—Typical Power Distribution For Multiple Connecting Arrangements

5.05 ***Traffic Usage Test:*** Connect the 81A test set from TU lead to ground. Strap CS to CG and the 81A test set should buzz indicating continuity.

B. ♦Circuit Test Using 142A Test Set (Fig. 8)

5.06 Prepare the circuit under test as follows:

(a) Disconnect the CPE by removing the B bridging clips or wire straps at the interface block.

(b) Connect the 10-conductor test set interface cord to the terminals on the telephone company side of the block as shown in Fig. 8. Use 841720527 lead assembly (with 961A connector) or 841224330 lead assembly (with clips).

(c) Connect the leads from the 2-conductor power cord, 841224322 lead assembly, to −24 volts and ground as shown in Fig. 8. This voltage should be obtained from the same source used to power the IU under test. The PWR lamp on the test set should light.

(d) Connect a 1013A hand test set to the HNDST terminals on the test set. Set the MON-TALK switch on the hand test set to MON position.

(e) On the 142A test set, set the CS-CG LOOP switch to the 100-ohm position (switch position 3).

5.07 After circuit preparation, proceed as follows:

(1) Operate switch on 1013A hand test set to the TALK position. The S relay in the 142A test set will operate, lighting the CS lamp and providing a ground path on the CG lead through the 100-ohm resistor on the CS-CG LOOP switch. Ground on the CS lead causes the S relay in the IU to operate and seize the CO trunk. Since this is a one-way incoming service, dial tone should not be heard in the hand test set. Return the hand test set switch to MON position.

(2) Dial the local test desk using another line and request that an incoming call be placed on the trunk under test.

(3) When the trunk is seized by the incoming call from the test desk and ringing is applied to the trunk, the C- lamp lights and follows the ringing cycle.

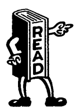
(4) Operate the hand test set switch to TALK. The C- lamp should extinguish and the CS lamp light indicating ringing has been tripped and the call answered. The trunk should now be cut through the IU, and satisfactory transmission may be judged by using the hand test set. If the CS lamp lights but ringing is not tripped, change the CS-CG LOOP switch to the 18-ohm position (switch position 2). If ringing is now tripped, IU operation may be considered marginal or it may indicate the CS-CG loop is of too high resistance.

(5) Have the test desk release the trunk. Operate the hand test set switch to MON. The CS lamp should be extinguished and the IU should be in the idle condition.♦

5.08 When trouble is indicated in the J53050J-2 IU, transfer the line to another circuit, if available, or replace the defective unit with another unit known to be functioning properly. Tag the defective IU and return it for repair.

5.09 If trouble is indicated in the KS-20944, List 2 protector, refer to Section 463-300-109 for testing procedures.

5.10 If tests are satisfactory, remove all test connections to restore the circuit to normal and replace the B bridging clips (or wire straps).

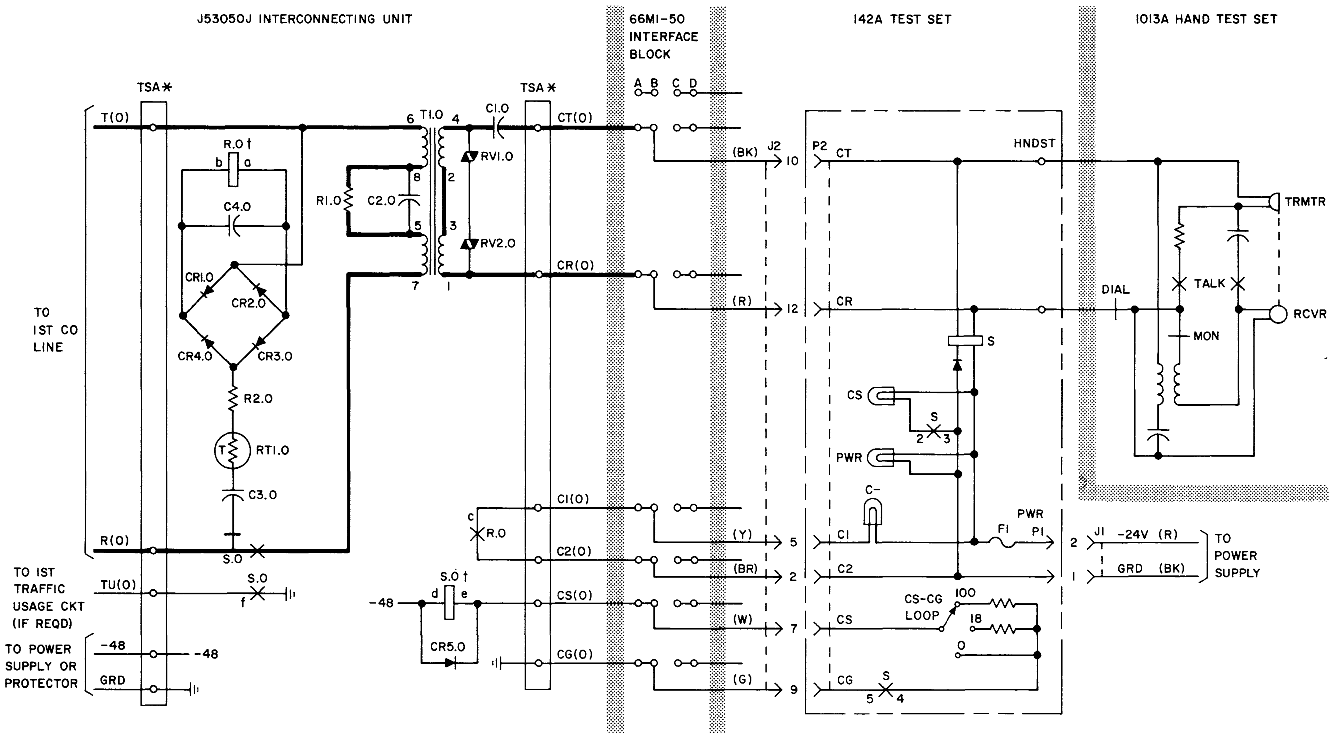


Do not attempt any tests or repairs to CPE.

5.11 When in the repairman's judgment the trouble is located in the CPE, the Repair Service Bureau should be notified so that proper Maintenance of Service Charge billing can be initiated as outlined in Section 660-101-312 entitled Maintenance of Service Charge on Services With Customer-Provided Equipment (CPE).

6. CONNECTIONS

6.01 For connection information to the 342A terminal strips (TSA and TSB) on the J53050J-2 IU, refer to Fig. 4 and 5 and Tables A, B, and C.



NOTE:

CONNECTIONS ARE SHOWN FOR IU NO. 0. MAKE SIMILAR CONNECTIONS FOR IUs 1 THROUGH 9.

* - SEE TABLES A, B AND C FOR TERMINAL NUMBERS

† - SEE RELAY DESIGNATION TABLE

RELAY DESIGNATION TABLE

RELAY SUFIX	CONTACT NUMBER						
	R RELAY			S RELAY			
	a	b	c	d	e	f	g
.0, .2, .4, .6, .8	1L	2L	4	2L	1L	5	2
.1, .3, .5, .7, .9	1U	2U	8	2U	1U	8	11

Fig. 8—Simplified Schematic—PCA TAS With 142A Test Set

6.02 For connection information using the KS-20944, List 2 protector, refer to Fig. 6 and 7.

6.03 The following are typical connecting circuits:

(a) Step-by-Step System, No. 1, 350A, 355A and 356A Subscriber Line Circuit—SD-32133-01.

(b) Crossbar System No. 5, Line, Link and Marker Connector Control Circuit—SD-26030-01.

(c) Panel System Subscriber Line Circuit—SD-21712-01.

TABLE A

CONNECTIONS TO CO LINES AND TRAFFIC USAGE CIRCUITS

LINE NO.	LEAD DESIG*	TERM STRIP A	TERM STRIP B	CONN CABLE COLOR	66M1-50 CONN BLK ROW NO.
1	T	107		W-BL	1
	R	97		BL-W	2
	TU	27		W-O	3
	SPARE			O-W	4
2	T	106		W-G	5
	R	96		G-W	6
	TU	26		W-BR	7
	SPARE			BR-W	8
3	T	105		W-S	9
	R	95		S-W	10
	TU	25		R-BL	11
	SPARE			BL-R	12
4	T	104		R-O	13
	R	94		O-R	14
	TU	24		R-G	15
	SPARE			G-R	16
5	T	103		R-BR	17
	R	93		BR-R	18
	TU	23		R-S	19
	SPARE			S-R	20
6	T		107	BK-BL	21
	R		97	BL-BK	22
	TU		27	BK-O	23
	SPARE			O-BK	24
7	T		106	BK-G	25
	R		96	G-BK	26
	TU		26	BK-BR	27
	SPARE			BR-BK	28
8	T		105	BK-W	29
	R		95	S-BK	30
	TU		25	Y-BL	31
	SPARE			BL-Y	32
9	T		104	Y-O	33
	R		94	O-Y	34
	TU		24	Y-G	35
	SPARE			G-Y	36
10	T		103	Y-BR	37
	R		93	BR-Y	38
	TU		23	Y-S	39
	SPARE			S-Y	40
	SPARE			V-BL	41
				BL-V	42
				V-O	43
				O-V	44
				V-G	45
				G-V	46
				V-BR	47
				BR-V	48
				V-S	49
				S-V	50

TABLE B

CONNECTIONS TO CUSTOMER-PROVIDED EQUIPMENT

CIRCUIT NO.	LEAD DESIG*	TERM STRIP		CONN CABLE COLOR	66M1-50 INTERFACE CONN BLK 1 ROW NO.
		A	B		
1	CT	87		W-BL	1
	CR	77		BL-W	2
	CS	67		W-O	3
	CG	57		O-W	4
	C1	47		W-G	5
	C2	37		G-W	6
2	CT	86		W-BR	7
	CR	76		BR-W	8
	CS	66		W-S	9
	CG	56		S-W	10
	C1	46		R-BL	11
	C2	36		BL-R	12
3	CT	85		R-O	13
	CR	75		O-R	14
	CS	65		R-G	15
	CG	55		G-R	16
	C1	45		R-BR	17
	C2	35		BR-R	18
4	CT	84		R-S	19
	CR	74		S-R	20
	CS	64		BK-BL	21
	CG	54		BL-BK	22
	C1	44		BK-O	23
	C2	34		O-BK	24
5	CT	83		BK-G	25
	CR	73		G-BK	26
	CS	63		BK-BR	27
	CG	53		BR-BK	28
	C1	43		BK-S	29
	C2	33		S-BK	30
6	CT		87	Y-BL	31
	CR		77	BL-Y	32
	CS		67	Y-O	33
	CG		57	O-Y	34
	C1		47	Y-G	35
	C2		37	G-Y	36
7	CT		86	Y-BR	37
	CR		76	BR-Y	38
	CS		66	Y-S	39
	CG		56	S-Y	40
	C1		46	V-BL	41
	C2		36	BL-V	42
8	CT		85	V-O	43
	CR		75	O-V	44
	CS		65	V-G	45
	CG		55	G-V	46
	C1		45	V-BR	47
	C2		35	BR-V	48
	SPARE			V-S	49
	SPARE			S-V	50

* Stencil lead designations on fanning strip.

TABLE C

CONNECTIONS FOR CUSTOMER-PROVIDED EQUIPMENT

CIRCUIT NO.	LEAD DESIG*	TERM STRIP A	TERM STRIP B	CONN CABLE COLOR	66M1-50 INTERFACE CONN BLK 2 ROW NO.
9	CT		84	W-BL	1
	CR		74	BL-W	2
	CS		64	W-O	3
	CG		54	O-W	4
	C1		44	W-G	5
	C2		34	G-W	6
10	CT		83	W-BR	7
	CR		73	BR-W	8
	CS		63	W-S	9
	CG		53	S-W	10
	C1		43	R-BL	11
	C2		33	BL-R	12
SPARE	SPARE	SPARE		R-O	13
				O-R	14
				R-G	15
				G-R	16
				R-BR	17
				BR-R	18
				R-S	19
				S-R	20
				BK-BL	21
				BL-BK	22
				BK-O	23
				O-BK	24
				BK-G	25
				G-BK	26
				BK-BR	27
				BR-BK	28
				BK-S	29
				S-BK	30
				Y-BL	31
				BL-Y	32
				Y-O	33
				O-Y	34
				Y-G	35
				G-Y	36
				Y-BR	37
				BR-Y	38
				Y-S	39
				S-Y	40
				V-BL	41
				BL-V	42
				V-O	43
				O-V	44
				V-G	45
				G-V	46
				V-BR	47
				BR-V	48
				V-S	49
				S-V	50

* Stencil lead designations on fanning strip.

PROTECTIVE CONNECTING ARRANGEMENTS CDQ4W AND CDQ4X

1. GENERAL

1.01 This section provides identification, installation, method of operation, maintenance, and connecting information for Protective Connecting Arrangements (PCA) CDQ4W and CDQ4X (Fig. 1 and 2). These PCAs provide for the connection of 2-way dial repeating tie trunks between a customer-provided (CP) switching system and a Bell System PBX or Centrex system. They present a 4-wire transmission interface with channel signaling provided by the telephone company between Bell System 4-wire facilities and the CP equipment (CPE). PCA CDQ4W is used with CP trunks designed for a dry contact type signaling interface. PCA CDQ4X is used with CP trunks designed for an E and M type signaling interface. PCA CDQ4W consists of an interconnecting unit (IU) J53050C, List 1 (MD) or List 3 (Fig. 3); DX signaling unit J98605AJ; 44V4A intermediate repeater shelf J98615AH, List 2, equipped with plug-in components; and KS-15620, List 22 rectifier. PCA CDQ4X uses the same equipment as CDQ4W with the exception of the J53050C IU which is a List 2 (Fig. 4) instead of a List 1 or 3.

> ***Note:*** An X76090 loop-back panel may be provided at the customer's premises to facilitate testing the connecting arrangement from the serving central office.

1.02 This section is reissued to:

- Include coverage of the J98605AJ DX signaling unit which replaces the J98605AG, now rated MD. (Information required for maintenance of existing installations using the J98605AG has been retained.)
- Rate the J53050C, List 1 IU MD.
- Include information on the KS-15620, List 22 rectifier which replaces the KS-15620, List 14, now rated MD.
- Add current drain information.
- Replace the term Voice Connecting Arrangement (VCA) with Protective Connecting Arrangement (PCA).
- Add post-installation tests.
- Expand maintenance information.
- Remove KS-20944 protector from Design Features.

1.03 If the customer wants a copy of the Technical Reference which covers this interface specification, he should contact the local Telephone Company Business Office or the Marketing Representative.

1.04 This issue of the section is based on the following drawings:

CD-1E206, Issue 1, Appendix 3B, and SD-1E206, Issue 4B (J53050C, L1 and L3 IU)

CD-1E254, Issue 1 and SD-1E254, Issue 1 (J53050C, L2 IU)

CD-97047, Issue 5D, Appendix 2D, and SD-97047, Issue 16D (44V4A Repeater)

J98605AJ-1, Issue 8 and SD-1C363, Issue 4B (J98605AJ DX Signaling Unit)

If this section is to be used with equipment or apparatus reflecting later issue(s) of the drawing(s), reference should be made to the SDs and CDs to determine the extent of the changes and the manner in which the section may be affected.

2. IDENTIFICATION

PURPOSE

- To provide a 4-wire voice connection between a CP PBX and Bell System tie line facilities
- To provide dry contact type signaling or E and M signaling to and from CPE

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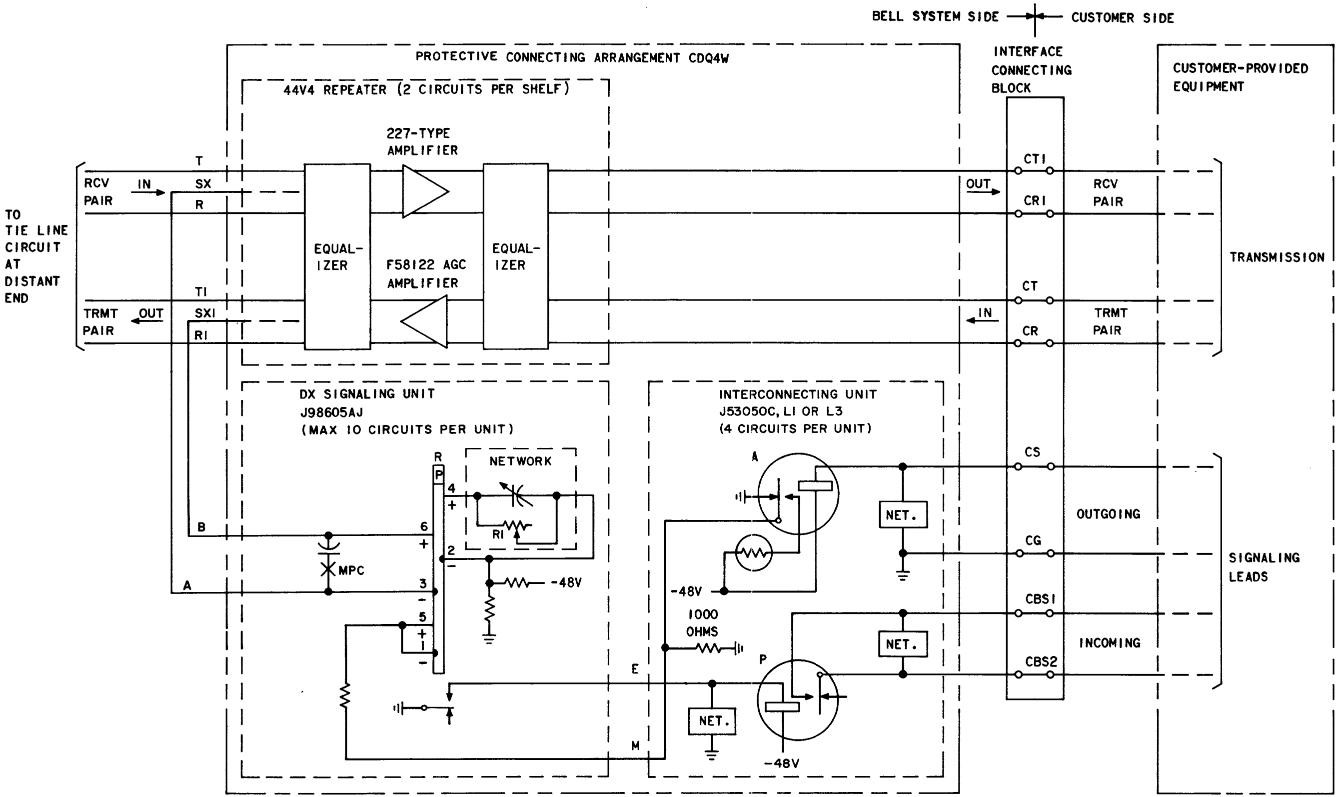


Fig. 1—Simplified Schematic—PCA CDQ4W

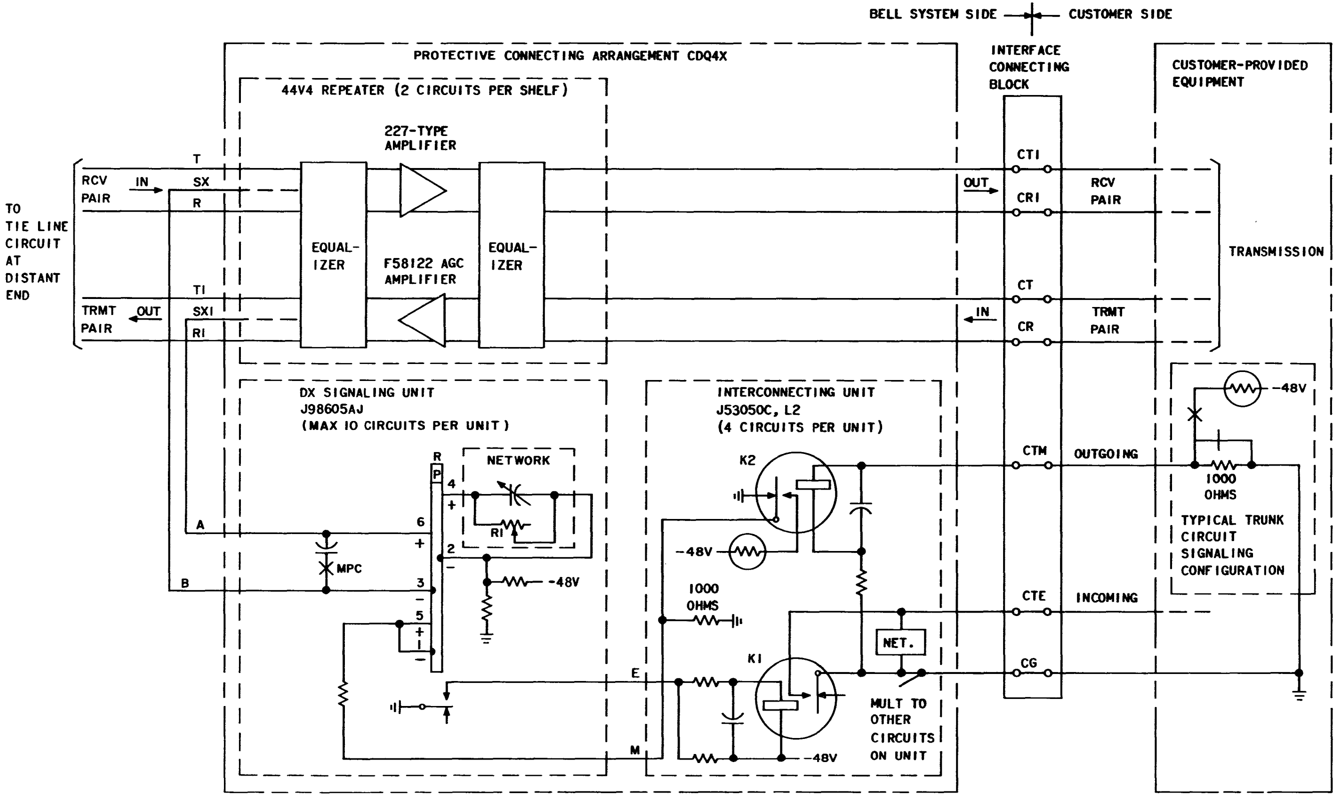


Fig. 2—Simplified Schematic—PCA CDQ4X

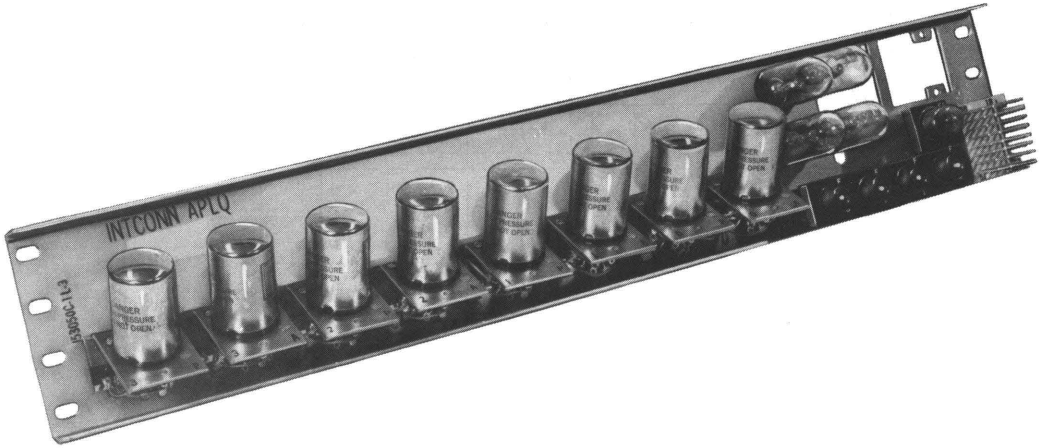


Fig. 3—J53050C, List 3 IU

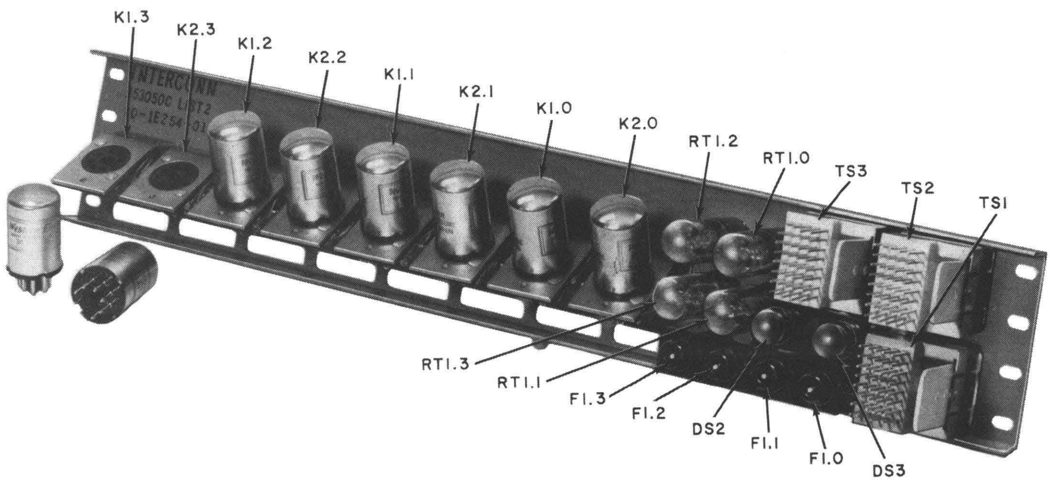


Fig. 4—J53050C, List 2 IU

- To limit excessive levels from CPE, to provide protection for telephone company personnel against hazardous voltages, to insure longitudinal balance, and to repeat network control signaling.

ORDERING GUIDE

- Unit, Interconnecting, J53050C, List 1 (MD) or List 3—for PCA CDQ4W. Each unit provides four signal isolation (applique) circuits.
- Unit, Interconnecting, J53050C, List 2—for PCA CDQ4X. Each unit provides four signal isolation (applique) circuits.
- Unit, Signaling DX, J98605AJ—order both List 1 and List A to get a mounting assembly with wiring and connectors for ten circuits; order required number of 334A relays separately, one per tie trunk circuit being served.
- Shelf, Repeater, Intermediate 44V4A, J98615AH, List 2—each shelf provides two circuits.

Note: For plug-in components, refer to Section 852-307-101. When automatic control of signal power level is required, order F58122 automatic gain control (AGC) amplifier for use in the ***transmitting leg from the CPE to Bell System facilities*** instead of the standard 227-type amplifier shown in Section 852-307-101 (see Fig. 1 and 2).

Associated Apparatus (Order Separately)

- Rectifier, List 22, KS-15620 (2 amperes at −48 volts).

Note: This rectifier meets acceptable noise requirements as explained under Power Supplies in Section 332-104-102. Other rectifiers may be used when specified by local engineering. Typical current drain for a single CDQ4W arrangement is 0.169 ampere; for a single CDQ4X, 0.212 ampere. Be sure that rectifier capacity is adequate for the number of PCAs installed.

- Adapter, Group 33, ED-90273-70 (two required)—for mounting 19-inch rectifier on relay rack.
- Cord, Power, KS-14532

  List 1—10 ft.

  List 2—2 ft.

  List 3—15 ft.

  List 4—20 ft.

  List 5—25 ft.

- Cable, Wiring, "D" Inside, 16-pair or equivalent—for cabling from connecting arrangement to interface connecting block.
- Block, Connecting, 66M1-50 (Fig. 5 and 6).

Note: Other types of blocks may be used when specified by local engineering.

- Clip, Bridging, B (25 per pkg).
- Block, Connecting, 66 Type—for connecting telephone company facilities.
- Panel, Loop-Back, X76090 (optional).

Note: The loop-back panel mounts on a standard 23-inch relay rack. Four circuits are provided per panel; one panel is required for each two 44V4A repeater panels. Power must be provided from a local −48 volt source with a local fusing arrangement.

- Protector, List 2, KS-20944 (optional)—***must*** be provided when CP power supply is used to power the PCAs. See Fig. 11 and 12.
- Block, Connecting, 66C1-16 or equivalent—for providing distribution of power when KS-20944 protector is used between CP power supply and ***more than one*** connecting arrangement of any type. See Fig. 13.

Note: The cumulative current drain of all the connecting arrangements connected to a KS-20944 protector must not exceed the maximum current rating of the protector. For instance, if the maximum current drain for one connecting arrangement is 1.0 ampere and the maximum current rating of a KS-20944, List 2 protector is 15 amperes, no more than 15 connecting arrangements may be connected to the protector (this example is for illustrative purposes only).

- Wire, AM, 14 gauge, paired, red and black, P-384614 or equivalent—for cabling from the KS-20944 protector to the 66C1-16 connecting block. See Fig. 13.

Replaceable Components

- Fuses, 70A (1-1/3 amp) (J53050C IU)
- Plug-in components of 44V4A repeater
- Relays, 303E (J53050C, List 1 [MD] and List 3 IU) or 303K (J53050C, List 2 IU)
- Relays, 334A (J98605AJ DX Signaling Unit).

DESIGN FEATURES

44V4A Repeater Shelf

- Mounts on standard 23-inch relay rack on 1-3/4 inch centers.
- Two repeater circuits per shelf.
- Each circuit provides a 4-wire voiceband transmission path (voice coupler) to and from the CP equipment.
- Limits the inband signal power applied to Bell System facilities when equipped with F58122 AGC amplifier.
- Typical current drain per circuit: 0.036 ampere.

J98605AJ DX Signaling Unit

- Mounts on standard 23-inch relay rack
- Up to ten circuits per unit
- Provides DX signaling to the distant end
- Provides loop-strapping options
- Typical current drain per circuit: 0.061 ampere.

J53050C, List 1 (MD) or List 3 Interconnecting Unit

- Mounts on standard 23-inch relay rack.
- Four signal isolation (applique) circuits per unit.
- Lists 1 and 3 are electrically the same with the exception that List 3 is equipped with four fuses (one per circuit); List 1 was manufactured prior to January 1971.
- Converts standard Bell System E lead signaling to a dry contact closure.
- Converts CP dry contact closure to standard Bell System M lead signaling.
- Provides dc isolation of the signaling leads between the CP equipment and the DX signaling unit.
- Typical current drain per circuit: 0.072 ampere.

J53050C, List 2 Interconnecting Unit

- Mounts on standard 23-inch relay rack
- Four signal isolation (applique) circuits per unit
- Accepts ground and battery supervisory signals over M lead from CP equipment
- Provides closure (to ground) and open supervisory signals over E lead to CP equipment
- Provides dc isolation of the signaling leads between the CP equipment and the DX signaling unit
- Typical current drain per circuit: 0.115 ampere.

3. INSTALLATION

3.01 Locate the PCAs in an area free of dampness and excessive dust or dirt with adequate room for access to front and rear of equipment and connecting blocks. The associated equipment typically mounts on a standard 23-inch relay rack (see Fig. 7).

3.02 Wire the equipment as shown in Fig. 9 and 10. Mount the interface connecting block in a position that will facilitate testing between it and the PCA equipment. Use the 16-pair "D" inside wiring cable or equivalent to terminate the leads associated with the CP equipment on the block. Stencil trunk number and lead designations on designation strip (see Fig. 5 and 6). Make DX signaling unit adjustments as given in 3.03. Install the proper plug-in components in the 44V4A repeater. (When the AGC amplifier is used, see 7.02 for adjustment procedures.) Apply power as shown in Fig. 9 and 10. Before installing bridging clips on the block to connect Bell System wiring to CP wiring, perform the appropriate quick test in 3.08 to determine if each PCA operates properly. If it does not, recheck installation and connections; if necessary, perform the maintenance procedures in Part 5 of this practice.

3.03 ***DX Signaling Unit Adjustments (J98605AJ) (Fig. 1, 2, and 8)***

(a) Adjust network resistor R1 to equal the simplex loop resistance (one half the resistance of one pair of the 4-wire facility), $\pm$125 ohms. When adjusting R1, be sure that at least one of the network capacitance screw switches (C1, C2, C3) is open (up). Using an ohmmeter, measure the resistance of R1 across test points TP1 and TP3 with the signaling circuit (334A relay) removed from its socket.

(b) It is desirable to have a 4 microfarad (μf) capacitor across the A and B leads. If the external circuit (the repeater) does not provide this, close the MPC screw switch on the signaling circuit to insert its 4 μf capacitor. In no case should the A-B capacitance exceed 4 μf; therefore, if the external circuit has a capacitor of more or less than 4 μf, disconnect it before connecting the 4 μf capacitor of the signaling circuit. To properly match the A-B capacitance of 4 μf, the signaling circuit network capacitance should be 6 μf (C1 and C2 closed). Refer to the SD-1C363-01 for more information on these adjustments.

Power Requirements

3.04 If Bell System power source is used to power the connecting arrangement, the customer must provide a 117V 60-Hz power outlet within power cord length of the customer-designated mounting location of the connecting arrangement (see ORDERING GUIDE for cord lengths).

3.05 The power outlet supplying connecting arrangement(s) must not be under control of a switch and should be on a separately fused power circuit to prevent accidental loss of ac line voltage. Where local instructions permit, secure the power cord to the outlet with a power cord plug retainer assembly.

3.06 Refer to appropriate sections in Division 167 for proper grounding of power plants.

3.07 ***KS-20944 Protector (Fig. 11 and 12):*** When a CP power source is used to power the connecting arrangement, a KS-20944 protector must be provided between the CP power source and the connecting arrangement. Mount the KS-20944 protector on a wall or suitable flat surface near the interface connecting block. Use the AM-type, 14-gauge wire or equivalent to make connections from the protector to the 66C1-16 connecting block. Terminate one end of the wiring to the screw terminals (term. $-$ and $+$) of the load terminal strip provided on the protector. Solder the other end of the wiring to terminals in column D of the connecting block as shown in Fig. 13; using the 14-gauge wire, solder the multiple straps to the terminals in column D of the connecting block as shown in Fig. 13, depending on the number of connecting arrangements provided. Use "D" inside wire cable or equivalent to make connections from the quick-connect terminals in columns A, B, and C of the connecting block to the battery, and ground terminals on the connecting arrangements. The customer must connect his power supply to the red (GRD) and black (-V) wires extending from the protector.

Warning: The circuit breaker switch removes voltage from the load (Bell System) side of the protector only; voltage will be present on the upper terminals of the circuit breaker inside the box as soon as customer power is connected.

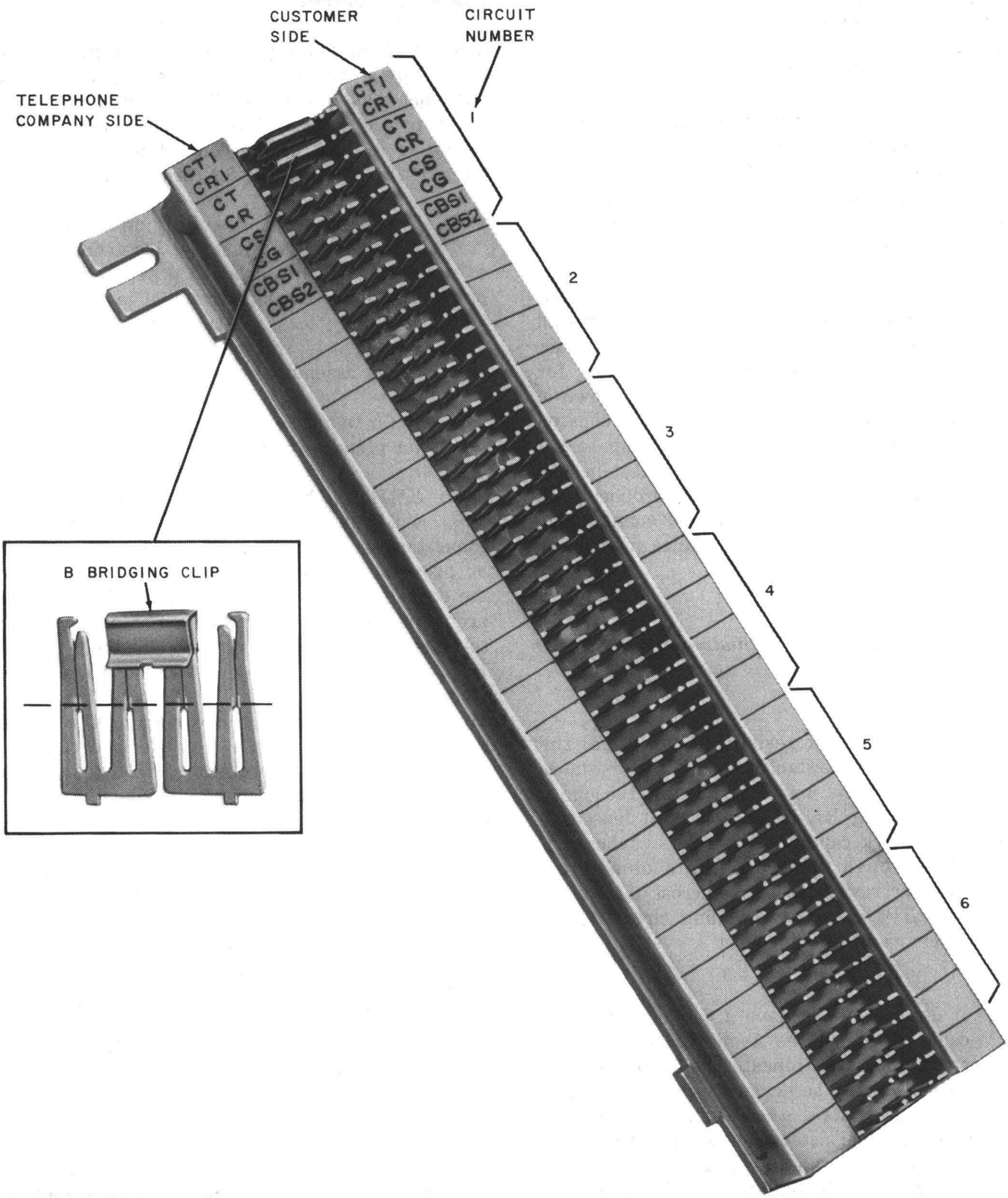


Fig. 5—Typical Interface Connecting Block—PCA CDQ4W

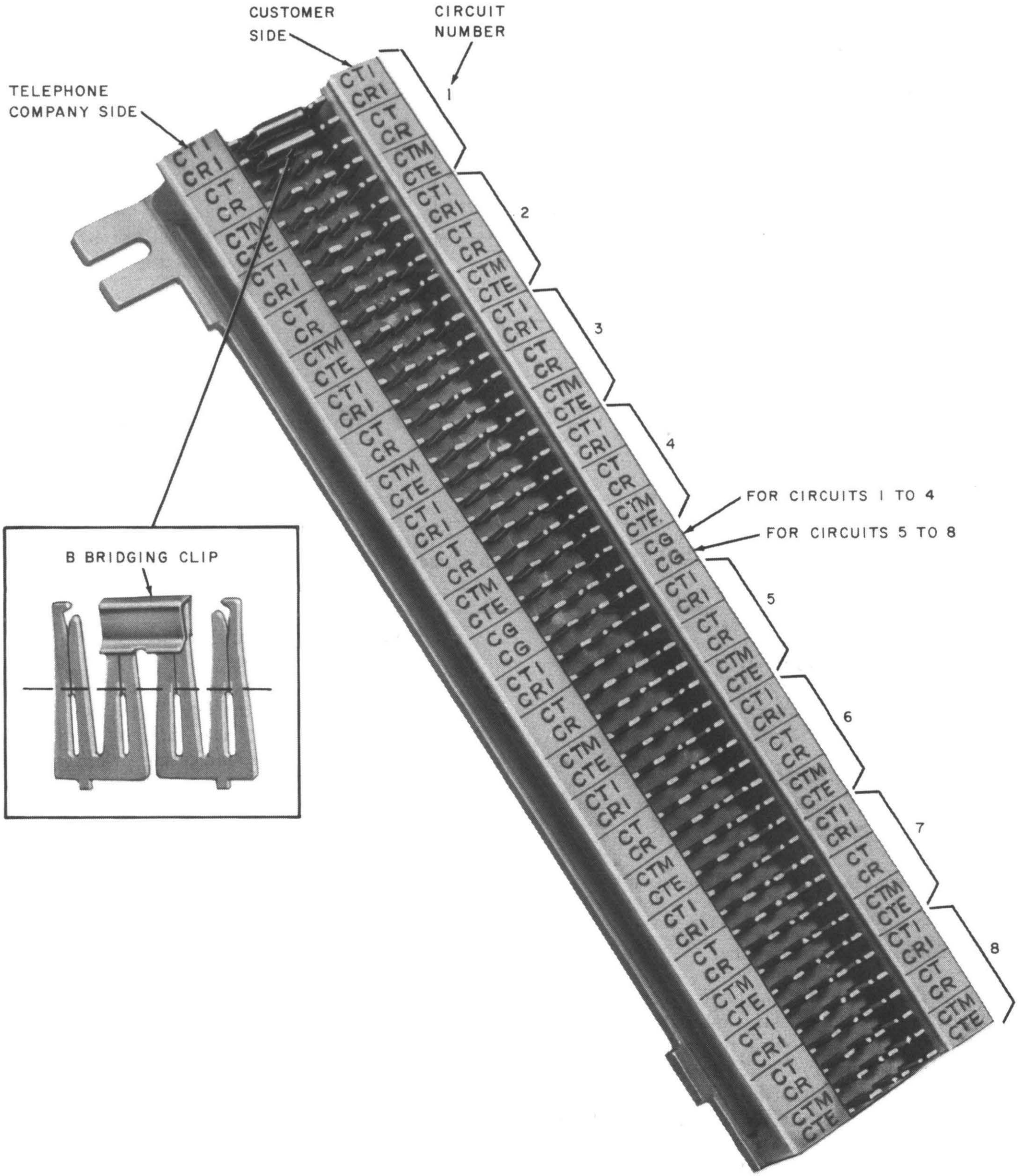


Fig. 6—Typical Interface Connecting Block—PCA CDQ4X

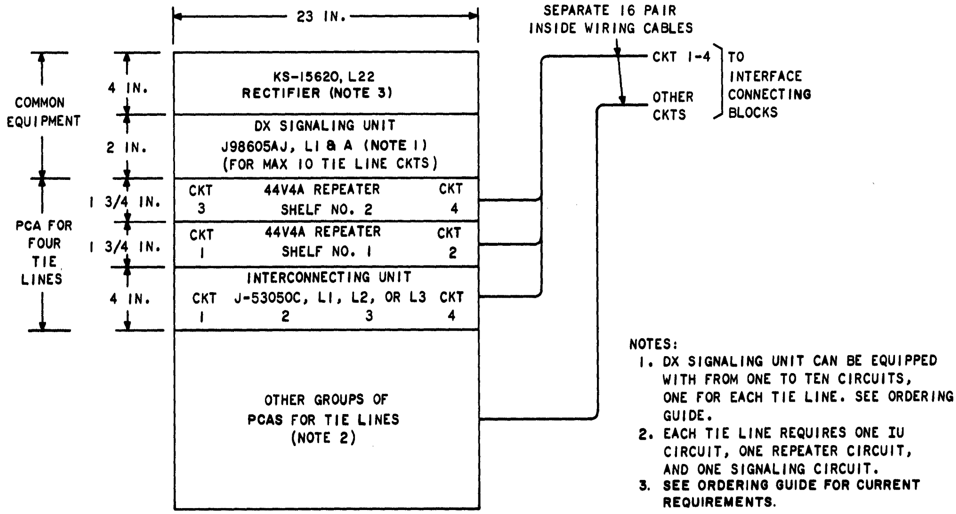


Fig. 7—Typical Rack Mounting—PCA CDQ4W or CDQ4X, Front View

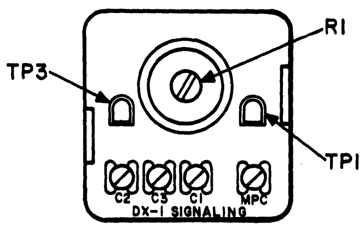


Fig. 8—334A Relay, End View

3.08 ***Post-Installation Tests***

(a) ***PCA CDQ4W (Fig. 1):*** At the telephone company side of the interface connecting block, connect a 4-wire telephone, such as a 500AD, to the CT, CR, CT1, and CR1 leads; a 1013A handset across the CS and CG leads; and an 81A test set across the CBS1 and CBS2 leads. Connect talk battery from the −48 volt supply through a 500-ohm resistor to CR and ground to CT. (A 2A or 31A KTU can be used for battery feed instead of the resistor; refer to Section 518-112-421 for connections.) With the 1013A in the TALK mode, dial the distant end while monitoring on the 500AD. The distant end should answer, and satisfactory transmission should be possible using the 500AD. Ask the distant end to call you back. Put the 1013A in the MON mode and the 500AD on-hook. When the distant end calls back, the 81A (in the "C" position) should buzz, indicating closure on the CBS1 and CBS2 leads. Use the 500AD to tell the distant end that the test is complete. Restore the circuit to normal.

(b) ***PCA CDQ4X (Fig. 2):*** Same as for CDQ4W except 1013A handset is connected between CTM lead and −48 volts, 81A test set is connected across CTE and CG leads, and ground is connected to CG.

4. METHOD OF OPERATION

4.01 ***Incoming Call—PCA CDQ4W (Fig. 1)***

(a) An incoming call from the distant PBX unbalances the DX signaling circuit causing R relay to operate which places a ground on the E lead, causing P relay to operate in the signal isolation (applique) circuit. P relay closes a contact toward the CP equipment across leads CBS1 and CBS2. The CP equipment must respond to this seizure by connecting dial pulse receiving equipment to those leads and returning dial tone, if provided, to the distant PBX over leads CT and CR to indicate readiness to receive dial pulses.

(b) When dial pulses have been received, the CP equipment may transmit answer supervision to the distant PBX by placing a closure across leads CS and CG. This operates the A relay in the signal isolation circuit, which in turn places battery on the M lead to the DX signaling circuit, which repeats the answer supervision to the distant tie trunk circuit.

(c) The 44V4A repeater provides a 4-wire transmission path to the CP equipment.

4.02 ***Outgoing Call—PCA CDQ4W (Fig. 1)***

(a) The CP equipment seizes the tie trunk by placing a closure across leads CS and CG. The closure across CS, CG operates the A relay in the signal isolation circuit which in turn places battery on the M lead to the DX signaling circuit. The DX circuit unbalances the signaling circuit and gives a seizure indication at the distant PBX; the distant PBX returns dial tone, if provided, over leads CT1 and CR1. The CP equipment then outpulses the digits over the CS, CG leads which are repeated to the distant PBX.

(b) If the distant tie trunk circuit receives the answer supervision signal from its associated PBX, it unbalances the near end DX circuit causing the R relay to operate, which in turn operates the P relay in the signal isolation circuit in the same manner as an incoming call. The resulting contact closure repeats the answer supervision to the CP equipment.

(c) The 44V4A repeater provides a 4-wire transmission path to the distant end.

4.03 ***Disconnect—PCA CDQ4W (Fig. 1)***

(a) When the customer at the near end goes on-hook first, the CP equipment removes the contact closure across leads CS, CG which releases the A relay. The A relay released removes battery from the M lead toward the signaling circuit. The signaling circuit subsequently transmits a disconnect signal to the distant PBX. When the distant end goes on-hook, a disconnect signal is returned to the near end DX signaling circuit; the DX circuit removes ground from the E lead which in turn causes the P relay in the signal isolation circuit to release, removing the closure across leads CBS1, CBS2 toward the CP equipment and restoring the connecting arrangement to the idle condition.

(b) When the customer at the distant end goes on-hook first, the signaling circuit removes ground from the E lead toward the signal isolation circuit causing the P relay to release. P relay released removes the contact closure across leads CBS1, CBS2 toward the CP equipment. The CP equipment subsequently removes the contact closure across leads CS, CG which releases the A relay in the signal isolation circuit. Release of the A relay removes battery from the M lead toward the signaling circuit and restores the connecting arrangement to the idle condition.

4.04 ***Incoming Call—PCA CDQ4X (Fig. 2)***

(a) An incoming call from the distant PBX unbalances the DX signaling circuit causing R relay to operate which places a ground on the E lead toward the signal isolation circuit. E lead grounded operates K1 relay in the signal isolation circuit which closes a contact toward the near end CP equipment across leads CTE, CG. The CP equipment must respond to this seizure by connecting dial pulse receiving equipment to these leads and returning dial tone, if provided, to the distant PBX over leads CT and CR to indicate readiness to receive dial pulses.

(b) Dial pulses from the distant end are recognized by the DX signaling circuit and repeated to the signal isolation circuit by alternately opening and closing the E lead. Relay K1 in the signal isolation circuit repeats dial pulses to the CP equipment over lead CTE.

(c) When dial pulses have been received, the CP equipment may transmit answer supervision to the distant PBX by placing battery (−48 volts) on the CTM lead. This operates the K2 relay in the signal isolation circuit, which in turn places battery on the M lead to the DX signaling circuit, which repeats the answer supervision to the distant tie trunk.

(d) The 44V4A repeater provides a 4-wire transmission path to the CP equipment.

4.05 *Outgoing Call—PCA CDQ4X (Fig. 2)*

(a) The CP equipment seizes the tie trunk by placing battery on the CTM lead. This operates the K2 relay in the signal isolation circuit, which in turn places battery on the M lead to the DX signaling circuit. The DX circuit unbalances the signaling circuit at the distant PBX; the distant PBX returns dial tone, if provided, over leads CT1 and CR1. The CP equipment then outpulses the digits over lead CTM, which are repeated to the distant PBX.

(b) If the distant tie trunk receives the answer supervision signal from its associated PBX, it unbalances the near end DX circuit causing the R relay to operate, which in turn operates K1 relay in the signal isolation circuit in the same manner as an incoming call. The resulting K1 contact closure repeats the answer supervision to the CP equipment by grounding the CTE lead.

(c) The 44V4A repeater provides a 4-wire transmission path to the distant end.

4.06 *Disconnect—PCA CDQ4X (Fig. 2)*

(a) When the customer at the near-end CP equipment goes on-hook first, the CP equipment removes battery from lead CTM which releases the K2 relay in the signal isolation circuit. The K2 relay released removes battery from the M lead toward the signaling circuit. The signaling circuit subsequently transmits a disconnect signal to the distant PBX. When the distant end goes on-hook, a disconnect signal is returned to the near end DX signaling circuit; the DX circuit removes ground from the E lead, which in turn causes the K1 relay in the signal isolation circuit to release, removing ground from lead CTE toward the CP equipment and restoring the connecting arrangement to the idle condition.

(b) When the distant end goes on-hook first, the signaling circuit removes ground from the E lead toward the signal isolation circuit, causing the K1 relay to release, removing ground from lead CTE toward the CP equipment. The CP equipment subsequently removes battery from lead CTM which releases the K2 relay in the signal isolation circuit. Relay K2 released removes battery from the M lead toward the signaling circuit and restores the connecting arrangement to the idle condition.

5. MAINTENANCE

5.01 Where there is an indication of trouble in the connecting arrangement(s), the circuit at fault must be opened at the interface connecting block to verify in which direction the trouble exists. The circuit can be opened at the connecting block by removing the B bridging clip associated with each lead.

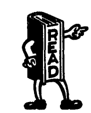
5.02 Precautions should be taken when performing tests to avoid adversely affecting service to the customer. Local instructions should be followed with reference to notifying the customer before performing the tests.

> ***Note:*** In no case should the CPE be used to perform end-to-end tests.

5.03 The repairman should first check the PCA for blown fuses, loose or broken wires and connectors, adequate battery and ground, and verify that the CO cable pairs are good. Any defects found should be repaired and tested before the equipment is reconnected to the customer's facility. If the trouble persists, continue with the trouble-shooting procedures described below.

5.04 Perform the post-installation tests described in 3.08 to determine if there is trouble in the PCA or the telephone company 4-wire facilities behind the PCA. If the tests in 3.08 can be completed successfully, and the areas checked in 5.03 are satisfactory, then the trouble is probably in the CPE.

5.05 When in the repairman's judgment the trouble is located in the CPE, the Repair Service Bureau should be notified so that proper maintenance of service charge billing can be initiated as outlined in BSP 660-101-312 entitled Maintenance of Service Charge on Services With Customer-Provided Equipment (CPE).



Do not attempt any tests or repairs to the customer-provided equipment.

5.06 If the trouble appears to be in the telephone company 4-wire facilities remote from the

PCA, follow local practices to have them tested and repaired. If the PCA appears to be at fault, test the circuits which are most likely to be involved, based on the results of the test in 5.04. Faulty transmission probably points to the repeater as the source of trouble. Signaling difficulties are most likely to be caused by a defective J53050C IU or DX signaling unit plug-in relay. If CP power is being used, check the protector. When the faulty circuit is found, replace components or the entire unit, as necessary, or move leads to an idle circuit if one is available.

5.07 ***Apparatus Required to Perform Tests***

(a) Test cord, 893 cord, 6 feet long, equipped with two 360A tools (1W13B cord), one KS-6278 connecting clip, and one 411B (test pick) tool (for connecting battery to alarm bar of 70-type fuses).

Note: To connect battery to the alarm bar of 70-type fuses mounted in a 21A fuse block, insert the tip of the 411B tool (attached to the 1W13B cord) into the aperture provided in the fuse block cover and touch the alarm bar.

(b) Volt-ohm-meter capable of measuring −48 volts and 1000 ohms.

(c) Two clip leads, one of sufficient length to reach from the interface connecting block to the connecting arrangement.

5.08 ***Tests—J53050C, List 1 (MD) or List 3 Interconnecting Unit***

(a) Using 893 cord, connect battery to alarm bar of fuse(s) on interconnecting unit—fuse alarm lamp should light.

(b) Open all eight leads of the circuit under test at the interface connecting block. Remove leads E and M from the DX signaling unit. Connect lead CG to lead E. The P relay should operate, indicated by closure across leads CBS1 and CBS2 (zero resistance). If P relay does not operate, replace it with a relay known to be good; if P relay still does not operate, check for faulty D1 diode or open on leads CBS1, CBS2, CG, or E.

(c) Connect lead CG to lead CS. The A relay should operate, indicated by battery (−48 volts) present on lead M. If A relay does not operate, replace it with a relay known to be good; if battery still is not present on lead M, measure the resistance from lead M to ground. If resistance measures zero, check for faulty D2 diode; if resistance measures 1000 ohms, check for faulty RT resistance lamp or open on lead CG, CS, or M.

(d) On completion of tests, reconnect leads E and M to the DX signaling unit and replace the B bridging clips at the interface connecting block associated with the circuit under test.

5.09 ***Tests—J53050C, List 2 Interconnecting Unit***

(a) Make fuse alarm test as shown in 5.08 (a).

(b) Open all seven leads of the circuit under test at the interface connecting block. Remove leads E and M from the DX signaling unit. Apply battery (−48 volts) to lead CTM and ground to lead CG. K2 relay should operate, indicated by battery (−48 volts) present on lead M. If K2 relay does not operate, replace it with a relay known to be good; if battery still is not present on lead M, measure the resistance from lead M to ground. If resistance measures zero, check for open on lead CTM, CG or M; if resistance measures 1000 ohms, check for faulty RT1 resistance lamp.

(c) Connect lead E to frame ground. K1 relay should operate, indicated by a closure across leads CG and CTE (zero resistance). If K1 relay does not operate, replace it with a relay known to be good; if K1 relay still does not operate, check for open on leads CTE, CG, or E.

(d) On completion of tests, reconnect leads E and M to the DX signaling unit and replace the B bridging clips at the interface connecting block associated with the circuit under test.

5.10 ***Tests—J98605AJ DX Signaling Unit:***

(a) Remove the 334A relay in the faulty PCA from its connector to perform tests. It is not a repairable item and will be replaced if defective.

(b) Verify the adjustments described in 3.03 and correct any discrepancies.

(c) Return the 334A relay to its connector in the signaling unit. If the trouble has not been cleared, replace the relay. (Perform 3.03 adjustments on any new relays before installing.)

5.11 ***Tests—J98605AG (MD) DX Signaling Unit:*** If the circuit malfunction is isolated to this unit, the entire unit must be replaced (unless an unused circuit is available).

5.12 ***Tests—44V4A Repeater:*** If the CO cable pairs are verified to be good and transmission trouble is still present, the repeater may be defective. The amplifiers, terminal sets, and equalizer are plug-in units which may be adjusted or removed and replaced individually to localize the fault. Refer to the practices listed in 5.15 for additional information. Alignment procedures for the F58122 AGC amplifier, when used with the 44V4A repeater, is covered in Part 7.

5.13 ***Tests—KS-20944 Protector (Fig. 11 and 12):*** If circuit breaker switches are tripped (in the ***off*** position), return them to the ***on*** position; if the circuit breaker switches cannot be operated to the ***on*** position, perform tests as follows:

(a) Disconnect telephone company-provided wiring from terminals 1 and 2 (− and +) of the load terminal strip on the protector under test. If the circuit breaker switches remain in the ***on*** position when operated, the trouble is in the telephone company-provided equipment. Check the proper polarity of the telephone company-provided leads at terminals 1 and 2 (− and +) of the load terminal strip on the protector; ascertain that the circuits connected to the protector do not exceed the current rating of the protector.

(b) If the trouble is not in the telephone company side, check the type, amount, and polarity of the CP voltage present on the leads provided for customer termination at the protector; this voltage should meet the specifications shown in Fig. 12.

5.14 After tests have been completed and defective equipment repaired or replaced, repeat the post-installation tests in 3.08 to determine that the PCA is operating correctly. If it is, restore all circuits to normal and close the connections between telephone company equipment and CPE.

5.15 When detailed maintenance information is required, refer to the following:

44V4A Repeater

- CD- and SD-97047-01
- Section 179-100-303
- Section 852-307-101
- Section 332-106-101.

359-Type Equalizer

- Sections 332-116-101 through 332-116-113.

227-Type Amplifier

- Section 024-140-101.

DX Signaling Circuit

- CD- and SD-95487-01 (for J98605AG)
- CD- and SD-1C363-01 (for J98605AJ)
- Section 179-100-309
- Section 859-501-101.

Signal Isolation (Applique) Circuit

- CD- and SD-1E206-01 (for Lists 1 or 3)
- CD- and SD-1E254-01 (for List 2).

KS-20944 Protector

- Section 463-300-109.

6. CONNECTIONS

6.01 For connecting information, refer to Fig. 1, 2, 9, 10, 12, and 13.

7. F58122 AUTOMATIC GAIN CONTROL (AGC) AMPLIFIER

7.01 ***Physical and Electrical Characteristics***

(a) The F58122 AGC amplifier is identical in size and connections to the 227-type amplifier used in the 44V4A repeater shelf; it is used to limit the inband signal power in the transmitting leg from CP facilities to Bell System facilities.

(b) The gain of the F58122 AGC amplifier is continuously adjustable from −10 dB to +25 dB. The ability to insert loss is necessary when interfacing with a +7 transmission level point (TLP) transmit leg from CP facilities. The clamped output power of the amplifier is adjustable from −20 dBm to 0 dBm.

(c) The F58122 amplifier is normally adjusted to clamp at a power level 13 dB below the TLP. When the output side of the amplifier is at the 0 TLP, the minimum protection criteria permits an inband 3-second average output power of −13 dBm. If the input signal to the amplifier should be increased to a level that produces an instantaneous signal greater than −7 dBm at the output of the amplifier, the AGC action of the amplifier changes the output to −7 dBm after 20 milliseconds and then to −13 dBm after a time interval varying from 300 to 500 milliseconds. When the input level to the amplifier is such that the output level of the amplifier is between −7 and −13 dBm, the AGC action of the amplifier changes the output level to −13 dBm after a time interval varying from 0.3 to 3 seconds.

7.02 ***Adjustments:*** Gain adjustments are made by means of the LEV ADJ control (R3) and switch S1 (see Fig. 14). The combined setting of these two controls provides a range of −10 to +25 dB gain. The setting of the AGC ADJ control (R20) determines the points at which clamping of the amplifier output begins. The range of the AGC ADJ control is from 0 to −20 dBm. Before making adjustments, refer to circuit order card to determine the TLP at the input and output of the amplifier. With an input signal 10 dB below the input TLP of the amplifier, the amplifier gain must be adjusted (using LEV ADJ and S1 as required) to provide an output level which is 10 dB below the output TLP of the amplifier. The AGC ADJ control must then be adjusted to reduce the output of the amplifier by 3 dB (13 dB below output TLP). The following example shows the method of adjusting F58122 AGC amplifier for a typical input and output TLP:

Example:

(a) Assume that the circuit order card shows an input TLP of −4 and an output TLP of +4.

(b) Set switch S1 to the counterclockwise position (when more than 10 dB of gain is required, set S1 to clockwise position) and LEV ADJ control (R3) to the +8 position; set the AGC ADJ control (R20) fully clockwise to the 0 dBm position. This provides an amplifier gain of +8 dB, the amount of gain required to raise the TLP from −4 to +4.

(c) Adjust the oscillator test level of a 21A transmission measuring set (TMS), or equivalent, to −14 dBm at 1000 Hz (10 dB below input TLP).

(d) Connect the OSC jack of the 21A TMS to the amplifier input (AMPL IN jack on the 44V4A repeater associated with the AGC amplifier). Connect the DET jack of the 21A TMS to the amplifier output (AMPL OUT jack on the 44V4A repeater associated with the AGC amplifier).

(e) Adjust the LEV ADJ control on the AGC amplifier for a detector reading of −6 dBm on the 21A TMS (10 dB below output TLP).

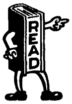
(f) ***Slowly adjust*** the AGC ADJ control on the AGC amplifier in a counterclockwise direction until a detector reading of −9 dBm is obtained on the 21A TMS (13 dB below output TLP). Because of long time constants, this adjustment must be made by turning the AGC ADJ ***slowly*** while noting the change in the detector reading.

(g) The amplifier is now adjusted to clamp the output power to a level 13 dB below the TLP (−9 dBm at +4 TLP).

(h) Reduce the oscillator test level of the 21A TMS by 5 dB (15 dB below input TLP); the detector reading should drop by 2 dB (15 dB below output TLP). This checks the limiting action of the amplifier.

(i) Disconnect the 21A TMS from the 44V4A repeater.

(j) Use the preceding method and refer to Fig. 14 to adjust the AGC amplifier for other TLPs.



The AGC action of the amplifier will make it impossible to measure the overall loss of the circuit using test levels that exceed 13 dB below the TLP. It is suggested that loss measurements from the customer equipment to another location be conducted at a test level of 13 dB below TLP. To minimize the possibility of a misunderstanding, it is imperative that each individual involved with testing the circuit understands that a reduced test level is being used. Some testboards and VF patch bays are not equipped to send reduced test levels. Higher test levels may be used to test those portions or directions of the circuit in which an AGC amplifier (F58122) is not used.

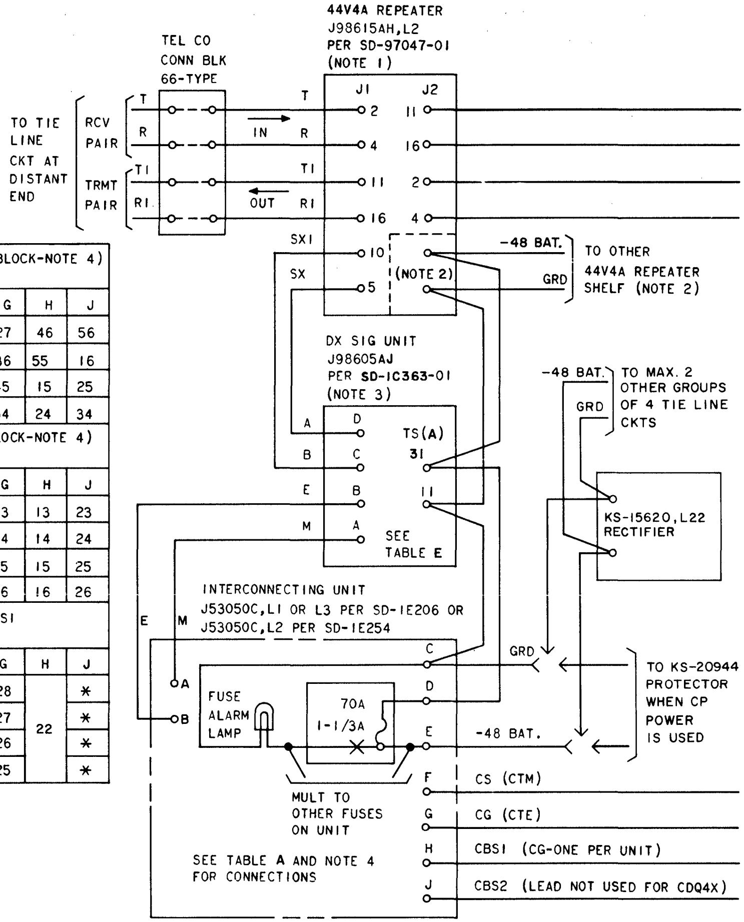


TABLE A

CKT NO.	TERMINALS ON J53050C,L3 (D5A BLOCK-NOTE 4) PCA CDQ4W								
	A	B	C	D	E	F	G	H	J
0	48	58	51	14	11	17	27	46	56
1	28	38				26	36	55	16
2	57	18				35	45	15	25
3	37	47				44	54	24	34
CKT NO.	TERMINALS ON J53050C,L1 (D3A BLOCK-NOTE 4) PCA CDQ4W								
	A	B	C	D	E	F	G	H	J
1	17	27	11	32	41	33	43	13	23
2	37	47				34	44	14	24
3	18	28				35	45	15	25
4	38	48				36	46	16	26
CKT NO.	TERMINALS ON J53050C,LIST 2 - TS1 PCA CDQ4X								
	A	B	C	D	E	F	G	H	J
0	48	58	52	18	11	38	28	22	*
1	47	57				37	27		*
2	46	56				36	26		*
3	45	55				35	25		*

* NO CONNECTION REQUIRED FOR CDQ4X

TABLE B

STRAPS ON J53050C,LIST 2					
TS1		TS2		TS3	
FROM	TO	FROM	TO	FROM	TO
54	53	58	28	58	28
44	53	48	38	48	38
34	14	38	57	38	57
24	14	47	37	47	37
11	21	27	46	27	46
21	31	17	56	17	56
31	41	23	42	23	42
		13	52	13	52
		52	22	52	22
		12	51	12	51
		41	11	41	11
		31	21	31	21

NOTES:

1. EACH 44V4A REPEATER SHELF HAS FACILITIES FOR 2 CIRCUITS. SHOWN ARE THE CONNECTIONS FOR 1 CIRCUIT. CONNECTIONS FOR OTHER 3 CIRCUITS ARE IDENTICAL AS SHOWN, EXCEPT FOR BATTERY AND GROUND CONNECTIONS, WHICH ARE EXPLAINED IN NOTE 2. FOR ALIGNMENT PROCEDURES FOLLOW EXISTING PRACTICES AND PART 7.
2. VIEWING THE 44V4A REPEATER SHELF FROM THE BACK, CONNECT BATTERY TO THE FIRST STANDOFF ON THE LEFT AND GROUND TO TERMINAL 15 OF J4 LOCATED ON THE LEFT. BATTERY AND GROUND IS FACTORY WIRED TO OTHER CIRCUIT ON THE SAME SHELF.
3. REFER TO SD-1C363-01 FOR NETWORK RESISTANCE AND CAPACITANCE ADJUSTMENTS AND FOR USE OF CAPACITOR ACROSS A AND B LEADS.
4. J53050C,LIST 3 INTERCONNECTING UNITS ARE EQUIPPED WITH A D5A TERMINAL STRIP; CONNECTIONS TO THESE UNITS ARE SHOWN IN THE FIRST PART OF TABLE A. J53050C, LIST 1 INTERCONNECTING UNITS ARE EQUIPPED WITH A D3A TERMINAL STRIP; CONNECTIONS TO THESE UNITS ARE SHOWN IN THE SECOND PART OF TABLE A. CONNECTIONS FOR J53050C,LIST 2 INTERCONNECTING UNITS(CDQ4X) ARE SHOWN IN THE LAST PART OF TABLE A. LEAD DESIGNATIONS IN PARENTHESES APPLY TO LIST 2. STRAPS MUST BE PROVIDED ON THE LIST 2 INTERCONNECTING UNIT AS SHOWN IN TABLE B.

Fig. 9—Connections for Four Trunks—PCA CDQ4W or CDQ4X Using DX Signaling Unit J98605AJ (Sheet 1 of 2)

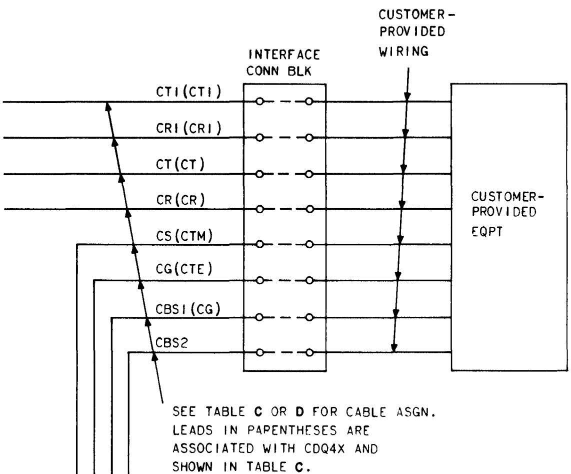


TABLE C

PCA CDQ4X			
CKT NO.	LEAD DESIG	CABLE COLOR	INTERFACE CONN BLK PAIR NO.
1	CT1 CR1	W-BL BL-W	1
	CT CR	W-O O-W	2
	CTM CTE	W-G G-W	3
2	CT1 CR1	W-BR BR-W	4
	CT CR	W-S S-W	5
	CTM CTE	R-BL BL-R	6
3	CT1 CR1	R-O O-R	7
	CT CR	R-G G-R	8
	CTM CTE	R-BR BR-R	9
4	CT1 CR1	R-S S-R	10
	CT CR	BK-BL BL-BK	11
	CTM CTE	BK-O O-BK	12
1-4	CG	BK-G	13
5-8	CG*	G-BK	

* USE G-BK LEAD FOR CG LEAD ON SECOND GROUP OF FOUR CIRCUITS TO PREVENT SPLITTING PAIRS (SEE FIG. 3)

TABLE D

PCA CDQ4W			
CKT NO.	LEAD DESIG	CABLE COLOR	INTERFACE CONN BLK PAIR NO.
1	CT1 CR1	W-BL BL-W	1
	CT CR	W-O O-W	2
	CS CG	W-G G-W	3
	CBS1 CBS2	W-BR BR-W	4
2	CT1 CR1	W-S S-W	5
	CT CR	R-BL BL-R	6
	CS CG	R-O O-R	7
	CBS1 CBS2	R-G G-R	8
3	CT1 CR1	R-BR BR-R	9
	CT CR	R-S S-R	10
	CS CG	BK-BL BL-BK	11
	CBS1 CBS2	BK-O O-BK	12
4	CT1 CR1	BK-G G-BK	13
	CT CR	BK-BR BR-BK	14
	CS CG	BK-S S-BK	15
	CBS1 CBS2	Y-BL BL-Y	16

TABLE E

CKT. NO.	TERMINALS ON TS(A) OF J98605AJ				TERMINALS ON TS(B) OF J98605AJ			
	A	B	C	D	A	B	C	D
1	47	28	38	48				
2	36	17	27	37				
3	25	45	16	26				
4	14	34	44	15				
5	42	23	33	43				
6					47	28	38	48
7					36	17	27	37
8					25	45	16	26
9					14	34	44	15
10					42	23	33	43

THIS TABLE SHOWS CONNECTIONS FOR FULLY EQUIPPED SIGNALING UNIT. SELECT ONE CIRCUIT FOR EACH TIE LINE.

Fig. 9—Connections for Four Trunks—PCA CDQ4W or CDQ4X Using DX Signaling Unit J98605AJ (Sheet 2 of 2)

TABLE A

CKT NO.	TERMINALS ON TS(E) OF J98605AG (MD)			
	A	B	C	D
1	28	38	48	58
2	27	37	47	57
3	26	36	46	56
4	25	35	45	55

TABLE B

CKT NO.	TERMINALS ON J53050C,L3 (D5A BLOCK-NOTE 4) PCA CDQ4W								
	A	B	C	D	E	F	G	H	J
0	48	58	51	14	11	17	27	46	56
1	28	38				26	36	55	16
2	57	18				35	45	15	25
3	37	47				44	54	24	34

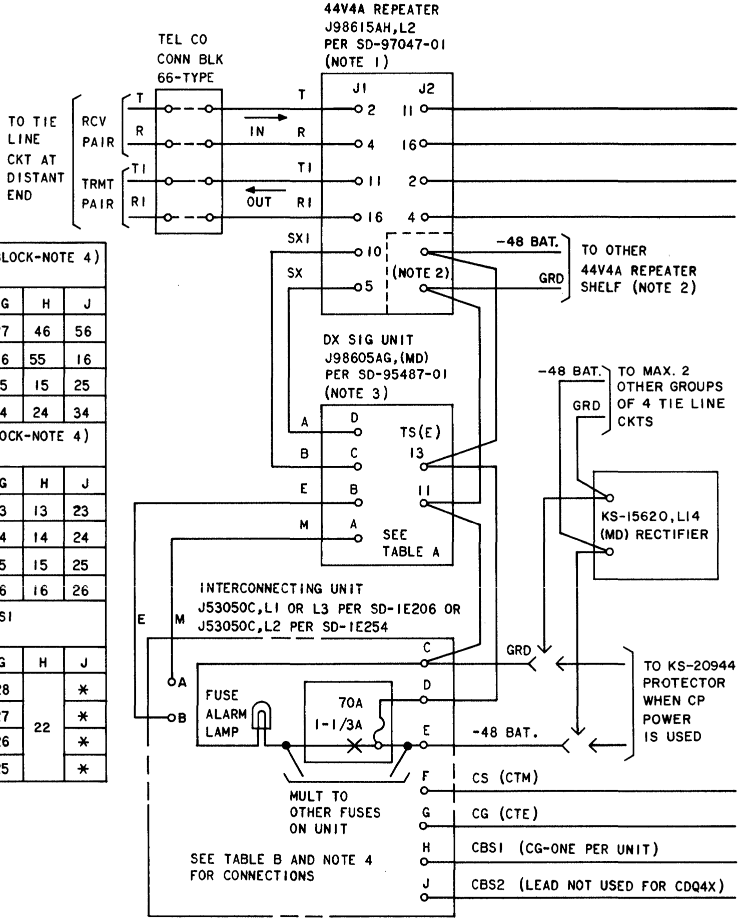
CKT NO.	TERMINALS ON J53050C,L1 (D3A BLOCK-NOTE 4) PCA CDQ4W								
	A	B	C	D	E	F	G	H	J
1	17	27	11	32	41	33	43	13	23
2	37	47				34	44	14	24
3	18	28				35	45	15	25
4	38	48				36	46	16	26

CKT NO.	TERMINALS ON J53050C,LIST 2-TS1 PCA CDQ4W								
	A	B	C	D	E	F	G	H	J
0	48	58	52	18	11	38	28	22	*
1	47	57				37	27		*
2	46	56				36	26		*
3	45	55				35	25		*

* NO CONNECTION REQUIRED FOR CDQ4X

TABLE C

STRAPS ON J53050C,LIST 2					
TS1		TS2		TS3	
FROM	TO	FROM	TO	FROM	TO
54	53	58	28	58	28
44	53	48	38	48	38
34	14	38	57	38	57
24	14	47	37	47	37
11	21	27	46	27	46
21	31	17	56	17	56
31	41	23	42	23	42
		13	52	13	52
		52	22	52	22
		12	51	12	51
		41	11	41	11
		31	21	31	21



NOTES:

1. EACH 44V4A REPEATER SHELF HAS FACILITIES FOR 2 CIRCUITS. SHOWN ARE THE CONNECTIONS FOR 1 CIRCUIT. CONNECTIONS FOR OTHER 3 CIRCUITS ARE IDENTICAL AS SHOWN, EXCEPT FOR BATTERY AND GROUND CONNECTIONS, WHICH ARE EXPLAINED IN NOTE 2. FOR ALIGNMENT PROCEDURES FOLLOW EXISTING PRACTICES AND PART 7.
2. VIEWING THE 44V4A REPEATER SHELF FROM THE BACK, CONNECT BATTERY TO THE FIRST STANDOFF ON THE LEFT AND GROUND TO TERMINAL 15 OF J4 LOCATED ON THE LEFT. BATTERY AND GROUND IS FACTORY WIRED TO OTHER CIRCUIT ON THE SAME SHELF.
3. REFER TO SD-95487-01, SHEET 4 (FIG. 4), AND SHEET 6 (FIG. 55) FOR STRAPPING OF A2, B2, C2, AND D2 LEADS (G, H, J, AND K OPTIONS).
4. J53050C,LIST 3 INTERCONNECTING UNITS ARE EQUIPPED WITH A D5A TERMINAL STRIP; CONNECTIONS TO THESE UNITS ARE SHOWN IN THE FIRST PART OF TABLE B. J53050C, LIST 1 INTERCONNECTING UNITS ARE EQUIPPED WITH A D3A TERMINAL STRIP; CONNECTIONS TO THESE UNITS ARE SHOWN IN THE SECOND PART OF TABLE B. CONNECTIONS FOR J53050C,LIST 2 INTERCONNECTING UNITS(CDQ4X) ARE SHOWN IN THE LAST PART OF TABLE B. LEAD DESIGNATIONS IN PARENTHESES APPLY TO LIST 2. STRAPS MUST BE PROVIDED ON THE LIST 2 INTERCONNECTING UNIT AS SHOWN IN TABLE C.

Fig. 10—Connections for Four Trunks—PCA CDQ4W or CDQ4X Using DX Signaling Unit J98605AG (MD) (Sheet 1 of 2)

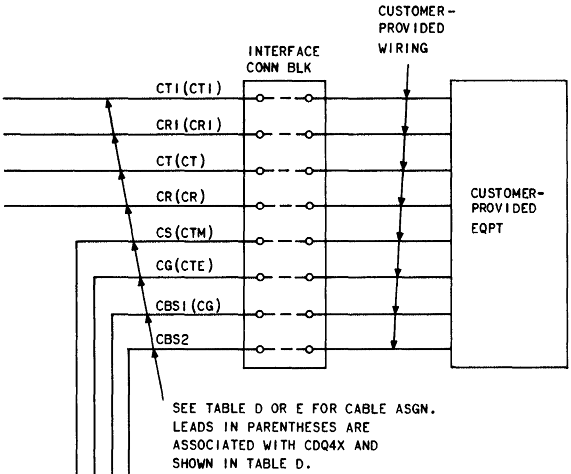


TABLE D

PCA CDQ4W			
CKT NO.	LEAD DESIG	CABLE COLOR	INTERFACE CONN BLK PAIR NO.
1	CT1 CR1	W-BL BL-W	1
1	CT CR	W-O O-W	2
1	CTM CTE	W-G G-W	3
2	CT1 CR1	W-BR BR-W	4
2	CT CR	W-S S-W	5
2	CTM CTE	R-BL BL-R	6
3	CT1 CR1	R-O O-R	7
3	CT CR	R-G G-R	8
3	CTM CTE	R-BR BR-R	9
4	CT1 CR1	R-S S-R	10
4	CT CR	BK-BL BL-BK	11
4	CTM CTE	BK-O O-BK	12
1-4	CG	BK-G	13
5-8	CG*	G-BK	

TABLE E

PCA CDQ4W			
CKT NO.	LEAD DESIG	CABLE COLOR	INTERFACE CONN BLK PAIR NO.
1	CT1 CR1	W-BL BL-W	1
1	CT CR	W-O O-W	2
1	CS CG	W-G G-W	3
1	CBS1 CBS2	W-BR BR-W	4
2	CT1 CR1	W-S S-W	5
2	CT CR	R-BL BL-R	6
2	CS CG	R-O O-R	7
2	CBS1 CBS2	R-G G-R	8
3	CT1 CR1	R-BR BR-R	9
3	CT CR	R-S S-R	10
3	CS CG	BK-BL BL-BK	11
3	CBS1 CBS2	BK-O O-BK	12
4	CT1 CR1	BK-G G-BK	13
4	CT CR	BK-BR BR-BK	14
4	CS CG	BK-S S-BK	15
4	CBS1 CBS2	Y-BL BL-Y	16

* USE G-BK LEAD FOR CG LEAD ON SECOND GROUP OF FOUR CIRCUITS TO PREVENT SPLITTING PAIRS (SEE FIG. 3)

Fig. 10—Connections for Four Trunks—PCA CDQ4W or CDQ4X Using DX Signaling Unit J98605AG (MD) (Sheet 2 of 2)

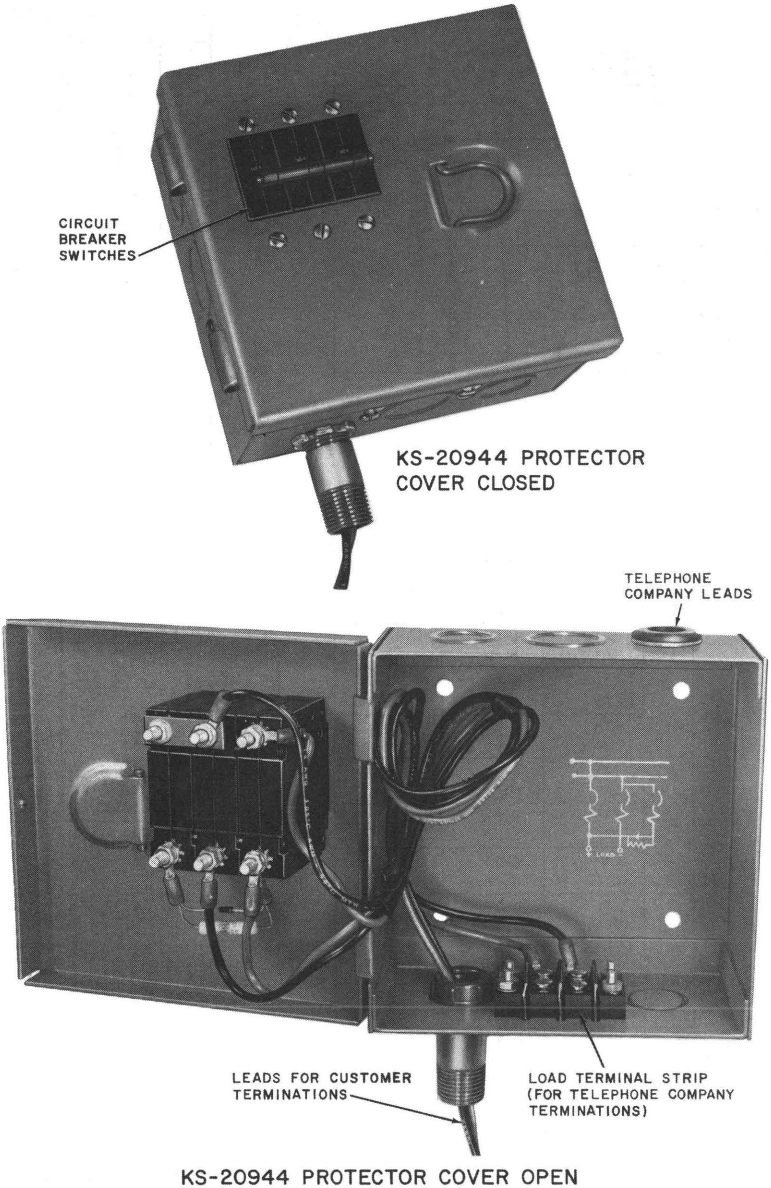
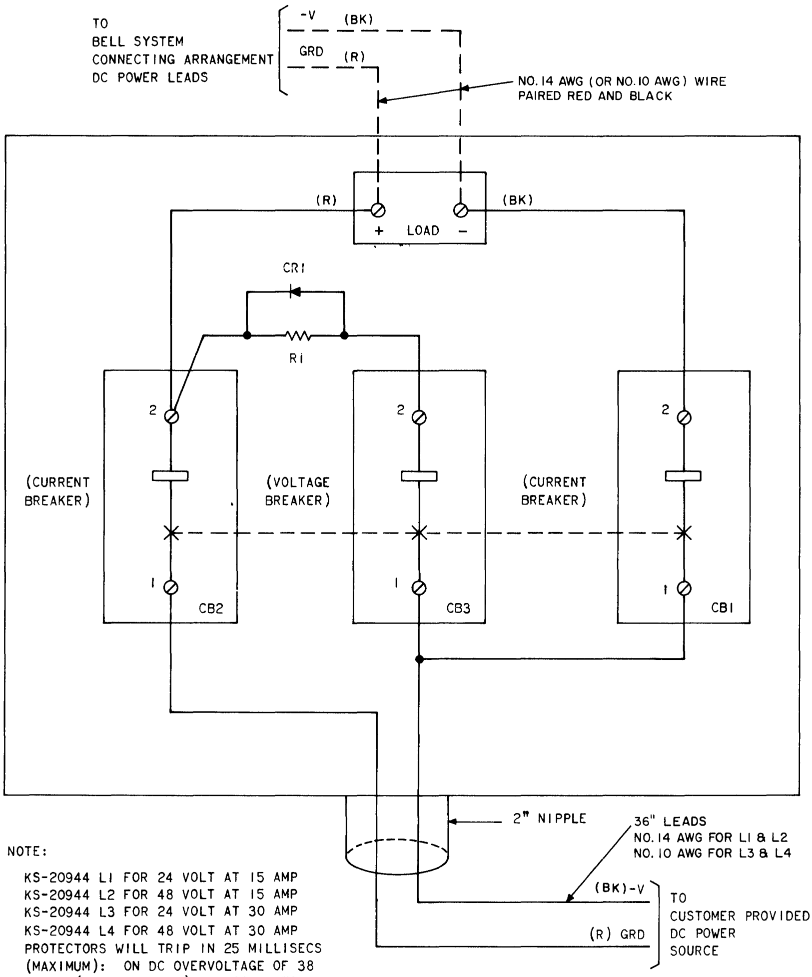


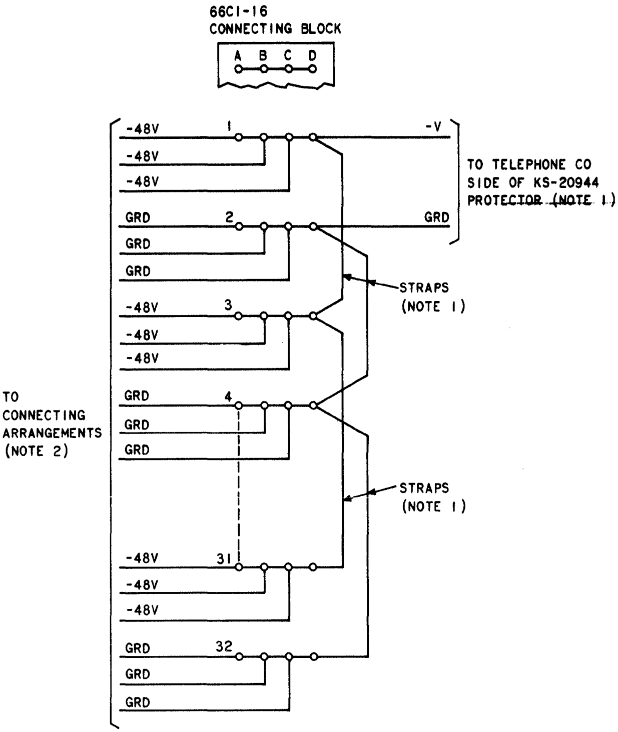
Fig. 11—KS-20944 Protector



NOTE:

KS-20944 L1 FOR 24 VOLT AT 15 AMP
KS-20944 L2 FOR 48 VOLT AT 15 AMP
KS-20944 L3 FOR 24 VOLT AT 30 AMP
KS-20944 L4 FOR 48 VOLT AT 30 AMP
PROTECTORS WILL TRIP IN 25 MILLISECS (MAXIMUM): ON DC OVERVOLTAGE OF 38 VOLTS (24 VOLT UNIT) AND 68 VOLTS (48 VOLT UNIT), ON OVERLOAD OF 18.75 AMPERES (15 AMP UNIT) AND 37.5 AMPERES (30 AMP UNIT), ON REVERSED POLARITY, OR AC VOLTAGE GREATER THAN 18 VOLTS, OR INCORRECT POWER SUPPLY GROUND.

Fig. 12—Schematic—KS-20944 Protector



NOTES:

1. USE 14-GAUGE WIRE TO CONNECT FROM KS-20944 PROTECTOR TO CONNECTING BLOCK; PROVIDE MULTIPLE STRAPS AS DETERMINED BY NUMBER OF CONNECTING ARRANGEMENTS TO BE CONNECTED TO. USE SOLDER TO MAKE THE CONNECTION OF THE 14-GAUGE WIRE AND STRAPS TO THE CONNECTING BLOCK.
2. USE "D" INSIDE WIRE OR EQUIVALENT TO MAKE CONNECTIONS FROM CONNECTING BLOCK TO CONNECTING ARRANGEMENTS.. EACH CONNECTING BLOCK PROVIDES MEANS FOR CONNECTING TO 48 CIRCUITS, HOWEVER, <u>DO NOT EXCEED</u> THE MAXIMUM CURRENT RATING OF THE KS-20944 PROTECTOR.

Fig. 13—Typical Power Distribution Connections Between KS-20944 Protector and PCAs

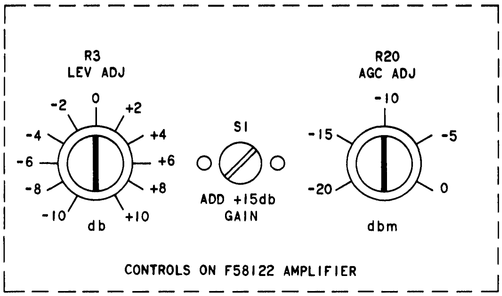


Fig. 14—Adjustment Controls—F58122 Automatic Gain Control Amplifier

PROTECTIVE CONNECTING ARRANGEMENTS CDQ2W AND CDQ2X

1. GENERAL

1.01 This section provides identification, installation, operation, maintenance, and connecting information for Protective Connecting Arrangements (PCA) CDQ2W and CDQ2X (Fig. 1 through 4). These PCAs provide for the connection of 2-way dial repeating tie trunks between a customer provided (CP) switching system and a Bell System PBX or Centrex system. They present a 2-wire transmission interface with channel signaling provided by the telephone company between the Bell System 2- or 4-wire facilities and the customer provided equipment (CPE). PCA CDQ2W is used with CP trunks designed for a dry contact type signaling interface. PCA CDQ2X is used with CP trunks designed for an E and M type signaling interface. PCA CDQ2W, when used with Bell System 2-wire facilities, consists of an interconnecting unit (IU) J53050C, List 1 (MD) or List 3 (Fig. 5); DX signaling unit J-98605AJ; interconnecting unit J53050D, List 1 (Fig. 7); and KS-15620, List 22 rectifier. When PCA CDQ2W is used with 4-wire facilities, a 24V4C repeater shelf J98615BJ, List 2, equipped with plug-in components, is used in place of the J53050D, List 1. PCA CDQ2X utilizes the same equipment as the CDQ2W with the exception of the J53050C IU which is a List 2 (Fig. 6) instead of a List 1 (MD) or 3.

1.02 This section is reissued to:

- Include coverage of the J98605AJ DX signaling unit which replaces the J98605AG, now rated MD. (Information required for maintenance of existing installations using the J98605AG has been retained.)
- Rate the J53050C, List 1 IU MD.
- Include information on the KS-15620, List 22 rectifier which replaces the KS-15620, List 14, now rated MD.
- Add current drain information.
- Replace the term Voice Connecting Arrangement (VCA) with Protective Connecting Arrangement (PCA).
- Add post-installation tests.
- Expand maintenance information.
- Remove KS-20944 protector from Design Features.

1.03 If the customer wants a copy of the Technical Reference which covers this interface specification, he should contact the local Telephone Company Business Office or the Marketing Representative.

1.04 This issue of the section is based on the following drawings:

CD-1E207, Issue 1 and SD-1E207, Issue 2D—J53050D, L1 IU

CD-1E254, Issue 1 and SD-1E254, Issue 1—J53050C, L2 IU

CD-97047, Issue 5D, Appendix 2D and SD-97047, Issue 16D—24V4C Repeater

CD-1E206, Issue 1, Appendix 3B and SD-1E206, Issue 4B—J53050C, L1 and L3 IU

J98605AJ-1, Issue 8 and SD-1C363, Issue 4B—J98605AJ DX Signaling Unit

If this section is to be used with equipment or apparatus reflecting later issue(s) of the drawing(s), reference should be made to the SDs and CDs to determine the extent of the changes and the manner in which the section may be affected.

2. IDENTIFICATION

PURPOSE

- To provide a connection between a CP 2-wire PBX and Bell System 2-wire or 4-wire tie line facilities
- To provide dry contact type signaling or E and M signaling to and from the CP equipment

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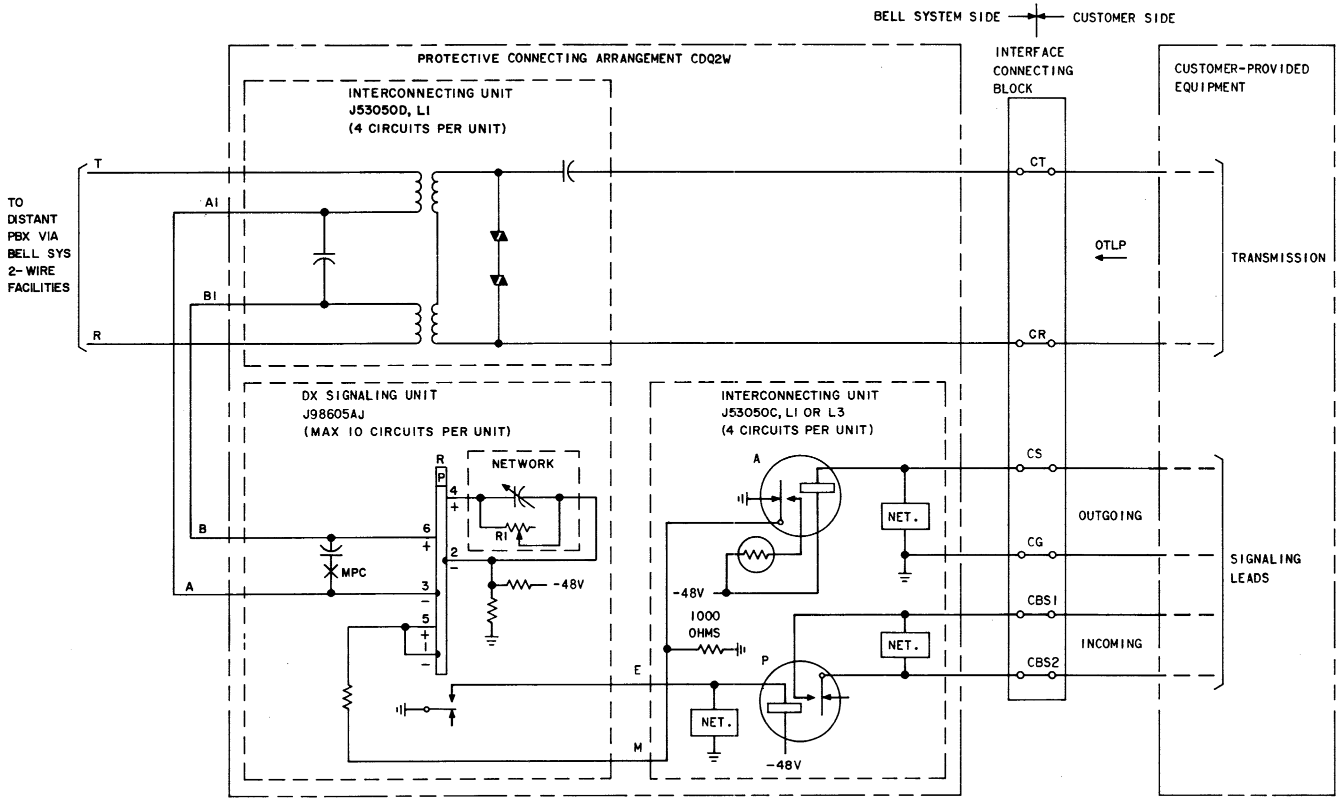


Fig. 1—Simplified Schematic—PCA CDQ2W, 2-Wire Facility

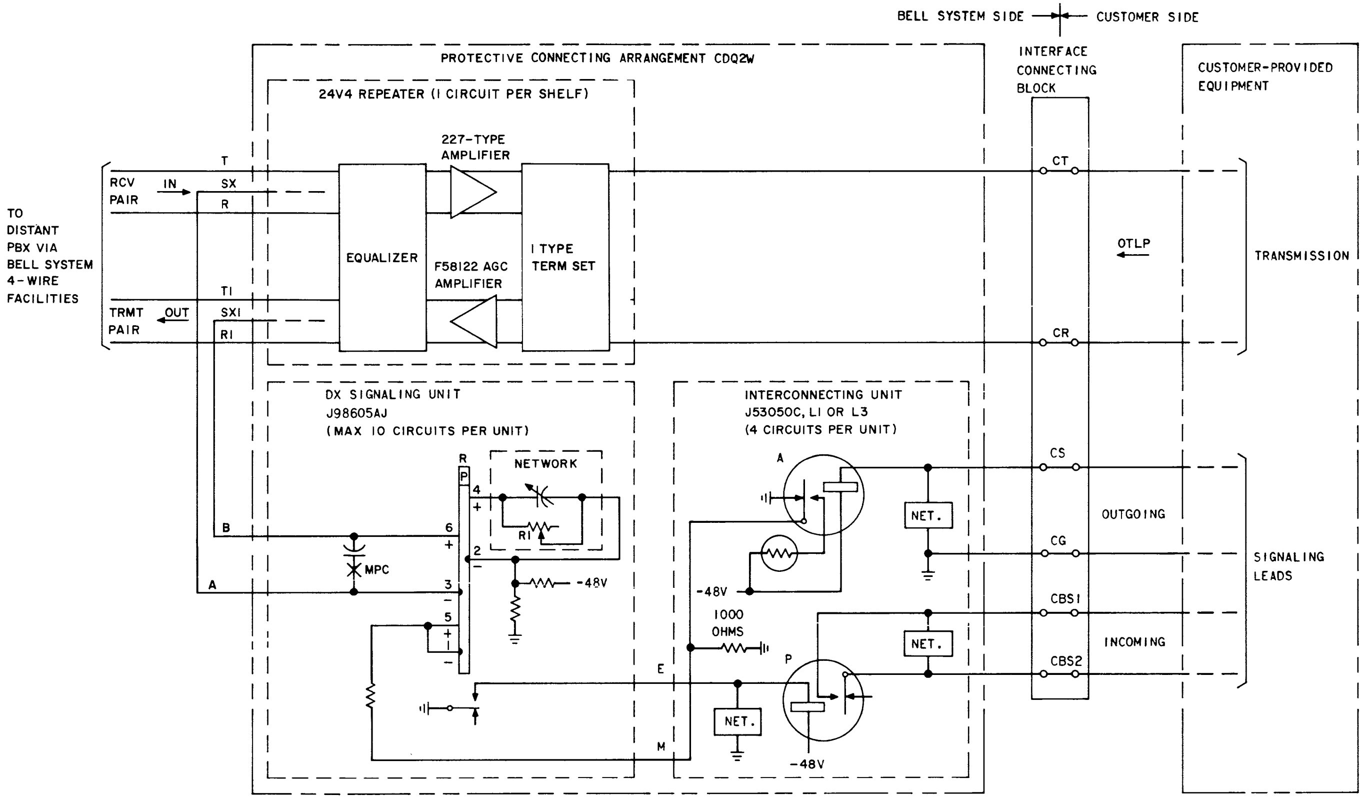


Fig. 2—Simplified Schematic—PCA CDQ2W, 4-Wire Facility

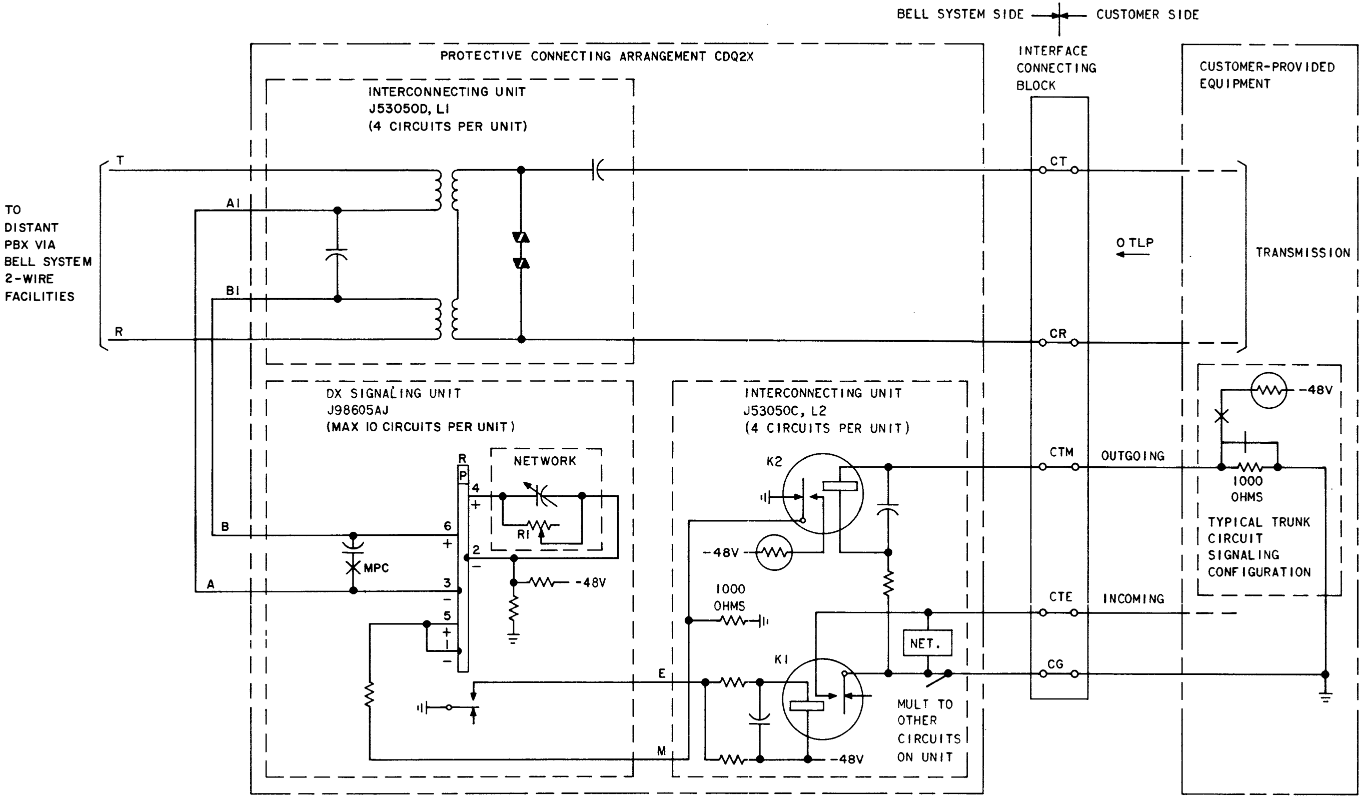


Fig. 3—Simplified Schematic—PCA CDQ2X, 2-Wire Facility

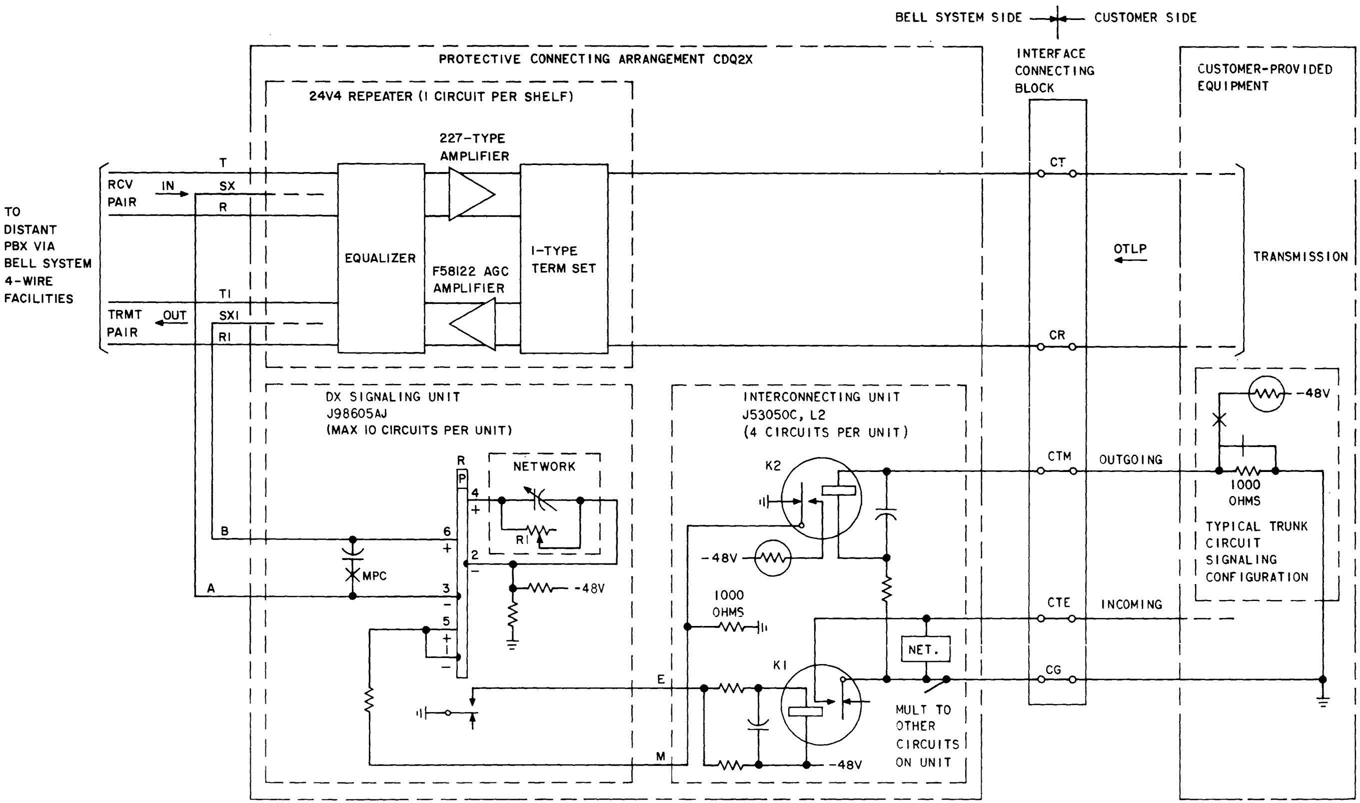


Fig. 4—Simplified Schematic—PCA CDQ2X, 4-Wire Facility

- To limit excessive levels from CP equipment, to provide protection for telephone company personnel against hazardous voltages, to insure longitudinal balance, and to repeat network control signaling

ORDERING GUIDE

- Unit, Interconnecting, J53050C, List 1 (MD) or List 3, for PCA CDQ2W—for use with 2- or 4-wire facilities. Each unit provides four signal isolation (applique) circuits.

- Unit, Interconnecting, J53050C, List 2, for PCA CDQ2X—for use with 2- or 4-wire facilities. Each unit provides four signal isolation (applique) circuits.

- Unit, Signaling DX, J98605AJ—order both List 1 and List A to get a mounting assembly with wiring and connectors for ten circuits; order required number of 334A relays separately, one per tie trunk being served.

- Unit, Interconnecting, J53050D, List 1—for use with 2-wire facilities. Each unit provides four voice coupler circuits.

  or

  Shelf, Repeater, Terminal 24V4C, J98615BJ, List 2—for use with 4-wire facilities. Each unit provides one voice coupler circuit. (24V4A can also be used but is not recommended because it does not have a terminal strip for easy connection to external circuits.)

Note: For plug-in components refer to Section 852-307-101; when automatic control of signal power level is required, order F58122 automatic gain control (AGC) amplifier for use in the ***transmitting leg from the CP equipment to Bell System facilities*** instead of the standard 227-type amplifier shown in Section 852-307-101. (See Fig. 2 and 4.)

Associated Apparatus (Order Separately)

- Rectifier, List 22, KS-15620 (2 amperes at −48 volts).

Note: This rectifier meets acceptable noise requirements as explained under Power Supplies in Section 332-104-102. Other rectifiers may be used when specified by local engineering. Typical current drains for the PCAs are as follows: CDQ2W 2-wire—0.133 ampere, 4-wire—0.169 ampere; CDQ2X 2-wire—0.176 ampere, 4-wire—0.212 ampere. Be sure that rectifier capacity is adequate for the number of PCAs installed.

- Adapter, Group 33, ED-90273-70 (two required)—for mounting 19-inch rectifier on relay rack.

- Cord, Power, KS-14532

  List 1—10 ft.

  List 2—2 ft.

  List 3—15 ft.

  List 4—20 ft.

  List 5—25 ft.

- Cable, Wiring, "D" Inside, 12 pair, or equivalent—for cabling from connecting arrangement to interface connecting block.

- Block, Connecting, 66M1-50 (Fig. 8 and 9).

Note: Other types of blocks may be used when specified by local engineering.

- Clip, Bridging, B (25 per pkg).

- Block, Connecting, 66 Type—for connecting telephone company facilities.

- Protector, List 2, KS-20944 (optional)—***must*** be provided when CP power supply is used to power the PCAs. See Fig. 17 and 18.

- Block, Connecting, 66C1-16 or equivalent—for providing distribution of power when KS-20944 protector is used between CP power supply and more than one connecting arrangement of any type. See Fig. 19.

Note: The cumulative current drain of the connecting arrangements connected to a KS-20944 protector must not exceed the maximum current rating of the protector. For instance, if the maximum current drain for one connecting arrangement is 1.0 ampere and the maximum current rating of a KS-20944, List 2 protector is 15 amperes, no more than 15 connecting arrangements may be connected to the protector (this example is for illustrative purposes only).

- Wire, AM, 14 gauge, paired, red and black, P384614 or equivalent—for cabling from the KS-20944 protector to the 66C1-16 connecting block. See Fig. 19.

Replaceable Components

- Fuses, 70A (1-1/3 amp) (J53050C IU)
- Plug-in components of 24V4C repeater
- Relays, 303E (J53050C, List 1 [MD] and List 3 IU) or 303K (J53050C, List 2 IU)
- Relay, 334A (J98605AJ DX signaling unit).

DESIGN FEATURES

J53050C, List 1 (MD) or 3 Interconnecting Unit (Fig. 5)

- Mounts on standard 23-inch relay rack.
- Four signal isolation (applique) circuits per unit.
- Lists 1 and 3 are electrically the same with the exception that List 3 is equipped with four fuses (one per circuit); List 1 was manufactured prior to January 1971.
- Converts standard Bell System E lead signaling to a dry contact closure.
- Converts CP dry contact closure to standard Bell System M lead signaling.
- Provides dc isolation of the signaling leads between the CP equipment and the DX signaling unit.
- Typical current drain per circuit: 0.072 ampere.

J53050C, List 2 Interconnecting Unit (Fig. 6)

- Mounts on standard 23-inch relay rack
- Four signal isolation (applique) circuits per unit
- Accepts ground and battery supervisory signals over M lead from CP equipment

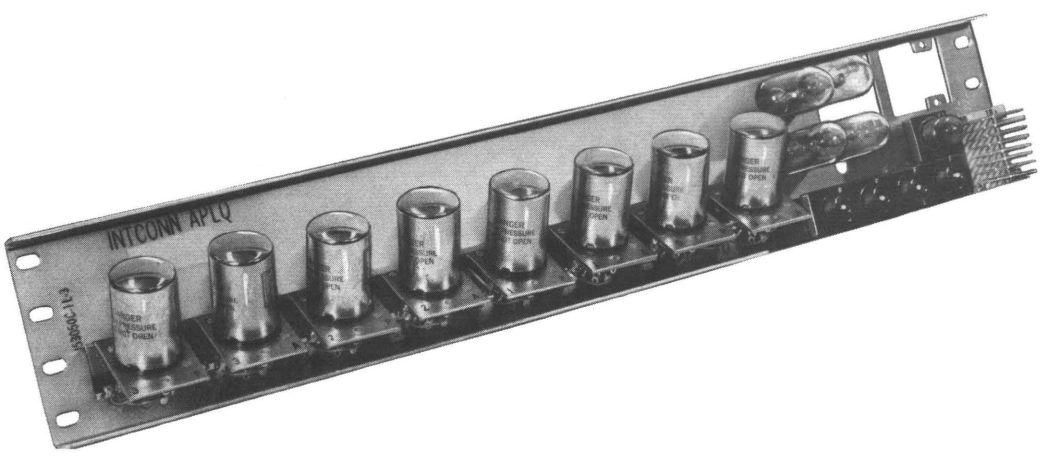


Fig. 5—J53050C, List 3 IU

- Provides closure (to ground) and open supervisory signals over E lead to CP equipment
- Provides dc isolation of the signaling leads between the CP equipment and the DX signaling unit
- Typical current drain per circuit: 0.115 ampere.

J98605AJ DX Signaling Unit

- Mounts on standard 23-inch relay rack
- Up to ten circuits per unit
- Provides DX signaling to the distant end
- Provides loop-strapping options
- Typical current drain per circuit: 0.061 ampere.

J53050D, List 1 Interconnecting Unit (Fig. 7)

- Mounts on standard 23-inch relay rack.
- Four circuits per unit.
- Each circuit provides a 2-wire voiceband transmission path (voice coupler) to and from the CP equipment.
- Provides transformer isolation and hazardous voltage protection between CP equipment and Bell System facilities.

24V4C Repeater Shelf

- Mounts on standard 23-inch relay rack on 1-3/4 inch center.
- One repeater circuit per shelf.
- Each circuit provides a 2-wire to 4-wire voiceband transmission path (voice coupler) from the CP equipment to Bell System facilities and a 4-wire to 2-wire voiceband transmission path from Bell System facilities to the CP equipment.
- Limits the inband signal power applied to Bell System facilities when equipped with F58122 AGC amplifier.
- Provides transformer isolation and hazardous voltage protection between CP equipment and Bell System facilities.

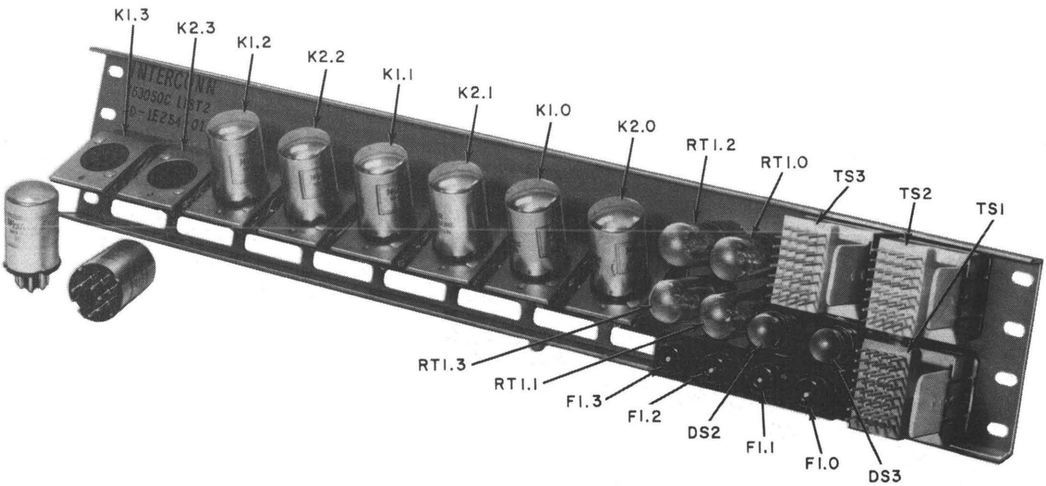


Fig. 6—J53050C, List 2 IU

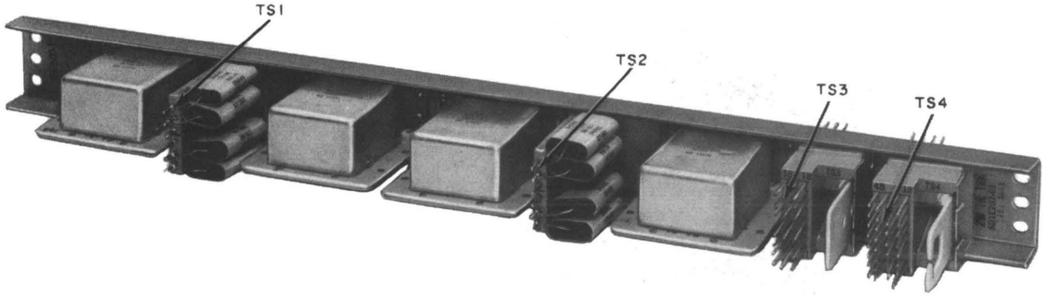


Fig. 7—J53050D, List 1 IU

- Typical current drain per circuit: 0.036 ampere.

3. INSTALLATION

3.01 Locate the PCAs in an area free of dampness and excessive dust or dirt, with adequate room for access to front and rear of equipment and connecting blocks. The associated equipment typically mounts on a standard 23-inch relay rack (see Fig. 10 and 11).

3.02 Wire the equipment as shown in Fig. 13 and 14. Mount the interface connecting block (Fig. 8 or 9) in a position that will facilitate testing between it and the PCA equipment. Use the 12-pair "D" inside wiring cable or equivalent to terminate the leads associated with the CP equipment on the block. Stencil trunk number and lead designations on designation strip (see Fig. 10 and 11). Make DX signaling unit adjustments as given in 3.03. Apply power as shown in Fig. 13 and 14. When 4-wire facilities are used, install the proper plug-in components in the 24V4C repeater. (When the AGC amplifier is used, see 7.02 for adjustment procedures.) Before installing bridging clips on the block to connect Bell System wiring to CP wiring, perform the appropriate quick test in 3.08 to determine if the PCA operates properly. If it does not, recheck installation and connections; if necessary, perform the maintenance procedures in Part 5 of this practice.

3.03 ***DX Signaling Unit Adjustments (J98605AJ) (Fig. 1 through 4, and 12)***

(a) Adjust network resistor R1 to equal the PBX loop resistance, ±125 ohms. When adjusting R1, be sure that at least one of the network capacitance screw switches (C1, C2, C3) is open (up). Using an ohmmeter, measure the resistance of R1 across test points TP1 and TP3 with the signaling circuit (334A relay) removed from its connector.

(b) It is desirable to have a 4 microfarad (μf) capacitor across the A and B leads. If the external circuit (the repeater) does not provide this, close the MPC screw switch on the signaling circuit to insert its 4 μf capacitor. In no case should the A-B capacitance exceed 4 μf; therefore, if the external circuit has a capacitor of more or less than 4 μf, disconnect it before connecting the 4 μf capacitor of the signaling circuit. To properly match the A-B capacitance of 4 μf, the signaling circuit network capacitance should be 6 μf (C1 and C2 closed). Refer to SD-1C363-01 for more information on these adjustments.

Power Requirements

3.04 When required, the customer must provide a 117V 60-Hz power outlet within power cord length of the customer-designated mounting location of the connecting arrangement (see ORDERING GUIDE for cord lengths).

3.05 The power outlet supplying connecting arrangement(s) must not be under control of a switch and should be on a separately fused power circuit to prevent accidental loss of ac line

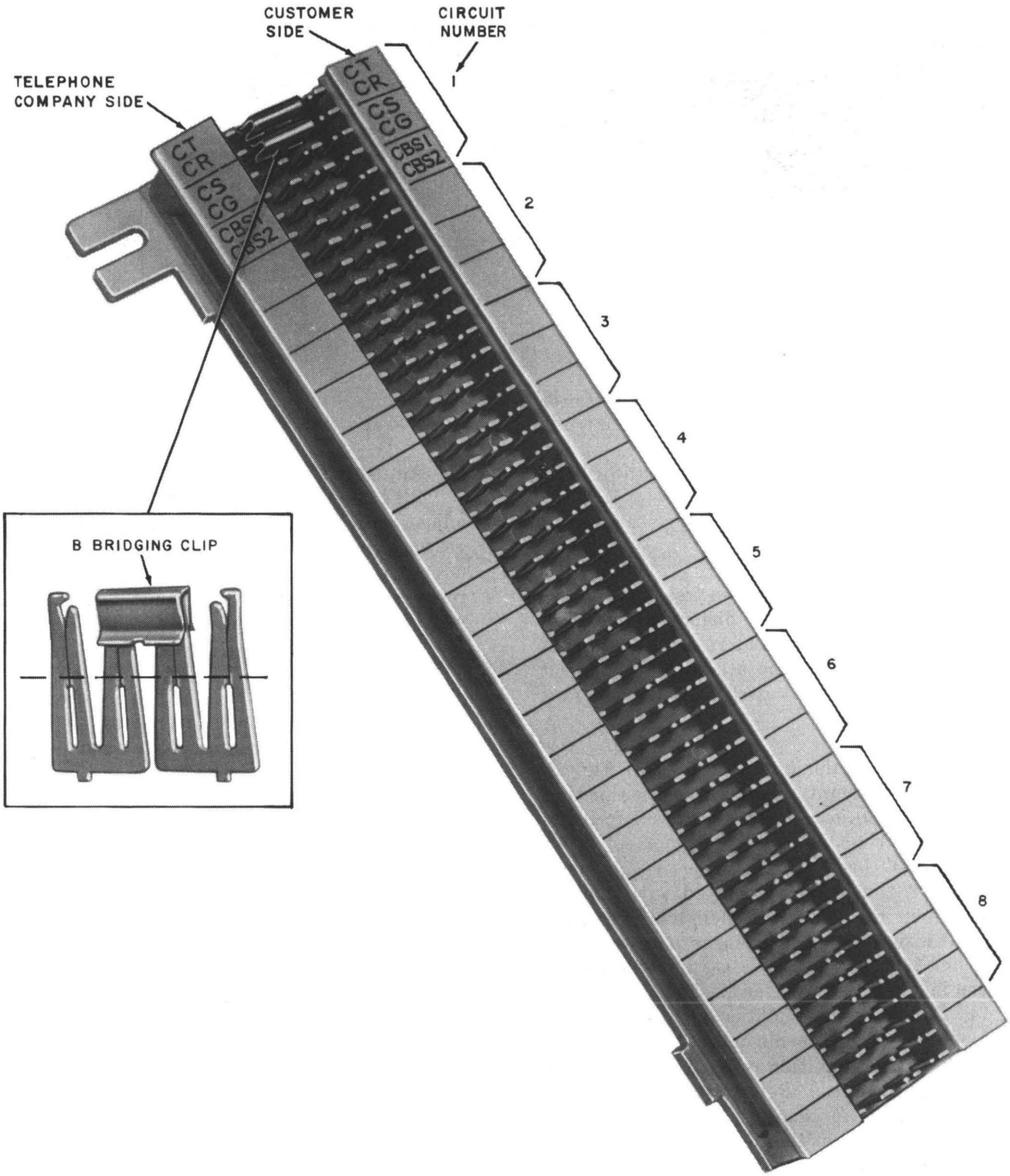


Fig. 8—Typical Interface Connecting Block—PCA CDQ2W

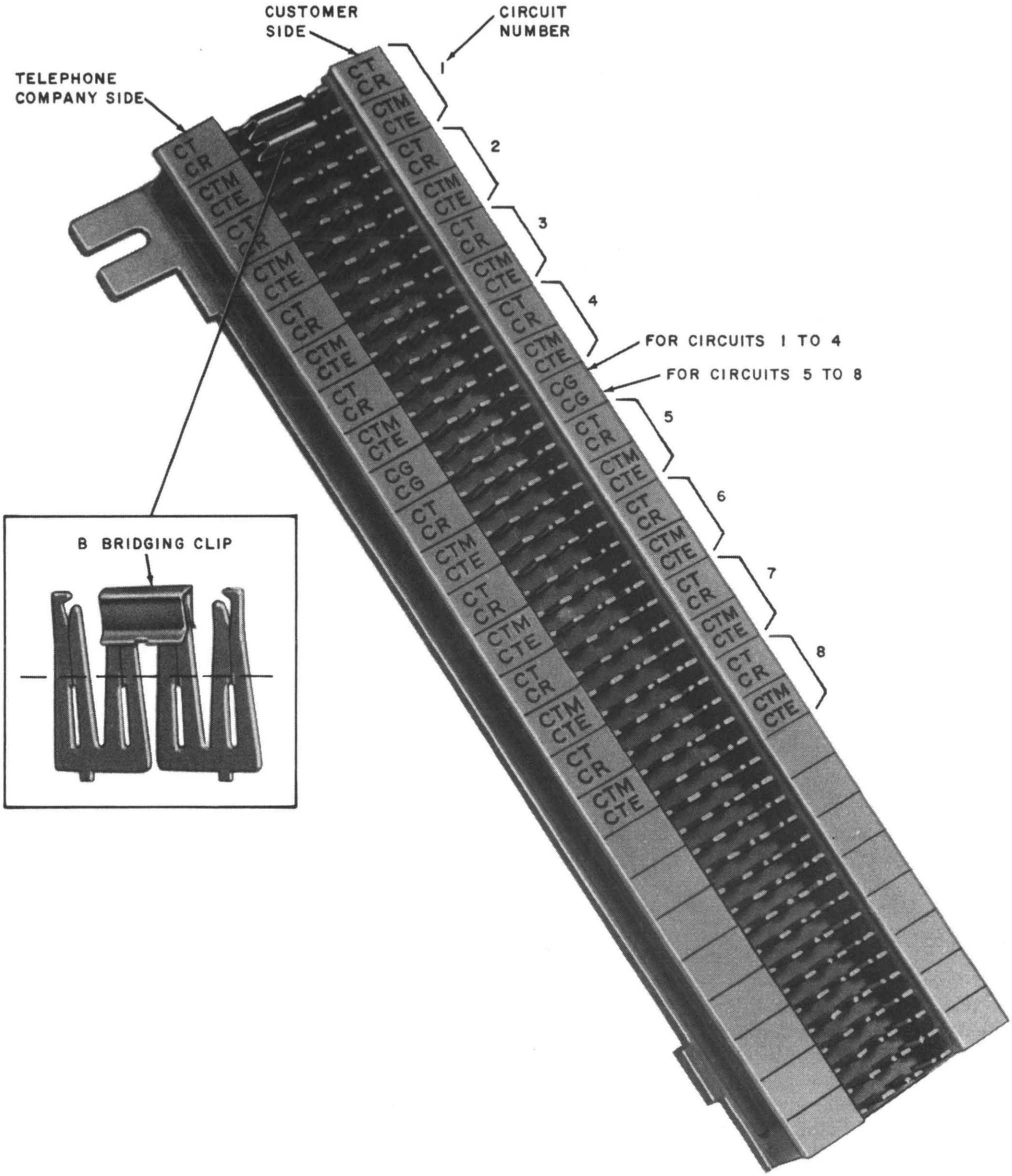
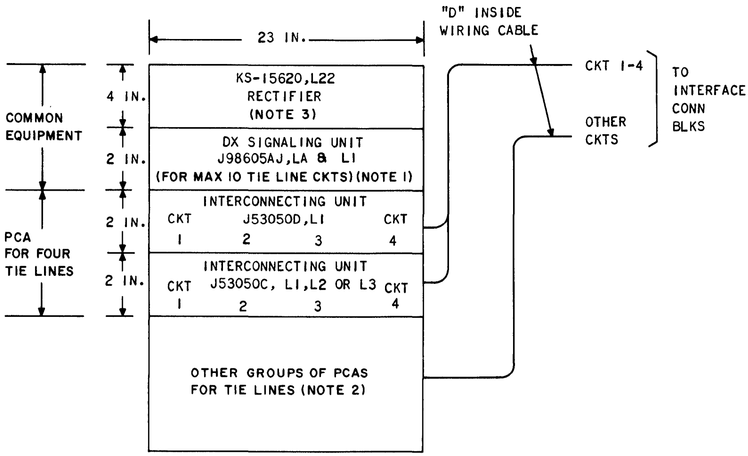


Fig. 9—Typical Interface Connecting Block—PCA CDQ2X



NOTES:
1. DX SIGNALING UNIT CAN BE EQUIPPED WITH FROM ONE TO TEN CIRCUITS, ONE FOR EACH TIE LINE. SEE ORDERING GUIDE.
2. EACH TIE LINE REQUIRES TWO IU CIRCUITS AND ONE SIGNALING CIRCUIT.
3. SEE ORDERING GUIDE FOR CURRENT REQUIREMENTS

Fig. 10—Typical Rack Mounting—PCA CDQ2W or CDQ2X, 2-Wire Facility, Front View

voltage. Where local instructions permit, secure the power cord to the outlet with a power cord plug retainer assembly.

3.06 Refer to appropriate section in Division 167 for proper grounding of power plants.

3.07 ***KS-20944 Protector (Fig. 17 and 18):*** When CP power source is used to power the connecting arrangement, a KS-20944 protector must be provided between the CP power source and the connecting arrangement. Mount the KS-20944 protector on a wall or suitable flat surface near the interface connecting block. Use the AM-type, 14-gauge wire or equivalent to make connections from the protector to the 66C1-16 connecting block. Terminate one end of the wiring to the screw terminals (term. − and +) of the load terminal strip provided on the protector. Solder the other end of the wiring to terminals in column D of the connecting block as shown in Fig. 19; using the 14-gauge wire, solder the multiple straps to the terminals in column D of the connecting block as shown in Fig. 19, depending on the number of connecting arrangements provided. Use "D" inside wire cable or equivalent to make connections from the quick-connect terminals in columns A, B, and C of the connecting block to the battery and ground terminals on the connecting arrangements. The customer must connect his power supply to the red (GRD) and black (−V) wires extending from the protector.

Warning: The circuit breaker switch removes voltage from the load (Bell System) side of the protector only; voltage will be present on the upper terminals of the circuit breaker inside the box as soon as customer power is connected.

3.08 ***Post-Installation Tests***

(a) ***PCA CDQ2W (Fig. 1 and 2):*** At the telephone company side of the interface connecting block, connect a 2-wire telephone, such as a 500D, to the CT and CR leads; a 1013A handset across the CS and CG leads; and an 81A test set across the CBS1 and CBS2 leads. Connect the talk battery from the −48 volt supply through a 500-ohm resistor to CR and ground

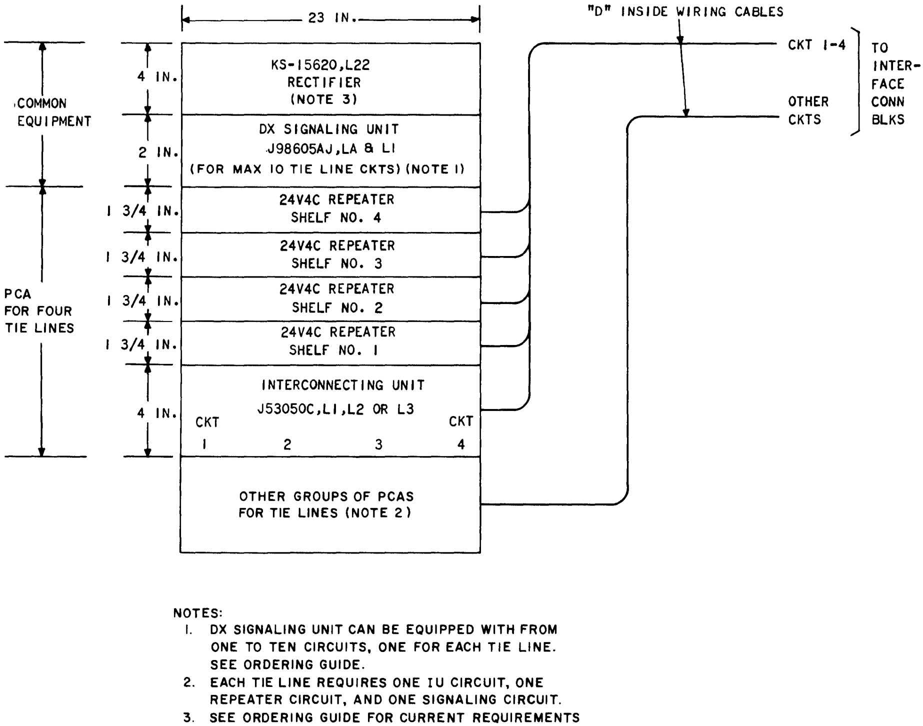


Fig. 11—Typical Rack Mounting—PCA CDQ2W or CDQ2X, 4-Wire Facility, Front View

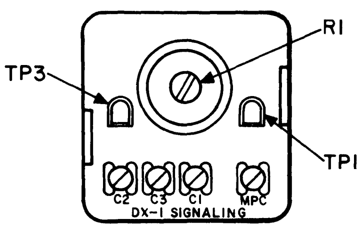


Fig. 12—334A Relay, End View

to CT. (A 2A or 31A KTU can be used for battery feed instead of the resistor; refer to Section 518-112-421 for connections.) With the 1013A in the TALK mode, dial the distant end while monitoring on the 500D. The distant end should answer, and satisfactory transmission should be possible using the 500D set. Ask the distant end to call you back. Put the 1013A in the MON mode and the 500D on-hook. When the distant end calls back, the 81A (in the "C" position) should buzz, indicating closure on the CBS1 and CBS2 leads. Use the 500D to tell the distant end that the test is complete. Restore the circuit to normal.

(b) ***PCA CDQ2X (Fig. 3 and 4):*** Same as for CDQ2W except 1013A handset is connected between CTM lead and −48 volts, 81A is connected across CTE and CG leads, and ground is connected to CG.

4. OPERATION

4.01 *Incoming Call—PCA CDQ2W (Fig. 1 and 2)*

(a) An incoming call from the distant PBX unbalances the DX signaling circuit causing R relay to operate which places a ground on the E lead, causing P relay to operate in the signal isolation (applique) circuit. P relay closes a contact toward the CP equipment across leads CBS1 and CBS2. The CP equipment must respond to this seizure by connecting dial pulse receiving equipment to these leads and returning dial tone, if provided, to the distant PBX over leads CT and CR to indicate readiness to receive dial pulses.

(b) When dial pulses have been received, the CP equipment may transmit answer supervision to the distant PBX by placing a closure across leads CS and CG. This operates the A relay in the signal isolation circuit, which in turn places battery on the M lead to the DX signaling circuit, which repeats the answer supervision to the distant tie trunk circuit.

(c) When 2-wire facilities are used (Fig. 1), the J53050D interconnecting unit (voice coupler circuit) provides a 2-wire transmission path to the CP equipment.

(d) When 4-wire facilities are used (Fig. 2), the 24V4C repeater provides a 4-wire to 2-wire transmission path to the CP equipment.

4.02 *Outgoing Call—PCA CDQ2W (Fig. 1 and 2)*

(a) The CP equipment seizes the tie trunk by placing a closure across leads CS and CG. The closure across CS, CG operates the A relay in the signal isolation circuit which in turn places battery on the M lead to the DX signaling circuit. The DX circuit unbalances the distant signaling circuit and gives a seizure indication at the distant PBX; the distant PBX returns dial tone, if provided, over leads CT and CR. The CP equipment then outpulses the digits over the CS, CG leads which are repeated to the distant PBX.

(b) If the distant tie trunk circuit receives the answer supervision signal from its associated PBX, it unbalances the near end DX circuit causing the R relay to operate, which in turn operates the P relay in the signal isolation circuit in the same manner as an incoming call. The resulting contact closure repeats the answer supervision to the CP equipment.

(c) When 2-wire facilities are used (Fig. 1), the J53050D interconnecting unit (voice coupler circuit) provides a 2-wire transmission path to the distant end.

(d) When 4-wire facilities are used (Fig. 2), the 24V4C repeater provides a 2-wire to 4-wire transmission path to the distant end.

4.03 *Disconnect—PCA CDQ2W (Fig. 1 and 2)*

(a) When the customer at the near end goes on-hook first, the CP equipment removes the contact closure across leads CS, CG which releases the A relay. The A relay released removes battery from the M lead toward the signaling circuit. The signaling circuit subsequently transmits a disconnect signal to the distant PBX. When the distant end goes on-hook, a disconnect signal is returned to the near end DX signaling circuit; the DX circuit removes ground from the E lead which in turn causes the P relay in the signal isolation circuit to release, removing the closure across leads CBS1, CBS2 toward the CP equipment and restoring the connecting arrangement to the idle condition.

(b) When the customer at the distant end goes on-hook first, the signaling circuit removes ground from the E lead toward the signal isolation circuit causing the P relay to release. P relay released removes the contact closure across leads CBS1, CBS2 toward the CP equipment. The CP equipment subsequently removes the contact closure across leads, CS, CG which releases the A relay in the signal isolation circuit. Release of the A relay removes battery from the M lead toward the signaling circuit and restores the connecting arrangement to the idle condition.

4.04 *Incoming Call—PCA CDQ2X (Fig. 3 and 4)*

(a) An incoming call from the distant PBX unbalances the DX signaling circuit causing R relay to operate which places a ground on the E lead toward the signal isolation (applique) circuit. E lead grounded operates the K1 relay in the signal isolation circuit which closes a contact toward the near end CP equipment across leads CTE, CG. The CP equipment must respond to this seizure by connecting dial pulse receiving equipment to these leads and returning dial tone, if provided, to the distant PBX over leads CT and CR to indicate readiness to receive dial pulses.

(b) Dial pulses from the distant end are recognized by the DX signaling circuit and repeated to the signal isolation circuit by alternately opening and closing the E lead. The K1 relay in the signal isolation circuit repeats dial pulses to the CP equipment over lead CTE.

(c) When dial pulses have been received, the CP equipment may transmit answer supervision to the distant PBX by placing battery (−48 volts) on the CTM lead. This operates the K2 relay in the signal isolation circuit, which in turn places battery on the M lead to the DX signaling circuit, which repeats the answer supervision to the distant tie trunk.

(d) When 2-wire facilities are used (Fig. 3), the J53050D interconnecting unit (voice coupler circuit) provides a 2-wire transmission path to the CP equipment.

(e) When 4-wire facilities are used (Fig. 4), the 24V4C repeater provides a 4-wire to 2-wire transmission path to the CP equipment.

4.05 ***Outgoing Call—PCA CDQ2X (Fig. 3 and 4)***

(a) The CP equipment seizes the tie trunk by placing battery on the CTM lead. This operates the K2 relay in the signal isolation circuit, which in turn places battery on the M lead to the DX signaling circuit. The DX circuit unbalances the signaling circuit at the distant PBX; the distant PBX returns dial tone, if provided, over leads CT and CR. The CP equipment then outpulses the digits by alternately applying battery and ground to lead CTM. The digits are repeated to the distant PBX.

(b) If the distant tie trunk receives the answer supervision signal from its associated PBX, it unbalances the near end DX circuit causing the R relay to operate, which in turn operates the K1 relay in the signal isolation circuit in the same manner as an incoming call. The resulting K1 contact closure repeats the answer supervision to the CP equipment by grounding the CTE lead.

(c) When 2-wire facilities are used (Fig. 3), the J53050D interconnecting unit (voice coupler circuit) provides a 2-wire transmission path to the distant end.

(d) When 4-wire facilities are used (Fig. 4), the 24V4C repeater provides a 2-wire to 4-wire transmission path to the distant end.

4.06 ***Disconnect—PCA CDQ2X (Fig. 3 and 4)***

(a) When the customer at the near-end CP equipment goes on-hook first, the CP equipment removes battery from and applies ground to lead CTM which releases the K2 relay in the signal isolation circuit. The K2 relay released removes battery from the M lead toward the signaling circuit. The signaling circuit subsequently transmits a disconnect signal to the distant PBX. When the distant end goes on-hook, a disconnect signal is returned to the near end DX signaling circuit; the DX circuit removes ground from the E lead, which in turn causes the K1 relay in the signal isolation circuit to release, removing ground from lead CTE toward the CP equipment and restoring the connecting arrangement to the idle condition.

(b) When the distant end goes on-hook first, the signaling circuit removes ground from the E lead toward the signal isolation circuit, causing the K1 relay to release, removing ground from lead CTE toward the CP equipment. The CP equipment subsequently removes battery from and applies ground to lead CTM which releases the K2 relay in the signal isolation circuit. Relay K2 released removes battery from and applies ground to the M lead toward the signaling circuit and restores the connecting arrangement to the idle condition.

5. MAINTENANCE

5.01 When there is an indication of trouble in the connecting arrangement(s), the circuit at fault must be opened at the interface connecting block to verify in which direction the trouble exists. The circuit can be opened at the connecting block by removing the B bridging clip associated with each lead.

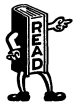
5.02 Precautions should be taken when performing tests to avoid adversely affecting service to the customer. Local instructions should be followed with reference to notifying the customer before performing the tests.

> ***Note:*** In no case should the CPE be used to perform end-to-end tests.

5.03 The repairman should first check the PCA for blown fuses, loose or broken wires and connectors, adequate battery and ground, and verify that the CO cable pairs are good. Any defects found should be repaired and tested before the equipment is reconnected to the customer's facility. If the trouble persists, continue with the trouble-shooting procedures described below.

5.04 Perform the post-installation tests described in 3.08 to determine if there is trouble in the PCA or the telephone company 2- or 4-wire facilities behind the PCA. If the tests in 3.08 can be completed successfully, and the areas checked in 5.03 are satisfactory, then the trouble is probably in the CPE.

5.05 When in the repairman's judgment the trouble is located in the CPE, the Repair Service Bureau should be notified so that proper maintenance of service charge billing can be initiated as outlined in BSP 660-101-312 entitled Maintenance of Service Charge on Services With Customer-Provided Equipment (CPE).



Do not attempt any tests or repairs to the customer-provided equipment.

5.06 If the trouble appears to be in the telephone company 2- or 4-wire facilities remote from the PCA, follow local practices to have them tested and repaired. If the PCA appears to be at fault, test the circuits which are most likely to be involved, based on the results of the test in 5.04. Faulty transmission probably points to the J53050D IU (2-wire interface) or the repeater (4-wire) as the source of trouble. Signaling difficulties are most likely to be caused by a defective J53050C IU or DX signaling unit plug-in relay. If CP power is being used, check the protector. When the faulty circuit is found, replace components on the entire unit, as necessary, or move leads to an idle circuit if one is available.

5.07 ***Apparatus Required to Perform Tests***

(a) Test cord, 893 cord, 6 feet long, equipped with two 360A tools (1W13B cord), one KS-6278 connecting clip, and one 411B (test pick) tool (for connecting battery to alarm bar of 70-type fuses).

> ***Note:*** To connect battery to the alarm bar of 70-type fuses mounted in a 21A fuse block, insert the tip of the 411B tool (attached to the 1W13B cord) into the aperture provided in the fuse block cover, and touch the alarm bar.

(b) Volt-ohm-meter capable of measuring −48 volts and 1000 ohms.

(c) Two clip leads, one of sufficient length to reach from the interface connecting block to the connecting arrangement.

5.08 ***Tests—J53050C, List 1 (MD) or List 3 Interconnecting Unit***

(a) Using 893 cord, connect battery to alarm bar of fuse(s) on interconnecting unit—fuse alarm lamp should light.

(b) Open all eight leads of the circuit under test at the interface connecting block. Remove leads E and M from the DX signaling unit. Connect lead CG to lead E. P relay should operate, indicated by closure across leads CBS1 and CBS2 (zero resistance). If P relay does not operate, replace it with a relay known to be good; if P relay still does not operate, check for faulty D1 diode or open on leads CBS1, CBS2, CG, or E.

(c) Connect lead CG to lead CS. The A relay should operate, indicated by battery (−48 volts) present on lead M. If A relay does not operate, replace it with a relay known to be good; if battery still is not present on lead M, measure the resistance from lead M to ground. If resistance measures zero, check for faulty D2 diode; if resistance measures 1000 ohms, check for faulty RT resistance lamp or open on leads CG, CS, or M.

(d) On completion of tests, reconnect leads E and M to the DX signaling unit and replace the B bridging clips at the interface connecting block associated with the circuit under test.

5.09 ***Tests—J53050C, List 2 Interconnecting Unit***

(a) Make fuse alarm test as shown in 5.08 (a).

(b) Open all seven leads of the circuit under test at the interface connecting block. Remove leads E and M from the DX signaling unit. Apply battery (−48 volts) to lead CTM and ground to lead CG. K2 relay should operate, indicated by battery (−48 volts) present on lead M. If K2 relay does not operate, replace it with a relay known to be good; if battery still is not present on lead M, measure the resistance from lead M to ground. If resistance measures zero, check for open on leads CTM, CG, or M; if resistance measures 1000 ohms, check for faulty RT1 resistance lamp.

(c) Connect lead E to frame ground. K1 relay should operate, indicated by a closure across leads CG and CTE (zero resistance). If K1 relay does not operate, replace it with a relay known to be good; if K1 relay still does not operate, check for open on leads CTE, CG, or E.

(d) On completion of tests, reconnect leads E and M to the DX signaling unit and replace the B bridging clips at the interface connecting block associated with the circuit under test.

5.10 ***Tests—J53050D, List 1 (MD) Interconnecting Unit:*** Perform normal circuit order transmission tests. The insertion loss of the IU is a nominal 1 dB at 1000 Hz.

5.11 ***Tests—J98605AJ DX Signaling Unit***

(a) Remove the 334A relay in the faulty PCA from its connector to perform tests. It is not a repairable item and will be replaced if defective.

(b) Verify the adjustments described in 3.03 and correct any discrepancies.

(c) Return the 334A relay to its connector in the signaling unit. If the trouble has not been cleared, replace the relay. (Perform 3.03 adjustments on any new relays before installing.)

5.12 ***Tests—J98605AG (MD) DX Signaling Unit:*** If the circuit malfunction is isolated to this unit, the entire unit must be replaced (unless an unused circuit is available).

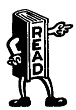
5.13 ***Tests—24V4C Repeater:*** In a 4-wire facility, if the CD cable pairs are verified to be good and transmission trouble is still present, the repeater may be defective. The amplifiers, terminal sets, and equalizer are plug-in units which may be adjusted or removed and replaced individually to localize the fault. Refer to the practices listed in 5.16 for additional information. Alignment procedures for the F58122 AGC amplifier, when used with the 24V4C repeater, is covered in Part 7.

5.14 ***Tests—KS-20944 Protector (Fig. 17 and 18):*** If circuit breaker switches are tripped (in the ***off*** position), return them to the ***on*** position; if circuit breaker switches cannot be operated to the ***on*** position, perform tests as follows:

(a) Disconnect telephone company-provided wiring from terminals 1 and 2 (− and +) of the load terminal strip on the protector under test. If the circuit breaker switches remain in the ***on*** position when operated, the trouble is in the telephone company-provided equipment. Check for proper polarity of the telephone company-provided leads at terminals 1 and 2 (− and +) of the load terminal strip on the protector; ascertain that the circuits connected to the protector do not exceed the current rating of the protector.

(b) If the trouble is not in the telephone company side, check the type, amount, and polarity of the CP voltage present on the leads provided for customer termination at the protector; this voltage should meet the specifications shown in Fig. 18.

5.15 After tests have been completed and defective equipment repaired or replaced, repeat the post-installation tests in 3.08 to determine that the PCA is operating correctly. If it is, restore all circuits to normal and close the connections between telphone company equipment and CPE.



Do not attempt any tests or repairs to the CP equipment.

5.16 When detailed maintenance information is required, refer to the following:

24V4C Repeater

CD- and SD-97047-01

Section 179-100-303

Section 852-307-101

Section 332-105-103.

359-Type Equalizer

Sections 332-116-101 through 332-116-113.

227-Type Amplifier

Section 024-140-101.

DX Signaling Circuit

CD- and SD-95487-01 (for J98605AG)

CD- and SD-1C363-01 (for J98605AJ)

Section 179-100-309

Section 859-501-101.

Signal Isolation (Applique) Circuit (J53050C)

CD- and SD-1E206-01 (for Lists 1 and 3)

CD- and SD-1E254-01 (for List 2).

Voice Coupler Circuit (J53050D)

CD- and SD-1E207.

KS-20944 Protector

Section 463-300-109.

6. CONNECTIONS

6.01 For connecting information, refer to Fig. 1, 2, 3, 4, 13, 14, 15, 16, 18, and 19.

7. F58122 AUTOMATIC GAIN CONTROL (AGC) AMPLIFIER

7.01 ***Physical and Electrical Characteristics***

(a) The F58122 AGC amplifier is identical in size and connections to the 227-type amplifier used in the 24V4C repeater shelf; it is used to limit the inband signal power in the transmitting leg from CP facilities to Bell System facilities.

(b) The gain of the F58122 AGC amplifier is continuously adjustable from −10 dB to +25 dB. The ability to insert loss is necessary when interfacing with a +7 transmission level point (TLP) transmit leg from CP facilities. The clamped output power of the amplifier is adjustable from −20 dBm to 0 dBm.

(c) The F58122 amplifier is normally adjusted to clamp at a power level 13 dB below the TLP. When the output side of the amplifier is at the 0 TLP, the minimum protection criteria permits an inband 3-second average output power of −13 dBm. If the input signal to the amplifier should be increased to a level that produces an instantaneous signal greater than −7 dBm at the output of the amplifier, the AGC action of the amplifier changes the output to −7 dBm after 20 milliseconds and then to −13 dBm after a time interval varying from 300 to 500 milliseconds. When the input level to the amplifier is such that the output level of the amplifier is between −7 and −13 dBm, the AGC action of the amplifier changes the output level to −13 dBm after a time interval varying from 0.3 to 3 seconds.

7.02 ***Adjustments:*** Gain adjustments are made by means of the LEV ADJ control (R3) and switch S1 (see Fig. 20). The combined setting of these two controls provides a range of −10 to +25 dB gain. The setting of the AGC ADJ control (R20) determines the points at which clamping of the amplifier output begins. The range of the AGC ADJ control is from 0 to −20 dBm. Before making adjustments, refer to circuit order card to determine the TLP at the input and output of the amplifier. With an input signal 10 dB below the input TLP of the amplifier, the amplifier gain must be adjusted (using LEV ADJ and S1 as required) to provide an output level which is 10 dB below the output TLP of the amplifier. The AGC ADJ control must then be adjusted to reduce the output of the amplifier by 3 dB (13 dB below output TLP). The following example shows the method of adjusting the F58122 AGC amplifier for a typical input and output TLP.

Example:

(a) Assume that the circuit order card shows an input TLP of −4 and an output TLP of +4.

(b) Set switch S1 to the counterclockwise position (when more than 10 dB of gain is required, set S1 to clockwise position) and LEV ADJ control (R3) to the +8 position; set the AGC ADJ control (R20) fully clockwise to the 0 dBm position. This provides an amplifier gain of +8 dB, the amount of gain required to raise the TLP from −4 to +4.

(c) Adjust the oscillator test level of a 21A transmission measuring set (TMS), or equivalent, to −14 dBm at 1000 Hz (10 dB below input TLP).

(d) Connect the OSC jack of the 21A TMS to the amplifier input (AMPL IN jack on the 24V4C repeater associated with the AGC amplifier). Connect the DET jack of the 21A TMS to the amplifier output (AMPL OUT jack on the 24V4C repeater associated with the AGC amplifier).

(e) Adjust the LEV ADJ control on the AGC amplifier for a detector reading of −6 dBm on the 21A TMS (10 dB below output TLP).

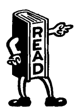
(f) ***Slowly adjust*** the AGC ADJ control on the AGC amplifier in a counterclockwise direction until a detector reading of −9 dBm is obtained on the 21A TMS (13 dB below output TLP). Because of long time constants, this adjustment must be made by turning the AGC ADJ ***slowly*** while noting the change in the detector reading.

(g) The amplifier is now adjusted to clamp the output power to a level 13 dB below the TLP (−9 dBm at +4 TLP).

(h) Reduce the oscillator test level of the 21A TMS by 5 dB (15 dB below input TLP); the detector reading should drop by 2 dB (15 dB below output TLP). This checks the limiting action of the amplifier.

(i) Disconnect the 21A TMS from the 24V4C repeater.

(j) Use the preceding method and refer to Fig. 18 to adjust the AGC amplifier for other TLPs.



The AGC action of the amplifier will make it impossible to measure the overall loss of the circuit using test levels that exceed 13 dB below the TLP. It is suggested that loss measurements from the customer equipment to another location be conducted at a test level of 13 dB below TLP. To minimize the possibility of a misunderstanding, it is imperative that each individual involved with testing the circuit understands that a reduced test level is being used. Some testboards and VE patch bays are not equipped to send reduced test levels. Higher test levels may be used to test those portions or directions of the circuit in which an AGC amplifier (F58122) is not used.

TABLE A

CKT NO.	TERMINALS ON J53050D,L1 TS(3) A	B	C	D	TS(4) A	B
1	11	14	13	12	14	16
2	15	18	17	16	24	26
3	21	24	23	22	34	36
4	25	28	27	26	44	46

TABLE B

STRAPS ON J53050D,L1 TS(4)-(SEE NOTE 3)

CKT NO.	OPTION Y FROM	OPTION Y TO	OPTION Z FROM	OPTION Z TO
1	17	16	15	16
	11	12	13	12
2	27	26	25	26
	21	22	23	22
3	37	36	35	36
	31	32	33	32
4	47	46	45	46
	41	42	43	42

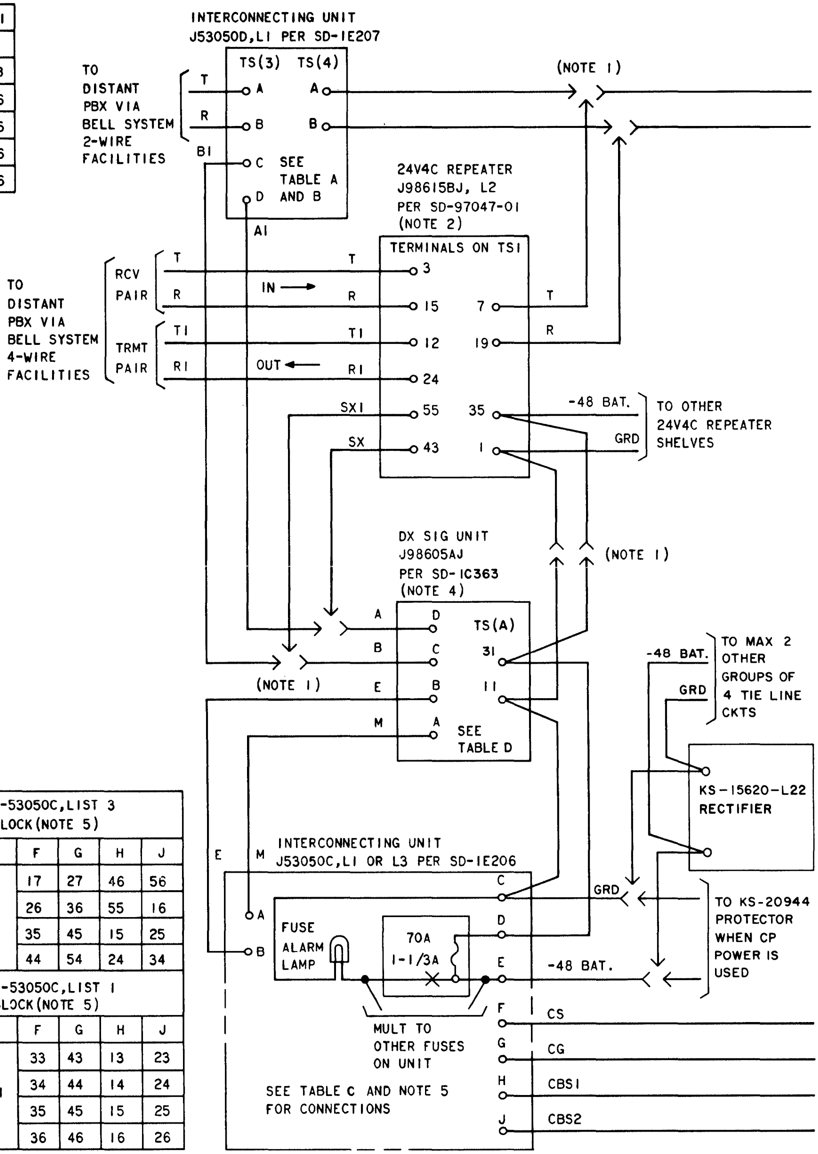


TABLE C

CKT NO.	TERMINALS ON J-53050C,LIST 3 D5A TERMINAL BLOCK (NOTE 5) A	B	C	D	E	F	G	H	J
0	48	58	51	14	11	17	27	46	56
1	28	38				26	36	55	16
2	57	18				35	45	15	25
3	37	47				44	54	24	34

CKT NO.	TERMINALS ON J-53050C,LIST 1 D3A TERMINAL BLOCK (NOTE 5) A	B	C	D	E	F	G	H	J
1	17	27	11	32	41	33	43	13	23
2	37	47				34	44	14	24
3	18	28				35	45	15	25
4	38	48				36	46	16	26

Fig. 13—Connections for Four Trunks—PCA CDQ2W (Using DX Signaling Unit J98605AJ) (Sheet 1 of 2)

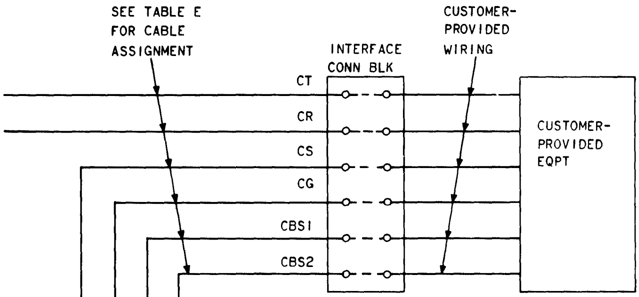


TABLE E

CKT NO.	LEAD DESIG	CABLE COLOR	INTERFACE CONN BLK TERM. NO.
1	CT	(W-BL)	1
	CR	(BL-W)	2
	CS	(W-O)	3
	CG	(O-W)	4
	CBS1	(W-G)	5
	CBS2	(G-W)	6
2	CT	(W-BR)	7
	CR	(BR-W)	8
	CS	(W-S)	9
	CG	(S-W)	10
	CBS1	(R-BL)	11
	CBS2	(BL-R)	12
3	CT	(R-O)	13
	CR	(O-R)	14
	CS	(R-G)	15
	CG	(G-R)	16
	CBS1	(R-BR)	17
	CBS2	(BR-R)	18
4	CT	(R-S)	19
	CR	(S-R)	20
	CS	(BK-BL)	21
	CG	(BL-BK)	22
	CBS1	(BK-O)	23
	CBS2	(O-BK)	24

TABLE D

CKT NO.	TERMINALS ON TS(A) OF J98605AJ				TERMINALS ON TS(B) OF J98605AJ			
	A	B	C	D	A	B	C	D
1	47	28	38	48				
2	36	17	27	37				
3	25	45	16	26				
4	14	34	44	15				
5	42	23	33	43				
6					47	28	38	48
7					36	17	27	37
8					25	45	16	26
9					14	34	44	15
10					42	23	33	43

THIS TABLE SHOWS CONNECTIONS FOR FULLY EQUIPPED SIGNALING UNIT. SELECT ONE CIRCUIT FOR EACH TIE LINE.

NOTES:

1. MAKE CONNECTIONS TO J53050D,L1 INTERCONNECTING UNIT WHEN USING 2-WIRE FACILITIES; MAKE CONNECTIONS TO 24V4C REPEATER WHEN USING 4-WIRE FACILITIES. BATTERY AND GROUND CONNECTIONS ARE NOT REQUIRED TO J53050D,L1 INTERCONNECTING UNIT.
2. EACH 24V4C REPEATER SHELF CONTAINS ONE CIRCUIT; CONNECTIONS FOR OTHER REPEATER CIRCUITS ARE IDENTICAL AS SHOWN. FOR ALIGNMENT PROCEDURES REFER TO EXISTING PRACTICES. WHEN F58122 AGC AMPLIFIER IS USED, ALIGN AS SHOWN IN PART 7.
3. WHEN CP EQUIPMENT TO BELL SYSTEM IMPEDANCE IS 900 OHMS TO 900 OHMS OR 600 OHMS TO 600 OHMS, USE OPTION Z; WHEN CP EQUIPMENT IMPEDANCE IS 600 OHMS AND BELL SYSTEM IMPEDANCE IS 900 OHMS, USE OPTION Y.
4. REFER TO SD-1C363-01 FOR NETWORK RESISTANCE AND CAPACITANCE ADJUSTMENTS AND FOR USE OF CAPACITOR ACROSS A AND B LEADS.
5. J53050C, LIST 3 INTERCONNECTING UNITS ARE EQUIPPED WITH A D5A TERMINAL STRIP; CONNECTIONS TO THESE UNITS ARE SHOWN IN THE FIRST PART OF TABLE C. J53050C, LIST 1 INTERCONNECTING UNITS ARE EQUIPPED WITH A D3A TERMINAL STRIP; CONNECTIONS TO THESE UNITS ARE SHOWN IN THE LAST PART OF TABLE C.

Fig. 13—Connections for Four Trunks—PCA CDQ2W (Using DX Signaling Unit J98605AJ) (Sheet 2 of 2)

TABLE A

CKT NO.	TERMINALS ON J53050D,L1 TS(3) A	B	C	D	TS(4) A	B
1	11	14	13	12	14	16
2	15	18	17	16	24	26
3	21	24	23	22	34	36
4	25	28	27	26	44	46

TABLE B

STRAPS ON J53050D,L1 TS(4)-(SEE NOTE 3)

CKT NO.	OPTION Y FROM	OPTION Y TO	OPTION Z FROM	OPTION Z TO
1	17	16	15	16
	11	12	13	12
2	27	26	25	26
	21	22	23	22
3	37	36	35	36
	31	32	33	32
4	47	46	45	46
	41	42	43	42

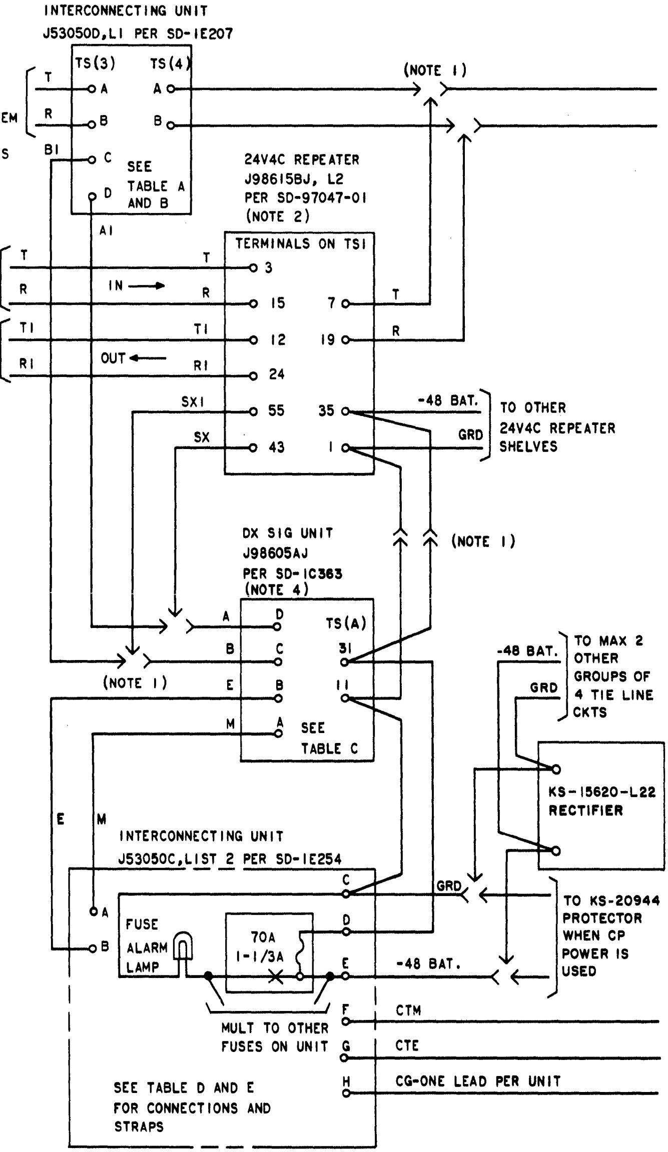


TABLE C

CKT NO.	TERMINALS ON TS(A) OF J98605AJ A	B	C	D	TERMINALS ON TS(B) OF J98605AJ A	B	C	D
1	47	28	38	48				
2	36	17	27	37				
3	25	45	16	26				
4	14	34	44	15				
5	42	23	33	43				
6					47	28	38	48
7					36	17	27	37
8					25	45	16	26
9					14	34	44	15
10					42	23	33	43

THIS TABLE SHOWS CONNECTIONS FOR FULLY EQUIPPED SIGNALING UNIT. SELECT ONE CIRCUIT FOR EACH TIE LINE.

TABLE D

<table>
<tr><th rowspan="2">CKT NO.</th><th colspan="8">TERMINALS ON J53050C, LIST 2-TS1</th></tr>
<tr><th>A</th><th>B</th><th>C</th><th>D</th><th>E</th><th>F</th><th>G</th><th>H</th></tr>
<tr><td>0</td><td>48</td><td>58</td><td rowspan="4">52</td><td rowspan="4">18</td><td rowspan="4">11</td><td>38</td><td>28</td><td rowspan="4">22</td></tr>
<tr><td>1</td><td>47</td><td>57</td><td>37</td><td>27</td></tr>
<tr><td>2</td><td>46</td><td>56</td><td>36</td><td>26</td></tr>
<tr><td>3</td><td>45</td><td>55</td><td>35</td><td>25</td></tr>
</table>

Fig. 14—Connections for Four Trunks—PCA CDQ2X (Using DX Signaling Unit J98605AJ) (Sheet 1 of 2)

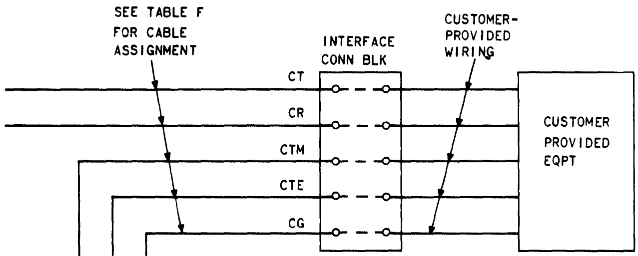


TABLE F

CKT NO.	LEAD DESIG	CABLE COLOR	INTERFACE CONN BLK TERM NO.
1	CT	W-BL	1
	CR	BL-W	2
	CTM	W-O	3
	CTE	O-W	4
2	CT	W-G	5
	CR	G-W	6
	CTM	W-BR	7
	CTE	BR-W	8
3	CT	W-S	9
	CR	S-W	10
	CTM	R-BL	11
	CTE	BL-R	12
4	CT	R-O	13
	CR	O-R	14
	CTM	R-G	15
	CTE	G-R	16
1-4	CG	R-BR	17
5-8	CG *	BR-R	18

* USE BR-R LEAD FOR CG LEAD ON SECOND GROUP OF FOUR CIRCUITS TO PREVENT SPLITTING PAIRS (SEE FIG. 4)

TABLE E

STRAPS ON J53050C, LIST 2					
TS(1)		TS(2)		TS(3)	
FROM	TO	FROM	TO	FROM	TO
54	53	58	28	58	28
44	53	48	38	48	38
34	14	38	57	38	57
24	14	47	37	47	37
11	21	27	46	27	46
21	31	17	56	17	56
31	41	23	42	23	42
		13	52	13	52
		52	22	52	22
		12	51	12	51
		41	11	41	11
		31	21	31	21

NOTES:

1. MAKE CONNECTIONS TO J53050D, L1 INTERCONNECTING UNIT WHEN USING 2-WIRE FACILITIES; MAKE CONNECTIONS TO 24V4C REPEATER WHEN USING 4-WIRE FACILITIES. BATTERY AND GROUND CONNECTIONS ARE NOT REQUIRED TO J53050D, L1 INTERCONNECTING UNIT.
2. EACH 24V4C REPEATER SHELF CONTAINS ONE CIRCUIT; CONNECTIONS FOR OTHER REPEATER CIRCUITS ARE IDENTICAL AS SHOWN. FOR ALIGNMENT PROCEDURES REFER TO EXISTING PRACTICES. WHEN F58122 AGC AMPLIFIER IS USED, ALIGN AS SHOWN IN PART 7.
3. WHEN CP EQUIPMENT TO BELL SYSTEM IMPEDANCE IS 900 OHMS TO 900 OHMS OR 600 OHMS TO 600 OHMS, USE OPTION Z; WHEN CP EQUIPMENT IMPEDANCE IS 600 OHMS AND BELL SYSTEM IMPEDANCE IS 900 OHMS, USE OPTION Y.
4. REFER TO SD-1C363-01 FOR NETWORK RESISTANCE AND CAPACITANCE ADJUSTMENTS AND FOR USE OF CAPACITOR ACROSS A AND B LEADS.

Fig. 14—Connections for Four Trunks—PCA CDQ2X (Using DX Signaling Unit J98605AJ) (Sheet 2 of 2)

TABLE A

CKT NO.	TERMINALS ON J53050D,L1 TS(3) A	B	C	D	TS(4) A	B
1	11	14	13	12	14	16
2	15	18	17	16	24	26
3	21	24	23	22	34	36
4	25	28	27	26	44	46

TABLE B

STRAPS ON J53050D,L1 TS(4)-(SEE NOTE 3)

CKT NO.	OPTION Y FROM	TO	OPTION Z FROM	TO
1	17	16	15	16
	11	12	13	12
2	27	26	25	26
	21	22	23	22
3	37	36	35	36
	31	32	33	32
4	47	46	45	46
	41	42	43	42

TABLE C

CKT NO.	TERMINALS ON TS(E) OF J98605AG(MD) A	B	C	D
1	28	38	48	58
2	27	37	47	57
3	26	36	46	56
4	25	35	45	55

TABLE D

CKT NO.	TERMINALS ON J-53050C,LIST 3 D5A TERMINAL BLOCK(NOTE 5) A	B	C	D	E	F	G	H	J
0	48	58	51	14	11	17	27	46	56
1	28	38				26	36	55	16
2	57	18				35	45	15	25
3	37	47				44	54	24	34

CKT NO.	TERMINALS ON J-53050C,LIST 1 D3A TERMINAL BLOCK(NOTE 5) A	B	C	D	E	F	G	H	J
1	17	27	11	32	41	33	43	13	23
2	37	47				34	44	14	24
3	18	28				35	45	15	25
4	38	48				36	46	16	26

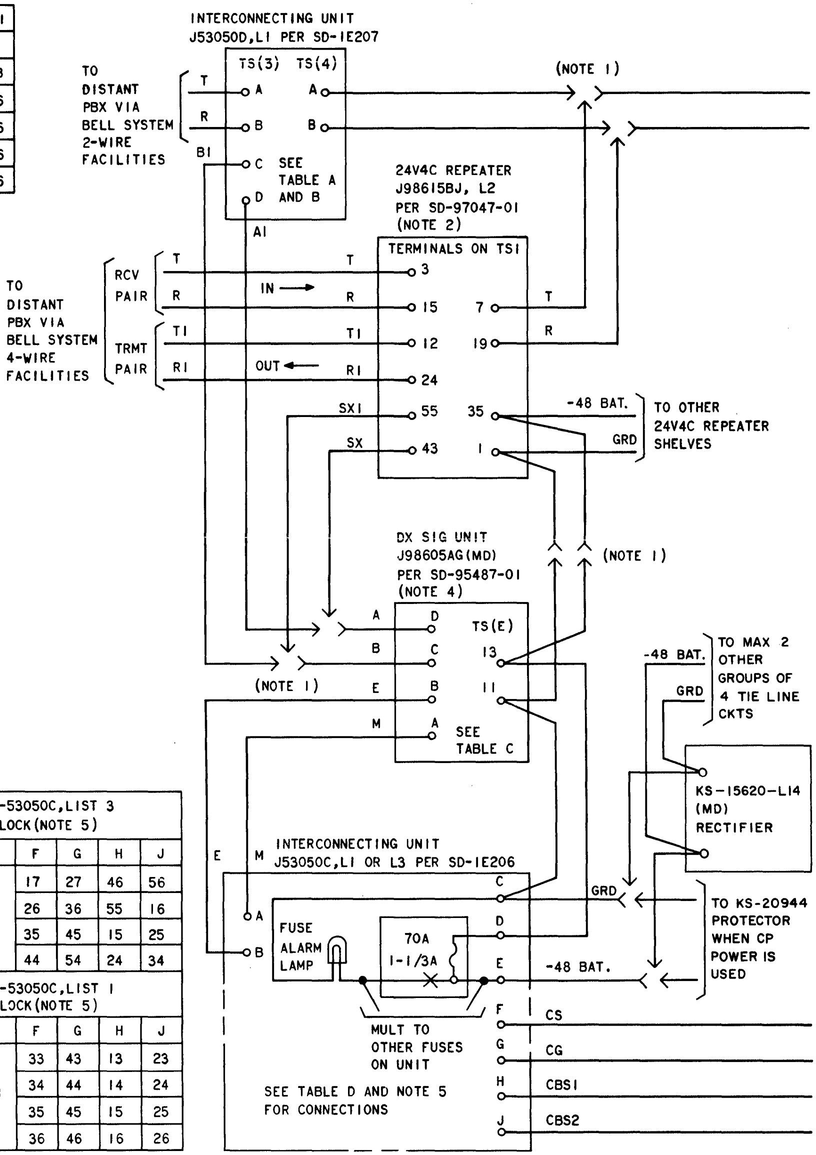


Fig. 15—Connections for Four Trunks—PCA CDQ2W (Using DX Signaling Unit J98605AG [MD]) (Sheet 1 of 2)

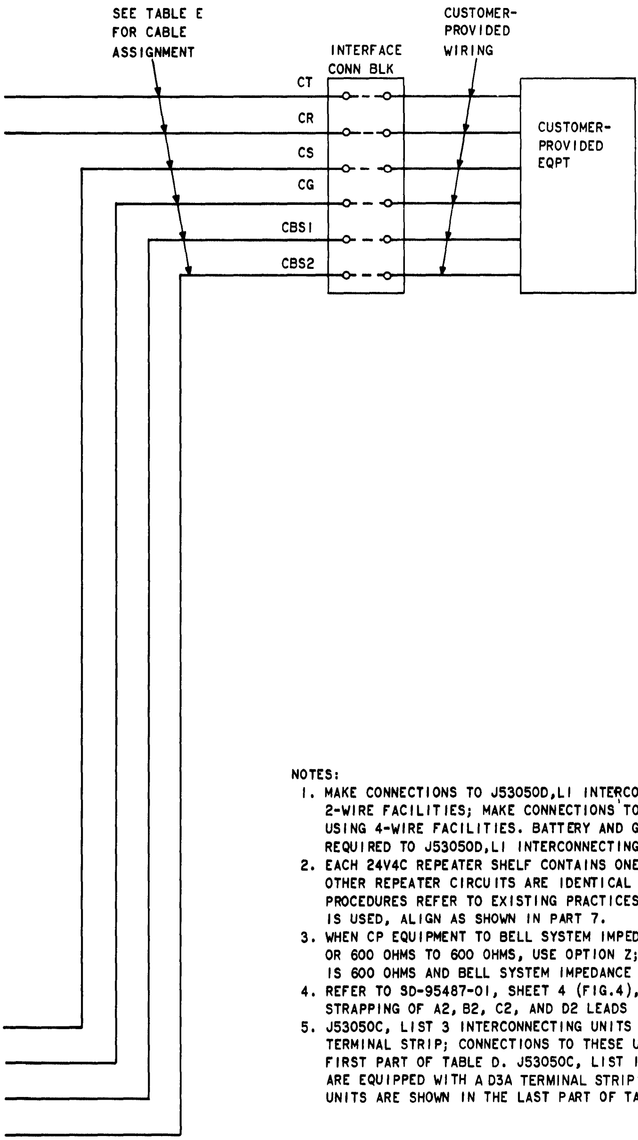


TABLE E

CKT NO.	LEAD DESIG	CABLE COLOR	INTERFACE CONN BLK TERM.NO.
1	CT	(W-BL)	1
	CR	(BL-W)	2
	CS	(W-O)	3
	CG	(O-W)	4
	CBS1	(W-G)	5
	CBS2	(G-W)	6
2	CT	(W-BR)	7
	CR	(BR-W)	8
	CS	(W-S)	9
	CG	(S-W)	10
	CBS1	(R-BL)	11
	CBS2	(BL-R)	12
3	CT	(R-O)	13
	CR	(O-R)	14
	CS	(R-G)	15
	CG	(G-R)	16
	CBS1	(R-BR)	17
	CBS2	(BR-R)	18
4	CT	(R-S)	19
	CR	(S-R)	20
	CS	(BK-BL)	21
	CG	(BL-BK)	22
	CBS1	(BK-O)	23
	CBS2	(O-BK)	24

NOTES:

1. MAKE CONNECTIONS TO J53050D,L1 INTERCONNECTING UNIT WHEN USING 2-WIRE FACILITIES; MAKE CONNECTIONS TO 24V4C REPEATER WHEN USING 4-WIRE FACILITIES. BATTERY AND GROUND CONNECTIONS ARE NOT REQUIRED TO J53050D,L1 INTERCONNECTING UNIT.
2. EACH 24V4C REPEATER SHELF CONTAINS ONE CIRCUIT; CONNECTIONS FOR OTHER REPEATER CIRCUITS ARE IDENTICAL AS SHOWN. FOR ALIGNMENT PROCEDURES REFER TO EXISTING PRACTICES. WHEN F58122 AGC AMPLIFIER IS USED, ALIGN AS SHOWN IN PART 7.
3. WHEN CP EQUIPMENT TO BELL SYSTEM IMPEDANCE IS 900 OHMS TO 900 OHMS OR 600 OHMS TO 600 OHMS, USE OPTION Z; WHEN CP EQUIPMENT IMPEDANCE IS 600 OHMS AND BELL SYSTEM IMPEDANCE IS 900 OHMS, USE OPTION Y.
4. REFER TO SD-95487-01, SHEET 4 (FIG.4), AND SHEET 6 (FIG.55) FOR STRAPPING OF A2, B2, C2, AND D2 LEADS (G, H, J, AND K OPTIONS).
5. J53050C, LIST 3 INTERCONNECTING UNITS ARE EQUIPPED WITH A D5A TERMINAL STRIP; CONNECTIONS TO THESE UNITS ARE SHOWN IN THE FIRST PART OF TABLE D. J53050C, LIST 1 INTERCONNECTING UNITS ARE EQUIPPED WITH A D3A TERMINAL STRIP; CONNECTIONS TO THESE UNITS ARE SHOWN IN THE LAST PART OF TABLE D.

Fig. 15—Connections for Four Trunks—PCA CDQ2W (Using DX Signaling Unit J98605AG [MD]) (Sheet 2 of 2)

TABLE A

CKT NO.	TERMINALS ON J53050D,L1					
	TS(3)				TS(4)	
	A	B	C	D	A	B
1	11	14	13	12	14	16
2	15	18	17	16	24	26
3	21	24	23	22	34	36
4	25	28	27	26	44	46

TABLE B

STRAPS ON J53050D,L1 TS(4)-(SEE NOTE 3)				
CKT NO.	OPTION Y		OPTION Z	
	FROM	TO	FROM	TO
1	17	16	15	16
	11	12	13	12
2	27	26	25	26
	21	22	23	22
3	37	36	35	36
	31	32	33	32
4	47	46	45	46
	41	42	43	42

TABLE C

CKT NO.	TERMINALS ON TS(E) OF J98605AG(MD)			
	A	B	C	D
1	28	38	48	58
2	27	37	47	57
3	26	36	46	56
4	25	35	45	55

TABLE D

CKT NO.	TERMINALS ON J53050C,LIST 2-TS1							
	A	B	C	D	E	F	G	H
0	48	58	52	18	11	38	28	22
1	47	57				37	27	
2	46	56				36	26	
3	45	55				35	25	

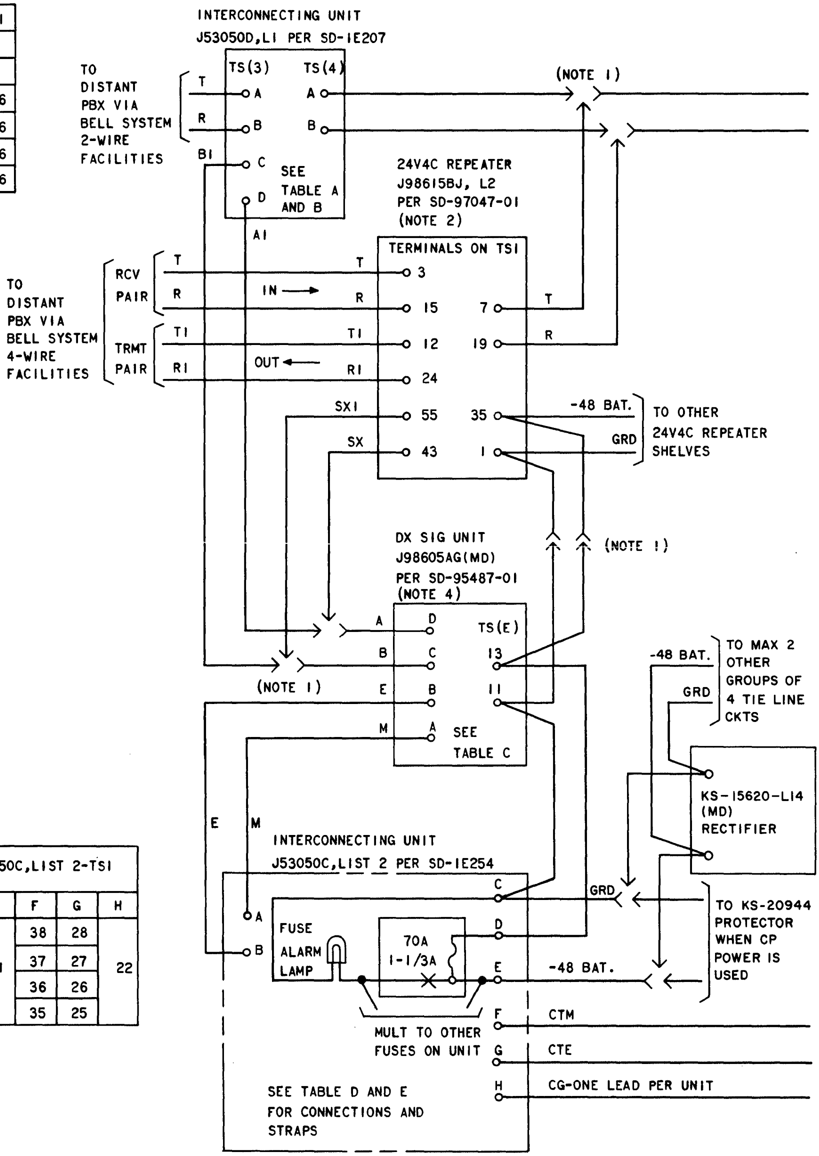


Fig. 16—Connections for Four Trunks—PCA CDQ2X (Using DX Signaling Unit J98605AG [MD]) (Sheet 1 of 2)

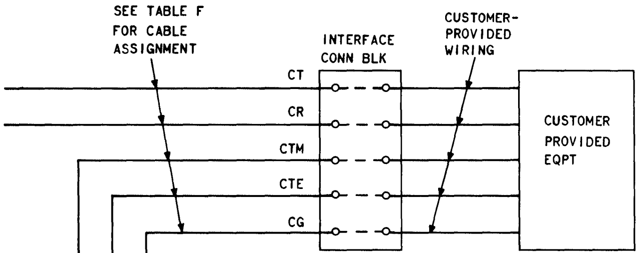


TABLE F

CKT NO.	LEAD DESIG	CABLE COLOR	INTERFACE CONN BLK TERM NO.
1	CT	W-BL	1
	CR	BL-W	2
	CTM	W-O	3
	CTE	O-W	4
2	CT	W-G	5
	CR	G-W	6
	CTM	W-BR	7
	CTE	BR-W	8
3	CT	W-S	9
	CR	S-W	10
	CTM	R-BL	11
	CTE	BL-R	12
4	CT	R-O	13
	CR	O-R	14
	CTM	R-G	15
	CTE	G-R	16
1-4	CG	R-BR	17
5-8	CG *	BR-R	18

* USE BR-R LEAD FOR CG LEAD ON SECOND GROUP OF FOUR CIRCUITS TO PREVENT SPLITTING PAIRS (SEE FIG. 4)

TABLE E

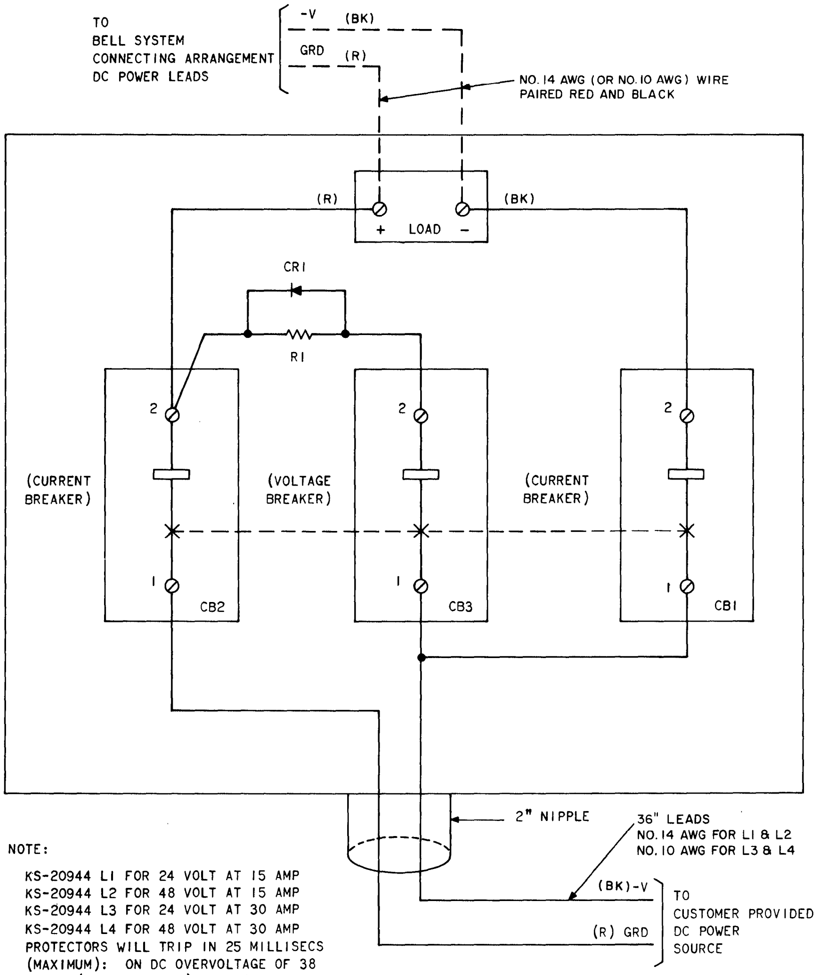
STRAPS ON J53050C, LIST 2					
TS(1)		TS(2)		TS(3)	
FROM	TO	FROM	TO	FROM	TO
54	53	58	28	58	28
44	53	48	38	48	38
34	14	38	57	38	57
24	14	47	37	47	37
11	21	27	46	27	46
21	31	17	56	17	56
31	41	23	42	23	42
		13	52	13	52
		52	22	52	22
		12	51	12	51
		41	11	41	11
		31	21	31	21

NOTES:

1. MAKE CONNECTIONS TO J53050D, L1 INTERCONNECTING UNIT WHEN USING 2-WIRE FACILITIES; MAKE CONNECTIONS TO 24V4C REPEATER WHEN USING 4-WIRE FACILITIES. BATTERY AND GROUND CONNECTIONS ARE NOT REQUIRED TO J53050D, L1 INTERCONNECTING UNIT.
2. EACH 24V4C REPEATER SHELF CONTAINS ONE CIRCUIT; CONNECTIONS FOR OTHER REPEATER CIRCUITS ARE IDENTICAL AS SHOWN. FOR ALIGNMENT PROCEDURES REFER TO EXISTING PRACTICES. WHEN F58122 AGC AMPLIFIER IS USED, ALIGN AS SHOWN IN PART 7.
3. WHEN CP EQUIPMENT TO BELL SYSTEM IMPEDANCE IS 900 OHMS TO 900 OHMS OR 600 OHMS TO 600 OHMS, USE OPTION Z; WHEN CP EQUIPMENT IMPEDANCE IS 600 OHMS AND BELL SYSTEM IMPEDANCE IS 900 OHMS, USE OPTION Y.
4. REFER TO SD-95487-01, SHEET 4 (FIG.4), AND SHEET 6 (FIG.55) FOR STRAPPING OF A2, B2, C2, AND D2 LEADS (G,H,J, AND K OPTIONS).

Fig. 16—Connections for Four Trunks—PCA CDQ2X (Using DX Signaling Unit (J98605AG [MD]) (Sheet 2 of 2)

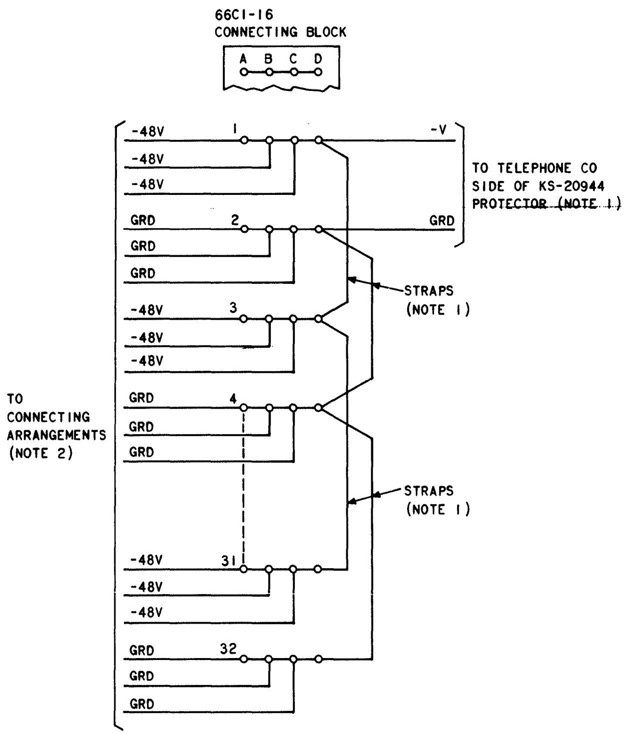
Fig. 17—KS-20944 Protector



NOTE:

KS-20944 L1 FOR 24 VOLT AT 15 AMP
KS-20944 L2 FOR 48 VOLT AT 15 AMP
KS-20944 L3 FOR 24 VOLT AT 30 AMP
KS-20944 L4 FOR 48 VOLT AT 30 AMP
PROTECTORS WILL TRIP IN 25 MILLISECS (MAXIMUM): ON DC OVERVOLTAGE OF 38 VOLTS (24 VOLT UNIT) AND 68 VOLTS (48 VOLT UNIT), ON OVERLOAD OF 18.75 AMPERES (15 AMP UNIT) AND 37.5 AMPERES (30 AMP UNIT), ON REVERSED POLARITY, OR AC VOLTAGE GREATER THAN 18 VOLTS, OR INCORRECT POWER SUPPLY GROUND.

Fig. 18—Schematic—KS-20944 Protector



NOTES:
1. USE 14-GAUGE WIRE TO CONNECT FROM KS-20944 PROTECTOR TO CONNECTING BLOCK; PROVIDE MULTIPLE STRAPS AS DETERMINED BY NUMBER OF CONNECTING ARRANGEMENTS TO BE CONNECTED TO. USE SOLDER TO MAKE THE CONNECTION OF THE 14-GAUGE WIRE AND STRAPS TO THE CONNECTING BLOCK.
2. USE "D" INSIDE WIRE OR EQUIVALENT TO MAKE CONNECTIONS FROM CONNECTING BLOCK TO CONNECTING ARRANGEMENTS. EACH CONNECTING BLOCK PROVIDES MEANS FOR CONNECTING TO 48 CIRCUITS, HOWEVER, DO NOT EXCEED THE MAXIMUM CURRENT RATING OF THE KS-20944 PROTECTOR.

Fig. 19—Typical Power Distribution Connections Between KS-20944 Protector and PCAs

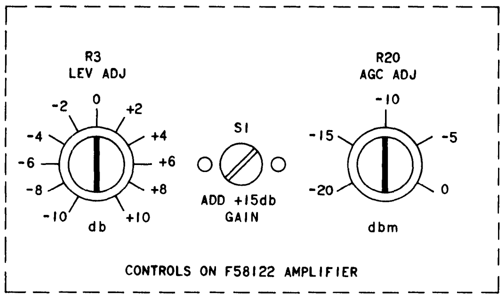


Fig. 20—Typical Adjustments—F58122 Automatic Gain Control Amplifier

VOICE CONNECTING ARRANGEMENT C234W

1. GENERAL

1.001 This addendum supplements Section 463-360-102, Issue 2.

1.002 This addendum is issued to change reference to a Section in Part 2 and Part 5.

1.003 The following change applies to Part 2:

(a) In Part 2, under ORDERING GUIDE, in the note associated with J98615AH, List 2, 44V4A Intermediate Repeater Shelf, change the reference to Section AB24.100.01 to read Section 852-307-101.

1.004 The following change applies to Part 5:

(a) In Part 5.05, under the heading ***44V4A Repeater,*** change the reference to Section AB24.100.01 to read Section 852-307-101.

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SEE ADDENDUM

VOICE CONNECTING ARRANGEMENT C234W

1. GENERAL

1.01 This section provides identification, installation, operation, maintenance, and connecting information for Voice Connecting Arrangement C234W, using J98615AH, List 2, 44V4A intermediate repeater shelf, equipped with plug-in components, and KS-15620, List 14 rectifier or equivalent power source.

> *Note:* An X76090 loop-back panel should be provided at the customer's premises to facilitate testing the connecting arrangement from the serving central office.

This arrangement provides a 4-wire voiceband only connection, without signaling, between customer-provided (CP) equipment and Bell System 4-wire facilities. This arrangement does not provide dc continuity between the CP equipment and the Bell System facility and does not pass 20-Hz ringing. The customer is expected to provide inband signaling when using this connecting arrangement.

1.02 This section is reissued to include information on the KS-20944 protector, to change Fig. 2, and to add Fig. 3, 4, and 5.

1.03 If the customer wants a copy of the Technical Reference which covers this interface specification, the customer should contact the local Telephone Company Business Office or the Marketing Representative.

1.04 This issue of the section is based on the following drawings:

SD-97047-01, Issue 16D

CD-97047-01, Issue 5D, Appendix 2D

If this section is to be used with equipment or apparatus reflecting later issue(s) of the drawing(s), reference should be made to the SDs and CDs to determine the extent of the changes and the manner in which the section may be affected.

2. IDENTIFICATION

PURPOSE

- To provide a 4-wire connection between a CP PBX and Bell System private line facilities
- To limit excessive levels from CP equipment and to provide protection for personnel against hazardous voltages
- To provide longitudinal isolation.

ORDERING GUIDE

- J98615AH, List 2, 44V4A Intermediate Repeater Shelf.

Note: For plug-in components refer to Section AB24.100.01; when automatic control of signal power level is required, order F58122 automatic gain control (AGC) amplifier for use in the ***transmitting leg from the CP equipment to Bell System facilities*** instead of the standard 227-type amplifier shown in Section AB24.100.01 (see Fig. 2).

Associated Apparatus (Order Separately)

- KS-15620, List 14 Rectifier.

Note: This rectifier meets acceptable noise requirements as explained under Power Supplies in Section 332-104-102. Other rectifiers may be used when specified by local engineering.

- KS-14532 Power Cord

List 1—10 ft.

List 2—2 ft.

List 3—15 ft.

List 4—20 ft.

List 5—25 ft.

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- Cable, Wiring, "D" inside, or equivalent (for cabling from connecting arrangement to interface connecting block).

- Block, Connecting, 66M1-50 (Fig. 1).

Note: Other types of blocks may be used when specified by local engineering.

- Clip, Bridging, B (25 per pkg).

- Panel, Loop-Back, X76090 (optional).

Note: The loop-back panel mounts on a standard 23-inch relay rack. Four circuits are provided per panel; one panel is required for each two 44V4A repeater panels. Power must be provided from a local −48 volt source with a local fusing arrangement.

- ➧KS-20944, List 2 Protector (Optional—***must*** be provided when CP power supply is used)—see Fig. 3 and 4.

- Block, Connecting, 66C1-16 or equivalent (for providing distribution of power when KS-20944 protector is used between CP power supply and ***more than one*** connecting arrangement of any type—see Fig. 5).

Note: The cumulative current drain of the connecting arrangements connected to a KS-20944 protector must not exceed the maximum current rating of the protector. For instance, if the maximum current drain for one connecting arrangement is 1.0 ampere and the maximum current rating of a KS-20944, List 2 protector is 15 amperes, no more than 15 connecting arrangements may be connected to the protector (this example is for illustrative purposes only).

- Wire, AM, 14 gauge, paired, red and black, P-384614 or equivalent (for cabling from the KS-20944 protector to the 66C1-16 connecting block—see Fig. 5).➧

Replaceable Components

- Plug-in components of 44V4A repeater.

DESIGN FEATURES

44V4A Repeater Shelf

- Mounts on standard 23-inch relay rack on 1-3/4 inch centers.

- Two repeater circuits per shelf.

- Each circuit provides a 4-wire voiceband transmission path (voice coupler) to and from the CP equipment.

- Limits the inband signal power applied to Bell System facilities when equipped with F58122 AGC amplifier.

- Provides transformer isolation and hazardous voltage protection between CP equipment and Bell System facilities.

➧KS-20944, List 2 Protector (Fig. 3 and 4)

- Components are mounted in a 5-1/2 by 4-1/2 by 3-1/2 inch box with hinged cover, designed to mount on a wall or any flat surface.

- Provides screw terminals inside of box for connection to Bell System equipment.

- Provides two external 14-gauge color-coded leads for connection to CP power source ([R] GRD, [BK] —V).

- Provides current and voltage limiting between Bell System equipment and CP power source.

- Protector circuit breakers trip in 25 milliseconds on overvoltage, current overload, reversed voltage polarity, improper grounding, or ac voltage from CP power source as follows:

(a) Overvoltage of 68 volts dc

(b) Current overload of 18 amperes

(c) Reversed dc polarity

(d) Improper ground

(e) AC voltage greater than 18 volts.

- Protector circuit breaker switch provides a means for removing CP power from Bell System interconnecting equipment.

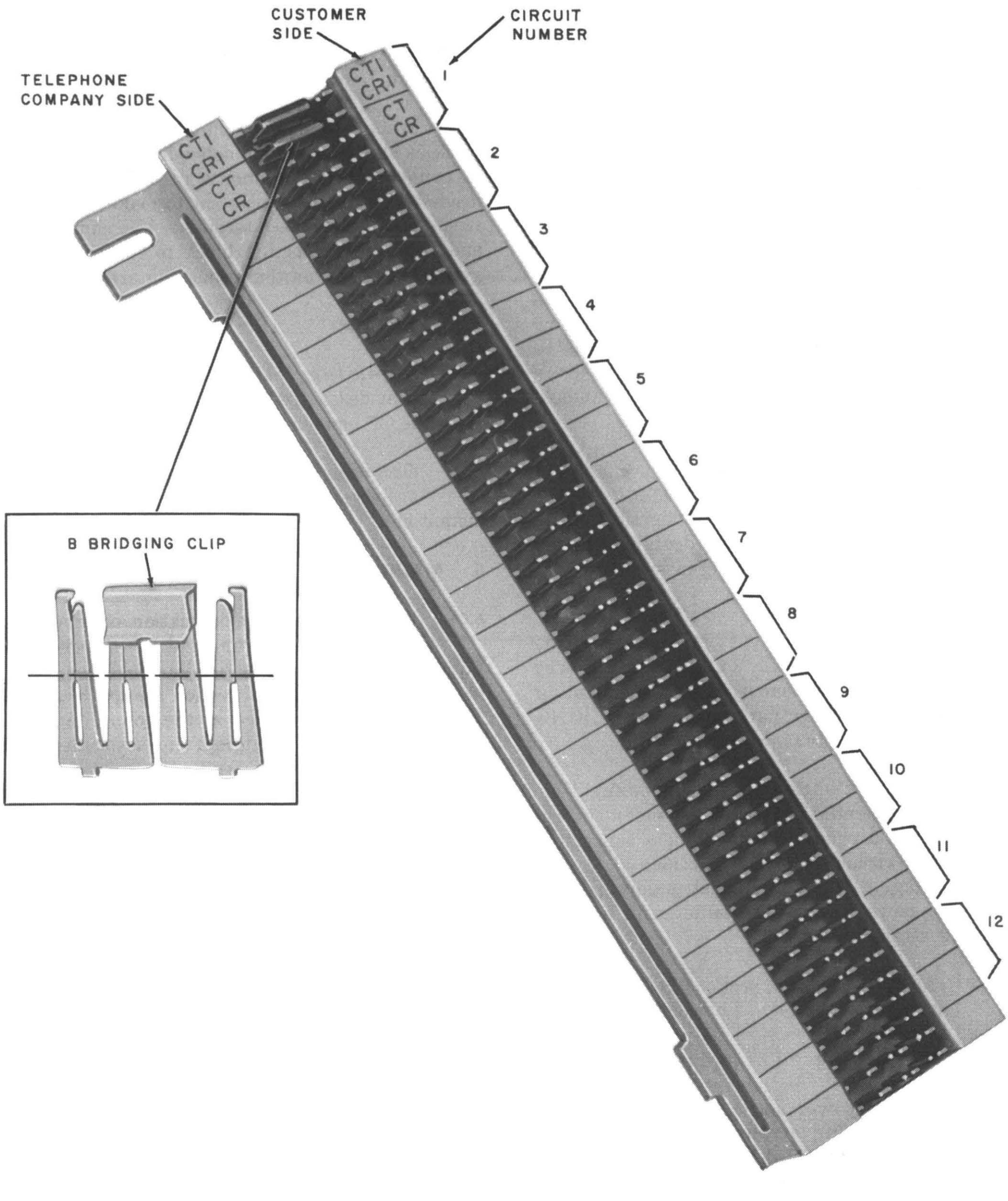


Fig. 1—Typical Interface Connecting Block

CAUTION: The circuit breaker switch removes voltage from the load (Bell System) side of the protector only; voltage will still be present on terminals and components inside the protector box.

- Provides hazardous voltage protection between CP power source and Bell System equipment.◀

3. INSTALLATION

3.01 Locate the voice connecting arrangements in an area free of dampness and excessive dust or dirt, with adequate room for access to front and rear of equipment and connecting blocks. The equipment typically mounts on a standard 23-inch relay rack.

3.02 Use the "D" inside wiring cable or equivalent to terminate the leads associated with the CP equipment on the interface connecting block. Stencil trunk number and lead designations on interface connecting block designation strip (see Fig. 1).

3.03 When required, the customer must provide a 117V 60-Hz power outlet within power cord length of the customer-designated mounting location of connecting arrangement (see ORDERING GUIDE for cord lengths).

3.04 The power outlet supplying connecting arrangement(s) must not be under control of a switch and should be fused on a separately fused power circuit to prevent accidental loss of ac line voltage. Where local instructions permit, secure the power cord to the outlet with a power cord plug retainer assembly.

3.05 Refer to appropriate sections in Division 167 for proper grounding of power plants.

▶KS-20944 PROTECTOR

3.06 When CP power source is used to power the connecting arrangement, a KS-20944 protector must be provided between the CP power source and the connecting arrangement. Mount the KS-20944 protector on a wall or suitable flat surface near the interface connecting block. Use the AM-type, 14-gauge wire or equivalent to make connections from the protector to the 66C1-16 connecting block. Terminate one end of the wiring to the screw terminals (term. − and +) of the load terminal strip provided on the protector (see Fig. 4). Solder the other end of the wiring to terminals in column D of the connecting block as shown in Fig. 5; using the 14-gauge wire, solder the multiple straps to the terminals in column D of the connecting block as shown in Fig. 5, depending on the number of connecting arrangements provided. Use "D" inside wire cable or equivalent to make connections from the quick-connect terminals in columns A, B, and C of the connecting block to the battery and ground terminals on the connecting arrangements.◀

4. OPERATION

4.01 ***Incoming Call:*** The 44V4A repeater provides a 4-wire transmission path to and from the CP equipment.

4.02 ***Outgoing Call:*** The 44V4A repeater provides a 4-wire transmission path to and from the distant end.

5. MAINTENANCE

5.01 Where there is an indication of trouble in the connecting arrangement(s) the circuit at fault must be opened at the interface connecting block to verify in which direction the trouble exists. The circuit can be opened at the connecting block by removing the B bridging clip associated with each lead.

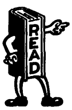
5.02 Precautions should be taken when performing tests to avoid adversely affecting service to the customer. Local instructions should be followed with reference to notifying the customer before performing the tests.

5.03 For maintenance and tests on 44V4A repeater refer to existing practices (see 5.05). Alignment procedure for the F58122 AGC amplifier, when used with the 44V4A repeater, is covered in Part 7.

5.04 ▶***Tests—KS-20944 Protector (Fig. 3 and 4):*** If circuit breaker switches are tripped (in the ***off*** position) return them to the ***on*** position; if circuit breaker switches cannot be operated to the ***on*** position perform tests as follows:

(a) Disconnect Telephone Company provided wiring from terminals 1 and 2 (− and +) of the load terminal strip on the protector under test. If the circuit breaker switches remain in the *on* position when operated, the trouble is in the Telephone Company provided equipment. Check for proper polarity of the Telephone Company provided leads at terminals 1 and 2 (− and +) of the load terminal strip on the protector; ascertain that the circuits connected to the protector do not exceed the current rating of the protector.

(b) If the trouble is not in the Telephone Company side, check the type, amount, and polarity of the CP voltage present on the leads provided for customer termination at the protector; this voltage should meet the specifications shown in Fig. 4.



Do not attempt any tests or repairs to the CP equipment.

5.05 When detailed maintenance information is required, refer to the following:

44V4A Repeater

- CD- and SD-97047-01
- Section 179-100-303
- Section AB24.100.01
- Section 332-106-101.

359-Type Equalizer

- Sections 332-116-101 through 332-116-113.

227-Type Amplifier

- Section 024-140-101.

6. CONNECTIONS

6.01 For connecting information refer to Fig. 2, 4, and 5.

7. F58122 AUTOMATIC GAIN CONTROL AMPLIFIER

7.01 ***Physical and Electrical Characteristics***

(a) The F58122 AGC amplifier is identical in size and connections to the 227-type amplifier used in the 44V4A repeater shelf. It is used to limit the inband signal power in the transmitting leg from CP facilities to Bell System facilities.

(b) The gain of the F58122 AGC amplifier is continuously adjustable from −10 dB to +25 dB. The ability to insert loss is necessary when interfacing with a +7 transmission level point (TLP) transmit leg from CP facilities. The clamped output power of the amplifier is adjustable from −20 dBm to 0 dBm.

(c) The F58122 amplifier is normally adjusted to clamp at a power level 13 dB below the TLP. When the output side of the amplifier is at the 0 TLP, the minimum protection criteria permits an inband 3-second average output power of −13 dBm. If the input signal to the amplifier should be increased to a level that produces an instantaneous signal greater than −7 dBm at the output of the amplifier, the AGC action of the amplifier changes the output to −7 dBm after 20 milliseconds and then to −13 dBm after a time interval varying from 300 to 500 milliseconds. When the input level to the amplifier is such that the output level of the amplifier is between −7 and −13 dBm, the AGC action of the amplifier changes the output level to −13 dBm after a time interval varying from 0.3 to 3 seconds.

7.02 ***Adjustments:*** Gain adjustments are made by means of the LEV ADJ control (R3) and switch S1 (see Fig. 6). The combined setting of these two controls provides a range of −10 to +25 dB gain. The setting of the AGC ADJ control (R20) determines the points at which clamping of the amplifier output begins. The range of the AGC ADJ control is from 0 to −20 dBm. Before making adjustments, refer to the circuit order card to determine the TLP at the input and output of the amplifier. With an input signal 10 dB below the input TLP of the amplifier, the amplifier gain must be adjusted (using LEV ADJ and S1 as required) to provide an output level which is 10 dB below the output TLP of the amplifier. The AGC ADJ control must then be adjusted to reduce the output of the amplifier by 3 dB (13 dB below output TLP). The following example shows the method of adjusting F58122 AGC amplifier for a typical input and output TLP.

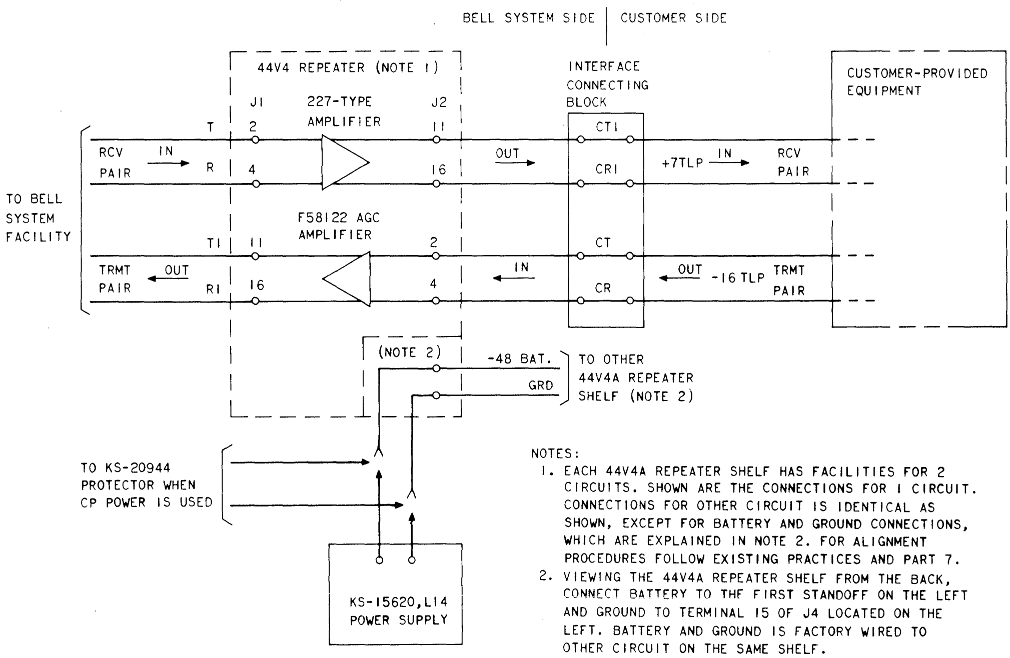


Fig. 2—Connections—Voice Connecting Arrangement C234W

Example:

(a) Assume that the circuit order card shows an input TLP of −4 and an output TLP of +4.

(b) Set switch S1 to the counterclockwise position (when more than 10 dB of gain is required set S1 to clockwise position) and LEV ADJ control (R3) to the +8 position; set the AGC ADJ control (R20) fully clockwise to the 0 dBm position. This provides an amplifier gain of +8 dB, the amount of gain required to raise the TLP from −4 to +4.

(c) Adjust the oscillator test level of a 21A transmission measuring set (TMS), or equivalent, to −14 dBm at 1000 Hz (10 dB below input TLP).

(d) Connect the OSC jack of the 21A TMS to the amplifier input (AMPL IN jack on the 44V4A repeater associated with the AGC amplifier). Connect the DET jack of the 21A TMS to the amplifier output (AMPL OUT jack on the 44V4A repeater associated with the AGC amplifier).

(e) Adjust the LEV ADJ control on the AGC amplifier for a detector reading of −6 dBm on the 21A TMS (10 dB below output TLP).

(f) ***Slowly adjust*** the AGC ADJ control on the AGC amplifier in a counterclockwise direction until a detector reading of −9 dBm is obtained on the 21A TMS (13 dB below output TLP). Because of long time constants, this adjustment must be made by turning the AGC ADJ ***slowly*** while noting the change in the detector reading.

(g) The amplifier is now adjusted to clamp the output power to a level 13 dB below the TLP (−9 dBm at +4 TLP).

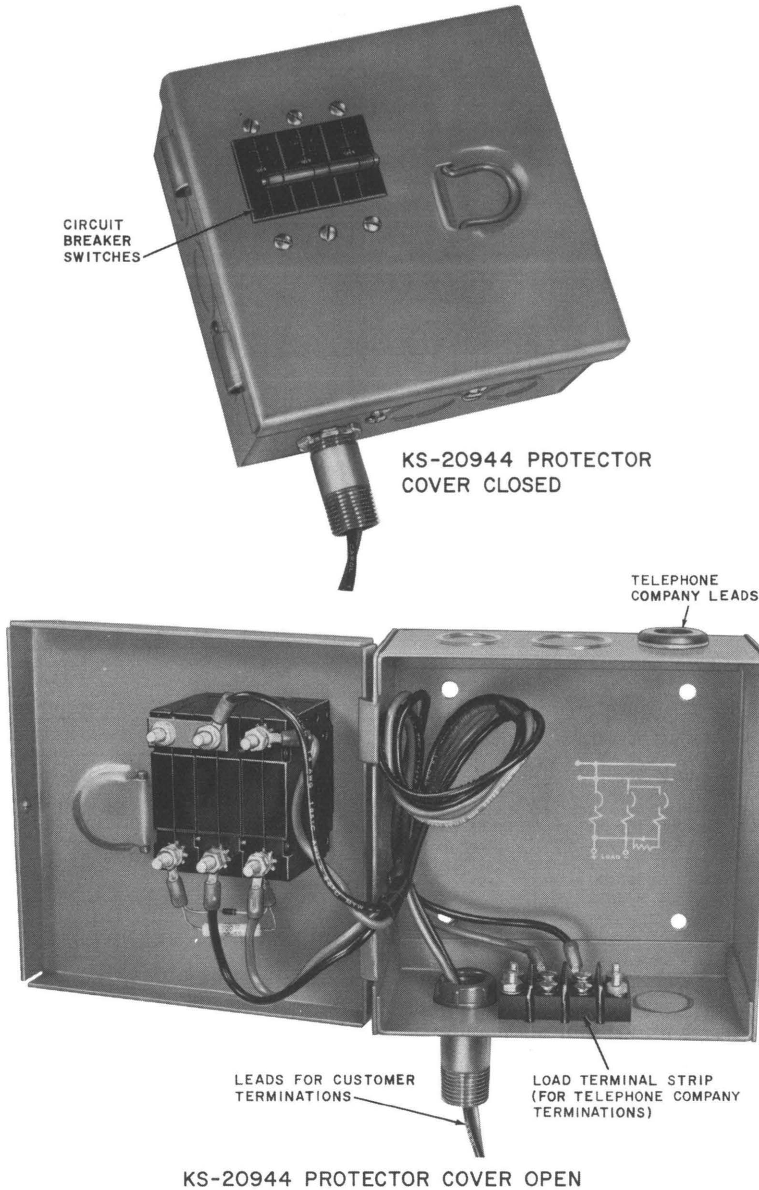


Fig. 3—▶KS-20944 Protector◀

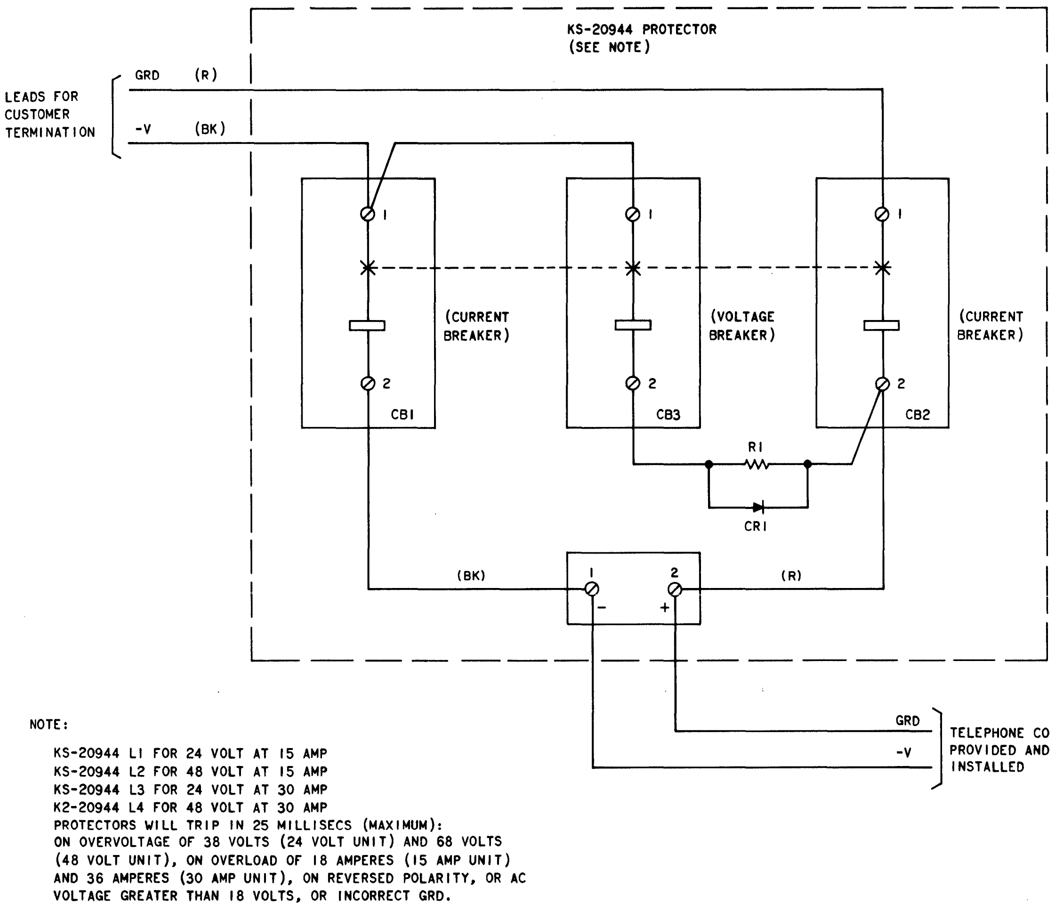


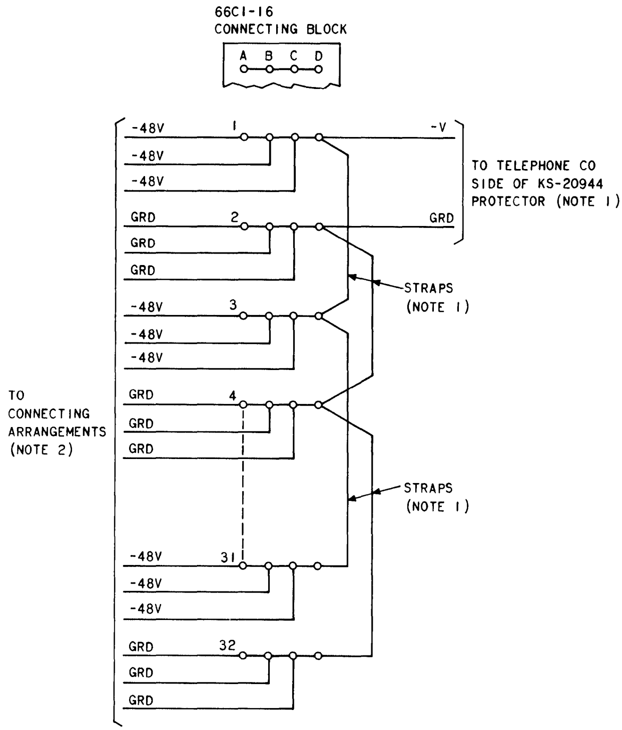
Fig. 4—♦Schematic—KS-20944 Protector♦

(h) Reduce the oscillator test level of the 21A TMS by 5 dB (15 dB below input TLP); the detector reading should drop by 2 dB (15 dB below output TLP). This checks the limiting action of the amplifier.

(i) Disconnect the 21A TMS from the 44V4A repeater.

(j) Use the preceding method and refer to Fig. 6 to adjust the AGC amplifier for other TLPS.

The AGC action of the amplifier will make it impossible to measure the overall loss of the circuit using test levels that exceed 13 dB below the TLP. It is suggested that loss



NOTES:

1. USE 14-GAUGE WIRE TO CONNECT FROM KS-20944 PROTECTOR TO CONNECTING BLOCK; PROVIDE MULTIPLE STRAPS AS DETERMINED BY NUMBER OF CONNECTING ARRANGEMENTS TO BE CONNECTED TO. USE SOLDER TO MAKE THE CONNECTION OF THE 14-GAUGE WIRE AND STRAPS TO THE CONNECTING BLOCK.
2. USE "D" INSIDE WIRE OR EQUIVALENT TO MAKE CONNECTIONS FROM CONNECTING BLOCK TO CONNECTING ARRANGEMENTS. EACH CONNECTING BLOCK PROVIDES MEANS FOR CONNECTING TO 48 CIRCUITS, HOWEVER, DO NOT EXCEED THE MAXIMUM CURRENT RATING OF THE KS-20944 PROTECTOR.

Fig. 5—♦Typical Power Distribution Connections Between KS-20944 Protector and Connecting Arrangements♦

measurements from the customer equipment to another location be conducted at a test level of 13 dB below TLP. To minimize the possibility of a misunderstanding, it is imperative that each individual involved with testing the circuit understands that a reduced test level is being used. Some testboards and VF patch bays are not equipped to send reduced test levels. Higher test levels may be used to test those portions or directions of the circuit in which an AGC amplifier (F58122) is not used.

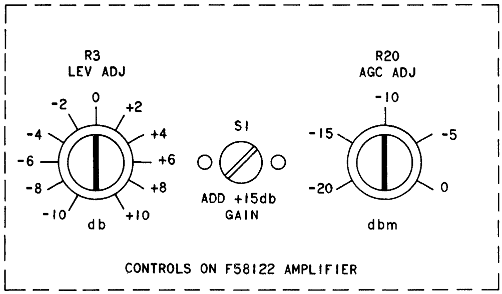


Fig. 6—Adjustment Controls on F58122 Automatic Gain Control Amplifier

VOICE CONNECTING ARRANGEMENT C232W

1. GENERAL

1.001 This addendum supplements Section 463-360-103, Issue 2.

1.002 This addendum is issued to change reference to a section in Part 2 and Part 5.

1.003 The following change applies to Part 2:

(a) In Part 2, under ORDERING GUIDE, in the note associated with J98615BJ, List 2, 24V4C Terminal Repeater Shelf or J98615BA, List 1, 24V4B Terminal Repeater Mounting Unit, change the reference to Section AB24.100.01 to read Section 852-307-101.

1.004 The following change applies to Part 5:

(a) In Part 5.07, under the heading ***24V4C Repeater,*** change the reference to Section AB24.100.01 to read Section 852-307-101.

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VOICE CONNECTING ARRANGEMENT C232W

1. GENERAL

1.01 This section provides identification, installation, operation, maintenance, and connecting information for Voice Connecting Arrangement C232W. The equipment used to implement Voice Connecting Arrangement C232W is determined by the requirements of the specific installation (see Table A and Part 2, ORDERING GUIDE and DESIGN FEATURES). This arrangement provides a 2-wire voiceband only connection, without signaling, between customer-provided (CP) equipment and Bell System 2-wire or 4-wire facilities. This arrangement does not provide dc continuity between the CP equipment and the Bell System facility, and does not pass 20-Hz ringing. The customer is expected to provide inband signaling when using this connecting arrangement.

1.02 This section is reissued to include information on the KS-20944 protector, to add Fig. 6, 7, and 8, and to change Fig. 4 and 5.

1.03 This issue of the section is based on the following drawings:

SD-1E207-01, Issue 1

SD-69613-01, Issue 2B

If this section is to be used with equipment or apparatus reflecting later issue(s) of the drawing(s), reference should be made to the SDs and CDs to determine the extent of the changes and the manner in which the section may be affected.

1.04 If the customer wants a copy of the Technical Reference which covers this interface specification, the customer should contact the local Telephone Company Business Office or the Marketing Representative.

2. IDENTIFICATION

PURPOSE

- To provide a voiceband only connection between CP 2-wire equipment and Bell System 2-wire or 4-wire facilities
- To provide longitudinal isolation
- To limit excessive levels from CP equipment and to provide protection for personnel against hazardous voltages.

TABLE A

BELL SYSTEM FACILITY	EQUIPMENT REQUIRED	NO. OF CKTS. PER UNIT	TYPE OF MOUNTING
2-Wire	31B-49 Voice Coupler	1	Backboard or Flat Surface
	J53050D,L1 Interconn. Unit	4	23-Inch Relay Rack
	Protected Repeat Coil (Locally Engineered)	1	Locally Engineered
4-Wire	J98615BA, L1 Repeater Unit	1	16C or 31A App. Mtg.
	J98615BJ,L2 Repeater Shelf		23-Inch Relay Rack

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ORDERING GUIDE

- J53050D, List 1 Interconnecting Unit, for use with 2-wire facilities—each unit provides four voice coupler circuits.

- Coupler, Voice, 31B-49, (Fig. 1) for use with 2-wire facilities—provides one voice coupler circuit per unit.

Note: A protected repeat coil (Fig. 2) may be used with 2-wire facilities if local requirements permit. Local engineering must specify repeat coil to be used and provide values and details for modification.

- J98615BJ, List 2, 24V4C Terminal Repeater Shelf or J98615BA, List 1, 24V4B Terminal Repeater Mounting Unit, for use with 4-wire facilities. Each unit provides one voice coupler circuit (the transmission characteristics of the J98615BJ, List 2 and the J98615BA, List 1 are identical; mounting requirements determine which repeater should be used).

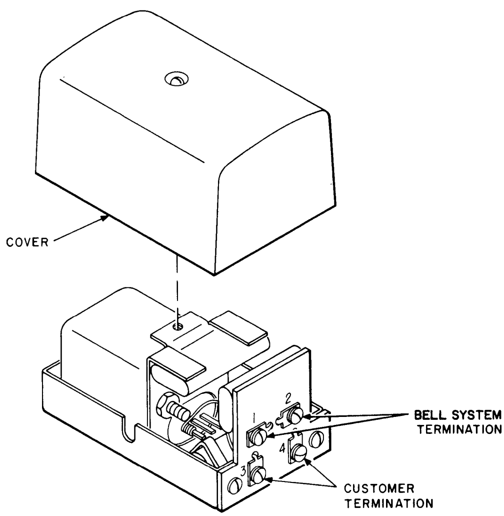


Fig. 1—31B Voice Coupler

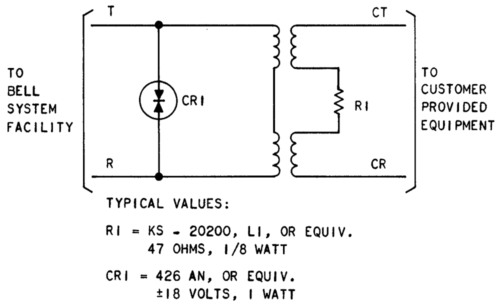


Fig. 2—Typical Protected Repeat Coil-Locally Engineered

Note: For plug-in components refer to Section AB24.100.01; when automatic control of signal power level is required, order F58122 automatic gain control (AGC) amplifier for use in the ***transmitting leg from the CP equipment to Bell System facilities*** instead of the standard 227-type amplifier shown in Section AB24.100.01 (Fig. 5).

Associated Apparatus (Order Separately)

- KS-15620, List 14 Rectifier or equivalent (to provide −48 volts to 24V4 repeaters when required).

Note: This rectifier meets acceptable noise requirements as explained under Power Supplies in Section 332-104-102. Other rectifiers may be used when specified by local engineering.

- ED-90273-70, Group 33 Adapter (two required) for mounting 19-inch rectifier on relay rack.

- KS-14532 Power Cord

  List 1—10 ft.

  List 2—2 ft.

  List 3—15 ft.

  List 4—20 ft.

  List 5—25 ft.

- Cable, Wiring, "D" inside, or equivalent (for cabling from connecting arrangement to interface connecting block).

- Block, Connecting, 66M1-50 (Fig. 3).

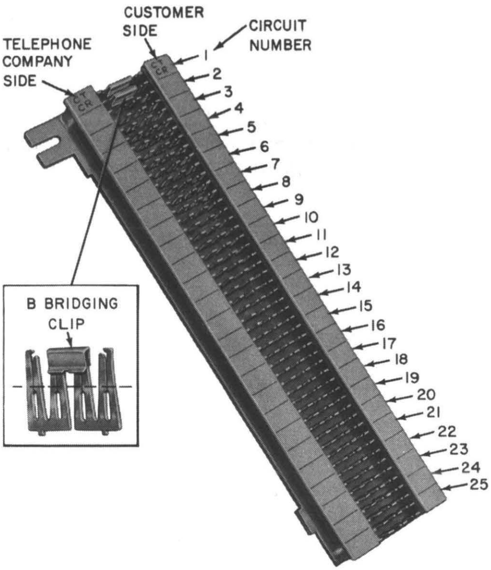


Fig. 3—Typical Interface Connecting Block

Note: Other types of blocks may be used when specified by local engineering.

- Clip, Bridging, B (25 per pkg).

- ➧KS-20944, List 2 Protector (Optional—***must*** be provided when CP power supply is used)—see Fig. 6 and 7.

- Block, Connecting, 66C1-16 or equivalent (for providing distribution of power when KS-20944 protector is used between CP power supply and ***more than one*** connecting arrangement of any type—see Fig. 8).

Note: The cumulative current drain of the connecting arrangements connected to a KS-20944 protector must not exceed the maximum current rating of the protector. For instance, if the maximum current drain for one connecting arrangement is 1.0 ampere and the maximum current rating of a KS-20944, List 2 protector is 15 amperes, no ***more*** than 15 connecting arrangements may be connected to the protector (this example is for illustrative purposes only).

- Wire, AM, 14 gauge, paired, red and black, P-384614 or equivalent (for cabling from the KS-20944 protector to the 66C1-16 connecting block—see Fig. 8).➧

Replaceable Components

- Plug in components of 24V4 repeater.

DESIGN FEATURES

J53050D, List 1 Interconnecting Unit

- Mounts on standard 23-inch relay rack.

- Four circuits per unit on 2-inch by 23-inch mounting plate.

- Each circuit provides a 2-wire voiceband transmission path (voice coupler) to and from the CP equipment.

- Provides impedance match of either 600 ohms to 600 ohms (option Z) or 900 ohms to 600 ohms (option Y).

- Provides transformer isolation and hazardous voltage protection between CP equipment and Bell System facilities.

31B Voice Coupler

- Approximate dimensions 4 inches long by 2-3/4 inches wide by 2 inches high.

- Mounts on backboard or any flat surface.

- Each unit provides one 2-wire voiceband transmission path to and from the CP equipment.

- Connects directly to CP equipment without use of interface connecting block (Fig. 4).

- Provides 1:1 impedance match.

- Provides transformer isolation and hazardous voltage protection between CP equipment and Bell System facilities.

24V4C Repeater Shelf

- Mounts on standard 23-inch relay rack on 1-3/4 inch centers.
- One repeater circuit per shelf.
- Each circuit provides a 2-wire to 4-wire voiceband transmission path (voice coupler) from the CP equipment to Bell System facilities and a 4-wire to 2-wire voiceband transmission path from Bell System facilities to the CP equipment.
- Provides transformer isolation and hazardous voltage protection between CP equipment and Bell System facilities.
- Limits the inband signal power applied to Bell System facilities when equipped with F58122 AGC amplifier.

24V4B Repeater Unit

- Mounts in key unit apparatus mountings such as the 16C or 31A.
- One repeater circuit per unit.
- Each circuit provides a 2-wire to 4-wire voiceband transmission path (voice coupler) from the CP equipment to Bell System facilities and a 4-wire to 2-wire voiceband transmission path from Bell System facilities to the CP equipment.
- Provides transformer isolation and hazardous voltage protection between CP equipment and Bell System facilities.
- Limits the inband signal power applied to Bell System facilities when equipped with F58122 AGC amplifier.

➧*KS-20944, List 2 Protector (Fig. 6 and 7)*

- Components are mounted in a 5-1/2 by 4-1/2 by 3-1/2 inch box with hinged cover, designed to mount on a wall or any flat surface.
- Provides screw terminals inside of box for connection to Bell System equipment.
- Provides two external 14-gauge color-coded leads for connection to CP power source ([R] GRD, [BK] −V).
- Provides current and voltage limiting between Bell System equipment and CP power source.
- Protector circuit breakers trip in 25 milliseconds on overvoltage, current overload, reversed voltage polarity, improper grounding, or ac voltage from CP power source as follows:

  (a) Overvoltage of 68 volts dc

  (b) Current overload of 18 amperes

  (c) Reversed dc polarity

  (d) Improper ground

  (e) AC voltage greater than 18 volts.

- Protector circuit breaker switch provides a means for removing CP power from Bell System interconnecting equipment.

Caution: The circuit breaker switch removes voltage from the load (Bell System) side of the protector only; voltage will still be present on terminals and components inside the protector box.

- Provides hazardous voltage protection between CP power source and Bell System equipment.➧

3. INSTALLATION

3.01 Locate the voice connecting arrangements in an area free of dampness and excessive dust or dirt, with adequate room for access to front and rear of equipment and connecting blocks. The 24V4C and the J53050D typically mount on a 23-inch relay rack, the 24V4B mounts in a key unit apparatus mounting, and the 31B voice coupler mounts on a backboard or any flat surface.

3.02 Use "D" inside wiring cable or equivalent to terminate the leads associated with the CP equipment on the interface connecting block.

Stencil trunk number and lead designations on interface connecting block designation strip (Fig. 3). When 31B voice couplers are used, make connections directly to the screw terminals on the coupler (Fig. 1).

3.03 When required, the customer must provide a 117V 60-Hz power outlet within power cord length of the customer-designated mounting location of the connecting arrangement (see ORDERING GUIDE for cord lengths).

3.04 The power outlet supplying connecting arrangement(s) must not be under control of a switch and should be on a separately fused power circuit to prevent accidental loss of ac line voltage. Where local instructions permit, secure the power cord to the outlet with a power cord plug retainer assembly.

3.05 Refer to the appropriate section in Division 167 for proper grounding of power plants.

➧KS-20944 PROTECTOR

3.06 When CP power source is used to power the connecting arrangement, a KS-20944 protector must be provided between the CP power source and the connecting arrangement. Mount the KS-20944 protector on a wall or suitable flat surface near the interface connecting block. Use the AM-type, 14-gauge wire or equivalent to make connections from the protector to the 66C1-16 connecting block. Terminate one end of the wiring to the screw terminals (term. − and +) of the load terminal strip provided on the protector (see Fig. 7). Solder the other end of the wiring to terminals in column D of the connecting block as shown in Fig. 8; using the 14-gauge wire, solder the multiple straps to the terminals in column D of the connecting block as shown in Fig. 8, depending on the number of connecting arrangements provided. Use "D" inside wire cable or equivalent to make connections from the quick-connect terminals in columns A, B, and C of the connecting block to the battery and ground terminals on the connecting arrangements.➧

4. OPERATION

4.01 ***Incoming Call:***

(a) When 2-wire facilities are used, the J53050D interconnecing unit (voice coupler circuit), the 31B voice coupler, or the locally modified repeat coil provides a 2-wire transmission path from Bell System facilities to the CP equipment.

(b) When 4-wire facilities are used, the 24V4C repeater or the 24V4B repeater provides a 4-wire to 2-wire transmission path from Bell System facilities to the CP equipment.

4.02 ***Outgoing Call:***

(a) When 2-wire facilities are used, the J53050D interconnecting unit (voice coupler circuit), the 31B voice coupler, or the locally modified repeat coil provides a 2-wire transmission path from the CP equipment to Bell System facilities.

(b) When 4-wire facilities are used, the 24V4C repeater or the 24V4B repeater provides a 2-wire to 4-wire transmission path from the CP equipment to Bell System facilities.

5. MAINTENANCE

5.01 When there is an indication of trouble in the connecting arrangement(s), the circuit at fault must be opened at the interface connecting block to verify in which direction the trouble exists. The circuit can be opened at the connecting block by removing the B bridging clip associated with each lead.

5.02 Precautions should be taken when performing tests to avoid adversely affecting service to the customer. Local instructions should be followed with reference to notifying the customer before performing the tests.

5.03 ***Tests—J53050D List 1 Interconnecting Unit:*** Perform normal circuit order transmission tests. The insertion loss of the interconnecting unit is a nominal 1 dB at 1000 Hz.

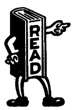
5.04 ***Tests—31B Voice Coupler:*** Perform normal circuit order transmission tests. The insertion loss of the voice coupler is a nominal 0.6 dB at 1000 Hz.

5.05 For maintenance and tests on the 24V4B repeater or the 24V4C repeater, refer to existing practices. Alignment procedures for the F58122 AGC amplifier, when used with the 24V4 repeater, are described in Part 7.

5.06 ▶*Tests—KS-20944 Protector (Fig. 6 and 7):* If circuit breaker switches are tripped (in the *off* position) return them to the *on* position; if circuit breaker switches cannot be operated to the *on* position, perform tests as follows:

(a) Disconnect Telephone Company provided wiring from terminals 1 and 2 (− and +) of the load terminal strip on the protector under test. If the circuit breaker switches remain in the *on* position when operated, the trouble is in the Telephone Company provided equipment. Check for proper polarity of the Telephone Company provided leads at terminals 1 and 2 (− and +) of the load terminal strip on the protector; ascertain that the circuits connected to the protector do not exceed the current rating of the protector.

(b) If the trouble is not in the Telephone Company side, check the type, amount, and polarity of the CP voltage present on the leads provided for customer termination at the protector; this voltage should meet the specifications shown in Fig. 7.◀



Do not attempt any tests or repairs to the CP equipment.

5.07 When detailed maintenance information is required, refer to the following:

24V4C Repeater

CD- and SD-97047-01

Section 179-100-303

Section AB 24.100.01

Section 332-105-103.

24V4B Repeater

CD- and SD-99739-01

Section 179-100-303

Section AB 24.100.01

Section 332-105-102.

359-Type Equalizer

Sections 332-116-101 through 332-116-113.

227-Type Amplifier

Section 024-140-101.

6. CONNECTIONS

6.01 For connecting information refer to Fig. 4, 5, 7, and 8.

7. F58122 AUTOMATIC GAIN CONTROL AMPLIFIER

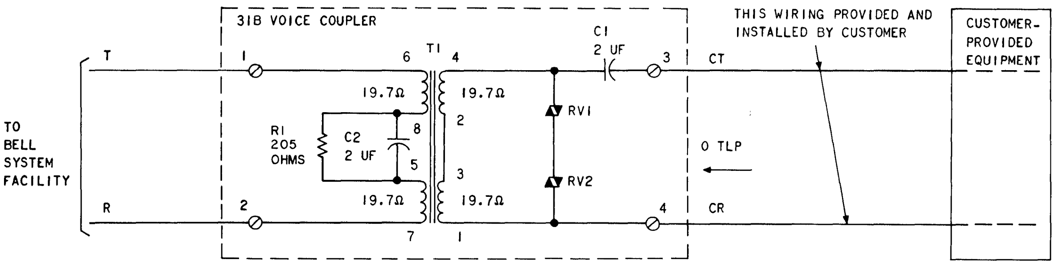
7.01 ***Physical and Electrical Characteristics:***

(a) The F58122 AGC amplifier is identical in size and connections to the 227-type amplifier used in the 24V4 repeater. It is used to limit the inband signal power in the transmitting leg from CP facilities to Bell System facilities.

(b) The gain of the F58122 AGC amplifier is continuously adjustable from −10 dB to +25 dB. The ability to insert loss is necessary when interfacing with a +7 transmission level point (TLP) transmit leg from CP facilities. The clamped output power of the amplifier is adjustable from −20 dBm to 0 dBm.

(c) The F58122 amplifier is normally adjusted to clamp at a power level 13 dB below the TLP. When the output side of the amplifier is at the 0 TLP, the minimum protection criteria permits an inband 3-second average output power of −13 dBm. If the input signal to the amplifier should be increased to a level that produces an instantaneous signal greater than −7 dBm at the output of the amplifier, the AGC action of the amplifier changes the output to −7 dBm after 20 milliseconds and then to −13 dBm after a time interval varying from 300 to 500 milliseconds. When the input level to the amplifier is such that the output level of the amplifier is between −7 and −13 dBm, the AGC action of the amplifier changes the output level to −13 dBm after a time interval varying from 0.3 to 3 seconds.

7.02 ***Adjustments:*** Gain adjustments are made by means of the LEV ADJ control (R3) and switches S1 (Fig. 9). The combined setting of these two controls provides a range of −10 to +25 dB



A. TYPICAL VOICE CONNECTING ARRANGEMENT C232W USING 31B VOICE COUPLER

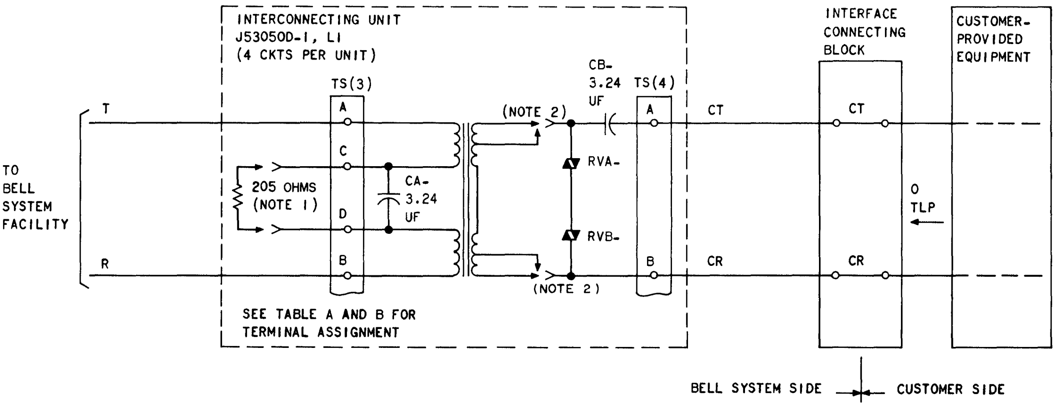


TABLE A

CKT NO.	TERMINALS ON J53050D, L1					
	TS(3)				TS(4)	
	A	B	C	D	A	B
1	11	14	13	12	14	16
2	15	18	17	16	24	26
3	21	24	23	22	34	36
4	25	28	27	26	44	46

TABLE B

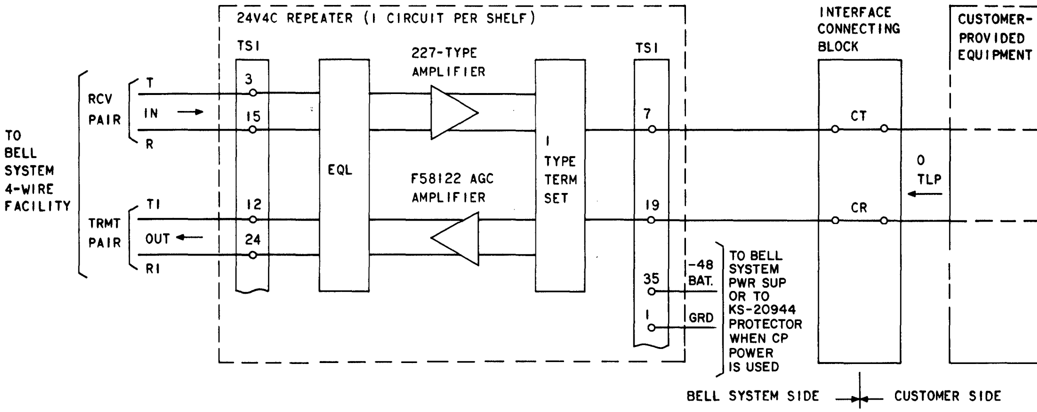
CKT. NO.	STRAPS ON J53050D, L1 TS(4) - (NOTE 2)			
	OPTION Y		OPTION Z	
	FROM	TO	FROM	TO
1	17	16	15	16
	11	12	13	12
2	27	26	25	26
	21	22	23	22
3	37	36	35	36
	31	32	33	32
4	47	46	45	46
	41	42	43	42

NOTES:

1. PROVIDE RESISTORS ON TS(3) AS SHOWN, KS-20289,L2A, OR EQUIV, IF REQUIRED FOR CIRCUIT CONTINUITY. SEE TABLE A FOR TERMINAL NUMBER ASSIGNMENT.
2. WHEN CP EQUIPMENT TO BELL SYSTEM IMPEDANCE IS 600 OHMS TO 600 OHMS PROVIDE STRAPS ON TS(4) FOR OPTION Z; WHEN CP EQUIPMENT IMPEDANCE IS 600 OHMS AND BELL SYSTEM IMPEDANCE IS 900 OHMS, PROVIDE STRAPS ON TS(4) FOR OPTION Y (SEE TABLE B).

B. TYPICAL VOICE CONNECTING ARRANGEMENT C232W USING J53050D, L1 INTERCONNECTING UNIT

Fig. 4—Connections-Voice Connecting Arrangement C232W, 2-Wire Facility



A. TYPICAL VOICE CONNECTING ARRANGEMENT C232W USING 24V4C REPEATER SHELF

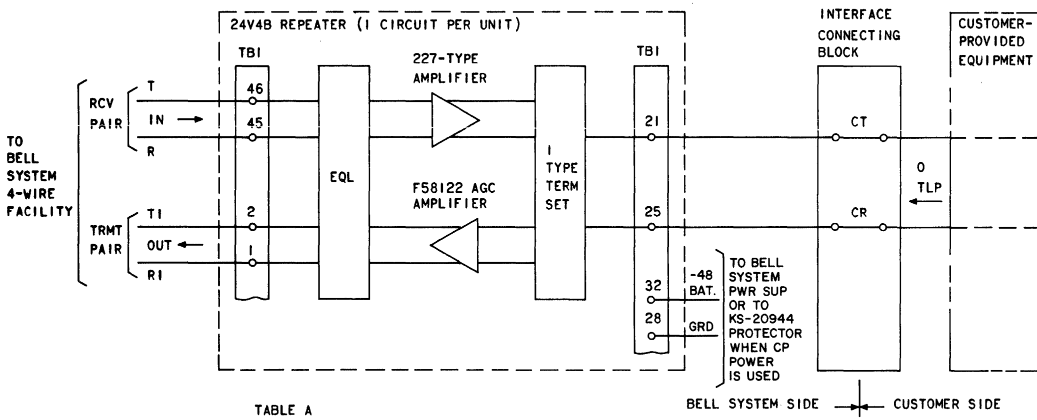


TABLE A

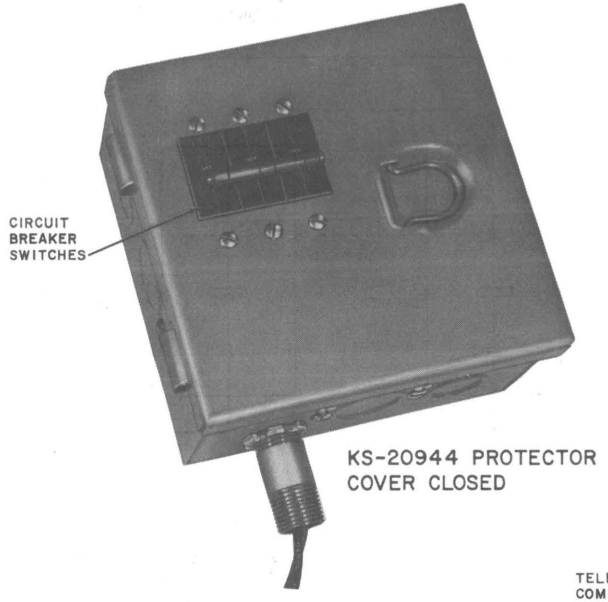
ON TB1-STRAP	
FROM	TO
3	4
7	8
14	15
18	19
35	36
43	44
47	48

NOTE:

WHEN 24V4B REPEATER IS USED PROVIDE STRAPS AS SHOWN IN TABLE A.

B. TYPICAL VOICE CONNECTING ARRANGEMENT C232W-USING 24V4B REPEATER UNIT

Fig. 5—Connections-Voice Connecting Arrangement C232W, 4-Wire Facility



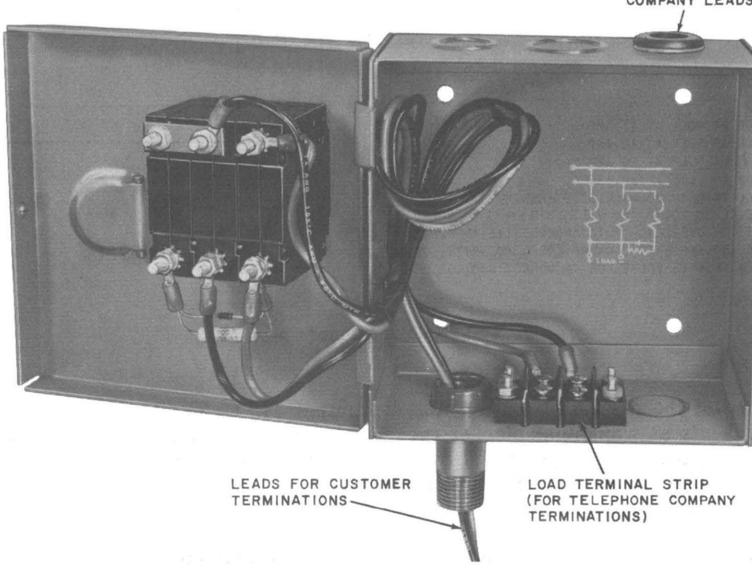
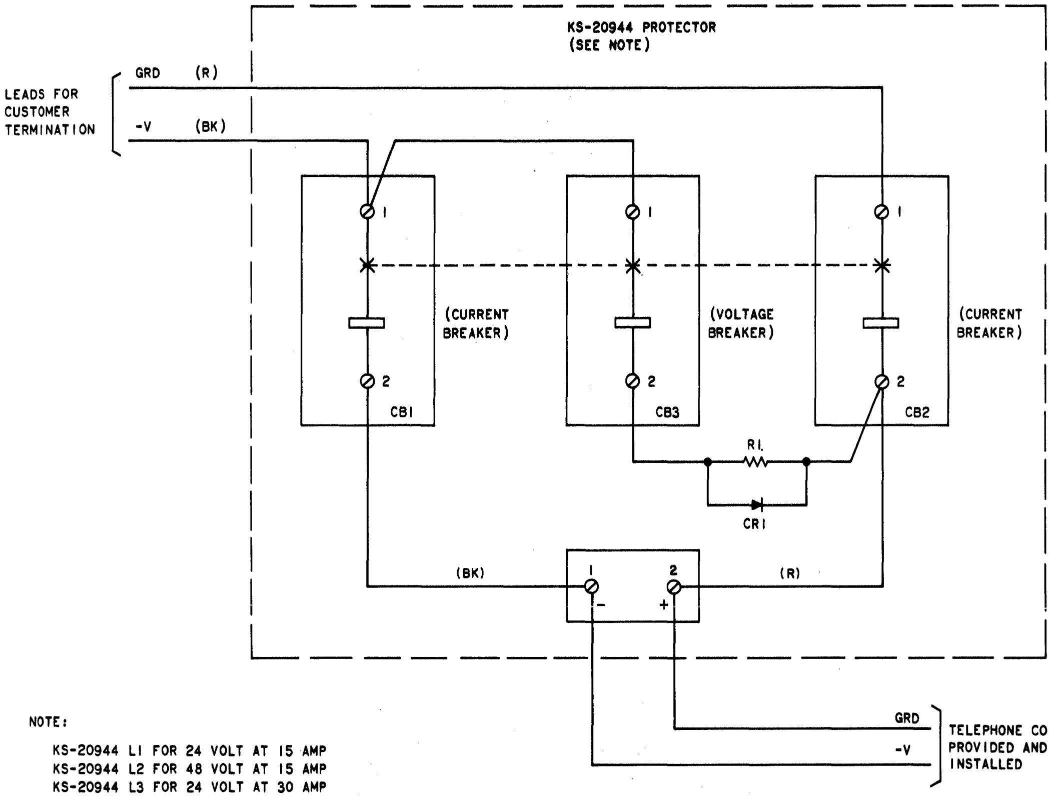


Fig. 6—▸KS-20944 Protector◂



NOTE:

KS-20944 L1 FOR 24 VOLT AT 15 AMP
KS-20944 L2 FOR 48 VOLT AT 15 AMP
KS-20944 L3 FOR 24 VOLT AT 30 AMP
K2-20944 L4 FOR 48 VOLT AT 30 AMP
PROTECTORS WILL TRIP IN 25 MILLISECS (MAXIMUM):
ON OVERVOLTAGE OF 38 VOLTS (24 VOLT UNIT) AND 68 VOLTS (48 VOLT UNIT), ON OVERLOAD OF 18 AMPERES (15 AMP UNIT) AND 36 AMPERES (30 AMP UNIT), ON REVERSED POLARITY, OR AC VOLTAGE GREATER THAN 18 VOLTS, OR INCORRECT GRD.

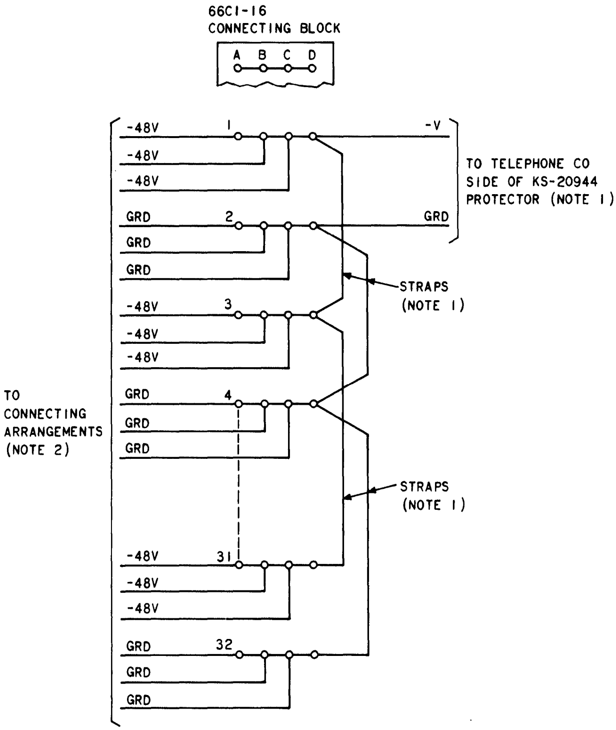
Fig. 7—♦Schematic—KS-20944 Protector♦

gain. The setting of the AGC ADJ control (R20) determines the points at which clamping of the amplifier output begins. The range of the AGC ADJ control is from 0 to −20 dBm. Before making adjustments, refer to the circuit order card to determine the TLP at the input and output of the amplifier. With an input signal 10 dB below the input TLP of the amplifier, the amplifier gain must be adjusted (using LEV ADJ and S1 as required) to provide an output level which is 10 dB below the output TLP of the amplifier. The AGC ADJ control must then be adjusted to reduce the output of the amplifier by 3 dB (13 dB below output TLP). The following example shows the method of adjusting F58122 AGC amplifier for a typical input and output TLP.

Example:

(a) Assume that the circuit order card shows an input TLP of −4 and an output TLP of +4.

(b) Set switch S1 to the counterclockwise position (when more than 10 dB of gain is required set S1 to clockwise position) and LEV ADJ control



NOTES:

1. USE 14-GAUGE WIRE TO CONNECT FROM KS-20944 PROTECTOR TO CONNECTING BLOCK; PROVIDE MULTIPLE STRAPS AS DETERMINED BY NUMBER OF CONNECTING ARRANGEMENTS TO BE CONNECTED TO. USE SOLDER TO MAKE THE CONNECTION OF THE 14-GAUGE WIRE AND STRAPS TO THE CONNECTING BLOCK.
2. USE "D" INSIDE WIRE OR EQUIVALENT TO MAKE CONNECTIONS FROM CONNECTING BLOCK TO CONNECTING ARRANGEMENTS. EACH CONNECTING BLOCK PROVIDES MEANS FOR CONNECTING TO 48 CIRCUITS, HOWEVER, DO NOT EXCEED THE MAXIMUM CURRENT RATING OF THE KS-20944 PROTECTOR.

Fig. 8—♦Typical Power Distribution Connections Between KS-20944 Protector and Connecting Arrangements♦

(R3) to the +8 position. Set the AGC ADJ control (R20) fully clockwise to the 0 dBm position. This provides an amplifier gain of +8 dB, the amount of gain required to raise the TLP from −4 to +4.

(c) Adjust the oscillator test level of a 21A transmission measuring set (TMS), or equivalent, to −14 dBm at 1000 Hz (10 dB below input TLP).

(d) Connect the OSC jack of the 21A TMS to the amplifier input (AMPL IN jack on the 24V4 repeater associated with the AGC amplifier). Connect the DET jack of the 21A TMS to the amplifier output (AMPL OUT jack on the 24V4 repeater associated with the AGC amplifier).

(e) Adjust the LEV ADJ control on the AGC amplifier for a detector reading of −6 dBm on the 21A TMS (10 dB below output TLP).

(f) ***Slowly adjust*** the AGC ADJ control on the AGC amplifier in a counterclockwise direction until a detector reading of −9 dBm is obtained on the 21A TMS (13 dB below output TLP). Because of long time constants, this adjustment must be made by turning the AGC ADJ ***slowly*** while noting the change in the detector reading.

(g) The amplifier is now adjusted to clamp the output power to a level 13 dB below the TLP (−9 dBm at +4 TLP).

(h) Reduce the oscillator test level of the 21A TMS by 5 dB (15 dB below input TLP); the detector reading should drop by 2 dB (15 dB below output TLP). This checks the limiting action of the amplifier.

(i) Disconnect the 21A TMS from the 24V4 repeater.

(j) Use the preceding method and refer to Fig. 9 to adjust the AGC amplifier for other TLPs.

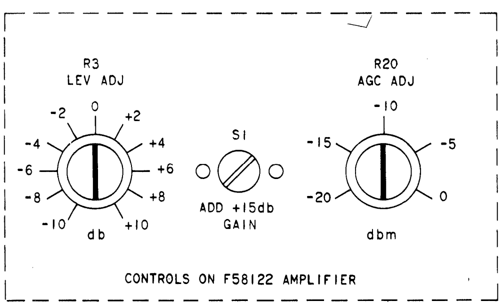
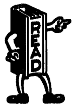


Fig. 9—Adjustment Controls on F58122 Automatic Gain Control Amplifier



The AGC action of the amplifier will make it impossible to measure the overall loss of the circuit using test levels that exceed 13 dB below the TLP. It is suggested that loss measurements from the customer equipment to another location be conducted at a test level of 13 dB below TLP. To minimize the possibility of a misunderstanding, it is imperative that each individual involved with testing the circuit understands that a reduced test level is being used. Some testboards and VF patch bays are not equipped to send reduced test levels. Higher test levels may be used to test those portions or directions of the circuit in which an AGC amplifier (F58122) is not used.

119A INTERCONNECTING UNIT

IDENTIFICATION, INSTALLATION, CONNECTIONS, OPERATION, AND MAINTENANCE

1. GENERAL

1.01 The 119A interconnecting unit (IU), Fig. 1, provides a connection between customer-provided (CP) 2-wire terminal equipment and Bell System 2-wire cable facilities for the transmission of dc supervisory signals and voiceband transmission over the same conductors (tip and ring). When a 4-wire to 4-wire application is required, two 119A IUs must be supplied. The 119A IU will maintain a degree of longitudinal balance of cable facilities at voiceband frequencies regardless of the balance to ground of the CP equipment. The 119A IU also provides for protection of cable facilities against hazardous voltages and current originating in the CP equipment. The circuit will not pass conventional ringing signals, does not provide protection against faulty network control signaling, and does not provide voiceband signal power limiting.

1.02 The 119A IU does not replace the need for station protector blocks. "Sneak" current fuse protection for the 119A IU is required at stations fed by exposed facilities.

1.03 This issue of the section is based on the following drawings:

SD-1G286-01 Issue 1

CD-1G286-01 Issue 1

If this section is to be used with equipment or apparatus reflecting later issue(s) of the drawing(s), reference should be made to the SDs and CDs to determine the extent of the changes and the manner in which the section may be affected.

2. IDENTIFICATION

PURPOSE

- To provide a 2-wire connection between CP terminal equipment and Bell System metallic voice-grade private line facilities
- To provide for the transmission of dc signaling and voice transmission over the same pair of wires
- To maintain longitudinal balance at voice frequencies
- To provide protection for Telephone Company personnel and equipment against hazardous voltages and currents.

ORDERING GUIDE

- Unit, Interconnecting, 119A (one IU required per CP terminal equipment—two units are required for 4-wire applications).

Associated Apparatus (order separately)

- Wire, Inside D, or equivalent (for connecting the T and R leads from the 119A IU to the Telephone Company 2-wire cable facility)
- Wire, Ground, No. 14 (for connecting the ground terminal of the 119A IU to an approved grounding electrode).

Replaceable Components

- Fuse, Type AGC, 175MA (3AG), Bussman, or Fuse, Type 312.175 (3AG), Littelfuse

The resistance and operate time of these fuses are vital to the proper operation of the circuit—do not substitute a different type.

- Pack, Circuit, FT6
- Pan, Base, 840804926
- Cover, 840129365
- Cover, Front, 840127948.

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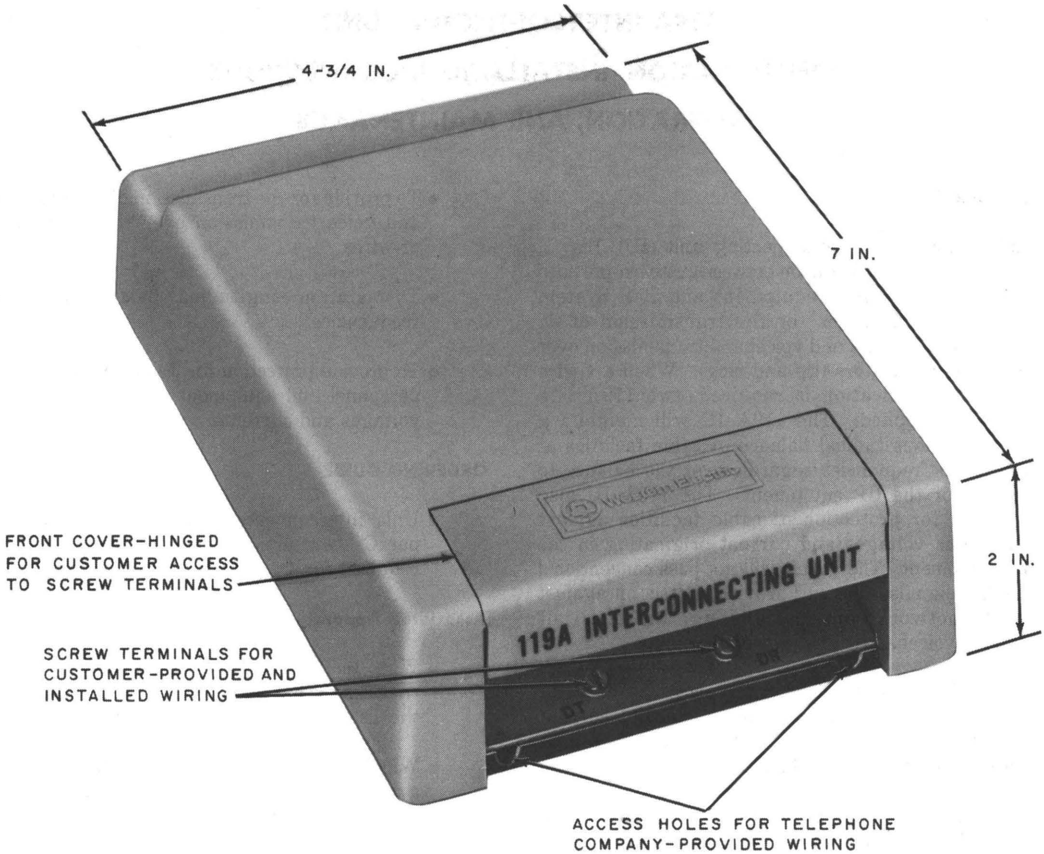


Fig. 1—119A Interconnecting Unit

DESIGN FEATURES

119A Interconnecting Unit

- Consists of an ***FT6 circuit pack*** mounted on an ***840804926 base pan,*** enclosed by an ***840129365 (light grey) cover.***
- Mounts in any position on a wall or any suitable flat surface.
- Provides one keyhole slot and one screw hole in base pan for mounting unit.
- Size—approximately 4 3/4 by 7 by 2 inches (See Fig. 1.)
- Weight—approximately 2.2 pounds.
- Passive device—does not require power for operation.
- Provides voice transmission range from approximately 300 to 3000 Hz.
- Maintains dc continuity for low speed signaling such as relay control or push-to-talk operation of intercom systems. Will pass loop signaling

or simplex dc pulses up to about 20 pulses per second between resistive station terminations. For other terminations, such as relays, the pulsing speed will be lower. DX signaling may be used up to about 12 pulses per second.

- Provides arresters to limit surge voltage levels in excess of 230 $\pm$35 volts applied to the IU from the Bell System cable facilities.

- Provides zener diodes and fuses to limit the voltage and current from the CP equipment to 75 $\pm$4 volts peak conductor to ground, 150 $\pm$8 volts peak between conductors and 175 ma per conductor.

- Provides thermal switches which can be manually reset after overload condition has occurred and been removed.

- Maintains dc continuity and permits metallic dc signaling with a maximum current of 150 ma per conductor; permits simplex or duplex signaling with a maximum current of 60 ma in either or both conductors. Maximum working voltage 70V peak conductor to ground or 140V peak between conductors.

- Provides a degree of balance at voiceband frequencies for the 2-wire transmission path regardless of the balance of the CP equipment.

- Provides screw terminals for connection to Bell System 2-wire cable facility and to CP equipment.

- Provides heavy-duty ground screw terminal for connection to an approved grounding electrode.

- Provides hinged front cover for customer access to screw terminals for connection to his equipment.

3. INSTALLATION AND CONNECTIONS

3.01 The location of the 119A IU shall be determined by the following conditions:

- The IU may be mounted in any position on a wall or other smooth flat surface.

- The IU should be located in an area free of dampness and excessive dust or dirt, with adequate room for access to the equipment for maintenance and connections. The ambient temperature of the area should not exceed 140°F.

Note: In general, there is no restriction on the length of the customer interface cord which provides the transmission path between the CP equipment and the IU. The Bell System responsibility terminates at the interface terminals of the IU. The D inside wire between the IU and the telephone line terminal or protector block is restricted only to the presentation of a neat station appearance. The No. 14 ground wire run from the IU should be as short and straight as possible.

3.02 Install the 119A IU as follows.

(1) Remove and discard Fiberglas tape.

(2) Remove the snap-off cover assembly and the FT6 circuit pack.

(3) To install the IU on a wall, position the base pan vertically against the wall with keyhole slot up. The base pan should be positioned so that the customer has unobstructed access to the screw terminals (DT and DR) on the unit which are provided for connection to the CP equipment. Secure the base with two screws (not supplied with unit).

(4) Remove 2 inches of the cable sheath from the D inside wire and cut off the two unused wires as close to the sheath as possible. Route the D inside wire (right side) and the No. 14 station ground wire (left side) through the access holes and strain relief posts on the base pan (see Fig. 1, 3, and 4).

Note: The No. 14 station ground wire must be routed to clear the component leads projecting from the underside of the FT6 circuit pack. Improper routing will result in bowing of the printed circuit board when the FT6 circuit pack is remounted on the base pan.

(5) Feed the ground wire and the D inside wire through the hole provided insuring that the sheath of the D inside wire remains below the

board and only the T, R, and ground wires pass through the hole. Reattach the FT6 circuit pack to the base pan using the four screws provided; ascertain that the circuit board is not bowed by the wiring underneath.

(6) Connect the No. 14 station ground wire to terminal G on the metal heat sink on the FT6 circuit pack (see Fig. 2, 3, and 4). Insure that the ground wire insulation extends above the level of the circuit board. The other end of the No. 14 station ground wire must be connected to an approved grounding electrode. Attach ground warning tag 3013B (not supplied with unit).

(7) Refer to Section 460-100-201 for proper station grounding procedures.

(8) Perform tests shown in 5.04 after installing.

(9) Connect the two leads from the D station wire to terminals T and R on the printed wiring board.

Caution: Do not overtighten screws on the printed wiring board.

(10) When connections have been completed, replace the snap-on cover assembly.

3.03 The installer should instruct the customer to raise only the hinged portion of cover to gain access to interface terminals DT and DR. ***Caution customer that overtightening screw terminals may cause stripping.*** The installer ***will not*** connect the interface leads to the IU and will not provide ground to the customer.

3.04 At locations served by exposed facilities provide "sneak" current protection by mounting 60A fuses on a 123-type station protector supported by a 94A protector mounting. Both units can be

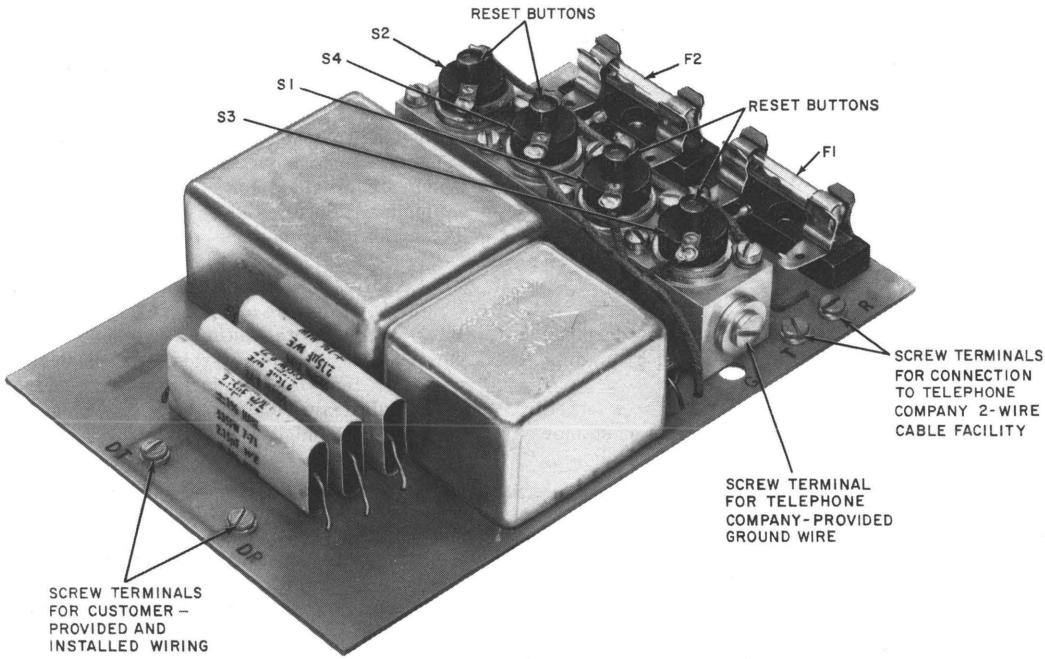


Fig. 2—FT6 Circuit Pack

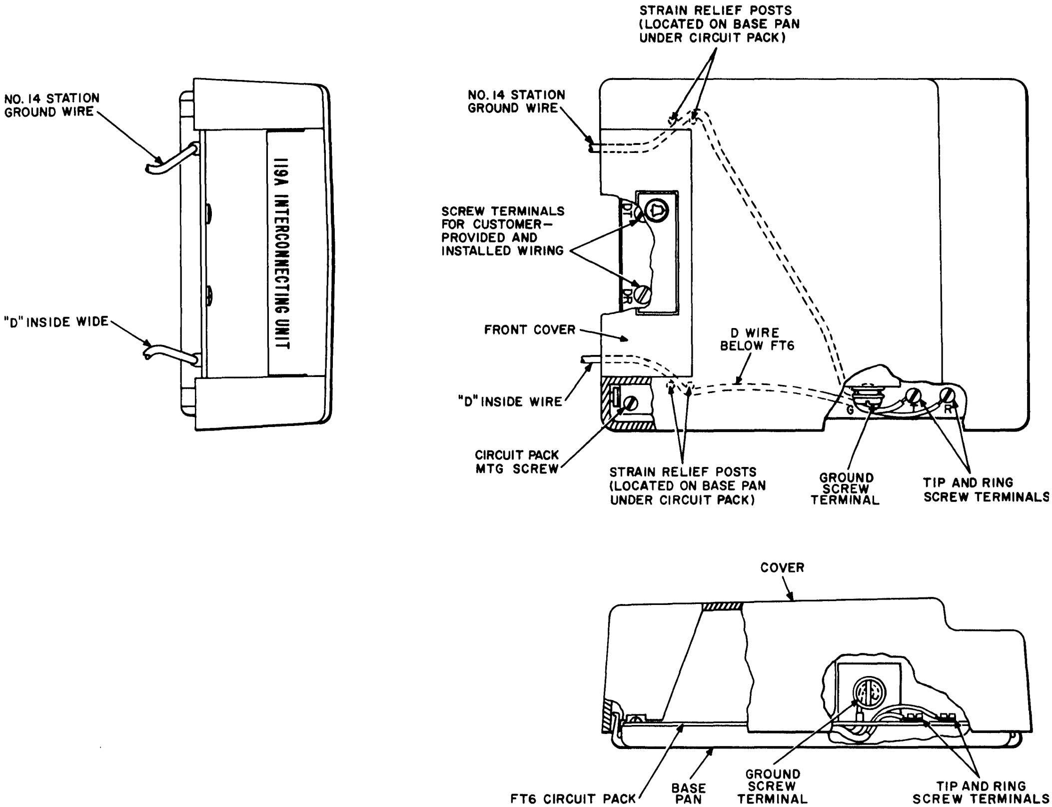


Fig. 3—119A Interconnecting Unit—Pictorial

mounted on a 1094 protector mounting as shown in Section 460-100-400.

4. OPERATION

4.01 ***Voltage and Current Protection:*** Fuses F1 and F2 (see Fig. 5), zener diodes CR1 and CR2, surge arresters E1 and E2, and thermal switches S1, S2, S3, and S4 provide hazardous current and hazardous voltage protection for personnel and equipment.

4.02 Surge arresters (gas tubes) E1 and E2 short the line to ground through the heavy duty ground screw terminal G and the No. 14 station ground wire, when potentials in excess of 230 volts are applied on the cable facility side of the IU. Since a path to ground can be established through the gas tubes (surge arresters) at voltages lower than the breakdown voltage of the regular station protector, "sneak" current protection for the 119A IU is required at locations served by exposed cables.

4.03 Fuses F1 and F2 have a resistance of approximately 10 ± 2 ohms and are rated to operate at 175 ma. When the circuit current, because of improper loading by the customer, exceeds 175 ma, one or both of the fuses will operate. The snap-off cover assembly must be removed to replace the fuses.

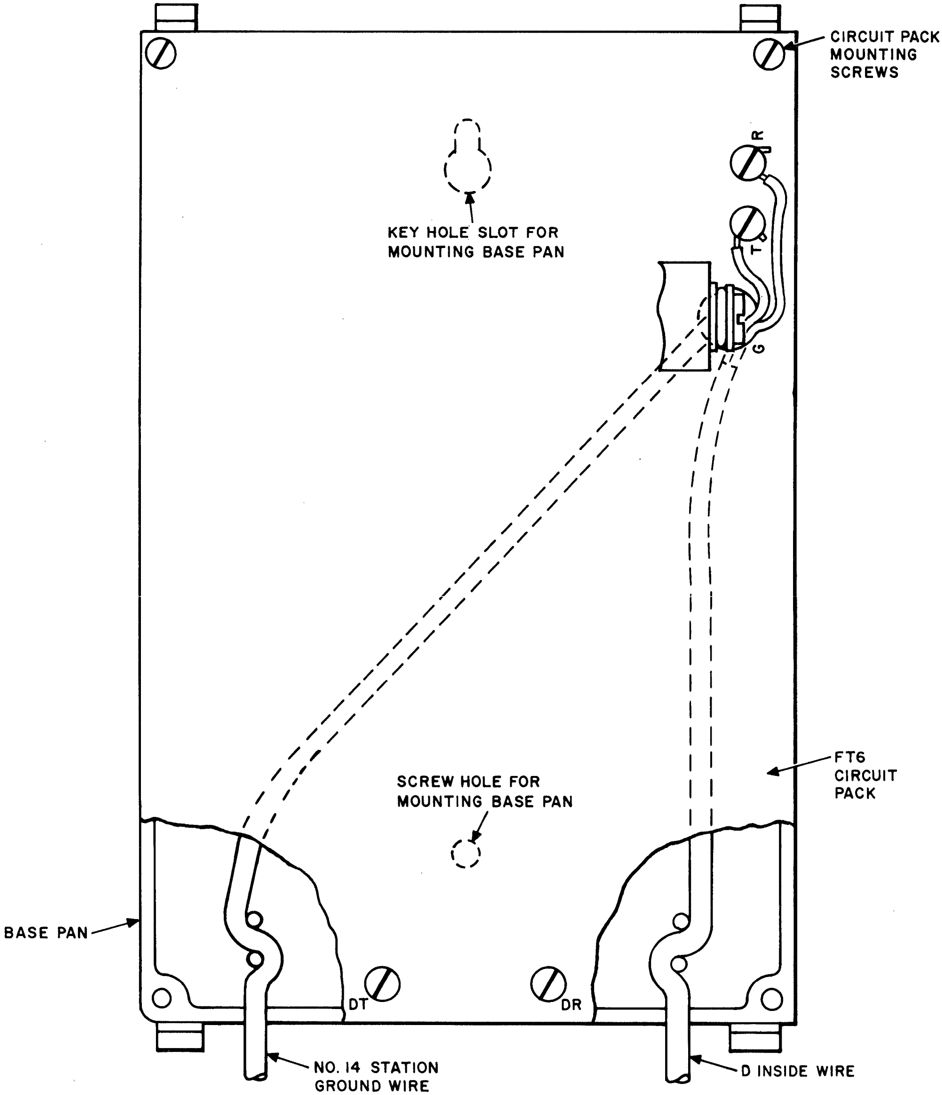
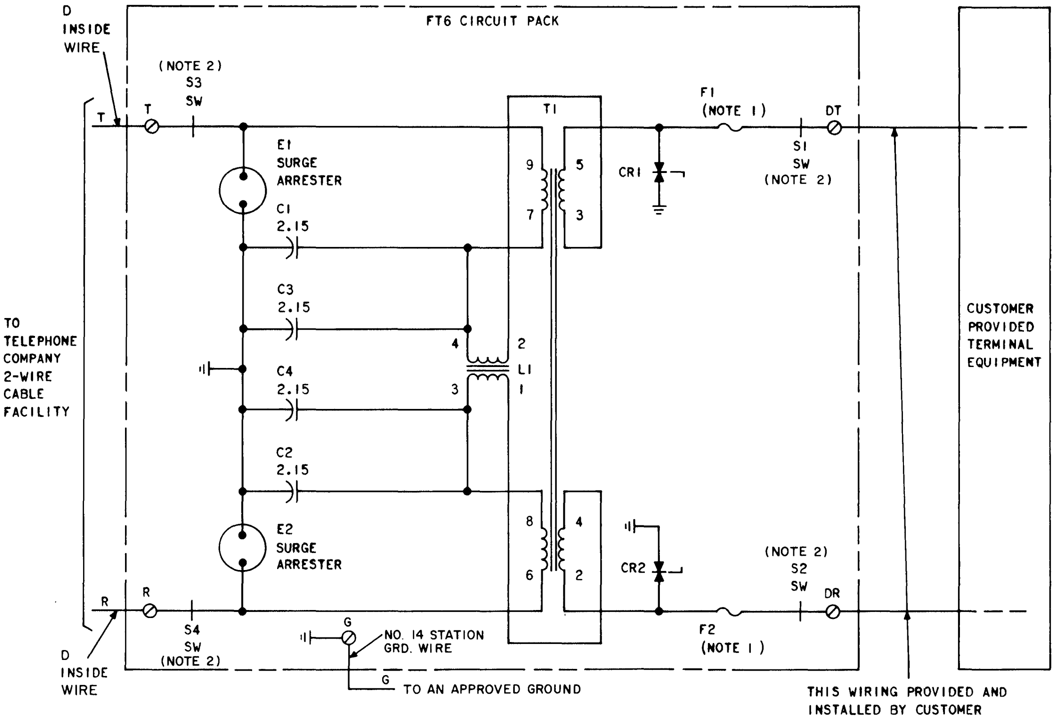


Fig. 4—Route of Station Wiring and Location of Terminals

4.04 When the voltage from the CP equipment exceeds 75 ± 4 volts peak to ground on either the tip or ring lead (150 ± 8 volts from tip to ring), zener diodes CR1 and CR2 will break down and limit the voltage to 75 ± 4 volts conductor to ground. When this overvoltage condition exists and the impedance of the CP equipment is sufficiently low, power will be dissipated in the zener diodes causing the zener diode heat sink to become warm. When the temperature of the aluminum block (heat sink)



NOTES:
1. FUSES ARE BUSSMAN TYPE AGC, 175MA(3AG), OR LITTELFUSE TYPE 312.175(3AG), REPLACEMENT WITH THE PROPER FUSE IS IMPERATIVE; THE RESISTANCE AND OPERATE TIME OF THE FUSE ARE VITAL TO THE PROPER OPERATION OF THE CIRCUIT.
2. S1, S2, S3 AND S4 ARE THERMAL SWITCHES MOUNTED ON THE SAME HEAT SINK AS CR1 AND CR2.

Fig. 5—Schematic—119A Interconnecting Unit

on which the diodes are mounted reaches 194°F, one or more of the thermal switches S1, S2, S3, or S4, which are mounted on the same heat sink, will function to open the circuit. Therefore, the IU circuit has the capability to limit the voltage from the CP equipment indefinitely. The reset buttons located on the top of the thermal switch body (see Fig. 2) must be depressed to restore the circuit to normal after the thermal switches have operated. The reset buttons will not restore the circuit to normal until the temperature of the heat sink drops to approximately 184°F. The snap-off cover assembly must be removed to gain access to the thermal switch reset buttons.

4.05 ***Transmission and Signaling:*** Signals to and from the CP equipment pass through transformer T1 in the 119A IU. This transformer is designed to provide a 1:1 coupling for ac signals with a minimum amount of low frequency envelope delay distortion. The transformer windings are connected series opposing to minimize the possibility of an unbalanced current saturating the transformer. Capacitors C1, C2, C3, and C4 together with inductor L1, serve to insure good longitudinal balance.

4.06 The 119A IU provides approximately 35 dB of longitudinal signal suppression at 1000

Hz. It provides a voice frequency range of approximately 300 to 3000 Hz; the return loss in this range is at least 24 dB; the attenuation deviation in this range is less than 0.4 dB. The insertion loss at 1000 Hz is 0.8 dB. Series dc loop resistance of the IU is 56 to 80 ohms.

5. MAINTENANCE

5.01 Follow local instructions to obtain circuit release before performing tests.

5.02 Maintenance of the 119A IU on the customer' premises should be limited to local tests, replacing fuses, resetting thermal breakers and checking the condition of the telephone line (protectors and sneak current fuses if used).

Note: Do not attempt individual component repair or replacement on the printed circuit pack; replace the 119A IU.

5.03 ***Apparatus Required to Perform Tests:***

- KS-16979, List 1 or KS-14510, List 1 volt-ohm-milliammeter, or equivalent.

5.04 ***Tests:***

(a) Before commencing tests check for hazardous voltages as follows: Measure the voltage from T to G, R to G, and from DT to G, from DR to G, and between DT and DR, and between T and R using the 300V scale on meter. (Measure both ac and dc.) If 70V dc or 50V ac or more is present from T to G, R to G, DT to G or DR to G, or 140V dc or 100V ac or more is present between DT and DR, or between T and R, it is an indication that a hazardous voltage may be present. In this case, wear rubber gloves and take proper safety precautions.

(b) Remove the wires from terminals DT, DR, T and R on the FT6 circuit pack. ***Do not remove the No. 14 station ground wire from terminal G.*** Mark or tag wires so that polarity is not reversed when reconnecting.

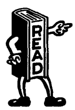
(c) If voltages exceeding the limits in step (a) are present, perform the following tests:

(1) With the unit disconnected repeat step (a) on the interface leads to determine the origin of the hazardous voltage.

(2) Take steps to remove the hazardous voltage from the line, or report the condition to your supervisor. If CP equipment is causing this condition, report the condition to the customer.

(3) Do not attempt further tests or repairs until the hazardous voltage condition has been corrected.

(d) Check for blown fuse (F1 or F2) on FT6 circuit pack. Measure the resistance of the fuses (10 $\pm$2 ohms). Replace with the same type fuse if defective. Retest after replacement.



The operate time and resistance of these fuses are vital to the proper operation of the circuit—do not substitute.

(e) Depress the reset buttons on thermal switches S1, S2, S3, and S4 (see Fig. 2).

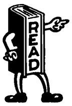
(f) Using the volt-ohm-milliammeter, measure the resistance between terminal DT and terminal T. Repeat this measurement between terminal DR and terminal R. The meter should indicate a resistance between 28 ohms and 40 ohms in each instance.

(g) Using the volt-ohm-milliammeter, measure the resistance between terminal DT and terminal G. The meter should indicate an open circuit after an initial capacitive charging current. Repeat this measurement between terminal DR and terminal G, between terminal T and terminal G, and between terminal R and terminal G. All terminals should indicate an open circuit to ground.

(h) If the above tests indicate trouble in the 119A IU, replace the FT6 circuit pack or 119A IU.

(i) Reconnect the T, R, DT and DR leads (maintain polarity).

5.05 If the tests are satisfactory, and trouble condition still exists, follow local reporting procedures for CP trouble.



Do not attempt any test or repair to the customer-provided equipment.

5.06 When in the repairman's judgment the trouble is located in the CP equipment, the Repair Service Bureau should be notified so that proper Maintenance of Service Charge billing can be initiated as outlined in Section 660-101-312 entitled Maintenance of Service Charge on Services With Customer-Provided Equipment (CPE).

PROTECTIVE CONNECTING ARRANGEMENTS C24 AND C2H

1. GENERAL

1.01 This section provides identification, installation, operation, maintenance, and connecting information for Protective Connecting Arrangements (PCAs) C24 and C2H (Fig. 1, 2, and 3). These PCAs provide for the connection of customer-provided (CP) 4-wire voice communications facilities to a tie trunk circuit associated with a Bell System PBX or Centrex system. They also provide an E and M type signaling interface. They are ***not*** intended for providing entrance facilities for CP microwave channels. PCA C24 provides for the connection of the CP facilities to a Bell System PBX trunk circuit and consists of an interconnecting unit J53050C, List 2 (Fig. 4), and a 24V4C repeater shelf J98615BJ, List 2, equipped with plug-in components. PCA C2H provides for the connection of the CP facilities to a trunk circuit associated with a Bell System Centrex system. When used with a Centrex-Customer (Centrex-CU) System, PCA C2H consists of the same equipment as PCA C24. For a Centrex-Central Office (Centrex-CO) system, PCA C2H consists of an interconnecting unit J53050C List 2, a signaling extension unit J98605AM, and either a 24V4C repeater shelf J98615BJ List 2, or a 44V4A intermediate repeater shelf J98615AH List 2 equipped with plug-in components. The 24V4C is used when the PCA is associated with Bell System 2-wire voice facilities while the 44V4A is used with Bell System 4-wire voice facilities. A KS-15620, List 22 rectifier, or equivalent, may be used to power the PCAs if other Bell System battery and ground are not available.

> ***Note:*** An X76090 loop-back panel may be provided at the customer's premises to facilitate testing the connecting arrangement from the serving central office.

1.02 This section is reissued to:

- Include coverage of the J98605AM signaling lead extension unit which replaces the J98605AH, now rated MD. (Information required for maintenance of existing installations using the J98605AH has been retained.)
- Include information on the KS-15620, List 22 rectifier which replaces the KS-15620, List 14, now rated MD.
- Add current drain information.
- Replace the term Voice Connecting Arrangement (VCA) with Protective Connecting Arrangement (PCA).
- Add post-installation test.
- Expand maintenance information.
- Remove KS-20944 protector from Design Features.

1.03 If the customer wants a copy of the Technical Reference which covers this interface specification, he should contact the local Telephone Company Business Office or the Marketing Representative.

1.04 This issue of the section is based on the following drawings:

> CD-1E254, Issue 1 and SD-1E254, Issue 1 (J53050C, L2 IU)
>
> CD-97047, Issue 5D, Appendix 2D, and SD-97047, Issue 16D (V4 Repeaters)
>
> J98605AM, Issue 13 (J98605AM Signaling Lead Extension Unit)

If this section is to be used with equipment or apparatus reflecting later issue(s) of the drawing(s), reference should be made to the SDs and CDs to determine the extent of the changes and the manner in which the section may be affected.

2. IDENTIFICATION

PURPOSE

- To provide a 4-wire connection between CP communications facilities and Bell System PBX or Centrex System

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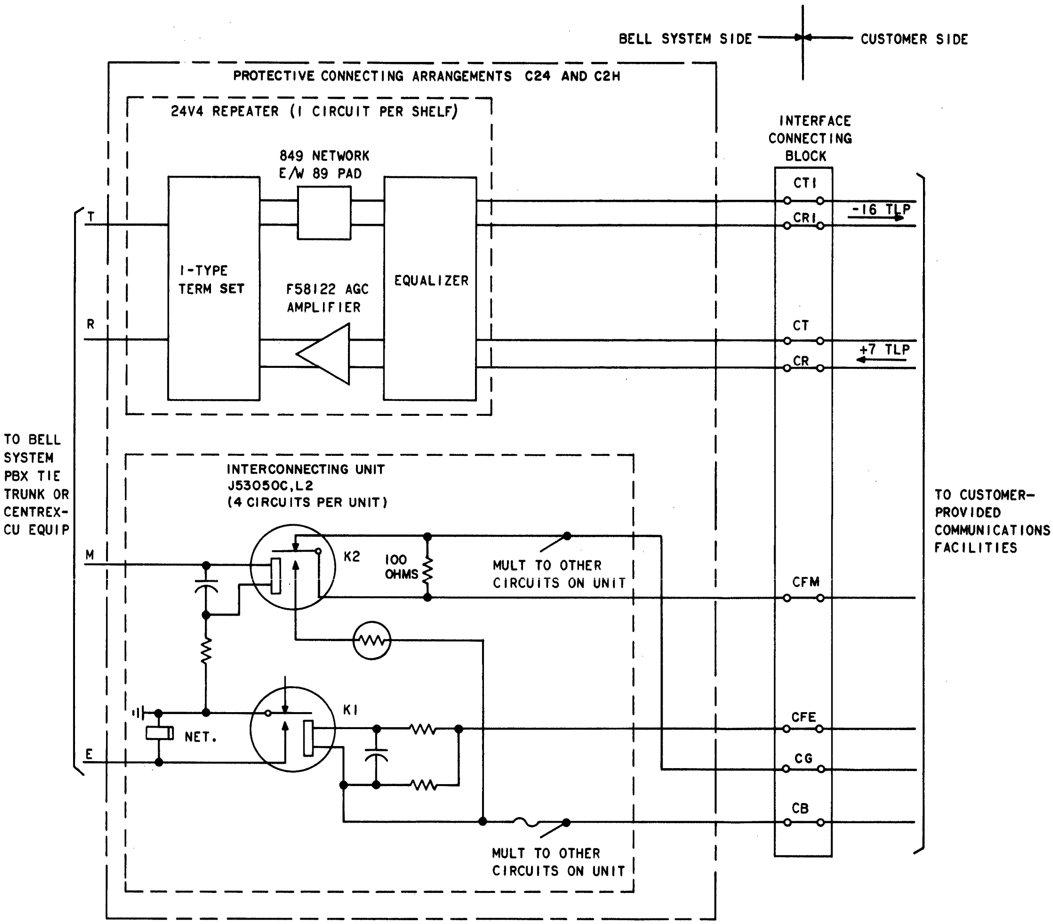


Fig. 1—Simplified Schematic—PCAs C24 (PBX) and C2H (Centrex-CU)

- To provide E and M signaling from and to CP communications facilities
- To provide for extension of the signaling and transmission leads to the central office when Centrex-CO is used
- To limit excessive levels from CP communications facilities, to provide protection for telephone company personnel against hazardous voltages, to insure longitudinal balance, and to repeat network control signaling.

ORDERING GUIDE

- Unit, Interconnecting, J53050C, List 2—for PCAs C24 and C2H. Each unit provides four signal isolation (applique) circuits.
- Shelf, Repeater, Terminal 24V4C, J98615BJ, List 2—for use with PCAs C24 (PBX), C2H (Centrex-CU), or when C2H (Centrex-CO) is used with Bell System 2-wire facilities. Each unit provides one voice coupler circuit; for plug-in components, see Note. (24V4A

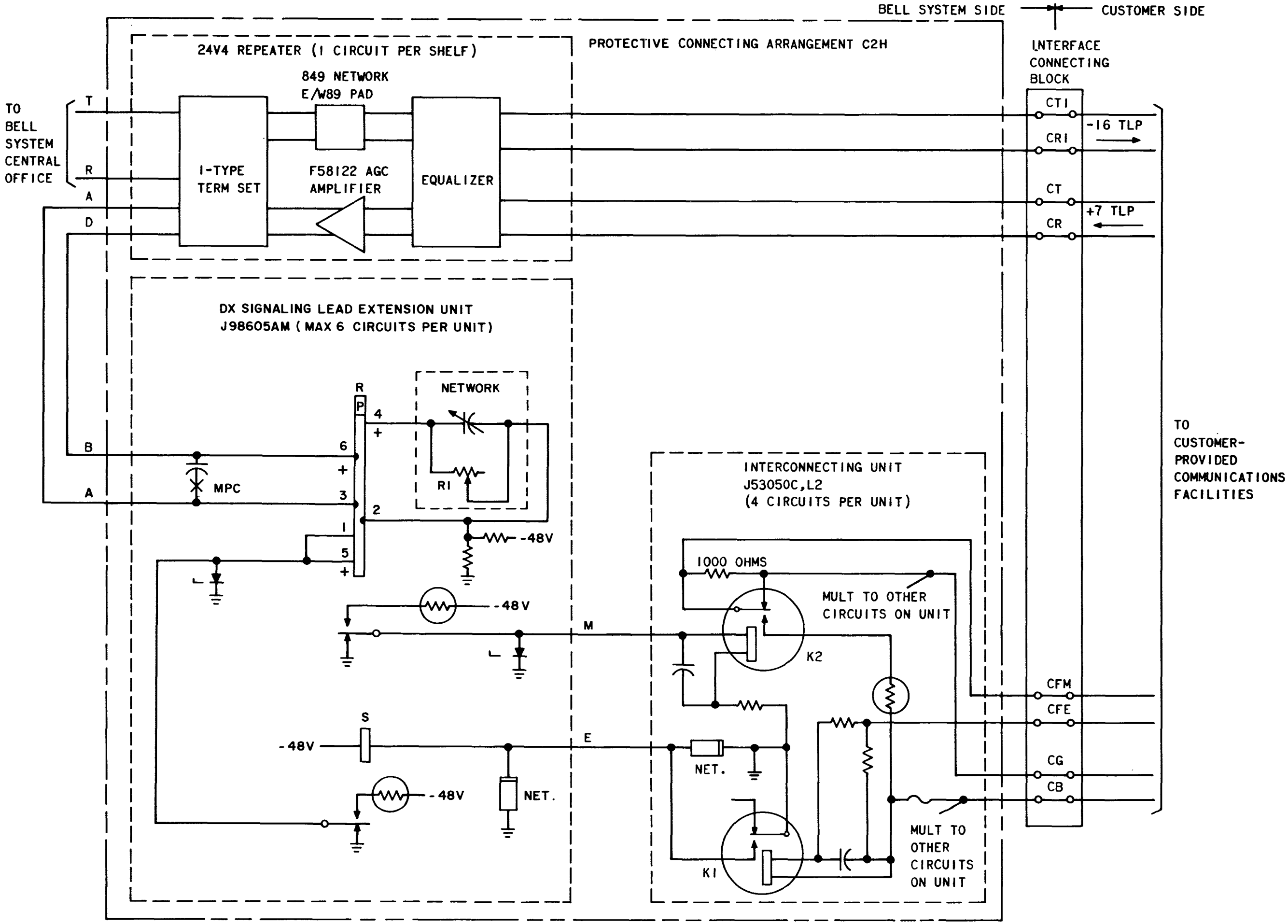


Fig. 2—Simplified Schematic—PCA C2H (Centrex-CO), 2-Wire Local Channel

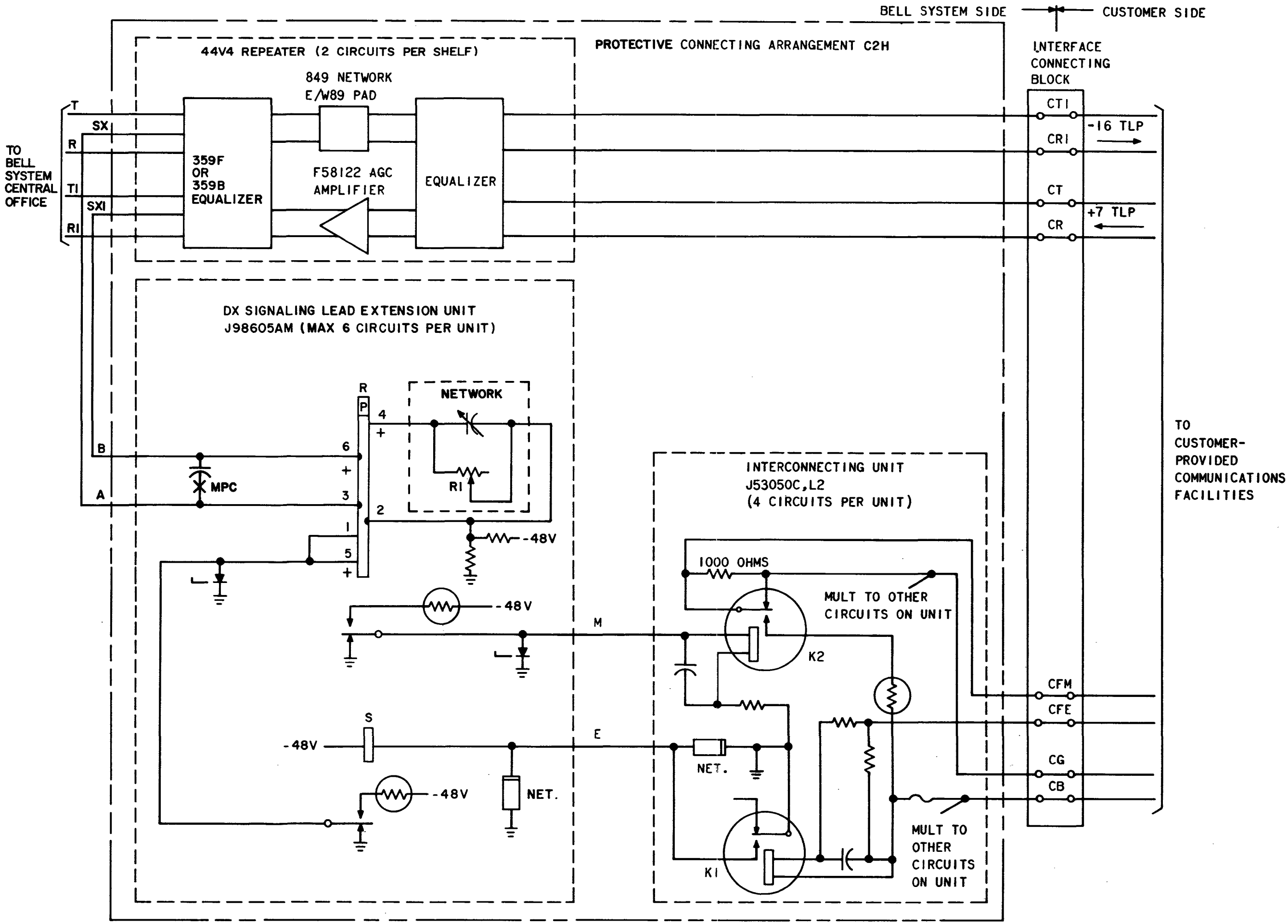


Fig. 3—Simplified Schematic—PCA C2H (Centrex-CO), 4-Wire Local Channel

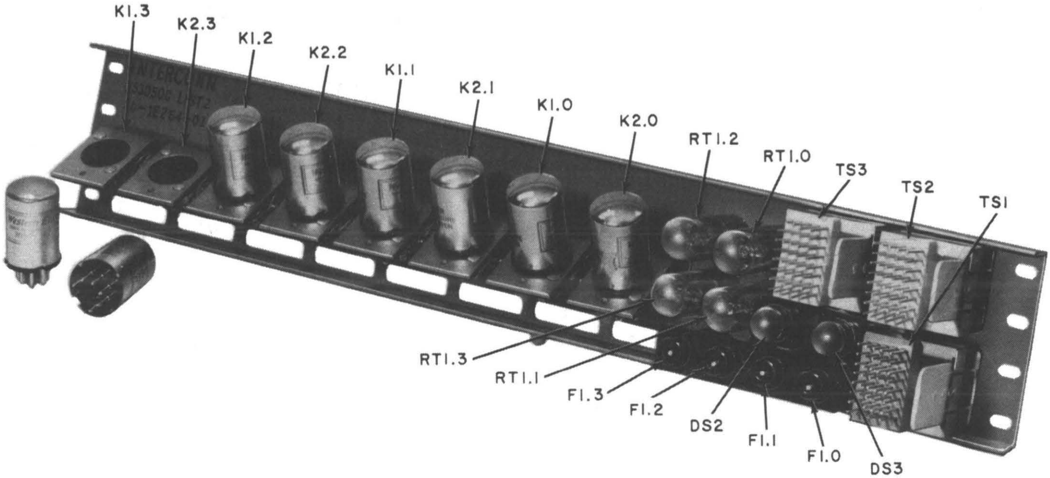


Fig. 4—J53050C, List 2 IU

can also be used but is not recommended because it does not have a terminal strip for easy connection to external circuits.)

- Shelf, Repeater, Intermediate 44V4A, J98615AH, List 2—for use when C2H (Centrex-CO) is used with Bell System 4-wire facilities. Each unit provides two voice coupler circuits per shelf. For plug-in components, see Note.

Note: For plug-in components, refer to Section 852-307-101. When automatic control of signal power level is required, order F58122 automatic gain control (AGC) amplifier for use in the ***transmitting leg from the CP facilities to Bell System equipment*** instead of the standard 227-type amplifier shown in Section 852-307-101. (See Fig. 1, 2, and 3.)

- Unit, Extension Lead Signaling, J98605AM-1 or 2—for use with PCA C2H (Centrex-CO):

J98605AM-1: Order both List 1 and List A to get a mounting assembly with wiring and connectors for six circuits; order one List WA (A-B lead capacitor) for each 334B relay to be installed; order required number of 334B relays (Fig. 12) separately, one per circuit.

J98605AM-2: Order List 1 to get a mounting assembly with wiring and connectors for six circuits; order required number of 334D relays (Fig. 12) separately, one per circuit.

Associated Apparatus (Order Separately)

- Rectifier, List 22, KS-15620 (2 amperes at −48 volts)—required when Bell System battery and ground are not available at installation site.

Note: This rectifier meets acceptable noise requirements as explained under Power Supplies in Section 332-104-102. Other rectifiers may be used when specified by local engineering. Typical current drain for a single C24 (PBX) or C2H (Centrex-CU) arrangement is 0.018 ampere; for a single C2H (Centrex-CO) arrangement, 0.205 ampere. Be sure that rectifier capacity is adequate for the number of PCAs installed.

- Adapter, Group 33, ED-90273-70 (two required)—for mounting 19-inch rectifier on relay rack.

- Cord, Power, KS-14532

  List 1—10 ft.

  List 2—2 ft.

  List 3—15 ft.

  List 4—20 ft.

  List 5—25 ft.

- Cable, Wiring, "D" Inside, or equivalent—for cabling from connecting arrangement to interface connecting block.

- Block, Connecting, 66M1-50 (Fig. 5).

Note: Other types of blocks may be used when specified by local engineering.

- Clip, Bridging, B (25 per pkg).

- Block, Connecting, 66 Type (for connecting telephone company facilities).

- Panel, Loop-Back, X76090 (optional).

Note: The loop-back panel mounts on a standard 23-inch relay rack. Four circuits are provided per panel. Power must be provided from a local −48 volt source with a local fusing arrangement.

- Protector, List 2, KS-20944 (optional)—***must*** be provided when CP power supply is used to power the PCAs. See Fig. 15 and 16.

- Block, Connecting, 66C1-16 or equivalent—for providing distribution of power when KS-20944 protector is used between CP power supply and *more than one* connecting arrangement of any type. See Fig. 17.

Note: The cumulative current drain of the connecting arrangements connected to a KS-20944 protector must not exceed the maximum current rating of the protector. For instance, if the maximum current drain for one connecting arrangement is 1.0 ampere and the maximum current rating of a KS-20944, List 2 protector is 15 amperes, no more than 15 connecting arrangements may be connected to the protector (this example is for illustrative purposes only).

- Wire, AM, 14 gauge, paired, red and black, P-384614 or equivalent—for cabling from the KS-20944 protector to the 66C1-16 connecting block. See Fig. 17.

Replaceable Components

- Fuses, 70A (1-1/3 amp) (J53050C, List 2 IU)

- Plug-in components of 44V4A repeater

- Plug-in components of 24V4C repeater

- Relay, 303K (J53050C, List 2 IU)

- Relay, 334B (J98605AM-1 Signaling Lead Extension Unit)

- Relay, 334D (J98605AM-2 Signaling Lead Extension Unit)

- Relay, 303E (J98605AH [MD] Signaling Lead Extension Unit).

DESIGN FEATURES

J53050C, List 2 Interconnecting Unit

- Mounts on standard 23-inch relay rack

- Size—4 by 23 inches

- Four signal isolation (applique) circuits per unit

- Accepts ground and battery supervisory signals over CFM lead from CP facilities

- Provides closure (to ground) and open supervisory signals over CFE lead to CP facilities

- Provides dc isolation of the signaling leads between the CP facilities and the signaling lead extension unit.

24V4C Repeater Shelf

- Mounts on standard 23-inch relay rack on 1-3/4 inch centers.

- Size—2 by 23 inches.
- One repeater circuit per shelf.
- Each circuit provides a 2-wire to 4-wire voiceband transmission path (voice coupler) from Bell System equipment to CP facilities and a 4-wire to 2-wire voiceband transmission path from CP facilities to Bell System equipment.
- Limits the inband signal power applied to Bell System facilities when equipped with F58122 AGC amplifier.
- Provides transformer isolation and hazardous voltage protection between CP facilities and Bell System equipment.
- Typical current drain per circuit: 0.018 ampere (single amplifier).

44V4A Repeater Shelf

- Mounts on standard 23-inch relay rack on 1-3/4 inch centers.
- Size—2 by 23 inches.
- Two repeater circuits per shelf.
- Each circuit provides a 4-wire voiceband transmission path (voice coupler) to and from the CP facilities.
- Limits the inband signal power applied to Bell System equipment when equipped with F58122 AGC amplifier.
- Typical current drain per circuit: 0.018 ampere (single amplifier).

J98605AM Signaling Lead Extension Unit

- Mounts on standard 23-inch relay rack
- Size—2 by 23 inches
- Six circuits per unit
- Provides signaling lead extension from connecting arrangement to central office
- Provides loop-strapping options
- Typical current drain per circuit: 0.187 ampere.

3. INSTALLATION

3.01 Locate the PCAs in an area free of dampness and excessive dust or dirt with adequate room for access to front and rear of equipment and connecting blocks. The associated equipment typically mounts on a standard 23-inch relay rack. (Fig. 6, 7, and 8).

3.02 Wire the equipment as shown in Fig. 9, 10, and 11. Mount the interface connecting block in a position that will facilitate testing between it and the PCA equipment. Use the "D" inside wiring cable or equivalent to terminate the leads associated with the CP equipment on the interface connecting block. Stencil trunk number and lead designations on interface connecting block designation strip (see Fig. 5). Install the proper plug-in components in the 24V4C or 44V4A repeaters. (When the AGC amplifier is used, see 7.02 for adjustment procedures.) For PCA C2H (Centrex-CO), make the signaling lead extension unit adjustments as given in 3.03. Apply power as shown in Fig. 9, 10, and 11. Before installing bridging clips on the block to connect Bell System wiring to CP wiring, perform the quick test in 3.08 to determine if the PCA operates properly. If it does not, recheck installation and connections; if necessary, perform the maintenance procedures in Part 5 of this practice.

> *Note:* The CB and CG terminals are for CP signal battery and CP signal ground, respectively. Telephone company battery and ground should ***never*** be connected to these terminals.

3.03 ***Signaling Lead Extension Unit Adjustments (J98605AM) (Fig. 2, 3, and 12)***

(a) Adjust network resistor R1 to equal the PBX or CO loop resistance, ± 125 ohms. When adjusting R1, be sure that at least one of the network capacitance screw switches (C1, C2, C3) is open (up). Using an ohmmeter, measure the resistance of R1 across test points TP1 and TP3 with the extension circuit (334-type relay) removed from its socket.

(b) It is desirable to have a 4 microfarad (μf) capacitor across the A and B leads. If the external circuit (the repeater) does not provide

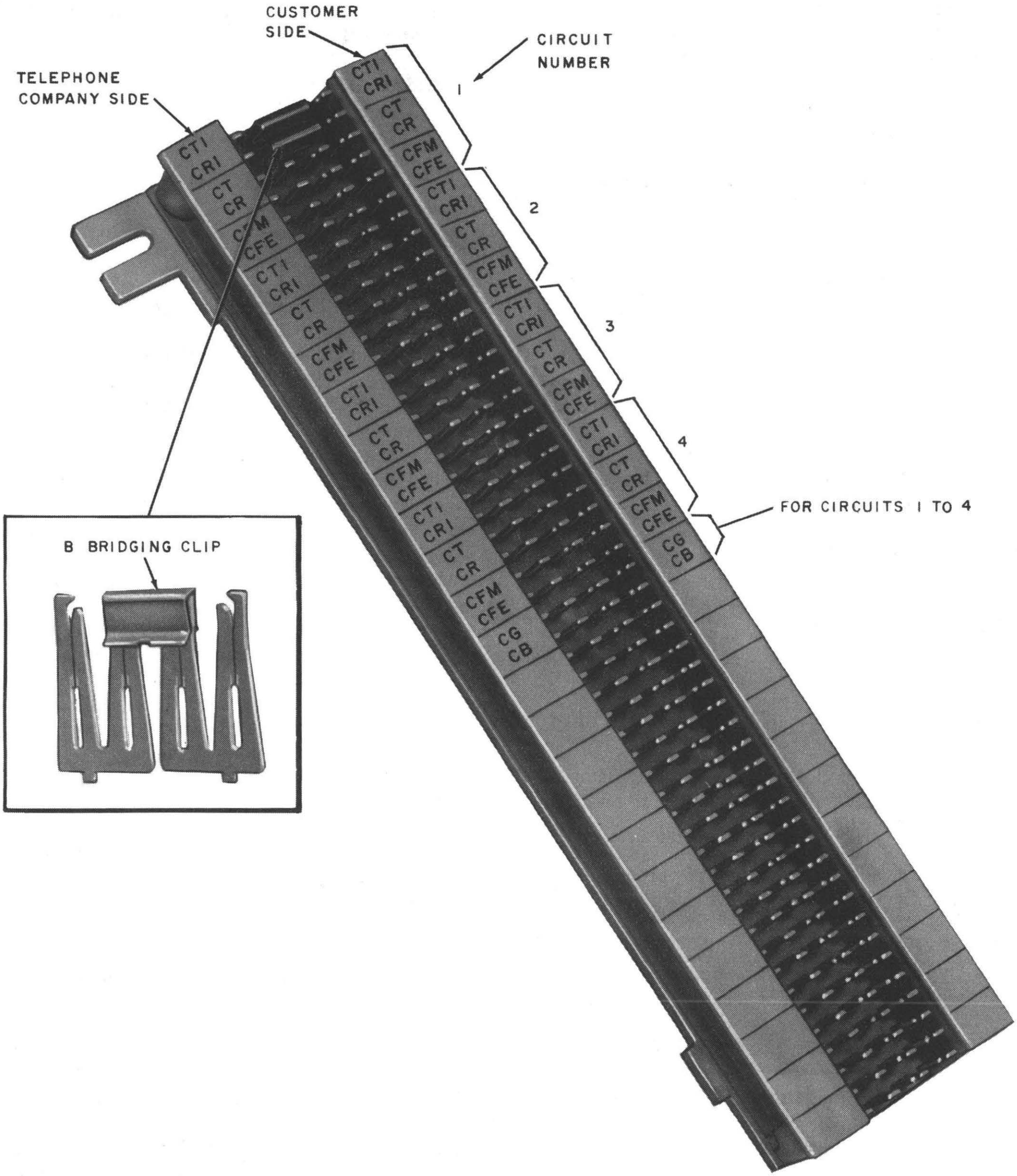
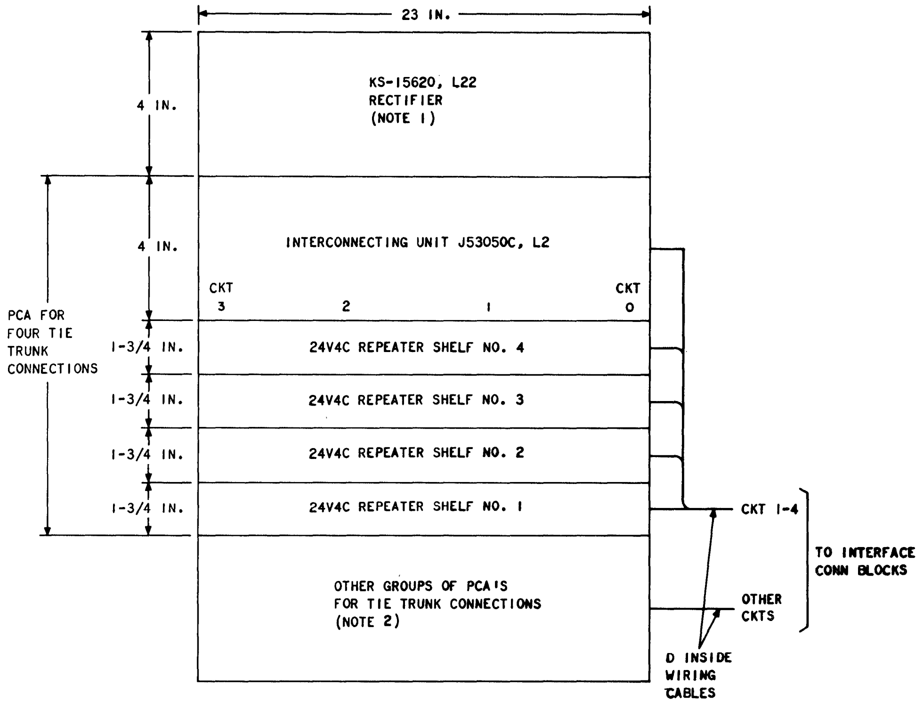


Fig. 5—Typical Interface Connecting Block



NOTES:
1. SEE ORDERING GUIDE FOR CURRENT REQUIREMENTS.
2. EACH TIE TRUNK CONNECTION REQUIRES ONE IU CIRCUIT AND ONE REPEATER CIRCUIT.

Fig. 6—Typical Rack Mounting—PCA C24 (PBX) or C2H (Centrex-CU), Front View

this, insert one by closing the MPC screw switch on the 334D relay, or, where 334B relays are used, by wiring one across the A and B leads. In no case should the A-B capacitance exceed 4 μf; therefore, if the external circuit has a capacitor of more or less than 4 μf, disconnect it before connecting the 4 μf capacitor of the extension circuit. To properly match the A-B capacitance of 4 μf, the extension circuit network capacitance should be 6 μf (C1 and C2 closed). Refer to SD-1C364-01 for more information on these adjustments.

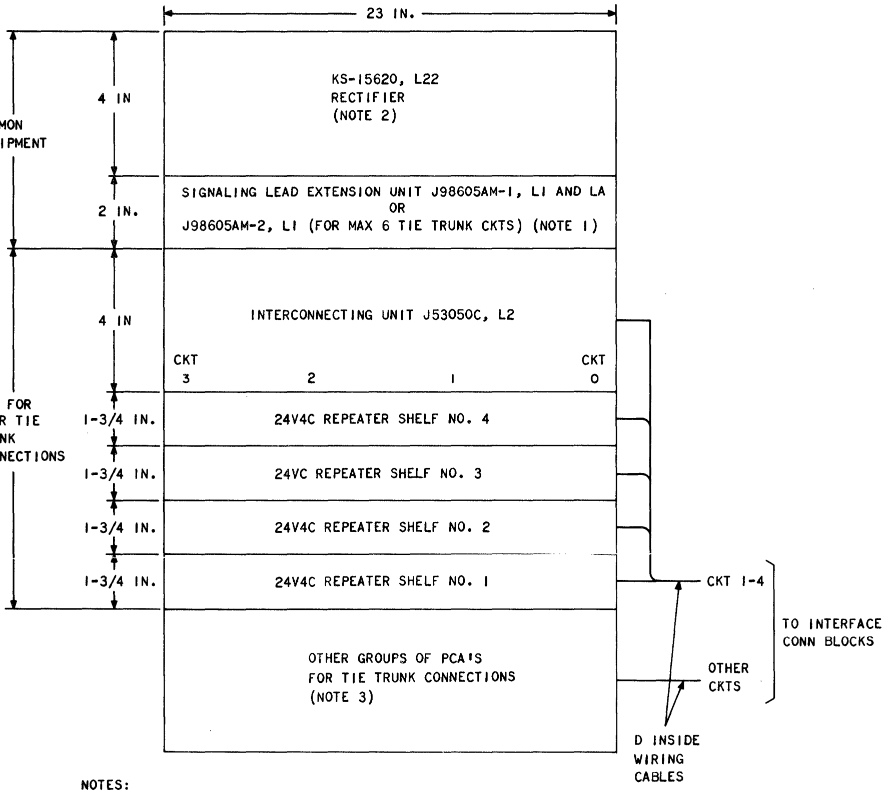
Power Requirements

3.04 When required, the customer must provide a 117V 60-Hz power outlet within power cord length of the customer-designated mounting location of the connecting arrangement (see ORDERING GUIDE for cord lengths).

3.05 The power outlet supplying connecting arrangement(s) must not be under control of a switch and should be on a separately fused power circuit to prevent accidental loss of ac line voltage. Where local instructions permit, secure the power cord to the outlet with a power cord plug retainer assembly.

3.06 Refer to appropriate section in Division 167 for proper grounding of power plants.

3.07 ***KS-20944 Protector (Fig. 15 and 16):*** When a CP power source is used to power the



NOTES:
1. SIGNALING LEAD EXTENSION UNIT CAN BE EQUIPPED WITH FROM ONE TO SIX CIRCUITS, ONE FOR EACH TIE TRUNK.
2. SEE ORDERING GUIDE FOR CURRENT REQUIREMENTS
3. EACH TIE TRUNK CONNECTION REQUIRES ONE IU CIRCUIT, ONE EXTENSION CIRCUIT, AND ONE REPEATER CIRCUIT.

Fig. 7—Typical Rack Mounting—PCA C2H (Centrex-CO), 2-Wire Local Channel, Front View

connecting arrangement, a KS-20944 protector must be provided between the CP power source and the connecting arrangement. Mount the KS-20944 protector on a wall or suitable flat surface near the interface connecting block. Use the AM-type, 14-gauge wire or equivalent, to make connections from the protector to the 66C1-16 connecting block. Terminate one end of the wiring to the screw terminals (term. − and +) of the load terminal strip provided on the protector. Solder the other end of the wiring to terminals in column D of the connecting block as shown in Fig. 17. Using the 14-gauge wire, solder the multiple straps to the terminals in column D of the connecting block as shown in Fig. 17, depending on the number of connecting arrangements provided. Use "D" inside wire cable or equivalent to make connections from the quick-connect terminals in columns A, B, and C of the connecting block to the battery and ground terminals on the connecting arrangements. The customer must connect his power supply to the red (GRD) and black (−V) wires extending from the protector.

Warning: The circuit breaker switch removes voltage from the load (Bell System)

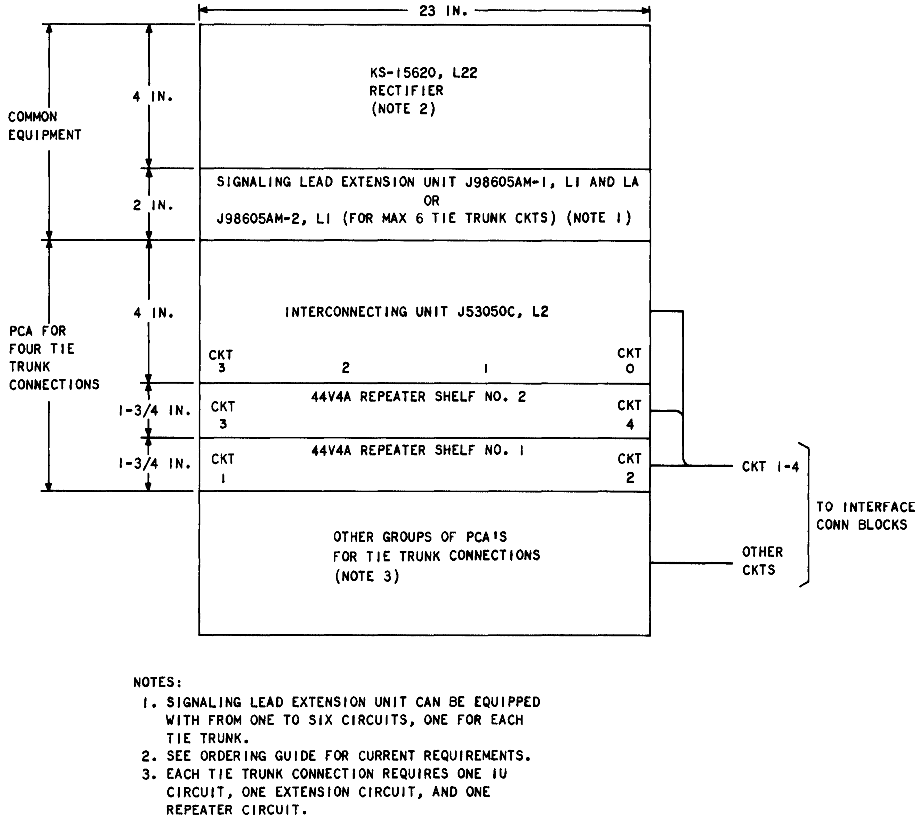


Fig. 8—Typical Rack Mounting—PCA C2H (Centrex-CO), 4-Wire Local Channel, Front View

side of the protector only; voltage will be present on the upper terminals of the circuit breaker inside the box as soon as customer power is connected.

3.08 ***Post-Installation Test:*** At the telephone company side of the interface connecting block (Fig. 1, 2, and 3), connect a 4-wire telephone, such as a 500AD, to the CT, CR, CT1, and CR1 leads; −48 volt battery to the CB lead; ground to the CG lead; a 1013A handset from lead CFE to ground; and an 81A test set from lead CFM to ground. Connect talk battery from the −48 volt supply through a 500-ohm resistor to CR and ground to CT. (A 2A or 31A KTU can be used for battery feed instead of the resistor. Refer to Section 518-112-421 for connections.) With the 1013A in the TALK mode, dial the distant end while monitoring on the 500AD. The distant end should answer, and satisfactory transmission should be possible using the 500AD set. Ask the distant end to call you back. Put the 1013A in the MON mode and the 500AD on hook. When the distant end calls back, the 81A (in the "C" position) should buzz, indicating battery on the CFM lead. Use the 500AD to tell the distant end that the test is complete. Restore the circuit to normal.

4. OPERATION

Note: The operational details for PCAs C24 and C2H depend upon the requirement of the switching system to which they are connected. The protective connecting arrangement provides a means of transmitting voice, dialing, and answer/disconnect signals between the telephone company switching equipment and the CP facility. When the distant end switching equipment is customer-provided, close coordination between the customer and the telephone company will be required to insure end-to-end compatibility of the terminal signaling and supervision circuits.

4.01 ***Incoming Call—PCAs C24 (PBX) and C2H (Centrex-CU) Fig. 1***

(a) The CP communications facility seizes the connecting arrangement by placing ground on lead CFE. This operates the K1 relay in the signal isolation (applique) circuit, which in turn places ground on the E lead toward the Bell System PBX tie trunk or the Centrex-CU equipment. The Bell System equipment responds to this seizure by connecting dial pulse receiving equipment to the E lead and returning dial tone, if provided, to the CP communications facility over leads CT1 and CR1 to indicate readiness to receive dial pulses.

(b) The CP communications facility transmits dial pulses by alternately opening and closing the CFE lead. Relay K1 in the signal isolation circuit repeats dial pulses to the Bell System equipment over lead E.

(c) When dial pulses have been received, the Bell System equipment may transmit answer supervision to the CP communications facility by placing battery on the M lead. This operates the K2 relay in the signal isolation circuit, which in turn places battery on the CFM lead toward the CP facility.

(d) The 24V4C repeater provides a 4-wire to 2-wire transmission path from the CP facility to the Bell System equipment.

4.02 ***Outgoing Call—PCAs C24 (PBX) and C2H (Centrex-CU) Fig. 1***

(a) The Bell System tie trunk or Centrex-CU equipment seizes the connecting arrangement by placing battery on the M lead. This operates the K2 relay in the signal isolation circuit, which in turn places battery on the CFM lead toward the CP facility; the CP facility returns dial tone, if provided, over leads CT and CR. The Bell System equipment then outpulses the digits by alternately applying battery and ground to lead M. The digits are repeated to the CP facility over lead CFM.

(b) The CP facility indicates answer supervision by placing ground on lead CFE which operates K1 relay in the signal isolation circuit in the same manner as an incoming call. The resulting K1 contact closure repeats the answer supervision to the Bell System equipment by grounding the E lead.

(c) The 24V4C repeater provides a 2-wire to 4-wire transmission path from the Bell System equipment to the CP facility.

4.03 ***Disconnect—PCAs C24 (PBX) and C2H (Centrex-CU) Fig. 1***

(a) When the Bell System end goes on-hook first, the Bell System equipment removes battery from lead M which releases the K2 relay in the signal isolation circuit. The K2 relay released removes battery from and applies ground to the CFM lead toward the CP facility. This ground should be recognized by the CP facility as a disconnect signal. The CP facility should then remove ground from the CFE lead, which in turn causes the K1 relay in the signal isolation circuit to release, removing ground from the E lead toward the Bell System equipment and restoring the connecting arrangement to the idle condition.

(b) When the customer end goes on-hook first, the CP facility removes ground from lead CFE toward the signal isolation circuit causing the K1 relay to release. K1 relay released removes ground from lead E toward the Bell System equipment. When the distant party goes on-hook, or is released by the switching system, the Bell System equipment subsequently removes battery from lead M which releases the K2 relay in the signal isolation circuit. Relay K2 released removes battery from and applies ground to the CFM lead toward the CP facility and restores the connecting arrangement to the idle condition.

4.04 ***Incoming Call—PCA C2H (Centrex-CO) 2-Wire or 4-Wire Local Channel (Fig. 2 and 3)***

(a) The CP communications facility seizes the connecting arrangement by placing ground on lead CFE. This operates the K1 relay in the signal isolation circuit, which in turn places ground on the E lead toward the signal lead extension circuit. This ground operates the S relay, which in turn causes the Bell System CO to connect dial pulse receiving equipment to the connecting arrangement and to return dial tone, if provided, to the CP communications facility over leads CT1 and CR1 to indicate readiness to receive dial pulses.

(b) The CP communications facility transmits dial pulses by alternately opening and closing the CFE lead. Relay K1 in the signal isolation circuit repeats dial pulses to the signal lead extension circuit over lead E. Relay S follows the dial pulses and subsequently extends them to the Bell System CO.

(c) When dial pulses have been received, the Bell System CO may transmit answer supervision to the CP communications facility by unbalancing the signal lead extension circuit in the connecting arrangement which causes R relay to operate which places battery on the M lead toward the signal isolation circuit. This operates the K2 relay, which in turn places battery on the CFM lead toward the CP facility.

(d) When 2-wire local channel to the Bell System CO is used, the 24V4C repeater provides a 4-wire to 2-wire transmission path from the CP facility to the CO.

(e) When 4-wire local channel to the Bell System CO is used, the 44V4A repeater provides a 4-wire transmission path to the CO.

4.05 ***Outgoing Call—PCA C2H (Centrex-CO) 2-Wire or 4-Wire Local Channel (Fig. 2 and 3)***

(a) The Bell System CO seizes the connecting arrangement by unbalancing the signal lead extension circuit which causes the R relay to operate, subsequently placing battery on the M lead toward the signal isolation circuit. Battery on the M lead operates the K2 relay, which in turn places battery on the CFM lead toward the CP facility; dial tone, if provided, is returned from the distant end over leads CT and CR. The Bell System CO equipment outpulses the digits to the connecting arrangement causing the R relay to follow the dial pulses. The R relay alternately applies battery and ground to the M lead toward the signal isolation circuit; the digits are subsequently repeated to the CP facility over lead CFM.

(b) The CP facility may provide answer supervision by placing ground on lead CFE which operates K1 relay in the signal isolation circuit in the same manner as an incoming call. The resulting K1 contact closure repeats the answer supervision by grounding the E lead toward the signal lead extension circuit. This ground operates the S relay which extends answer supervision to the Bell System CO.

(c) When 2-wire local channel to the Bell System CO is used, the 24V4C repeater provides a 2-wire to 4-wire transmission path from the CO to the CP facility.

(d) When 4-wire local channel to the Bell System CO is used, the 44V4A repeater provides a 4-wire transmission path to the CP facility.

4.06 ***Disconnect—PCA C2H (Centrex-CO) 2-Wire or 4-Wire Local Channel (Fig. 2 and 3)***

(a) When the Bell System end goes on-hook first, a disconnect signal is sent from the CO to the signal lead extension circuit. The signal lead extension circuit removes battery from lead M which releases the K2 relay in the signal isolation circuit. The K2 relay released removes battery from and applies ground to the CFM lead toward the CP facility. This ground should be recognized by the CP facility as a disconnect signal. The CP facility should then remove ground from the CFE lead, which in turn causes the K1 relay in the signal isolation circuit to release, removing ground from the E lead toward the signal lead extension circuit. This releases the S relay and restores the connecting arrangement to the idle condition.

(b) When the customer end goes on-hook first, the CP facility removes ground from lead CFE toward the signal isolation circuit causing the K1 relay to release, which removes ground from lead E toward the signal lead extension circuit. This releases the S relay, sending a disconnect to the CO. When the CO releases, the R relay operates, removing battery from lead M toward the signal isolation circuit, subsequently releasing the K2 relay. The K2 relay released removes battery from and applies ground to the CFM lead toward the CP facility, restoring the connecting arrangement to the idle condition.

5. MAINTENANCE

5.01 Where there is an indication of trouble in the connecting arrangement(s), the circuit at fault must be opened at the interface connecting block to verify in which direction the trouble exists. The circuit can be opened at the connecting block by removing the B bridging clip associated with each lead.

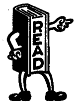
5.02 Precautions should be taken when performing tests to avoid adversely affecting service to the customer. Local instructions should be followed with reference to notifying the customer before performing the tests.

> ***Note:*** In no case should the CPE be used to perform end-to-end testing.

5.03 The repairman should first check the PCA for blown fuses, loose or broken wires and connectors, adequate battery and ground, and verify that the CO/PBX cable pairs are good. Any defects found should be repaired and tested before the equipment is reconnected to the customer's facility. If the trouble persists, continue with the trouble-shooting procedures described below.

5.04 Perform the post-installation tests described in 3.08 to determine if there is trouble in the PCA or the telephone company 2- or 4-wire facilities behind the PCA. If the tests in 3.08 can be completed successfully, and the areas checked in 5.03 are satisfactory, then the trouble is probably in the CPE.

5.05 When in the repairman's judgment the trouble is located in the CPE, the Repair Service Bureau should be notified so that proper maintenance of service charge billing can be initiated as outlined in BSP 660-101-312 entitled Maintenance of Service Charge on Services With Customer-Provided Equipment (CPE).



Do not attempt any tests or repairs to the customer-provided equipment.

5.06 If the trouble appears to be in the telephone company 2- or 4-wire facilities remote from the PCA, follow local practices to have them tested and repaired. If the PCA appears to be at fault, test the circuits which are most likely to be involved, based on the results of the test in 5.04. Faulty transmission probably points to the repeater as the source of trouble. Signaling difficulties are most likely to be caused by a defective J53050C IU or signaling lead extension unit plug-in relay. If CP power is being used, check the protector. When the faulty circuit is found, replace components or the entire unit, as necessary, or move leads to an idle circuit if one is available.

5.07 ***Apparatus Required to Perform Tests***

(a) Test cord, 893 cord, 6 feet long, equipped with two 360A tools (1W13B cord), one KS-6278 connecting clip, and one 411B (test pick) tool (for connecting battery to alarm bar of 70-type fuses).

> ***Note:*** To connect battery to the alarm bar of 70-type fuses mounted in a 21A fuse block, insert the tip of the 411B tool (attached to the 1W13B cord) into the aperture provided in the fuse block cover, and touch the alarm bar.

(b) Volt-ohm-meter capable of measuring −48 volts and 1000 ohms.

(c) Two clip leads, one of sufficient length to reach from the interface connecting block to the connecting arrangement.

5.08 ***Tests—J53050C, List 2 Interconnecting Unit***

(a) Using 893 cord, connect battery to alarm bar of fuse(s) on interconnecting unit—fuse alarm lamp DS3 should light.

(b) Open all of the leads of the circuit under test at the interface connecting block. Connect battery and ground to leads CB and CG. Remove leads E and M from the signal lead extension unit or the Bell System PBX or

Centrex-CU equipment. Apply battery (−48 volts) to lead M. The K2 relay should operate, indicated by battery (−48 volts) present between lead CFM and CG. If K2 relay does not operate, replace it with a relay known to be good; if battery still is not present across leads CFM and CG, measure the resistance between the two leads. If resistance measures zero, check for open on lead M; if resistance measures 1000 ohms, check for faulty RT1 resistance lamp or blown fuse; if resistance measures infinity, check for open on lead CFM or CG.

(c) Connect lead CFE to lead CG; K1 relay should operate, indicated by a ground on lead E. If K1 relay does not operate, replace it with a relay known to be good; if K1 relay still does not operate, check for open on leads CFE, CG, or E.

(d) On completion of tests, reconnect leads E and M to the signal lead extension unit or the Bell System PBX or Centrex-CU equipment. Remove battery and ground from leads CB and CG. Replace the B bridging clips at the interface connecting block associated with the circuit under test.

5.09 ***Tests—J98605AM Signaling Lead Extension Unit***

(a) Remove the 334-type relay in the faulty PCA from its socket to perform tests. It is not a repairable item and will be replaced if defective.

(b) Verify the adjustments described in 3.03 and correct any discrepancies.

(c) Return the 334-type relay to its connector in the signaling unit. If the trouble has not been cleared, replace the relay. (Perform 3.03 adjustments on any new relays before installing.)

5.10 ***Tests—J98605AH (MD) Signaling Lead Extension Unit***

(a) Remove the 303E relay in the faulty PCA from its socket and replace it with a known good one.

(b) Verify all option strapping (Fig. 13 and 14).

5.11 ***Tests—24V4C and 44V4A Repeaters:*** If the CO cable pairs are verified to be good and transmission trouble is still present, the repeater may be defective. The amplifiers, terminal sets, and equalizers are plug-in units which may be adjusted or removed and replaced individually to localize the fault. Refer to the practices listed in 5.14 for additional information. Alignment procedures for the F58122 AGC amplifier, when used with the repeater, is covered in Part 7.

5.12 ***Tests—KS-20944 Protector (Fig. 15 and 16):*** If circuit breaker switches are tripped (in the ***off*** position), return them to the ***on*** position; if circuit breaker switches cannot be operated to the ***on*** position, perform tests as follows:

(a) Disconnect telephone company-provided wiring from terminals 1 and 2 (− and +) of the load terminal strip on the protector under test. If the circuit breaker switches remain in the ***on*** position when operated, the trouble is in the telephone company-provided equipment. Check for proper polarity of the telephone company-provided leads at terminals 1 and 2 (− and +) of the load terminal strip on the protector; ascertain that the circuits connected to the protector do not exceed the current rating of the protector.

(b) If the trouble is not in the telephone company side, check the type, amount, and polarity of the CP voltage present on the leads provided for customer termination at the protector; this voltage should meet the specifications shown in Fig. 16.

5.13 After tests have been completed and defective equipment repaired or replaced, repeat the post-installation tests in 3.08 to determine that the PCA is operating correctly. If it is, restore all circuits to normal and close the connections between telephone company equipment and CPE.

5.14 When detailed maintenance information is required, refer to the following:

44V4A Repeater

- CD- and SD-97047-01
- Section 179-100-303
- Section 332-106-101

- Section 852-307-101.

24V4C Repeater

- CD- and SD-97047-01
- Section 179-100-303
- Section 332-105-103
- Section 852-307-101.

359-Type Equalizer

- Sections 332-116-101 through 332-116-113.

227-Type Amplifier

- Section 024-140-101.

Signal Isolation (Applique) Circuit (J53050C)

- CD- and SD-1E254.

Signal Lead Extension Circuit

- CD- and SD-95488-01 (for J98605AH)
- CD- and SD-1C364-01 (for J98605AM)
- Section 179-100-309
- Section 859-501-101.

KS-20944 Protector

- Section 463-300-109.

6. CONNECTIONS

6.01 For connecting information, refer to Fig. 9, 10, 11, 13, 16, and 17.

7. F58122 AUTOMATIC GAIN CONTROL (AGC) AMPLIFIER

7.01 *Physical and Electrical Characteristics*

(a) The F58122 AGC amplifier is identical in size and connections to the 227-type amplifier used in the V4 repeater shelf. It is used to limit the inband signal power in the transmitting leg from CP facilities to Bell System equipment.

(b) The gain of the F58122 AGC amplifier is continuously adjustable from −10 dB to +25 dB. The ability to insert loss is necessary when interfacing with a +7 transmission level point (TLP) transmit leg from CP facilities. The clamped output power of the amplifier is adjustable from −20 dBm to 0 dBm.

(c) The F58122 AGC amplifier is normally adjusted to clamp at a power level 13 dB below the TLP. When the output side of the amplifier is at the 0 TLP, the minimum protection criteria permits an inband 3-second average output power of −13 dBm. If the input signal to the amplifier should be increased to a level that produces an instantaneous signal greater than −7 dBm at the output of the amplifier, the AGC action of the amplifier changes the output to −7 dBm after 20 milliseconds and then to −13 dBm after a time interval varying from 300 to 500 milliseconds. When the input level to the amplifier is such that the output level of the amplifier is between −7 and −13 dBm, the AGC action of the amplifier changes the output level to −13 dBm after a time interval varying from 0.3 to 3 seconds.

7.02 *Adjustments:* Gain adjustments are made by means of the LEV ADJ control (R3) and switch S1 (see Fig. 18). The combined setting of these two controls provides a range of −10 to +25 dB gain. The setting of the AGC ADJ control (R20) determines the points at which clamping of the amplifier output begins. The range of the AGC ADJ control is from 0 to −20 dBm. Before making adjustments, refer to circuit order card to determine the TLP at the input and output of the amplifier. With an input signal 10 dB below the input TLP of the amplifier, the amplifier gain must be adjusted (using LEV ADJ and S1 as required) to provide an output level which is 10 dB below the output TLP of the amplifier. The AGC ADJ control must then be adjusted to reduce the output of the amplifier by 3 dB (13 dB below output TLP). The following example shows the method of adjusting F58122 AGC amplifier for a typical input and output TLP:

Example:

(a) Assume that the circuit order card shows an input TLP of −4 and an output TLP of +4.

(b) Set switch S1 to the counterclockwise position (when more than 10 dB of gain is required set S1 to clockwise position) and LEV ADJ control (R3) to the +8 position; set the AGC ADJ control (R20) fully clockwise to the 0 dBm position. This provides an amplifier gain of +8 dB, the amount of gain required to raise the TLP from −4 to +4.

(c) Adjust the oscillator test level of a 21A transmission measuring set (TMS), or equivalent, to −14 dBm at 1000 Hz (10 dB below input TLP).

(d) Connect the OSC jack of the 21A TMS to the amplifier input (AMPL IN jack on the V4 repeater associated with the AGC amplifier). Connect the DET jack of the 21A TMS to the amplifier output (AMPL OUT jack on the V4 repeater associated with the AGC amplifier).

(e) Adjust the LEV ADJ control on the AGC amplifier for a detector reading of −6 dBm on the 21A TMS (10 dB below output TLP).

(f) ***Slowly adjust*** the AGC ADJ control on the AGC amplifier in a counterclockwise direction until a detector reading of −9 dBm is obtained on the 21A TMS (13 dB below output TLP). Because of long time constants, this adjustment must be made by turning the AGC ADJ ***slowly*** while noting the change in the detector reading.

(g) The amplifier is now adjusted to clamp the output power to a level 13 dB below the TLP (−9 dBm at +4 TLP).

(h) Reduce the oscillator test level of the 21A TMS by 5 dB (15 dB below input TLP); the detector reading should drop by 2 dB (15 dB below output TLP). This checks the limiting action of the amplifier.

(i) Disconnect the 21A TMS from the V4 repeater.

(j) Use the preceding method and refer to Fig. 14 to adjust the AGC amplifier for other TLPs.

READ ***The AGC action of the amplifier will make it impossible to measure the overall loss of the circuit using test levels that exceed 13 dB below the TLP. It is suggested that loss measurements from the customer equipment to another location be conducted at a test level of 13 dB below TLP. To minimize the possibility of a misunderstanding, it is imperative that each individual involved with testing the circuit understands that a reduced test level is being used. Some testboards and VF patch bays are not equipped to send reduced test levels. Higher test levels may be used to test those portions or directions of the circuit in which an AGC amplifier (F58122) is not used.***

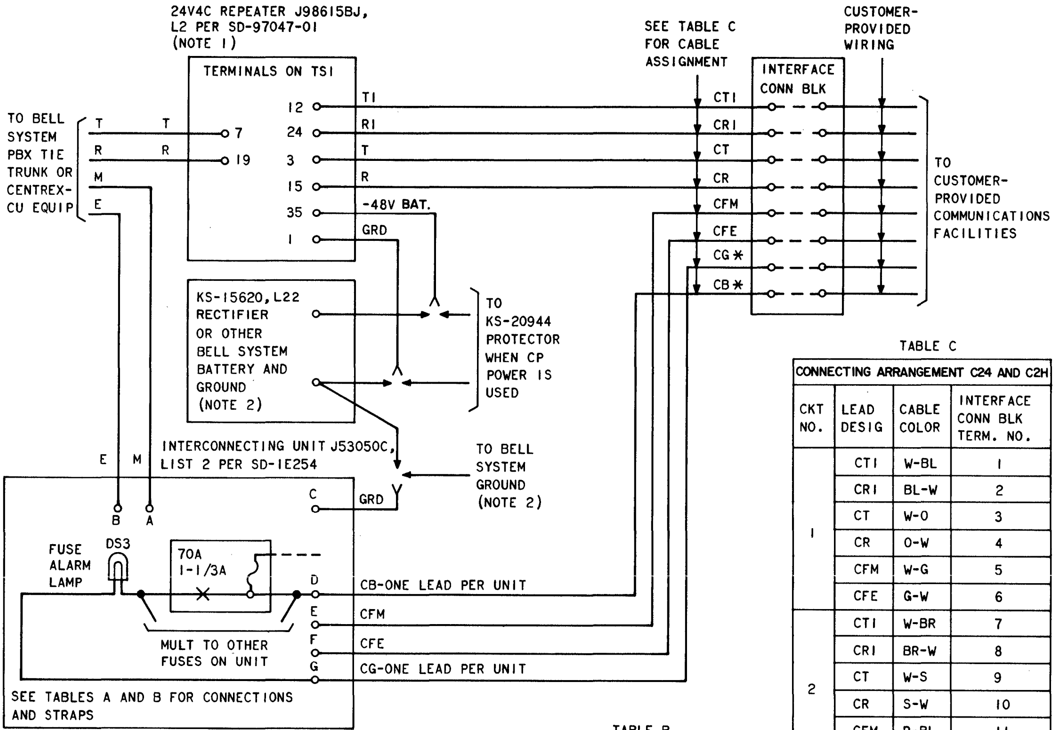


TABLE A

CKT NO.	TERMINALS ON J53050C, LIST 2 - TS(1)						
	A	B	C	D	E	F	G
0	38	28	52	41	48	58	22
1	37	27			47	57	
2	36	26			46	56	
3	35	25			45	55	

TABLE B

STRAPS ON J53050C, LIST 2					
TS(1)		TS(2)		TS(3)	
FROM	TO	FROM	TO	FROM	TO
54	33	58	28	58	28
44	33	48	38	48	38
34	43	38	57	38	57
24	43	47	37	47	37
11	21	27	17	27	17
21	31	56	46	56	46
31	41	23	42	23	42
		13	52	13	52
		52	22	52	22
		12	51	12	51
		41	31	41	31
		21	11	21	11

TABLE C

CONNECTING ARRANGEMENT C24 AND C2H			
CKT NO.	LEAD DESIG	CABLE COLOR	INTERFACE CONN BLK TERM. NO.
1	CT1	W-BL	1
	CR1	BL-W	2
	CT	W-O	3
	CR	O-W	4
	CFM	W-G	5
	CFE	G-W	6
2	CT1	W-BR	7
	CR1	BR-W	8
	CT	W-S	9
	CR	S-W	10
	CFM	R-BL	11
	CFE	BL-R	12
3	CT1	R-O	13
	CR1	O-R	14
	CT	R-G	15
	CR	G-R	16
	CFM	R-BR	17
	CFE	BR-R	18
4	CT1	R-S	19
	CR1	S-R	20
	CT	BK-BL	21
	CR	BL-BK	22
	CFM	BK-O	23
	CFE	O-BK	24
1-4	CG*	BK-G	25
	CB*	G-BK	26

NOTES:

1. EACH 24V4C REPEATER SHELF CONTAINS ONE CIRCUIT; CONNECTIONS FOR OTHER REPEATER CIRCUITS ARE IDENTICAL AS SHOWN. FOR ALIGNMENT PROCEDURES REFER TO EXISTING PRACTICES. WHEN F58122 AGC AMPLIFIER IS USED, ALIGN AS SHOWN IN PART 7.
2. BELL SYSTEM GROUND MUST BE CONNECTED TO THE J53050C, L2 INTERCONNECTING UNIT; BELL SYSTEM OR CUSTOMER-PROVIDED BATTERY AND GROUND MUST BE CONNECTED TO THE 24V4C REPEATER SHELF. KS-15620, L22 RECTIFIER MAY BE USED, HOWEVER, CONNECTIONS MAY BE MADE TO OTHER BELL SYSTEM BATTERY AND GROUND. WHEN CP POWER IS USED, CONNECT BELL SYSTEM GROUND TO J53050C IU.

* ONLY ONE CG AND CB LEAD PER FOUR CIRCUITS.

Fig. 9—Connections—PCAs C24 (PBX) and C2H (Centrex-CU)

TABLE A

CKT NO.	TERMINALS ON J53050C,L2-TS(1) A	B	C	D	E	F	G
0	38	28	52	41	48	58	22
1	37	27			47	57	
2	36	26			46	56	
3	35	25			45	55	

TABLE B

STRAPS ON J53050C, LIST 2					
TS(1)		TS(2)		TS(3)	
FROM	TO	FROM	TO	FROM	TO
54	33	58	28	58	28
44	33	48	38	48	38
34	43	38	57	38	57
24	43	47	37	47	37
11	21	27	17	27	17
21	31	56	46	56	46
31	41	23	42	23	42
		13	52	13	52
		52	22	52	22
		12	51	12	51
		41	31	41	31
		21	11	21	11

TABLE C

CKT NO.	TERMINALS ON TS(A) OF J98605AM A	B	C	D
1	41	51	32	42
2	52	13	43	53
3	14	24	54	15
4	25	35	16	26
5	36	46	27	37
6	47	57	38	48

TABLE SHOWS CONNECTIONS FOR FULLY EQUIPPED UNIT. SELECT REQUIRED CIRCUITS

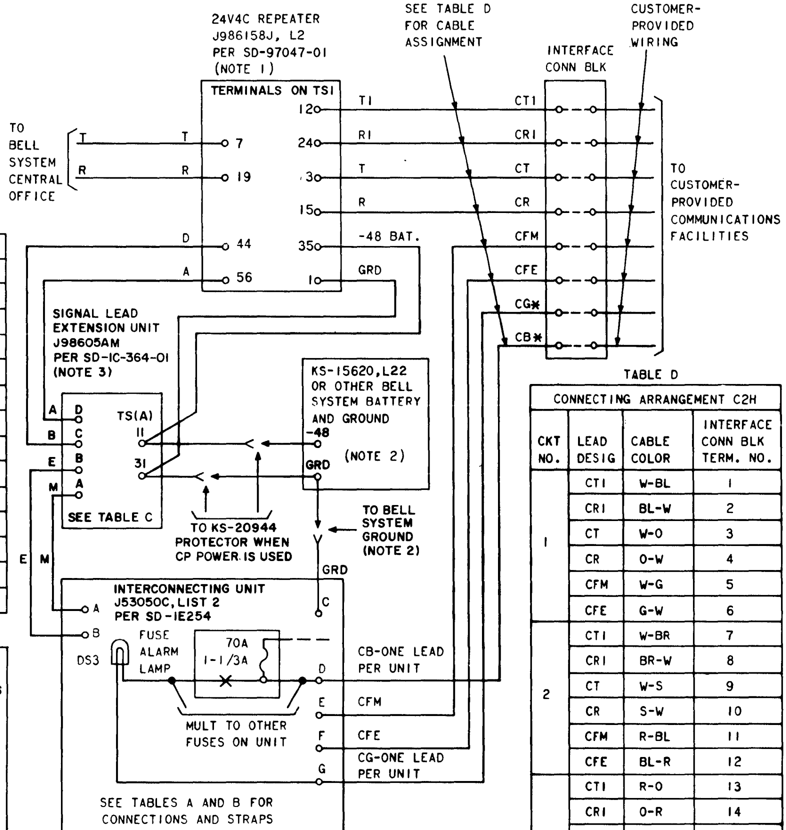


TABLE D

CONNECTING ARRANGEMENT C2H			
CKT NO.	LEAD DESIG	CABLE COLOR	INTERFACE CONN BLK TERM. NO.
1	CT1	W-BL	1
	CR1	BL-W	2
	CT	W-O	3
	CR	O-W	4
	CFM	W-G	5
	CFE	G-W	6
2	CT1	W-BR	7
	CR1	BR-W	8
	CT	W-S	9
	CR	S-W	10
	CFM	R-BL	11
	CFE	BL-R	12
3	CT1	R-O	13
	CR1	O-R	14
	CT	R-G	15
	CR	G-R	16
	CFM	R-BR	17
	CFE	BR-R	18
4	CT1	R-S	19
	CR1	S-R	20
	CT	BK-BL	21
	CR	BL-BK	22
	CFM	BK-O	23
	CFE	O-BK	24
1-4	CG*	BK-G	25
	CB*	G-BK	26

* ONLY ONE CG AND CB LEAD PER FOUR CIRCUITS

NOTES:

1. EACH 24V4C REPEATER SHELF CONTAINS ONE CIRCUIT; CONNECTIONS FOR OTHER REPEATER CIRCUITS ARE IDENTICAL AS SHOWN. FOR ALIGNMENT PROCEDURES REFER TO EXISTING PRACTICES. WHEN F58122 AGC AMPLIFIER IS USED, ALIGN AS SHOWN IN PART 7.
2. BELL SYSTEM GROUND MUST BE CONNECTED TO THE J53050C, L2 INTERCONNECTING UNIT; BELL SYSTEM OR CUSTOMER-PROVIDED BATTERY AND GROUND MUST BE CONNECTED TO THE 24V4C REPEATER SHELF. KS-15620, L22 RECTIFIER MAY BE USED, HOWEVER CONNECTIONS MAY BE MADE TO OTHER BELL SYSTEM BATTERY AND GROUND. WHEN CP POWER IS USED, CONNECT BELL SYSTEM GROUND TO J53050C IU.
3. REFER TO SD-95488-01, SHEET 4 (FIG. 4), AND SHEET 6 (FIG. 56) FOR STRAPPING OF A1,B1,C1, AND D1 LEADS (R,V,W, AND J OPTIONS).

Fig. 10—Connections—PCA C2H (Centrex-CO) Using Signaling Lead Extension Unit J98605AM, 2-Wire Local Channel

TABLE A

CKT NO.	TERMINALS ON J53050C,L2-TS(1) A	B	C	D	E	F	G
0	38	28			48	58	
1	37	27	52	51	47	57	22
2	36	26			46	56	
3	35	25			45	55	

TABLE B

STRAPS ON J53050C, LIST 2					
TS(1)		TS(2)		TS(3)	
FROM	TO	FROM	TO	FROM	TO
54	33	58	28	58	28
44	33	48	38	48	38
34	43	38	57	38	57
24	43	47	37	47	37
11	21	27	17	27	17
21	31	56	46	56	46
31	41	23	42	23	42
		13	52	13	52
		52	22	52	22
		12	51	12	51
		41	31	41	31
		21	11	21	11

TABLE C

CKT NO.	TERMINALS ON TS(A) OF J98605AM A	B	C	D
1	41	51	32	42
2	52	13	43	53
3	14	24	54	15
4	25	35	16	26
5	36	46	27	37
6	47	57	38	48

TABLE SHOWS CONNECTIONS FOR FULLY EQUIPPED UNIT. SELECT REQUIRED CIRCUITS

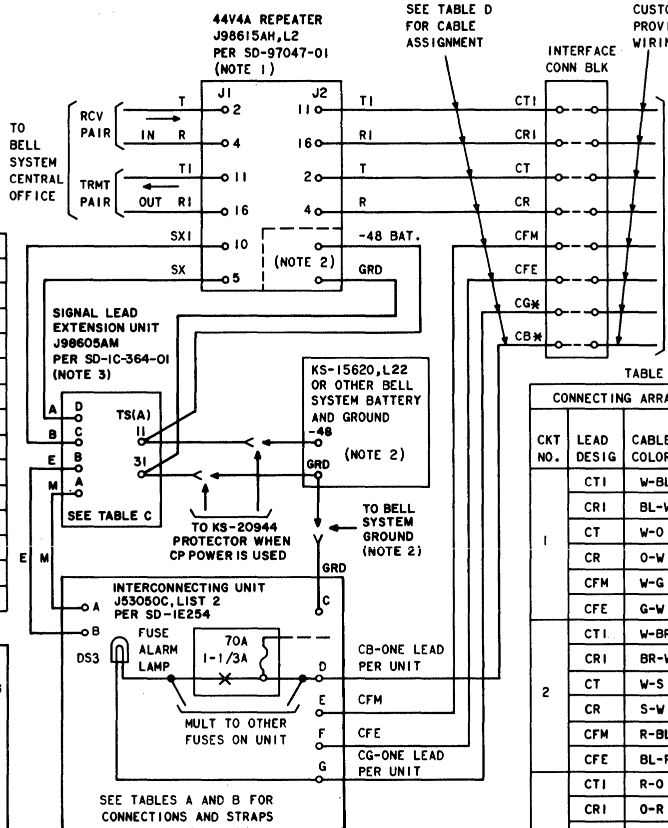


TABLE D

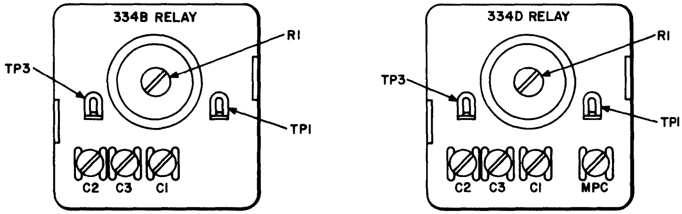
CONNECTING ARRANGEMENT C2H			
CKT NO.	LEAD DESIG	CABLE COLOR	INTERFACE CONN BLK TERM. NO.
1	CT1	W-BL	1
	CR1	BL-W	2
	CT	W-O	3
	CR	O-W	4
	CFM	W-G	5
	CFE	G-W	6
2	CT1	W-BR	7
	CR1	BR-W	8
	CT	W-S	9
	CR	S-W	10
	CFM	R-BL	11
	CFE	BL-R	12
3	CT1	R-O	13
	CR1	O-R	14
	CT	R-G	15
	CR	G-R	16
	CFM	R-BR	17
	CFE	BR-R	18
4	CT1	R-S	19
	CR1	S-R	20
	CT	BK-BL	21
	CR	BL-BK	22
	CFM	BK-O	23
	CFE	O-BK	24
1-4	CG*	BK-G	25
	CB*	G-BK	26

* ONLY ONE CG AND CB LEAD PER FOUR CIRCUITS

NOTES:

1. EACH 44V4A REPEATER SHELF HAS FACILITIES FOR 2 CIRCUITS. SHOWN ARE THE CONNECTIONS FOR 1 CIRCUIT. CONNECTIONS FOR OTHER 3 CIRCUITS ARE IDENTICAL AS SHOWN, EXCEPT FOR BATTERY AND GROUND CONNECTIONS, WHICH ARE EXPLAINED IN NOTE 2. FOR ALIGNMENT PROCEDURES FOLLOW EXISTING PRACTICES AND PART 7.
2. BELL SYSTEM GROUND MUST BE CONNECTED TO THE J53050C, L2 INTERCONNECTING UNIT; BELL SYSTEM OR CUSTOMER-PROVIDED BATTERY AND GROUND MUST BE CONNECTED TO THE 44V4A REPEATER SHELF. KS-15620, L22 RECTIFIER MAY BE USED, HOWEVER CONNECTIONS MAY BE MADE TO OTHER BELL SYSTEM BATTERY AND GROUND. WHEN CP POWER IS USED, CONNECT BELL SYSTEM GROUND TO J53050C IU. VIEWING THE 44V4A REPEATER SHELF FROM THE BACK, CONNECT BATTERY TO THE FIRST STANDOFF ON THE LEFT AND GROUND TO TERMINAL 15 OF J4 LOCATED ON THE LEFT. BATTERY AND GROUND IS FACTORY WIRED TO OTHER CIRCUIT ON THE SAME SHELF.
3. REFER TO SD-95488-01, SHEET 4 (FIG. 4), AND SHEET 6 (FIG. 56) FOR STRAPPING OF A1,B1,C1, AND D1 LEADS (R,V,W, AND J OPTIONS).

Fig. 11—Connections—PCA C2H (Centrex-CO) Using Signaling Lead Extension Unit J98605AM, 4-Wire Local Channel



NOTE:
334B IS USED WITH J98605AM-I SIGNALING LEAD EXTENSION UNIT; 334D IS USED WITH J98605AM-2.

Fig. 12—334B and 334D Relays, End Views

TABLE A

CKT NO.	TERMINALS ON J53050C,L2-TS(1) A	B	C	D	E	F	G
0	38	28	52	41	48	58	22
1	37	27			47	57	
2	36	26			46	56	
3	35	25			45	55	

TABLE B

STRAPS ON J53050C, LIST 2					
TS(1)		TS(2)		TS(3)	
FROM	TO	FROM	TO	FROM	TO
54	33	58	28	58	28
44	33	48	38	48	38
34	43	38	57	38	57
24	43	47	37	47	37
11	21	27	17	27	17
21	31	56	46	56	46
31	41	23	42	23	42
		13	52	13	52
		52	22	52	22
		12	51	12	51
		41	31	41	31
		21	11	21	11

TABLE C

CKT NO.	TERMINALS ON TS(E) OF J98605AH(MD) A	B	C	D
1	28	38	48	58
2	27	37	47	57
3	26	36	46	56
4	25	35	45	55

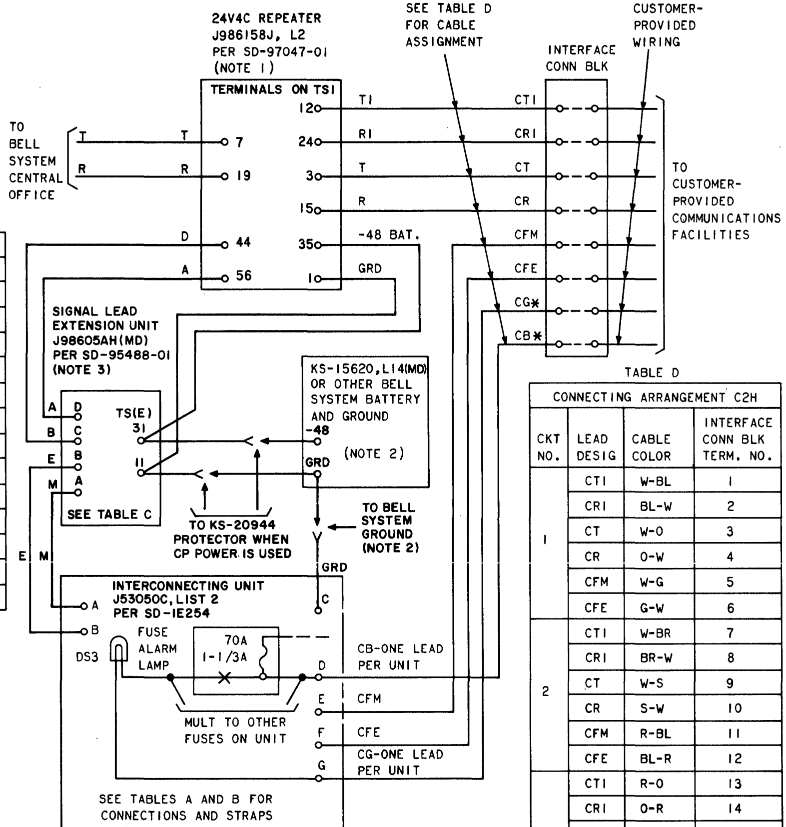


TABLE D

CONNECTING ARRANGEMENT C2H			
CKT NO.	LEAD DESIG	CABLE COLOR	INTERFACE CONN BLK TERM. NO.
1	CT1	W-BL	1
	CR1	BL-W	2
	CT	W-O	3
	CR	O-W	4
	CFM	W-G	5
	CFE	G-W	6
2	CT1	W-BR	7
	CR1	BR-W	8
	CT	W-S	9
	CR	S-W	10
	CFM	R-BL	11
	CFE	BL-R	12
3	CT1	R-O	13
	CR1	O-R	14
	CT	R-G	15
	CR	G-R	16
	CFM	R-BR	17
	CFE	BR-R	18
4	CT1	R-S	19
	CR1	S-R	20
	CT	BK-BL	21
	CR	BL-BK	22
	CFM	BK-O	23
	CFE	O-BK	24
1-4	CG *	BK-G	25
	CB *	G-BK	26

* ONLY ONE CG AND CB LEAD PER FOUR CIRCUITS

NOTES:

1. EACH 24V4C REPEATER SHELF CONTAINS ONE CIRCUIT; CONNECTIONS FOR OTHER REPEATER CIRCUITS ARE IDENTICAL AS SHOWN. FOR ALIGNMENT PROCEDURES REFER TO EXISTING PRACTICES. WHEN F58122 AGC AMPLIFIER IS USED, ALIGN AS SHOWN IN PART 7.
2. BELL SYSTEM GROUND MUST BE CONNECTED TO THE J53050C, L2 INTERCONNECTING UNIT; BELL SYSTEM OR CUSTOMER-PROVIDED BATTERY AND GROUND MUST BE CONNECTED TO THE 24V4C REPEATER SHELF. KS-15620, L22 RECTIFIER MAY BE USED, HOWEVER CONNECTIONS MAY BE MADE TO OTHER BELL SYSTEM BATTERY AND GROUND. WHEN CP POWER IS USED, CONNECT BELL SYSTEM GROUND TO J53050C IU.
3. REFER TO SD-95488-01, SHEET 4 (FIG. 4), AND SHEET 6 (FIG. 56) FOR STRAPPING OF A1,B1,C1, AND D1 LEADS (R,V,W, AND J OPTIONS).

Fig. 13—Connections—PCA C2H (Centrex-CO) Using Signaling Lead Extension Unit J98605AH (MD), 2-Wire Local Channel

TABLE A

CKT NO.	TERMINALS ON J53050C,L2-TS(1)						
	A	B	C	D	E	F	G
0	38	28	52	51	48	58	22
1	37	27			47	57	
2	36	26			46	56	
3	35	25			45	55	

TABLE B

STRAPS ON J53050C, LIST 2					
TS(1)		TS(2)		TS(3)	
FROM	TO	FROM	TO	FROM	TO
54	33	58	28	58	28
44	33	48	38	48	38
34	43	38	57	38	57
24	43	47	37	47	37
11	21	27	17	27	17
21	31	56	46	56	46
31	41	23	42	23	42
		13	52	13	52
		52	22	52	22
		12	51	12	51
		41	31	41	31
		21	11	21	11

TABLE C

CKT NO.	TERMINALS ON TS(E) OF J98605AH(MD)			
	A	B	C	D
1	28	38	48	58
2	27	37	47	57
3	26	36	46	56
4	25	35	45	55

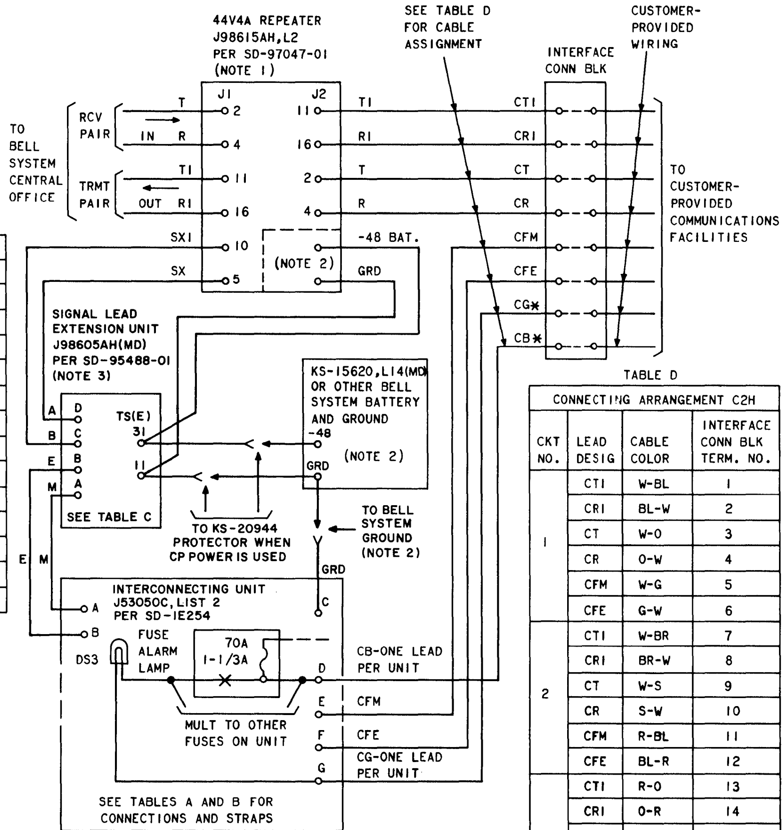


TABLE D

CONNECTING ARRANGEMENT C2H			
CKT NO.	LEAD DESIG	CABLE COLOR	INTERFACE CONN BLK TERM. NO.
1	CT1	W-BL	1
	CR1	BL-W	2
	CT	W-O	3
	CR	O-W	4
	CFM	W-G	5
	CFE	G-W	6
2	CT1	W-BR	7
	CR1	BR-W	8
	CT	W-S	9
	CR	S-W	10
	CFM	R-BL	11
	CFE	BL-R	12
3	CT1	R-O	13
	CR1	O-R	14
	CT	R-G	15
	CR	G-R	16
	CFM	R-BR	17
	CFE	BR-R	18
4	CT1	R-S	19
	CR1	S-R	20
	CT	BK-BL	21
	CR	BL-BK	22
	CFM	BK-O	23
	CFE	O-BK	24
1-4	CG*	BK-G	25
	CB*	G-BK	26

* ONLY ONE CG AND CB LEAD PER FOUR CIRCUITS

NOTES:

1. EACH 44V4A REPEATER SHELF HAS FACILITIES FOR 2 CIRCUITS. SHOWN ARE THE CONNECTIONS FOR 1 CIRCUIT. CONNECTIONS FOR OTHER 3 CIRCUITS ARE IDENTICAL AS SHOWN, EXCEPT FOR BATTERY AND GROUND CONNECTIONS, WHICH ARE EXPLAINED IN NOTE 2. FOR ALIGNMENT PROCEDURES FOLLOW EXISTING PRACTICES AND PART 7.
2. BELL SYSTEM GROUND MUST BE CONNECTED TO THE J53050C, L2 INTERCONNECTING UNIT; BELL SYSTEM OR CUSTOMER-PROVIDED BATTERY AND GROUND MUST BE CONNECTED TO THE 44V4A REPEATER SHELF. KS-15620, L22 RECTIFIER MAY BE USED, HOWEVER CONNECTIONS MAY BE MADE TO OTHER BELL SYSTEM BATTERY AND GROUND. WHEN CP POWER IS USED, CONNECT BELL SYSTEM GROUND TO J53050C IU. VIEWING THE 44V4A REPEATER SHELF FROM THE BACK, CONNECT BATTERY TO THE FIRST STANDOFF ON THE LEFT AND GROUND TO TERMINAL 15 OF J4 LOCATED ON THE LEFT. BATTERY AND GROUND IS FACTORY WIRED TO OTHER CIRCUIT ON THE SAME SHELF.
3. REFER TO SD-95488-01, SHEET 4 (FIG. 4), AND SHEET 6 (FIG. 56) FOR STRAPPING OF A1,B1,C1, AND D1 LEADS (R,V,W, AND J OPTIONS).

Fig. 14—Connections—PCA C2H (Centrex-CO) Using Signaling Lead Extension Unit J98605AH (MD), 4-Wire Local Channel

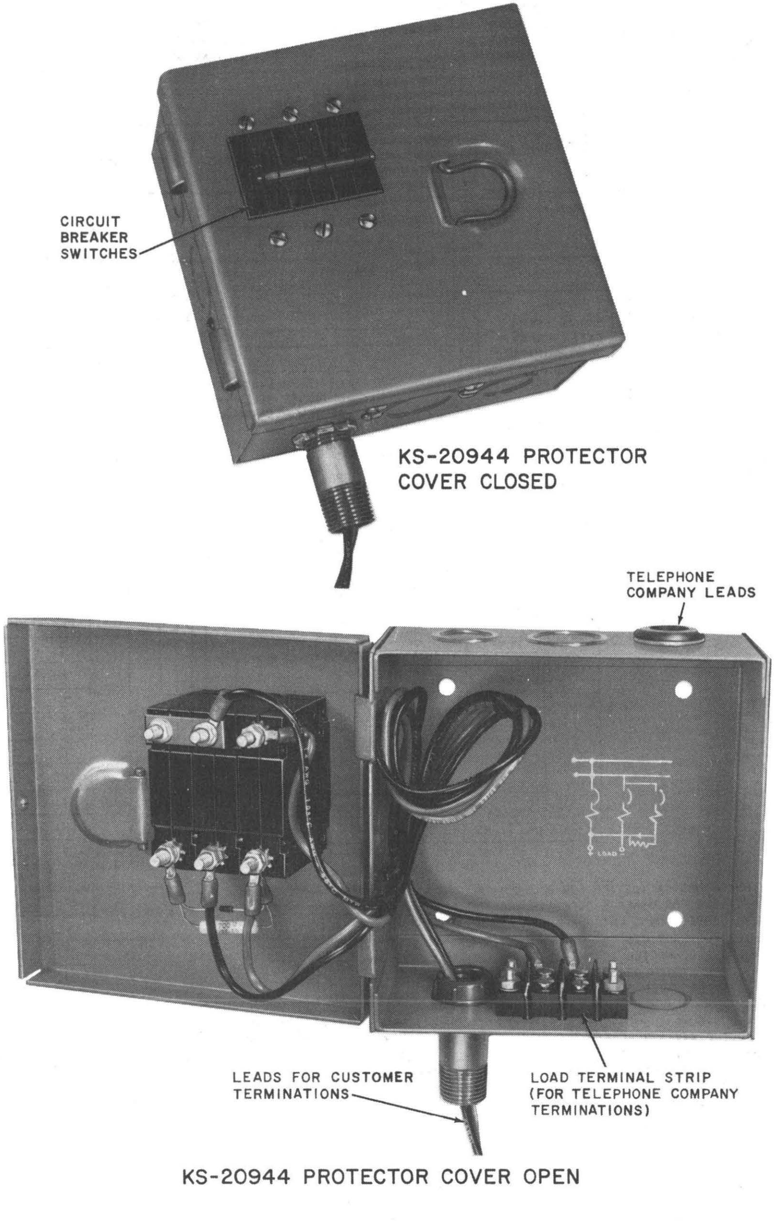
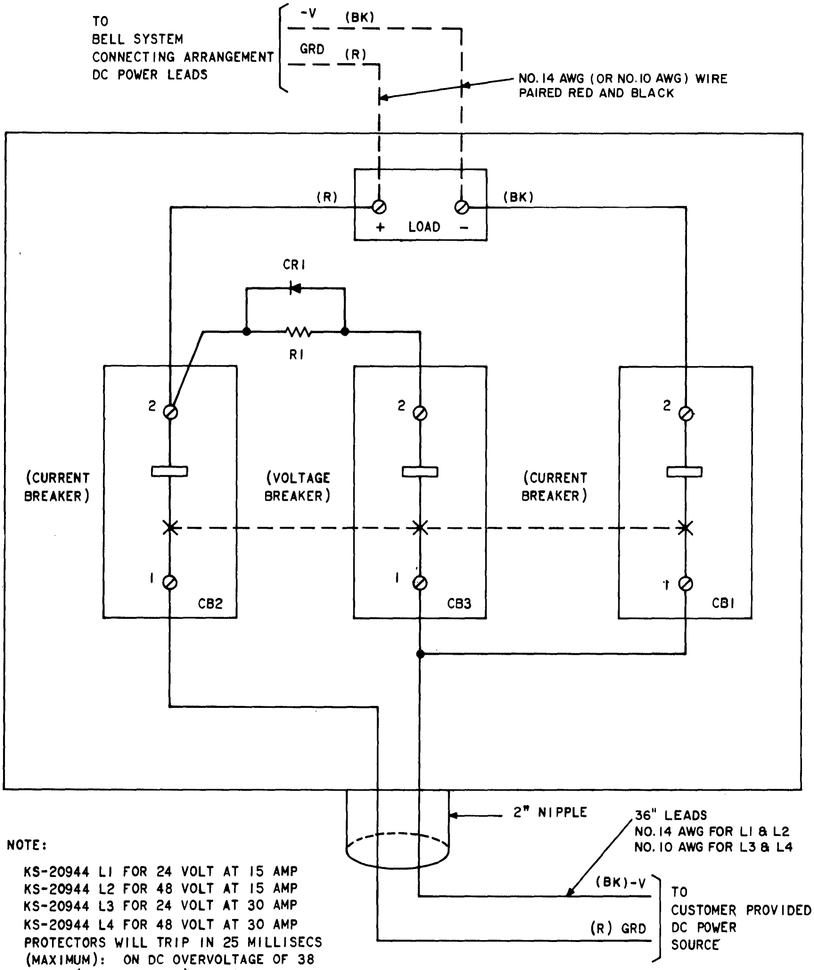


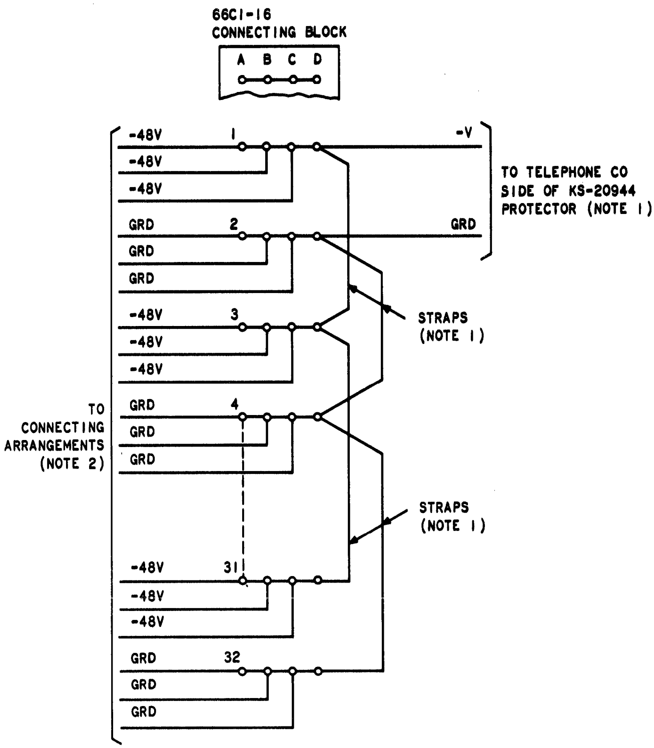
Fig. 15—KS-20944 Protector



NOTE:

KS-20944 L1 FOR 24 VOLT AT 15 AMP
KS-20944 L2 FOR 48 VOLT AT 15 AMP
KS-20944 L3 FOR 24 VOLT AT 30 AMP
KS-20944 L4 FOR 48 VOLT AT 30 AMP
PROTECTORS WILL TRIP IN 25 MILLISECS (MAXIMUM): ON DC OVERVOLTAGE OF 38 VOLTS (24 VOLT UNIT) AND 68 VOLTS (48 VOLT UNIT), ON OVERLOAD OF 18.75 AMPERES (15 AMP UNIT) AND 37.5 AMPERES (30 AMP UNIT), ON REVERSED POLARITY, OR AC VOLTAGE GREATER THAN 18 VOLTS, OR INCORRECT POWER SUPPLY GROUND.

Fig. 16—Schematic—KS-20944 Protector



NOTES:

1. USE 14-GAUGE WIRE TO CONNECT FROM KS-20944 PROTECTOR TO CONNECTING BLOCK; PROVIDE MULTIPLE STRAPS AS DETERMINED BY NUMBER OF CONNECTING ARRANGEMENTS TO BE CONNECTED TO. USE SOLDER TO MAKE THE CONNECTION OF THE 14-GAUGE WIRE AND STRAPS TO THE CONNECTING BLOCK.
2. USE "D" INSIDE WIRE OR EQUIVALENT TO MAKE CONNECTIONS FROM CONNECTING BLOCK TO CONNECTING ARRANGEMENTS. EACH CONNECTING BLOCK PROVIDES MEANS FOR CONNECTING TO 48 CIRCUITS, HOWEVER, DO NOT EXCEED THE MAXIMUM CURRENT RATING OF THE KS-20944 PROTECTOR.

Fig. 17—Typical Power Distribution—Connections Between KS-20944 Protector and PCAs

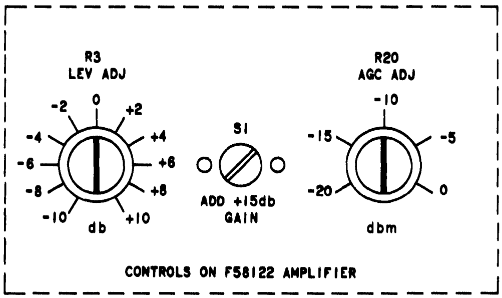


Fig. 18—Adjustment Controls on F58122 Automatic Gain Control Amplifier

VOICE CONNECTING ARRANGEMENTS C27 AND C2K

1. GENERAL

1.01 This section provides identification, installation, operation, maintenance, and connecting information for Voice Connecting Arrangements C27 and C2K. Voice Connecting Arrangements C27 and C2K consist of an interconnecting unit J53050C, List 2 and an interconnecting unit J53050D, List 1. Voice Connecting Arrangement C27 provides 2-wire voice transmission with E and M type signaling between a customer-provided (CP) communications facility and a Bell System PBX trunk circuit. Voice Connecting Arrangement C2K provides the same service when used with Bell System Centrex—CU equipment.

1.02 If the customer wants a copy of the Technical Reference which covers this interface specification, the customer should contact the local Telephone Company Business Office or the Marketing Representative.

1.03 This issue of the section is based on the following drawings:

CD-1E207 Issue 1

SD-1E207 Issue 1

CD-1E254 Issue 1

SD-1E254 Issue 1

If this section is to be used with equipment or apparatus reflecting later issue(s) of the drawing(s), reference should be made to the SDs and CDs to determine the extent of the changes and the manner in which the section may be affected.

2. IDENTIFICATION

PURPOSE

- To provide a 2-wire connection between CP communication facilities and Bell System PBX or Centrex System
- To provide E and M signaling from and to CP communication facilities
- To limit excessive levels from CP communication facilities and to provide protection for personnel against hazardous voltages.

ORDERING GUIDE

- J53050C, List 2 Interconnecting Unit, for Voice Connecting Arrangements C27 and C2K—each unit provides four signal isolation (applique) circuits. (See Fig. 1).
- J53050D, List 1 Interconnecting Unit, for use with 2-wire facilities—each unit provides four voice coupler circuits. (See Fig. 2).

Associated Apparatus (Order Separately)

- Cable, Wiring, "D" inside, or equivalent (for cabling from connecting arrangement to interface connecting block)
- Block, Connecting, 66M1-50 (Fig. 3)

Note: Other types of blocks may be used when specified by local engineering.

- Clip, Bridging, B (25 per pkg).

Replaceable Components

- Fuses, 70A (1-1/3 ampere)—J53050C, List 2 Interconnecting Unit
- Relays, 303K—J53050C,List 2 Interconnecting Unit.

DESIGN FEATURES

J53050C, List 2 Interconnecting Unit

- Mounts on standard 23-inch relay rack
- Size—4 by 23 inches
- Four signal isolation (applique) circuits per unit
- Accepts ground and battery supervisory signals over CFM lead from CP facilities

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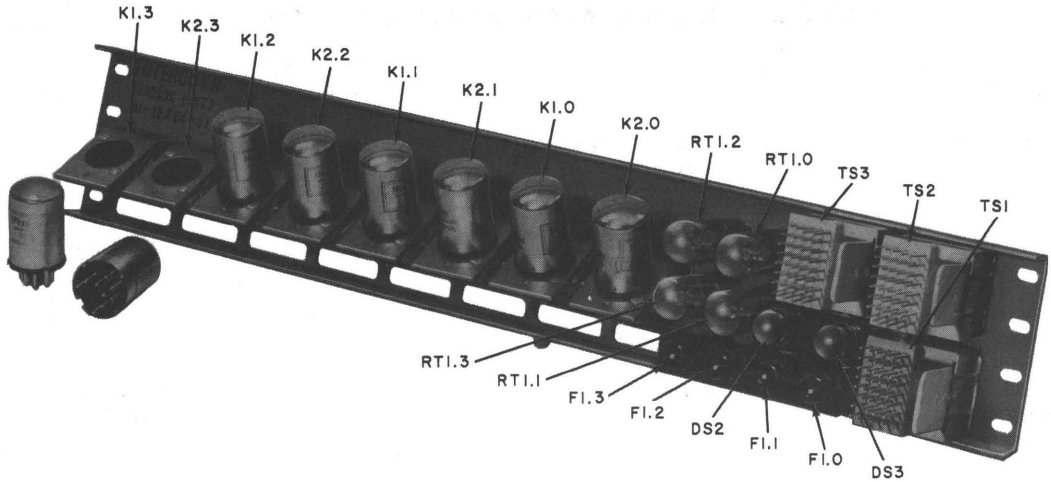


Fig. 1—J53050C, List 2 Interconnecting Unit

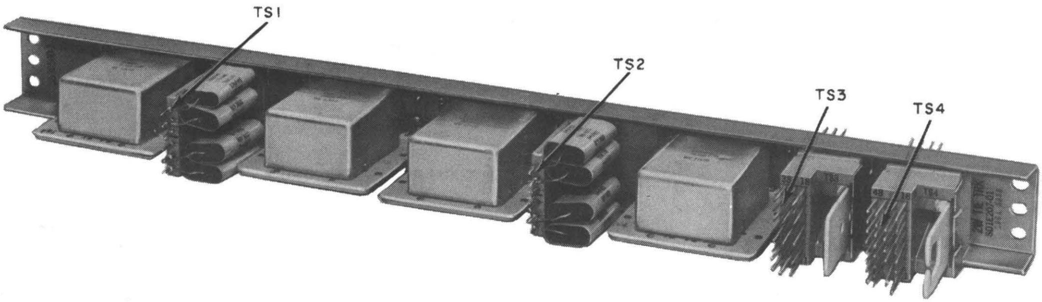


Fig. 2—J53050D, List 1 Interconnecting Unit

- Provides closure (to ground) and open supervisory signals over CFE lead to CP facilities

- Provides DC isolation of the signaling leads between the CP facilities and the signaling lead extension unit.

J53050D, List 1 Interconnecting Unit

- Mounts on standard 23-inch relay rack.

- Four circuits per unit on 2-inch by 23-inch mounting plate.

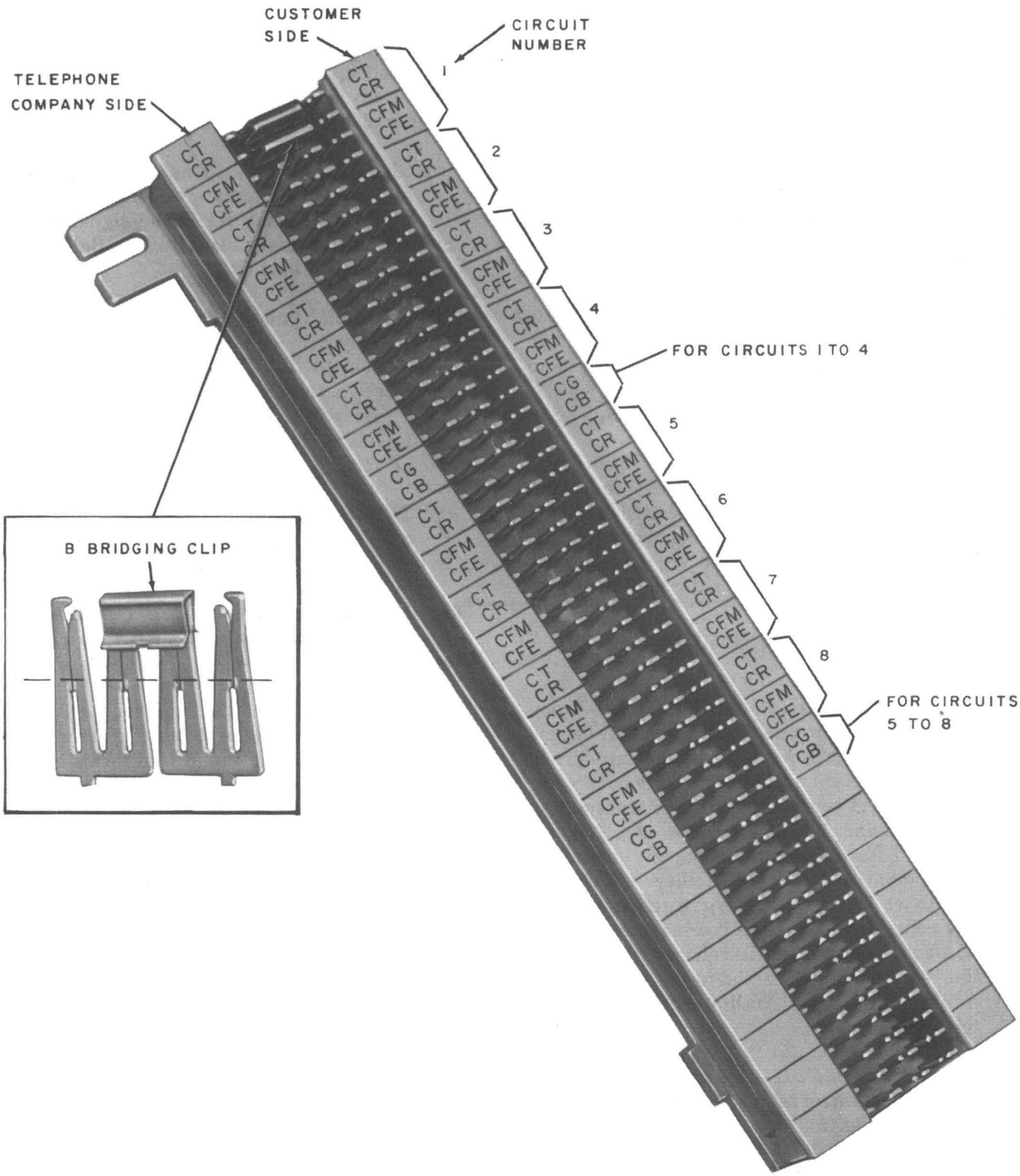


Fig. 3—Typical Interface Connecting Block

- Each circuit provides a 2-wire voiceband transmission path (voice coupler) to and from the CP facilities.
- Provides impedance match of either 600 ohms to 600 ohms (option Z) or 900 ohms to 600 ohms (option Y).
- Provides transformer isolation and hazardous voltage protection between CP facilities and Bell System equipment.

3. INSTALLATION

3.01 Locate the voice connecting arrangements in an area free of dampness and excessive dust or dirt, with adequate room for access to front and rear of equipment and connecting blocks. The associated equipment typically mounts on a standard 23-inch relay rack.

3.02 Use the "D" inside wiring cable or equivalent to terminate the leads associated with the CP equipment on the interface connecting block. Stencil trunk number and lead designations on interface connecting block designation strip (see Fig. 3).

4. OPERATION

Note: The operational details for Voice Connecting Arrangements C27 and C2K depend on the requirements of the switching system to which it is connected. The voice connecting arrangement provides a means of transmitting voice, dialing, and answer/disconnect signals between the Telephone Company switching equipment and the CP facility. When the distant end switching equipment is customer-provided, close coordination between the customer and the Telephone Company will be required to insure end-to-end compatibility of the terminal signaling and supervision circuits.

4.01 ***Incoming Call— Voice Connecting Arrangements C27 (PBX) and C2K (Centrex-CU) Fig. 4***

(a) The CP communications facility seizes the connecting arrangement by placing ground on lead CFE. This operates the K1 relay in the signal isolation (applique) circuit which in turn places ground on the E lead toward the Bell System PBX tie trunk or the Centrex-CU equipment. The Bell System equipment responds to this seizure by connecting dial pulse receiving equipment to the E lead and returning dial tone, if provided, to the CP communications facility over leads CT and CR to indicate readiness to receive dial pulses.

(b) The CP communications facility transmits dial pulses by alternately opening and closing the CFE lead. Relay K1 in the signal isolation circuit repeats dial pulses to the Bell System equipment over lead E.

(c) When dial pulses have been received, the Bell System equipment transmits answer supervision to the CP communications facility by placing battery on the M lead. This operates the K2 relay in the signal isolation circuit which in turn places battery on the CFM lead toward the CP facility.

(d) The J53050D Interconnecting Unit (voice coupler) provides a 2-wire transmission path from the CP facility to the Bell System equipment.

4.02 ***Outgoing Call-Voice Connecting Arrangements C27 (PBX) and C2K (Centrex-CU) Fig. 4***

(a) The Bell System tie trunk or Centrex-CU equipment seizes the connecting arrangement by placing battery on the M lead. This operates the K2 relay in the signal isolation circuit which in turn places battery on the CFM lead toward the CP facility; dial tone, if provided, is returned from the distant end over leads CT and CR. The Bell System equipment then outpulses the digits by alternately applying battery and ground to lead M. The digits are repeated to the CP facility over lead CFM.

(b) The CP facility indicates answer supervision by placing ground on lead CFE which operates K1 relay in the signal isolation circuit in the same manner as an incoming call. The resulting K1 contact closure repeats the answer supervision to the Bell System equipment by grounding the E lead.

(c) The J53050D Interconnecting Unit (voice coupler) provides a 2-wire transmission path from the Bell System equipment to the CP facility.

4.03 ***Disconnect—Voice Connecting Arrangements C27 (PBX) and C2K (Centrex-CU) Fig. 4***

(a) When the Bell System end goes on-hook first, the Bell System equipment removes battery from lead M which releases the K2 relay in the signal isolation circuit. The K2 relay released removes battery from and applies ground to the CFM lead toward the CP facility. This ground is recognized by the CP facility as a disconnect signal. The CP facility subsequently removes ground from the CFE lead which in turn causes the K1 relay in the signal isolation circuit to release, which removes ground from the E lead toward the Bell System equipment restoring the connecting arrangement to the idle condition.

(b) When the customer end goes on-hook first, the CP facility removes ground from lead CFE toward the signal isolation circuit causing the K1 relay to release which removes ground from lead E toward the Bell System equipment. The Bell System equipment subsequently removes battery from lead M which releases the K2 relay in the signal isolation circuit. Relay K2 released removes battery from and applies ground to the CFM lead toward the CP facility, restoring the connecting arrangement to the idle condition.

5. MAINTENANCE

5.01 Where there is an indication of trouble in the connecting arrangement(s), the circuit at fault must be opened at the interface connecting block to verify in which direction the trouble exists. The circuit can be opened at the connecting block by removing the B bridging clip associated with each lead.

5.02 Precautions should be taken when performing tests to avoid adversely affecting service to the customer. Local instructions should be followed with reference to notifying the customer before performing the test.

5.03 ***Apparatus Required to Perform Tests***

(a) Test cord, 893 cord, 6 feet long, equipped with two 360A tools (1W13B cord), one KS-6278 connecting clip, and one 411B (test pick) tool (for connecting battery to alarm bar of 70-type fuses).

Note: To connect battery to the alarm bar of 70-type fuses mounted in a 21A fuse block, insert the tip of the 411B tool (attached to the 1W13B cord) into the aperture provided in the fuse block cover, and touch the alarm bar.

(b) Volt-ohm-meter capable of measuring −48 volts and 1000 ohms. Two clip leads, one of sufficient length to reach from the interface connecting block to the connecting arrangement.

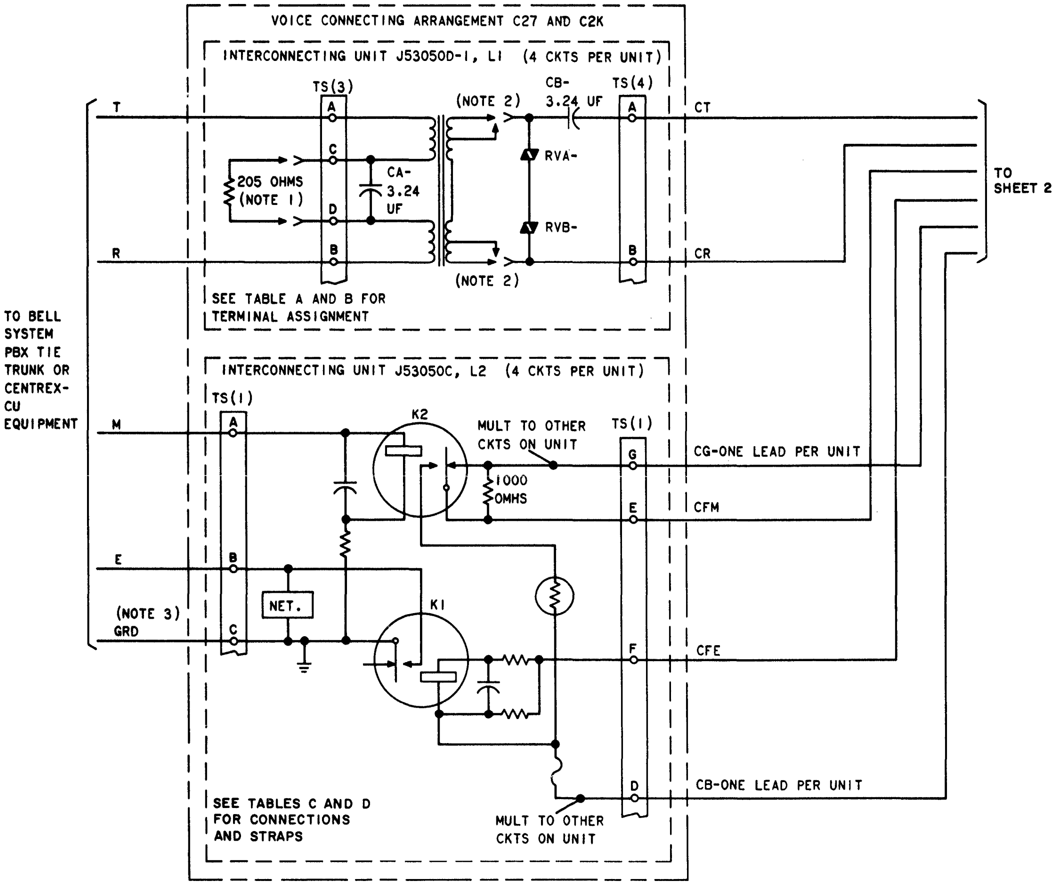
5.04 ***Tests—J53050C, List 2 Interconnecting Unit***

(a) Using 893 cord, connect battery to alarm bar of fuse(s) on interconnecting unit—fuse alarm lamp DS3 should light.

(b) Open all of the leads of the circuit under test at the interface connecting block except leads CB and CG. Remove leads E and M from the Bell System PBX or Centrex-CU equipment. To check customer battery (−48 volts) connect the volt-ohm-meter across leads CB and CG with the negative lead (black) on CB and the positive lead (red) on CG. The volt-ohm-meter should indicate 48 volts. Apply Bell System battery (−48 volts) to lead M; relay K2 should operate, indicated by battery (−48 volts) present between lead CFM and CG. If K2 relay does not operate, replace it with a relay known to be good; if battery still is not present across leads CFM and CG, measure the resistance between the two leads. If resistance measures zero, check for open on lead M; if resistance measures 1000 ohms, check for faulty RT1 resistance lamp or blown fuse; if resistance measures infinity, check for open on lead CFM or CG.

(c) Connect lead CFE to lead CG. The K1 relay should operate, indicated by a ground on lead E. If K1 relay does not operate, replace it with a relay known to be good; if K1 relay still does not operate, check for open on leads CFE, CG, or E.

(d) On completion of tests, reconnect leads E and M to the signal lead extension unit or the Bell System PBX or Centrex-CU equipment. Replace the B bridging clips at the interface connecting block associated with the circuit under test.



NOTES:

1. PROVIDE RESISTORS ON TS(3) AS SHOWN, KS-20289, L2A, OR EQUIV; SEE TABLE A FOR TERMINAL NUMBER ASSIGNMENT.
2. WHEN CP EQUIPMENT TO BELL SYSTEM IMPEDANCE IS 600 OHMS TO 600 OHMS PROVIDE STRAPS ON TS(4) FOR OPTION Z; WHEN CP EQUIPMENT IMPEDANCE IS 600 OHMS AND BELL SYSTEM IMPEDANCE IS 900 OHMS, PROVIDE STRAPS ON TS(4) FOR OPTION Y (SEE TABLE B).
3. BELL SYSTEM GROUND MUST ALWAYS BE CONNECTED TO THE J53050C, LIST 2 IU.

Fig. 4—Connections For Four Circuits—Voice Connecting Arrangements C27 and C2K

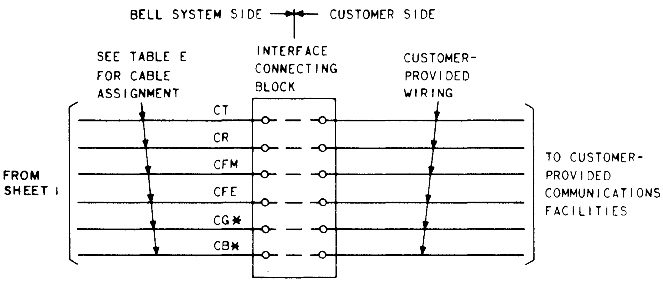


TABLE A

CKT NO.	TERMINALS ON J53050D, L1					
	TS(3)				TS(4)	
	A	B	C	D	A	B
1	11	14	13	12	14	16
2	15	18	17	16	24	26
3	21	24	23	22	34	36
4	25	28	27	26	44	46

TABLE B

STRAPS ON J53050D, L1 TS(4) - (NOTE 2)				
CKT NO.	OPTION Y		OPTION Z	
	FROM	TO	FROM	TO
1	17	16	15	16
	11	12	13	12
2	27	26	25	26
	21	22	23	22
3	37	36	35	36
	31	32	33	32
4	47	46	45	46
	41	42	43	42

TABLE C

CKT NO.	TERMINALS ON J53050C, L2-TS(1)						
	A	B	C	D	E	F	G
0	38	28	52	41	48	58	22
1	37	27			47	57	
2	36	26			46	56	
3	35	25			45	55	

TABLE D

STRAPS ON J53050C, LIST 2					
TS(1)		TS(2)		TS(3)	
FROM	TO	FROM	TO	FROM	TO
54	33	58	28	58	28
44	33	48	38	48	38
34	43	38	57	38	57
24	43	47	37	47	37
11	21	27	17	27	17
21	31	56	46	56	46
31	41	23	42	23	42
		13	52	13	52
		52	22	52	22
		12	51	12	51
		41	31	41	31
		21	11	21	11

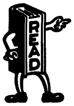
TABLE E

CKT NO.	LEAD DESIG	CABLE COLOR	INTERFACE CONN BLK TERM. NO.
1	CT	W-BL	1
	CR	BL-W	2
	CFM	W-O	3
	CFE	O-W	4
2	CT	W-G	5
	CR	G-W	6
	CFM	W-BR	7
	CFE	BR-W	8
3	CT	W-S	9
	CR	S-W	10
	CFM	R-BL	11
	CFE	BL-R	12
4	CT	R-O	13
	CR	O-R	14
	CFM	R-G	15
	CFE	G-R	16
1-4	CG*	R-BR	17
	CB*	BR-R	18

*- ONLY ONE CG AND CB LEAD PER FOUR CIRCUITS

Fig. 4—Connections For Four Circuits—Voice Connecting Arrangements C27 and C2K

5.05 ***Tests—J53050D, List 1 Interconnecting Unit:*** Perform normal circuit order transmission tests. The insertion loss of the interconnecting unit is nominal 1 dB at 1000 Hz.



Do not attempt any tests or repairs to the CP equipment.

6. CONNECTIONS

6.01 For connecting information refer to Fig. 4.

CONNECTING ARRANGEMENT CEK

J53050E INTERCONNECTING UNIT

1. GENERAL

1.01 This section provides identification, operation, installation, maintenance, and connection information for Connecting Arrangement CEK using J53050E Interconnecting Unit (IU), formerly F58356 Interconnecting Unit.

1.02 This section is reissued to include reference to the J53050E IU, to provide information on both third wire and paired wire operation, and to add modification procedures for the F58356 IU (MD) when used for paired wire operation.

1.03 This issue of the section is based on the following drawings:

SD-1E229-01 Issue 3

CD-1E229-01 Issue 1, Appendix 1B

If this section is to be used with equipment or apparatus reflecting later issue(s) of the drawing(s), reference should be made to the SDs and CDs to determine the extent of the changes and the manner in which the section may be affected.

1.04 The J53050E IU (Fig. 1) is used to connect from 1 to 10 customer-provided (CP) message registers to Bell System equipment arranged for remote register operation. The J53050E IU arranged as shown in Fig. 4 (Option Z) or the F58356 IU arranged as shown in Fig. 6 is used for operation over a third wire; the J53050E IU arranged as shown in Fig. 5 (option Y) or the F58356 IU arranged as shown in Fig. 7, and modified as shown in Fig. 8 and 9, is used for operation over paired wires.

1.05 If the customer wants a copy of the Technical Reference which covers this interface specification, the customer should contact the local Telephone Company Business Office or the Marketing Representative.

2. IDENTIFICATION

(a) ***Purpose***

- To provide a connection from the central office (CO) message register (SXS, No. 1 or No. 5 Crossbar, and Panel Systems) or remote control applique circuit of No. 1 ESS to CP message registers.

- To limit excessive levels from CP equipment to provide protection for personnel against hazardous voltages.

(b) ***Application***

Used with Voice Connecting Arrangement CD8 or CDH (loop or ground start trunks) which provide service for CP PBX.

(c) ***Ordering Guide***

- ➧J53050E Interconnecting Unit (one per each 10 or less CP message registers)➧

Associated Apparatus (Order Separately)

Fig. 1—➧J53050E➧ Interconnecting Unit

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- Block, Connecting, 66M1-50

Note: Other types of blocks may be used when specified by local engineering.

- ➧Clip, Bridging, B (25 per pkg.)➧

(d) ***Design Features***

- Components mounted on a 189A (2- by 23-inch) mounting plate for use with standard relay rack
- Detects message unit pulses from CO over third wire or paired wire connection
- Provides contact closure to CP message register when message unit registration from CO is detected
- ➧Maximum loop resistance from IU to CO for paired wire operation is 2000 ohms➧
- ➧Maximum resistance from IU to CO for third wire operation is 1250 ohms.➧

3. OPERATION

3.01 ***Incoming Message Registration Pulse from the Central Office:*** When a station on the CP PBX originates a call for which a message charge will be registered and the CO equipment completes the connection to the called party, a message register in the CO operates, causing a contact closure to apply battery over the CO facility to the input lead (I-lead) of this connecting arrangement. Application of battery to the input lead operates the K relay closing the dry contacts in the output leads to the CP equipment. The K Relay remains operated for the duration of the message registration pulse and releases when the pulse ends. A diode-resistor network across the relay winding prevents the relay from releasing before a full pulse is transmitted to the CP equipment. The K Relay operates and releases each time a message registration pulse is received from the central office, providing the pulse rate is no faster than 10 pulses-per-second.

4. INSTALLATION

4.01 The ➧J53050E➧ Interconnecting Unit will mount on a standard relay rack or in the same equipment cabinet that houses the associated CO trunk voice connecting arrangements (604A panel).

4.02 Electrical connection is made to the D5A terminal strip (Fig. 1) using a wire-wrap tool.

4.03 Terminate output leads for required quantity of circuits to the customer equipment on the 66M1-50 connecting block (stencil lead designations on designation strip, Fig. 2) which serves as an interface connecting block.

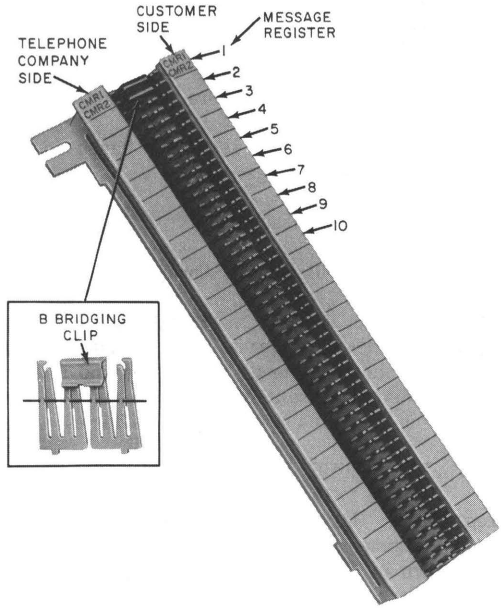


Fig. 2—➧Typical Interface Connecting Block➧

5. MAINTENANCE

5.01 ➧When there is an indication of trouble in the connecting arrangement(s), the circuit at fault must be opened at the interface connecting block to verify in which direction the trouble exists. The circuit can be opened at the connecting block by removing the B bridging clip associated with each lead.

5.02 Precautions should be taken when performing tests to avoid adversely affecting service to the customer. Local instructions should be followed with reference to notifying the customer before performing the tests.

5.03 ***Apparatus Required to Perform Tests***

(a) A dc voltage source with a capability of 35 ma at 48 volts

(b) Resistor, 2400 ohm $\pm 5\%$, 1 watt

(c) Ohmmeter or buzzer capable of checking contact closure

(d) Clip leads for connecting battery and ground to the interconnecting unit.

5.04 ***Tests—J53050E or F58356 Interconnecting Unit***

(a) Open the two leads of the circuit under test at the interface connecting block. Remove the I-lead of the circuit under test at the 66B3-50 connecting block (when paired wire operation is used also remove the G-lead of the circuit under test). With ground connected to the circuit under test, apply -48 ± 3 volts through the 2400 ohm resistor to the I-lead of the circuit under test (see Table A). Observe that the relay associated with the circuit under test operates. At the interface connecting block check for closure across leads CMR1, CMR2 associated with circuit under test.

(b) Using Table A and Fig. 4, 5, 6, or 7, perform the preceding tests on all circuits on the interconnecting unit.

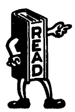
(c) On completion of tests, reconnect leads I- (and G-leads when paired wire operation is used) to the 66B3-50 connecting block and replace the B bridging clips at the interface connecting block associated with the circuit under test.

5.05 If the trouble is toward the CP equipment, inform the customer that the trouble tests toward his equipment.◀

▶TABLE A◀

CKT NO.	INPUT LEADS*	RELAY ON UNIT	CMR1,CMR2 LEADS-MESSAGE REGISTER NO.
1	I1,G1	K1.0	1
2	I2,G2	K2.0	2
3	I3,G3	K1.1	3
4	I4,G4	K2.1	4
5	I5,G5	K1.2	5
6	I6,G6	K2.2	6
7	I7,G7	K1.3	7
8	I8,G8	K2.3	8
9	I9,G9	K1.4	9
10	I10,G10	K2.4	10

*Apply battery to I leads and ground to G leads; when third wire operation is used, only one G lead per unit is provided.



Do not attempt any tests or repairs to the customer-provided equipment.

6. CONNECTIONS

6.01 For connecting information, refer to Fig. 2, 3, 4, ▶5, 6, 7, 8, and 9.◀

7. ▶F58356 IU MODIFICATION

7.01 The F58356 IU may be locally modified for use in paired wire operation. The common ground used in the F58356 IU must be replaced with an individual ground path from each circuit to the D5A terminal strip. Perform the modification as follows:

(a) Cut the bare strap wires between the bottom terminals on the terminal board on which networks Z1.0-Z1.4 and Z2.0-Z2.4 are mounted (see Fig. 8 and 9).

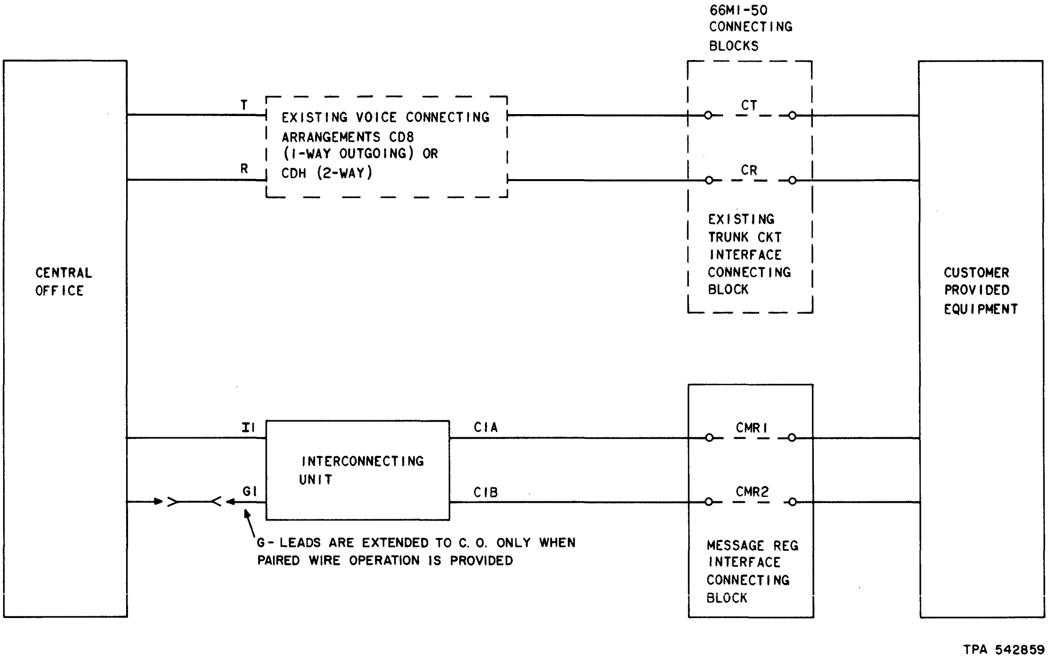


Fig. 3—♦Typical Installation of Connecting Arrangement CEK, Block Diagram♦

(b) Remove the black ground wire multiple (see Fig. 8 and 9) from terminals 1 upper and 1 lower of all relays. Remove the black ground wire from terminal 1B of the terminal board on which the networks are mounted. ***Do not*** remove the black ground wire from terminal 11 of the D5A terminal strip to terminal 1U of K1.0 relay.

(c) Using black, 24AWG wire or equivalent, refer to Fig. 9 and provide individual ground wiring as shown in Table B.♦

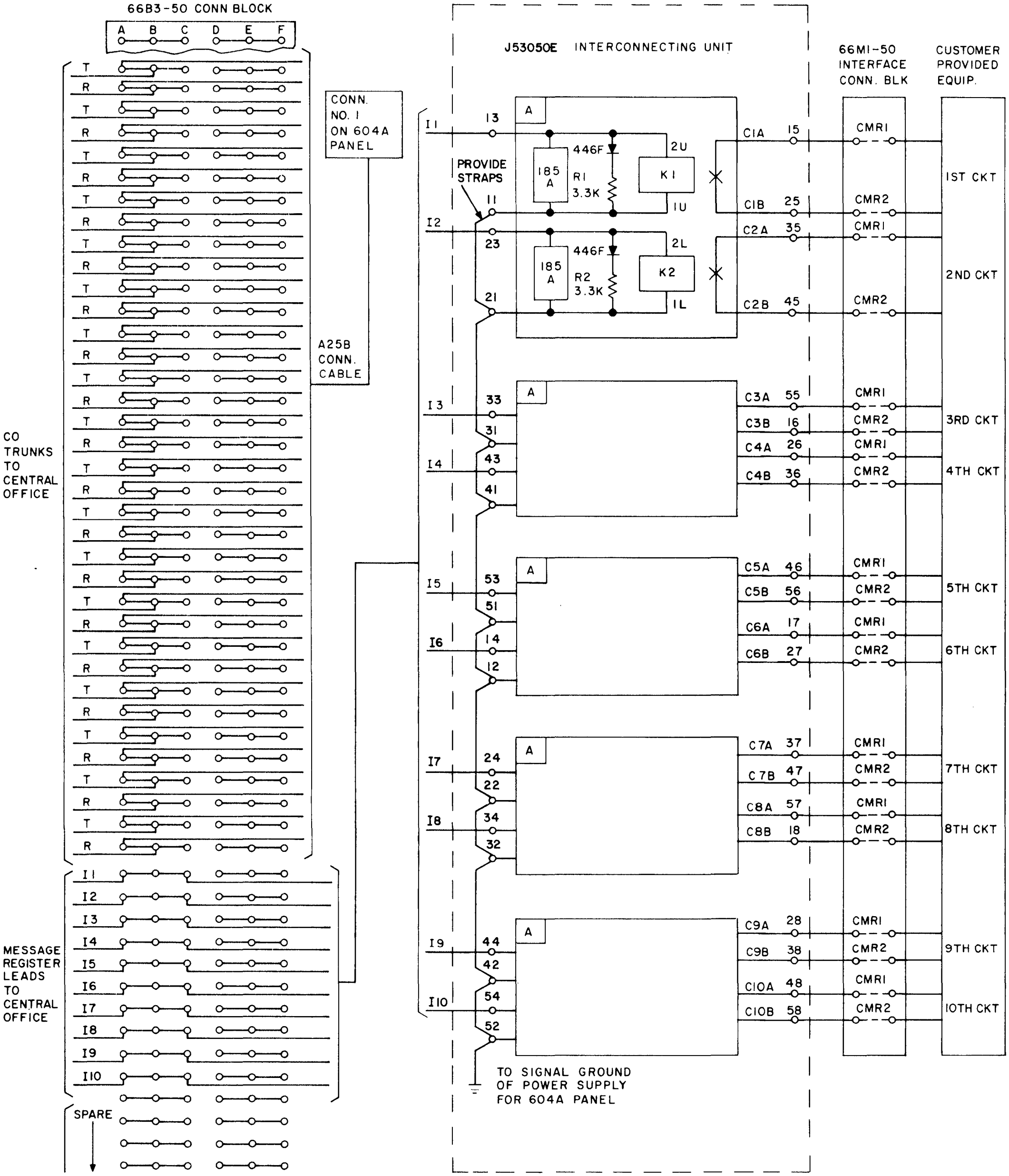


Fig. 4—▶Connecting Arrangement CEK, Third Wire Operation, Using J53050E Interconnecting Unit (Option Z), Schematic◀

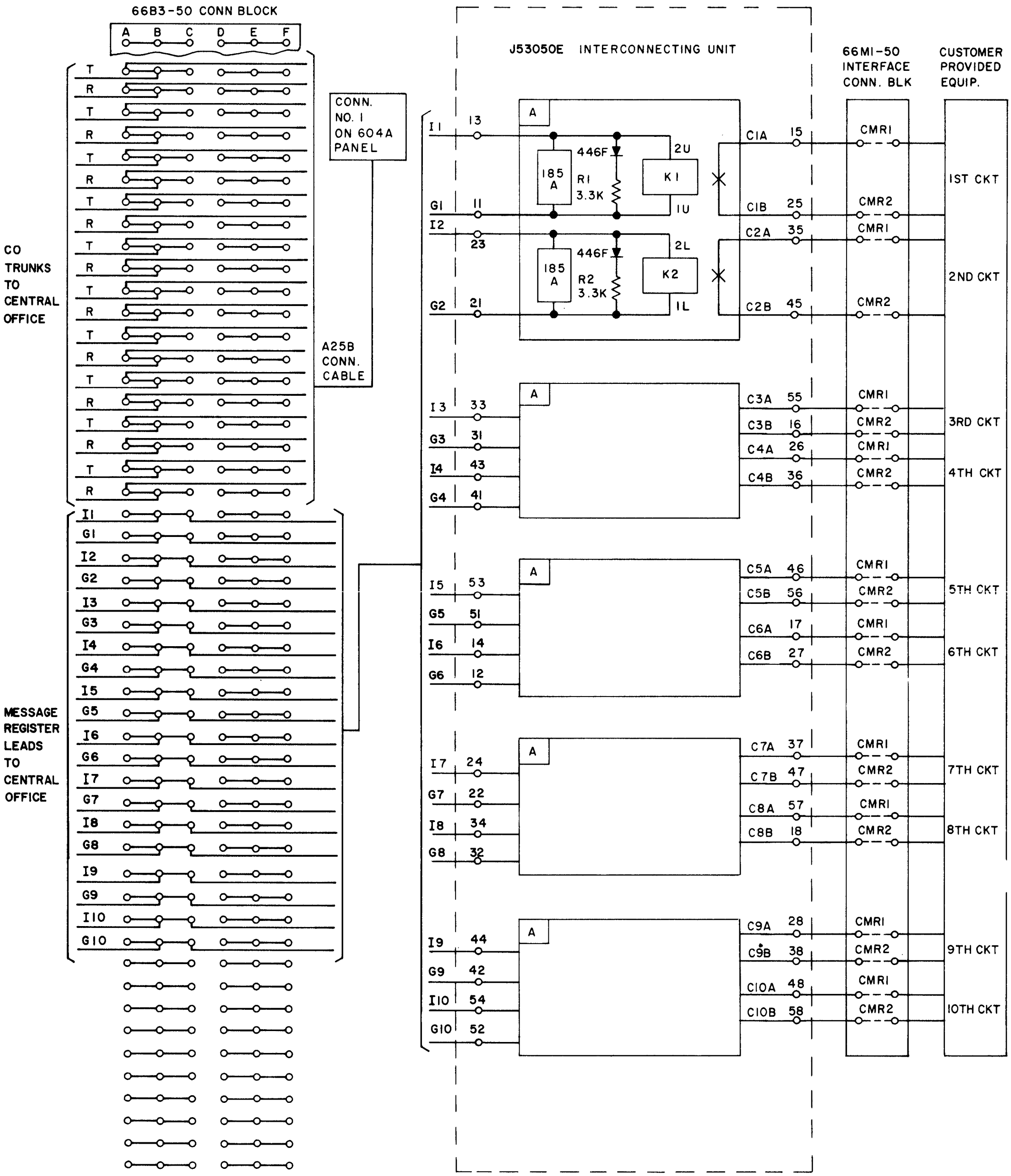


Fig. 5—Connecting Arrangement CEK, Paired Wire Operation, Using J53050E Interconnecting Unit (Option Y), Schematic

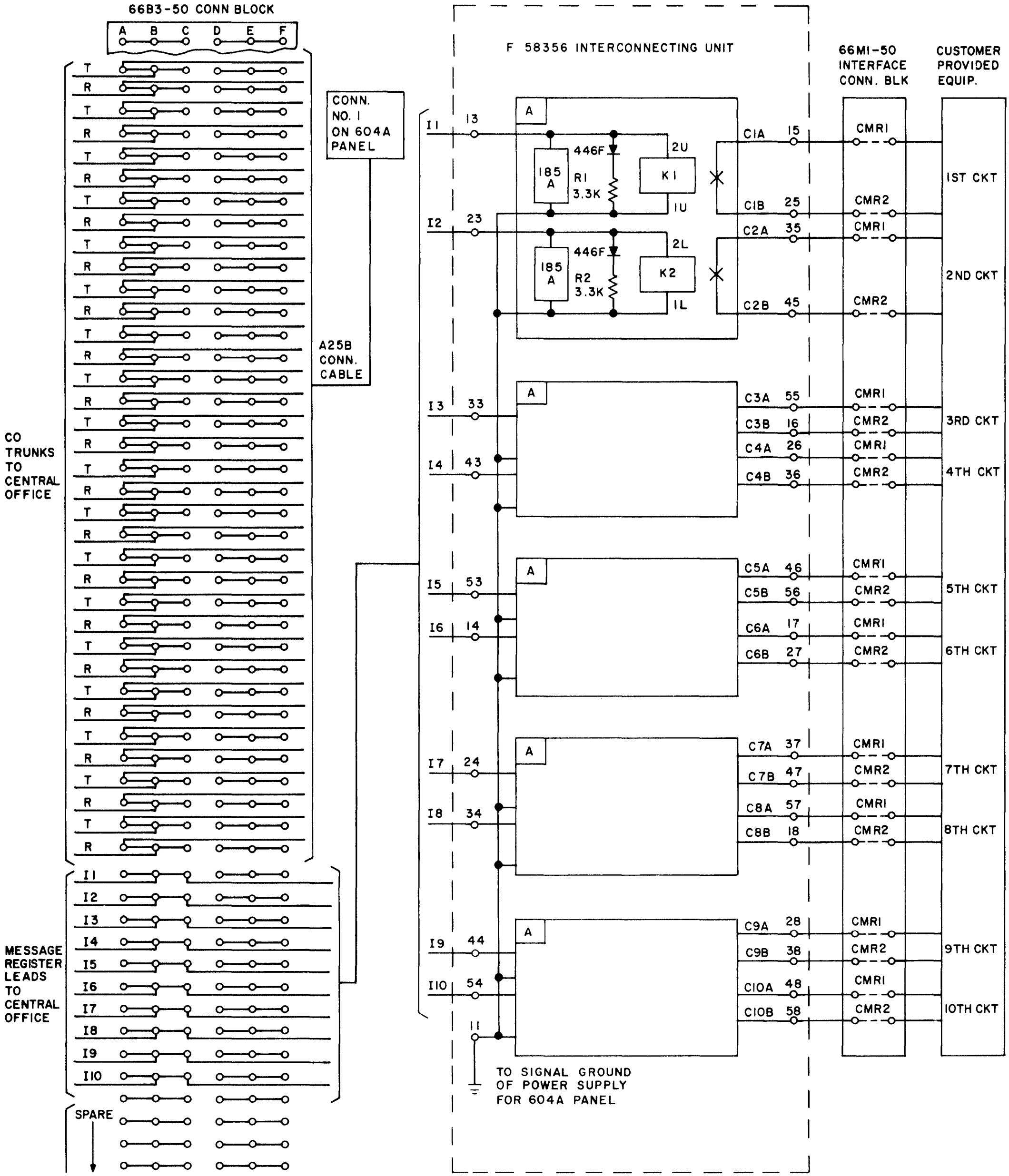


Fig. 6—Connecting Arrangement CEK, Third Wire Operation, Using F58356 Interconnecting Unit, Schematic

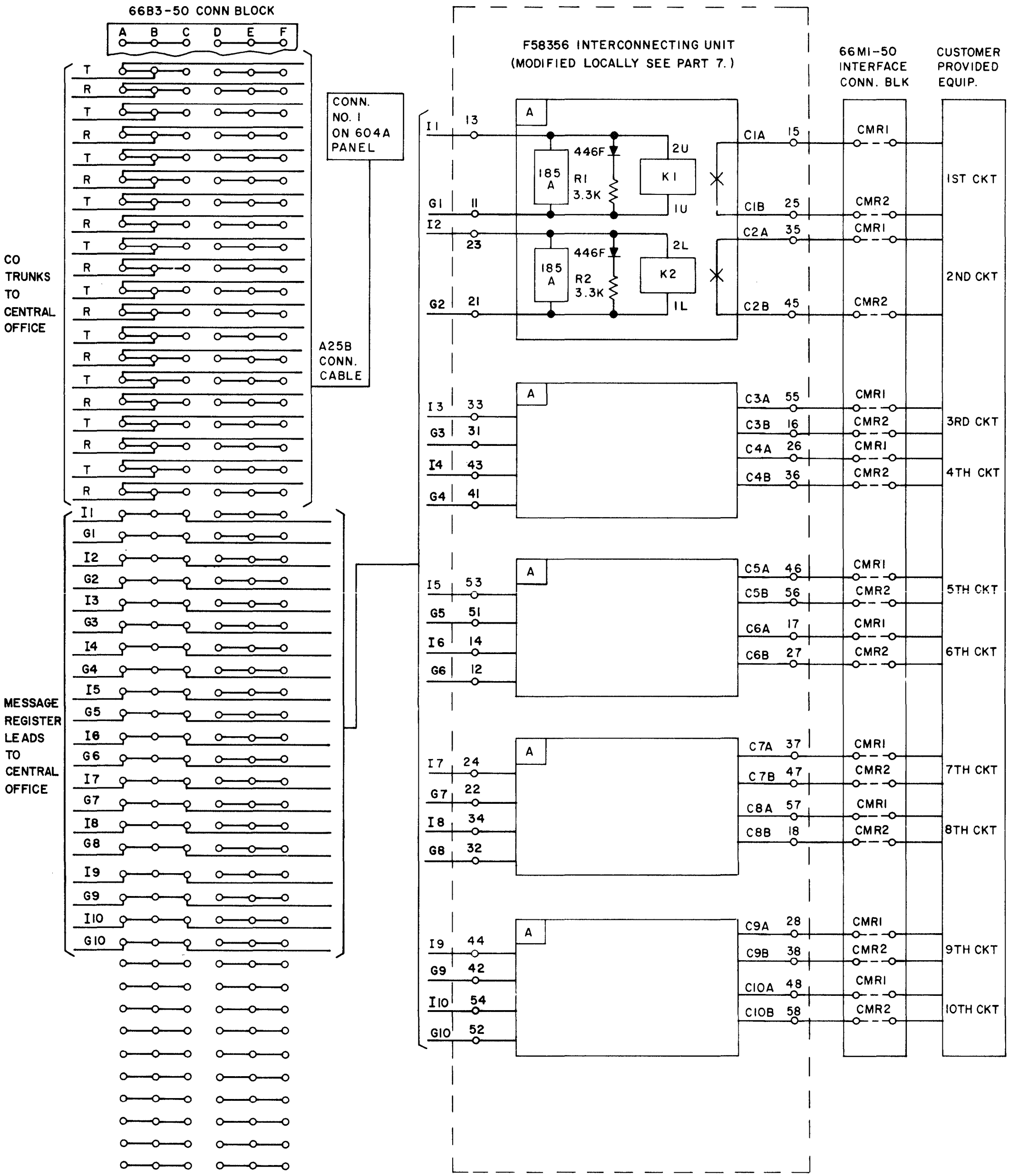


Fig. 7— ▶Connecting Arrangement CEK, Paired Wire Operation, Using Modified F58356 Interconnecting Unit, Schematic◀

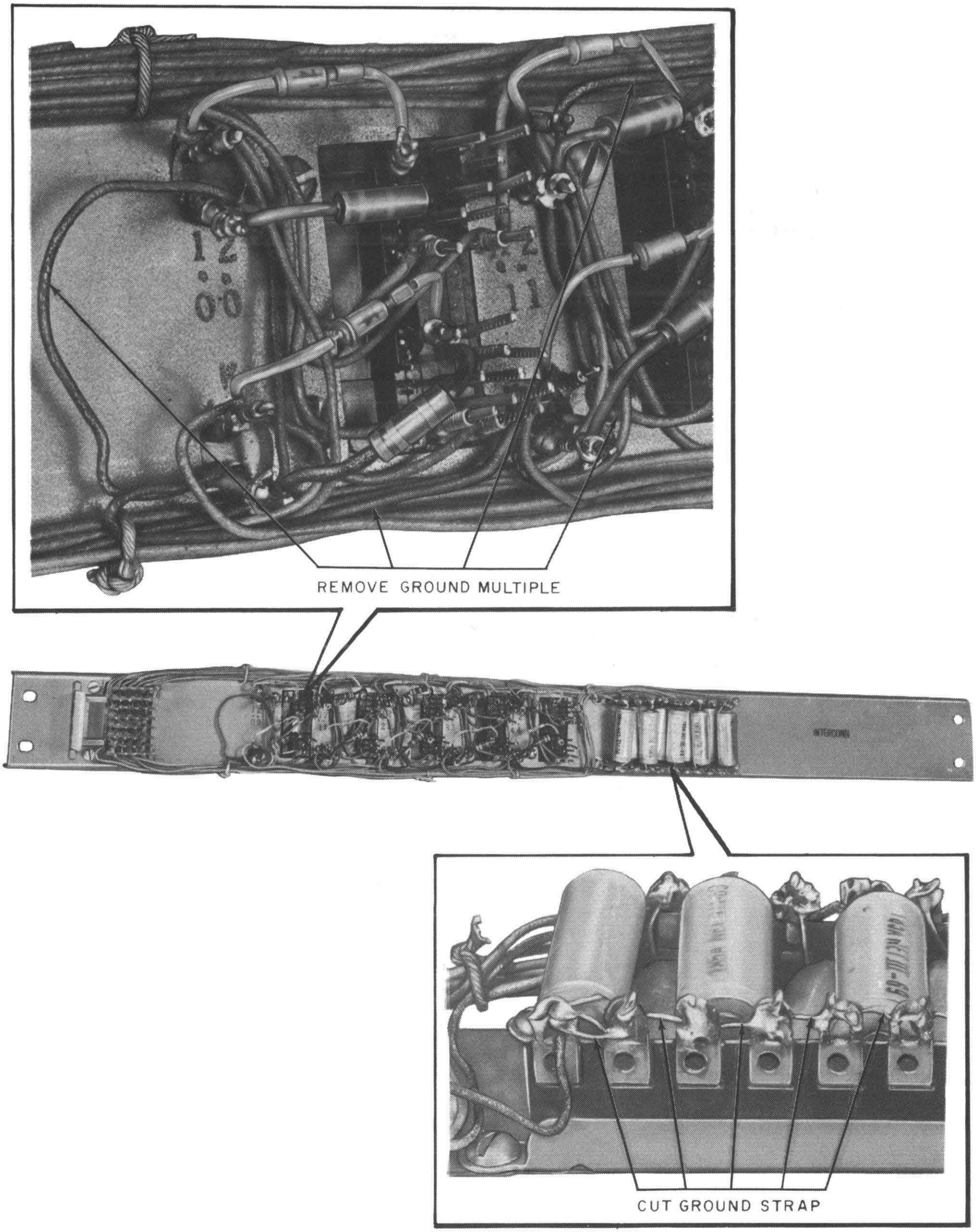


Fig. 8—F58356 Interconnecting Unit, Unmodified

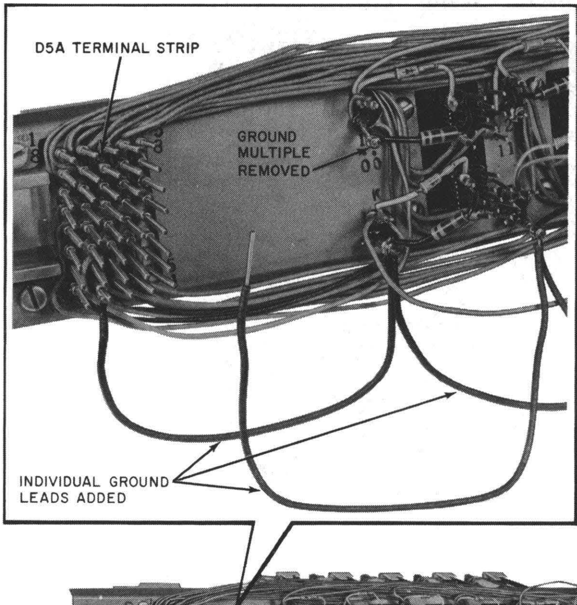
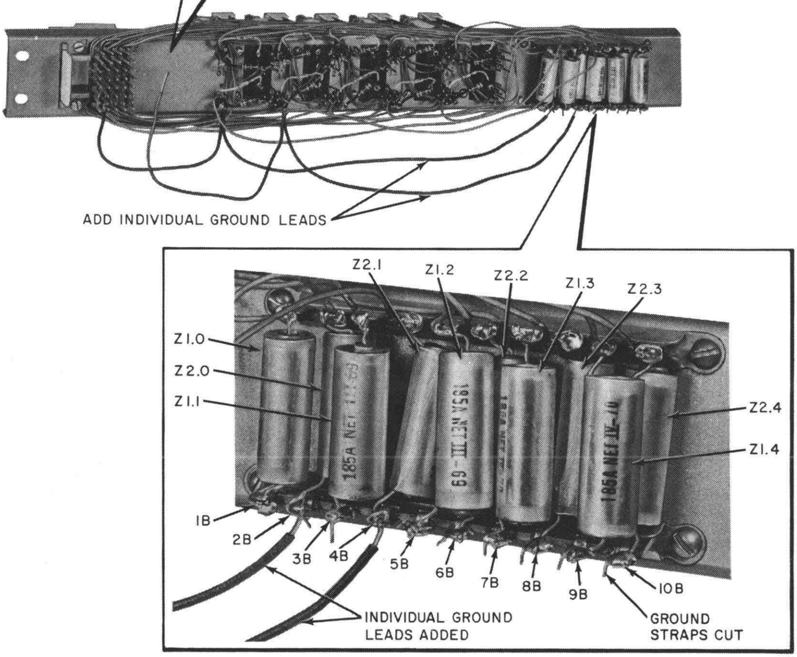


TABLE B

CONNECT INDIVIDUAL GROUND WIRE				
FROM		TO		TO
NETWORK	TB TERM. NO.	RELAY	TERM. NO.	D5A TERM. NO.
Z1.0	1B	K1.0	1U	11*
Z2.0	2B	K2.0	1L	21
Z1.1	3B	K1.1	1U	31
Z2.1	4B	K2.1	1L	41
Z1.2	5B	K1.2	1U	51
Z2.2	6B	K2.2	1L	12
Z1.3	7B	K1.3	1U	22
Z2.3	8B	K2.3	1L	32
Z1.4	9B	K1.4	1U	42
Z2.4	10B	K2.4	1L	52

* THE WIRE FROM K1.0 RELAY TERM. 1U TO D5A BLOCK TERM. 11 SHOULD ALREADY BE WIRED IN—SEE 7.01(b)



◆Fig. 9—F58356 Interconnecting Unit, Modification For Paired Wire Operation◆

CONNECTING ARRANGEMENT C25
118A INTERCONNECTING UNIT

1. GENERAL

1.01 This section provides identification, installation, operation, maintenance, and connecting information for Connecting Arrangement C25. Connecting Arrangement C25 provides a connection, over a voice-grade private line, between the customer-provided (CP) automatic number identification (ANI) equipment of a CP communications system (typically a PBX) and the station identification frame (SIF) in a Bell System central office (CO). This arrangement provides automatic identified outward dial (AIOD) capabilities to the CP equipment.

1.02 Connecting Arrangement C25 consists of a 118A interconnecting unit (IU), Fig. 1, 2, and 3. Strapping options are provided for SF signaling when required. One Connecting Arrangement C25 and its associated voice-grade private line has the capacity to handle the identification for up to 250 outgoing trunks depending upon the call attempts and traffic load on the CO. If two or more groups of trunks are terminated on different serving COs, a separate Connecting Arrangement C25 must be ordered for each trunk group.

1.03 This issue of the section is based on the following drawings:

CD-1E239-01, Issue 1

SD-1E239-01, Issue 1

If this section is to be used with equipment or apparatus reflecting later issue(s) of the drawing(s), reference should be made to the SDs and CDs to determine the extent of the changes and the manner in which the section may be affected.

2. IDENTIFICATION

PURPOSE

- To provide access from CP equipment to a Telephone Company CO associated with automatic message accounting equipment for automatic calling station identification.
- To convert Electronic Industries Association (EIA) serial binary signals from CP equipment to frequency-shift-keying (FSK) signals of the proper level for transmission over the voice-grade private line to the CO.
- To provide protection for personnel against hazardous voltages.

APPLICATION

- Used with Voice Connecting Arrangement(s) CD7, CD8, or CDH (loop- or ground-start trunks) which provide outgoing service for CP PBX.

ORDERING GUIDE

- Unit, Interconnecting, 118A (consists of a 614A panel equipped with an HJ1 circuit pack).

Associated Apparatus (Order Separately)

- Bracket, 99B
- Cabling, Wiring, "D" Inside or equivalent (for cabling the supervisory leads from the connecting arrangement to the interface connecting block)
- Wire, DL-1, P-46F616 or equivalent (for cabling the clock and data leads from the connecting arrangement to the interface connecting block)
- Block, Connecting, 66M1-50 (Fig. 4)

Note: Spare terminals on interface connecting blocks associated with Voice Connecting Arrangement(s) CD7, CD8, or CDH may be used when available; other types of blocks may be used where specified by local engineering.

- Clip, Bridging, B (25 per pkg.)

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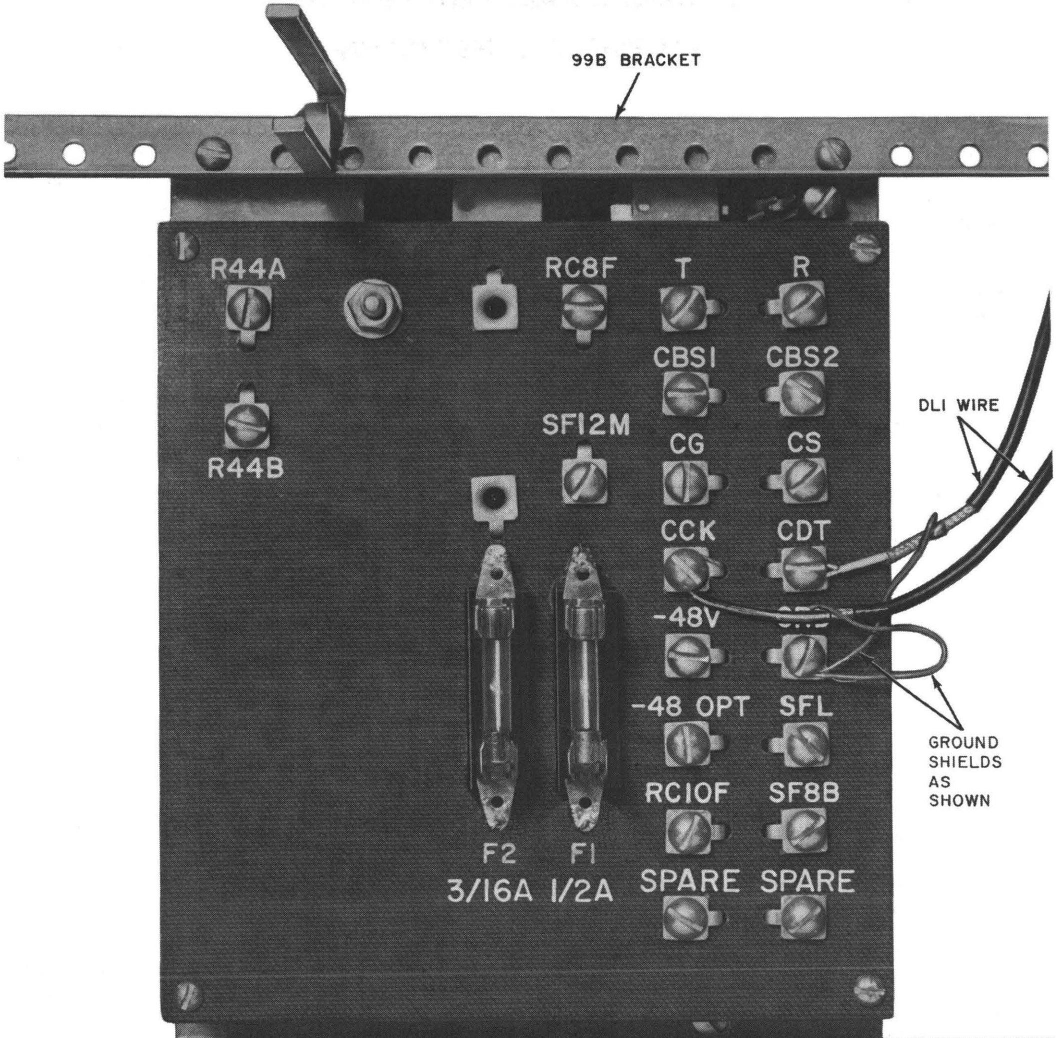


Fig. 1—118A Interconnecting Unit—Clock and Data Leads Connected

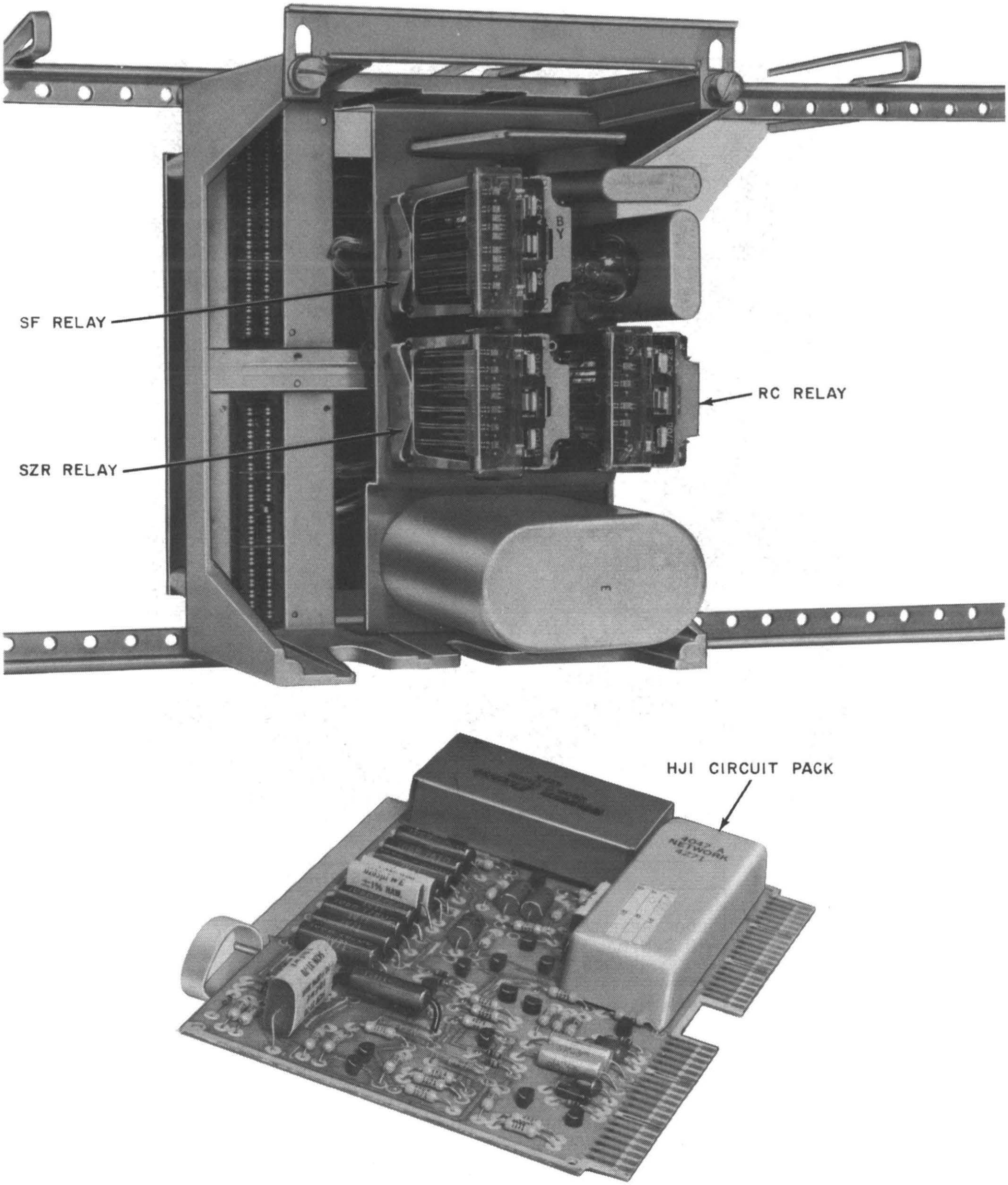
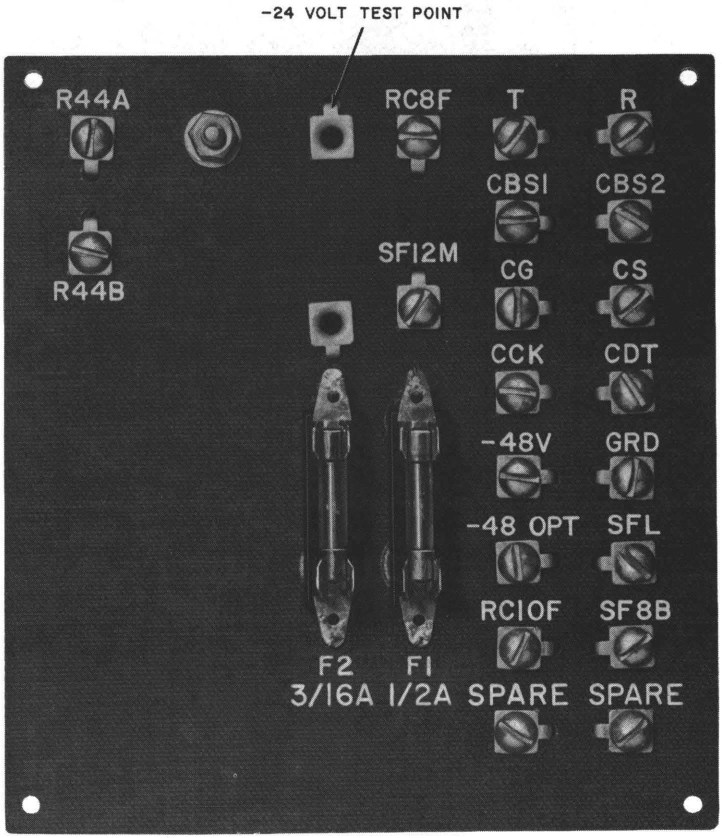


Fig. 2—118A Interconnecting Unit—Front View With HJ1 Circuit Pack Removed



FOR	PROVIDE STRAPS	
	FROM	TO
LOOP RESISTANCE TO CENTRAL OFFICE 500 OHMS OR LESS	R44A	R44B
SF SIGNALING NOT PROVIDED BETWEEN PBX AND CENTRAL OFFICE (OPTION Z)	CBSI	RC8F
	-48 OPT	RCIOF
SF SIGNALING PROVIDED BETWEEN PBX AND CENTRAL OFFICE (OPTION Y)	CBSI	SFI2M
	-48 OPT	SF8B
	-48 OPT	SFL

Fig. 3—118A Interconnecting Unit—Rear View

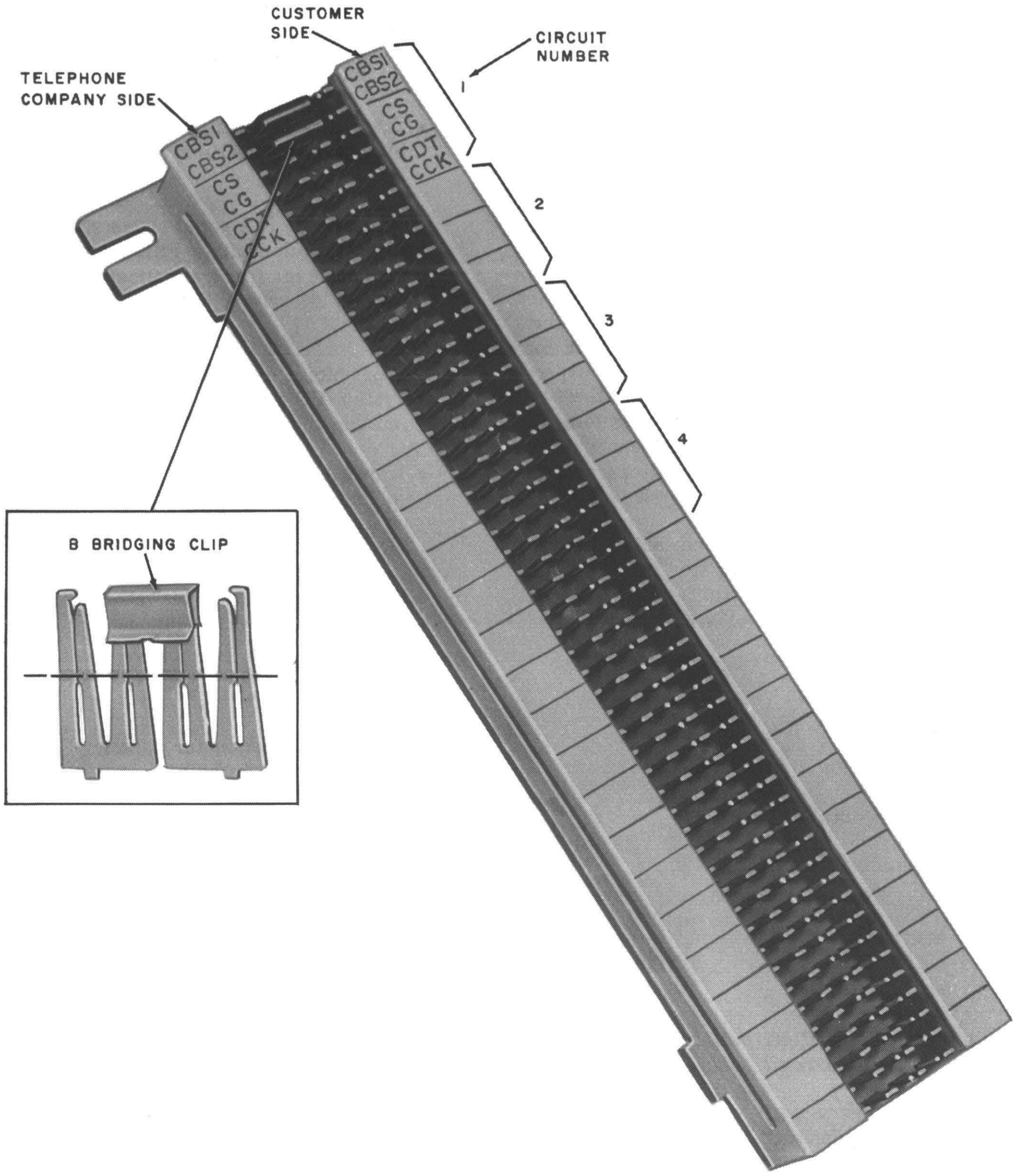


Fig. 4—Typical Interface Connecting Block

- KS-20944, List 2 Protector (Optional—***must*** be provided when CP power supply is used)—see Fig. 8
- Block, Connecting, 66C1-16 or equivalent (for providing distribution of power when KS-20944 protector is used between CP power supply and ***more than one*** connecting arrangement of any type—see Fig. 9)

Note: The cumulative current drain of the connecting arrangements connected to a KS-20944 protector must not exceed the maximum current rating of the protector. For instance, the maximum current drain for one Connecting Arrangement C25 is 0.5 ampere and the maximum current rating of a KS-20944, List 2 protector is 15 amperes; therefore, no more than 30 Connecting Arrangements C25 may be connected to the protector (this example is for illustrative purposes only).

- Wire, AM, 14 gauge, paired, red and black, P-384614 or equivalent (for cabling from the KS-20944 protector to the 66C1-16 connecting block—see Fig. 9).

Replaceable Components

- Fuse, AGC#1/2 (1/2 amp-F1)
- Fuse, AGC#3/16 (3/16 amp-F2)
- Pack, Circuit, HJ1
- Panel, 614A.

DESIGN FEATURES

118A Interconnecting Unit

- Consists of a ***614A panel*** equipped with a plug-in ***HJ1 circuit pack***
- Detects loop closure on leads CS, CG from CP ANI equipment
- Signals the Bell System CO AIOD equipment over leads T, R that a trunk number and a station number have been identified
- Recognizes a transmit data command signal over leads T, R from the Bell System CO
- Signals CP ANI equipment with a contact closure on leads CBS1, CBS2 that a transmit data command signal has been received from the Bell System CO
- Provides a terminator as specified in EIA Standard RS-232C for CP clock and data leads
- Converts the EIA serial binary signals from the CP equipment to FSK signals of the proper level for transmission over the voice-grade private line to the Bell System CO
- Transmits a disconnect signal to the Bell System CO when the CP ANI equipment removes the closure on leads CS, CG
- Transmits a disconnect signal to the CP ANI equipment by removing the contact closure on leads CBS1, CBS2, when the Bell System CO disconnects first
- Provides dc isolation between Bell System facilities and CP ANI equipment
- Provides strapping options for loop and SF signaling
- Provides protection for personnel against hazardous voltages.

614A Panel—See Fig. 2

- Mounts on a standard 23-inch relay rack or in a 16C apparatus mounting, using a 99B bracket
- Size—approximately 8 by 6 by 8 inches
- Weight—approximately seven and one-half pounds (without circuit pack)
- Equipped with two 914A 40-pin connectors arranged to mount one HJ1 circuit pack
- Provides supervisory circuit, power circuit, and fuses for 118A IU
- Provides screw terminals for option straps and connections to the CP equipment and the Bell System CO.

HJ1 Circuit Pack—See Fig. 2

- Components are mounted on a 40-pin printed wiring board.
- Plugs into connector on 614A panel.
- Size—approximately 5-1/2 by 7-1/2 inches.
- Weight—approximately one pound.
- Provides EIA interface, output flip-flop, and data transmitter circuits for 118A IU.

KS-20944, List 2 Protector (Fig. 8 and 9)

- Components are mounted in a 5-1/2 by 4-1/2 by 3-1/2 inch box with hinged cover, designed to mount on a wall or any flat surface.
- Provides screw terminals inside of box for connection to Bell System equipment.
- Provides two external 14-gauge color-coded leads for connection to CP power source ([R] GRD, [BK] −V).
- Provides current and voltage limiting between Bell System equipment and CP power source.
- Protector circuit breakers trip in 25 milliseconds on overvoltage, current overload, reversed voltage polarity, improper grounding, or ac voltage from CP power source as follows:

  (a) Overvoltage of 68 volts dc

  (b) Current overload of 18 amperes

  (c) Reversed dc polarity

  (d) Improper ground

  (e) AC voltage greater than 18 volts.

- Protector circuit breaker switch provides a means for removing CP power from Bell System interconnecting equipment.

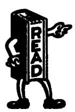
CAUTION: The circuit breaker switch removes voltage from the load (Bell System) side of the protector only; voltage will still be present on terminals and components inside the protector box.

- Provides hazardous voltage protection between CP power source and Bell System equipment.

3. INSTALLATION

118A INTERCONNECTING UNIT

3.01 Locate the connecting arrangement in an area free of dampness and excessive dust or dirt, with adequate room for access to front and rear of equipment and connecting blocks. The connecting arrangement should be mounted as close as possible to the CP ANI equipment; maximum distance between the connecting arrangement and the CP ANI equipment, including the customer-provided and installed wiring, must not exceed 50 feet. Mount the 118A IU on a 23-inch relay rack or 16C apparatus mounting using 99B brackets. (Provide a separate GRD to rack or mounting.)



To protect transistors and other electrical components of the interconnecting unit, remove fuses before installing or replacing a circuit pack or interconnecting unit.

3.02 Use the "D" inside wiring cable or equivalent to terminate the supervisory leads (CBS1, CBS2, CS and CG) associated with the CP equipment on the interface connecting block. Use the DL-1 shielded wire or equivalent to terminate the clock and data leads (CCK and CDT) associated with the CP equipment on the interface connecting block. ***The shields on leads CCK and CDT must be grounded at the 118A IU only; do not ground the shields at the interface connecting block.*** Stencil circuit number and lead designations on interface connecting block designation strip (see Fig. 4).

3.03 Provide straps on the 118A IU for loop and signaling options as shown in Fig. 3, 6, and 7.

KS-20944 PROTECTOR

3.04 When CP power source is used to power the connecting arrangement, a KS-20944 protector must be provided between the CP power source and the connecting arrangement. Mount the KS-20944 protector on a wall or suitable flat surface near the interface connecting block. Use the AM-type, 14-gauge wire or equivalent to make connections from the protector to the 66C1-16 connecting block. Terminate one end of the wiring to the screw terminals (term. − and +) of the load terminal strip provided on the protector (see Fig. 8). Solder the other end of the wiring to terminals in column D of the connecting block as shown in Fig. 9; using the 14-gauge wire, solder the multiple straps to the terminals in column D of the connecting block as shown in Fig. 9, depending on the number of connecting arrangements provided. Use "D" inside wire cable or equivalent to make connections from the quick-connect terminals in columns A, B, and C of the connecting block to the screw terminals on the connecting arrangements.

4. OPERATION

4.01 ***Idle Condition—Connecting Arrangement C25 (Fig. 6 and 7):*** When the connecting arrangement is in the idle condition, leads CS, CG and CBS1, CBS2 from the CP equipment are open; a −48 volt battery signal is maintained through resistance lamp A, contact 8B of relay SZR, and the primary winding of relay RC, to leads T, R of the data channel toward the CO. The CP ANI equipment provides a positive EIA voltage signal (binary 0) over lead CDT and standard clock pulses over lead CCK to the connecting arrangement. The EIA interface and output flip-flop circuit detects the CP signal and in turn causes the data transmitter circuit to transmit a 1150-Hz signal over leads T, R of the data channel (voice-grade private line) toward the CO.

4.02 ***Seizure—Connecting Arrangement C25—SF Signaling Not Provided (Fig. 6):*** When the seizure of a trunk for an outgoing dialed call is recognized by the CP ANI equipment, the trunk and associated station number is identified and stored; the CP ANI equipment provides a bid signal to the connecting arrangement for access to the CO by placing a contact closure across leads CS, CG. This closure operates relay SZR through contact 10B of relay RC. Relay SZR operated prepares a closure path across leads CBS1, CBS2 and transfers the supervisory signal (through relay RC to leads T, R) from battery to ground. This ground activates the supervisory relay in the associated CO signaling circuit. The trunk scanner in the digit register connector circuit of the CO SIF recognizes this service request and assigns it a preference. When an idle digit register is connected to the line and conditioned to accept PBX identification information, a transmit data signal in the form of simplex battery is returned to the connecting arrangement over leads T, R. This battery operates relay RC through contact 8M of relay SZR. Relay RC operated completes the closure path across leads CBS1, CBS2 toward the CP ANI circuit as a transmit data command signal.

4.03 ***Seizure—Connecting Arrangement C25—SF Signaling Provided (Fig. 7):*** Seizure of the connecting arrangement when SF signaling is provided is accomplished in the same manner as described in 4.02 with the exception that the operation of the RC relay provides an operate path for the SF relay through contact 4M of the RC relay. Relay SF operated completes the closure path across leads CBS1, CBS2 toward the CP ANI circuit as a transmit data command signal. This extends the time between customer bid for data channel access (CS, CG closed) and connecting arrangement transmit data command (CBS1, CBS2 closed) by approximately 35 milliseconds. This 35-millisecond delay is required to allow the SF signaling equipment to clear the signaling transmission path to the CO.

4.04 ***Information Transmission—Connecting Arrangement C25 (Fig. 6 and 7):*** Within a timed interval (greater than 10 milliseconds but less than 20 milliseconds—see 4.07 and Fig. 10) after the CP equipment receives the transmit data command signal (contact closure across leads CBS1, CBS2), it must transmit the trunk and station number to the connecting arrangement over lead CDT. Each complete message from the CP equipment to the connecting arrangement consists of 41 binary bits, one premessage bit followed by a 40-bit word (8 digits, 5 bits per digit); 4 digits (20 bits) identify the trunk, the other 4 (20 bits) identify the station. Each 5-bit digit consists of two "1" bits and three "0" bits (2/5 code, see Table A). The premessage bit level is always a "1" bit.

> ***Note:*** As a trouble-locating aid, the CO equipment is normally conditioned to interpret an all "1" bit transmission (beginning with the first detected error digit and lasting for the remainder of the message) as admission of the CP equipment that it has detected an error or failed to identify the station making the call (see 4.06).

TABLE A

2/5 DIGIT CODE

DIGIT NUMBER	CHRONOLOGICAL POSITIONS OF 1 BITS	SEQUENTIAL APPEARANCE OF SERIAL BINARY DIGITS				
		0	1	2	4	7
0	4,7	○	○	○	●	●
1	0,1	●	●	○	○	○
2	0,2	●	○	●	○	○
3	1,2	○	●	●	○	○
4	0,4	●	○	○	●	○
5	1,4	○	●	○	●	○
6	2,4	○	○	●	●	○
7	0,7	●	○	○	○	●
8	1,7	○	●	○	○	●
9	2,7	○	○	●	○	●

These pulses are negative-going, standard EIA serial binary pulses synchronized with the repetition rate of the CP clock pulses on lead CCK (see Fig. 11). The rise time and duration of the data pulse is not critical; however, it must have reached peak amplitude at the leading edge of the clock pulse. The data pulse does not change until after the clock pulse is no longer present; consequently, the leading edge of the data pulse must precede the clock pulse by at least 3 microseconds and the trailing edge must lag the clock pulse by at least 3 microseconds. The CP clock pulses on lead CCK are accurate negative-going pulses with a repetition rate of 735.5 pps ± 0.1 percent, rise time of 2 microseconds, and a duration of 30 microseconds. Clock pulses need not be provided continually, just during signal transmission only. If the clock pulses are stopped for any reason, they must be resumed before a bid signal is initiated by the CP equipment. At least three clock pulses must be transmitted to the connecting arrangement following the end of the data message. The EIA interface and output flip-flop circuit in the connecting arrangement detects the data pulses from the CP ANI circuit and in turn causes the data transmitter to shift from the space or zero bit frequency (1150 Hz) to the mark or "1" bit frequency (1850 Hz) of a level suitable for transmission to the CO over leads T, R of the data channel (voice-grade private line).

4.05 ***Disconnection—Connecting Arrangement C25 (Fig. 6 and 7):*** The CP ANI equipment must maintain uninterrupted contact closure across leads CS, CG from seizure of the connecting arrangement until completion of transmission of trunk and station number data (see 4.07 and Fig. 10). When the CP equipment disconnects first, the CP ANI circuit removes the contact closure across leads CS, CG. An open on leads CS, CG causes SZR relay to release; SZR relay released opens leads CBS1, CBS2 toward the CP equipment, causes relay RC to release, transfers the supervisory signal (through relay RC to leads T, R toward the CO) from ground to battery as a disconnect signal, and returns the connecting arrangement to the idle condition (the RC relay released causes the SF relay to release when provided). When the CO disconnects first, the supervisory relay in the CO signaling circuit removes battery from leads T, R of the connecting arrangement causing relay RC to release. Relay RC released removes the closure across leads CBS1, CBS2 toward the CP equipment (see Fig. 6); when SF signaling is provided (see Fig. 7), relay RC released causes the SF relay to release which in turn removes the closure across leads CBS1, CBS2 toward the CP equipment. The CP ANI circuit recognizes the open on leads CBS1, CBS2 as a disconnect signal and subsequently removes the closure across leads CS, CG toward the connecting arrangement. An open on leads CS, CG causes SZR relay to release and returns the connecting arrangement to the idle condition.

4.06 ***Call Billing:*** The CO receives the identification information and stores the station number in a memory slot associated with the trunk number for all outgoing calls using the trunk lines whether or not the information is required for call billing. When the AMA equipment requires the station number for call billing, the number is read out of storage. If the equipment determines that the number is invalid either because of digits in error or an incomplete number, the call is either billed to the listed PBX number or billed by operator number identification or billed by an alternate method.

4.07 ***Functional Sequence of Operation (Fig. 10):*** The CP ANI equipment initiates a bid for data channel access to the CO with a contact closure across leads CS, CG. Following a minimum interval of 45 milliseconds, the connecting arrangement provides a closure across leads CBS1, CBS2 as a transmit data command signal to the CP ANI equipment (a delay of 3 seconds between the CS, CG closure and the CBS1, CBS2 closure usually indicates trouble on the data channel or temporary traffic overload in CO data processing equipment). Following the CBS1, CBS2 closure the CP equipment begins data transmission; the interval between the CBS1, CBS2 closure and data transmission must be greater than 10 milliseconds but less than 20 milliseconds. Data transmission time is approximately equal to 55.76 milliseconds. Following the last bit of data, the CP equipment shall remove the closure across leads CS, CG to release connection to the CO. The interval between the last bit of data and removal of the closure across leads CS, CG must be less than or equal to 10 milliseconds. Following the release of the CO connection by the CP equipment (open on leads CS, CG) there must be a minimum interval of 45 milliseconds before the CP equipment initiates another bid for data channel access (closure across leads CS, CG).

5. MAINTENANCE

5.01 Precautions should be taken when performing tests to avoid adversely affecting service to the customer. Local instructions should be followed with reference to notifying the customer and CO personnel before performing the tests.

5.02 When there is an indication of trouble in the connecting arrangement(s), the circuit at fault must be opened at the interface connecting block to verify in which direction the trouble exists. The circuit can be opened at the interface connecting block by removing the B bridging clip associated with each lead.

5.03 ***Tests—Connecting Arrangement C25 (Fig. 6 and 7):***

(a) Check for blown fuses (F1 and F2) on 118A IU.

(b) Check for presence of battery and ground and proper polarity on −48V and GRD terminals.

(c) Check for presence of −48 volts between −48 OPT terminal and GRD terminal (see Fig. 3, 6, and 7); if voltage is not present check fuse F1.

(d) Check for presence of −24 volts between −24 volt test point and GRD terminal (see Fig. 3, 6, and 7); if voltage is not present check fuse F2, resistor R48, and zener diode CR18.

5.04 ***Tests—Connecting Arrangement C25—SF Signaling Not Provided (Fig. 6):***

Note: Notify CO before proceeding with this test.

(a) Open all the leads of the circuit under test at the interface connecting block. Block the RC relay non-operated. Disconnect leads T and R (data channel) from terminals T and R on the 118A IU.

(b) Connect lead CS to lead CG; observe that relay SZR operates. If relay SZR does not operate, check fuse F1, check for faulty RC relay contact 10B, and check for open on leads CS, CG, or the strap between terminals −48 OPT and RC10F.

(c) With relay SZR operated, block operated relay RC; check for closure across leads CBS1, CBS2. If closure is not present across lead CBS1, CBS2 check for faulty RC relay contact 8M, faulty SZR relay contact 10M, or open on leads CBS1, CBS2, or the strap between terminals RC8F and CBS1.

(d) If trouble is indicated in the data channel see 5.06.

(e) On completion of tests, reconnect leads T and R to terminals T and R on the 118A IU, replace the B bridging clips at the interface connecting block associated with the circuit under test, and remove the block from relay RC.

5.05 ***Tests—Connecting Arrangement C25—SF Signaling Provided (Fig. 7):***

Note: Notify CO before proceeding with this test.

(a) Open all the leads of the circuit under test at the interface connecting block. Block the RC relay non-operated. Disconnect leads T and R (data channel) from terminals T and R on the 118A IU.

(b) Connect lead CS to lead CG; observe that relay SZR operates. If relay SZR does not operate, check fuse F1, check for faulty SF relay contact 8B, and check for open on leads CS, CG, or the strap between terminals −48 OPT and SF8B.

(c) With relay SZR operated, block operated relay RC; observe that relay SF operates and check for closure across leads CBS1, CBS2. If relay SF does not operate, check for faulty RC relay contact 4M or open on the strap between terminals −48 OPT and SFL. If closure is not present across leads CBS1, CBS2, check for faulty SF relay contact 12M, faulty SZR relay contact 10M, or open on leads CBS1, CBS2, or the strap between terminals SF12M and CBS1.

(d) If trouble is indicated in the data channel, see 5.06.

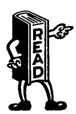
(e) On completion of tests, reconnect leads T and R to terminals T and R on the 118A IU, replace the B bridging clips at the interface connecting block associated with the circuit under test, and remove the block from relay RC.

5.06 ***Tests—Data Channel (Fig. 6 and 7):*** When trouble is indicated in the data channel, replace the HJ1 circuit pack. If trouble is still present, check for open or short on leads CDT and CCK. Perform normal circuit order transmission tests over leads T and R toward the CO. Using a 716C receiver, check for presence of 1150-Hz tone across leads T and R from the connecting arrangement when the connecting arrangement is in the idle condition.

5.07 ***Tests—KS-20944 Protector (Fig. 8):*** If circuit breaker switches are tripped (in the ***off*** position) return them to the ***on*** position; if circuit breaker switches cannot be operated to the ***on*** position perform tests as follows:

(a) Disconnect Telephone Company provided wiring from terminals 1 and 2 (− and +) of the load terminal strip on the protector under test. If the circuit breaker switches remain in the ***on*** position when operated, the trouble is in the Telephone Company provided equipment. Check for proper polarity of the Telephone Company provided leads at terminals 1 and 2 (− and +) of the load terminal strip on the protector; ascertain that the circuits connected to the protector do not exceed the current rating of the protector.

(b) If the trouble is not in the Telephone Company side, check the type, amount, and polarity of the CP voltage present on the leads provided for customer termination at the protector; this voltage should meet the specifications shown in Fig. 8.



Do not attempt any tests or repairs to the CP equipment.

6. CONNECTIONS

6.01 For connecting information refer to Fig. 3, 5,6, 7, and 9.

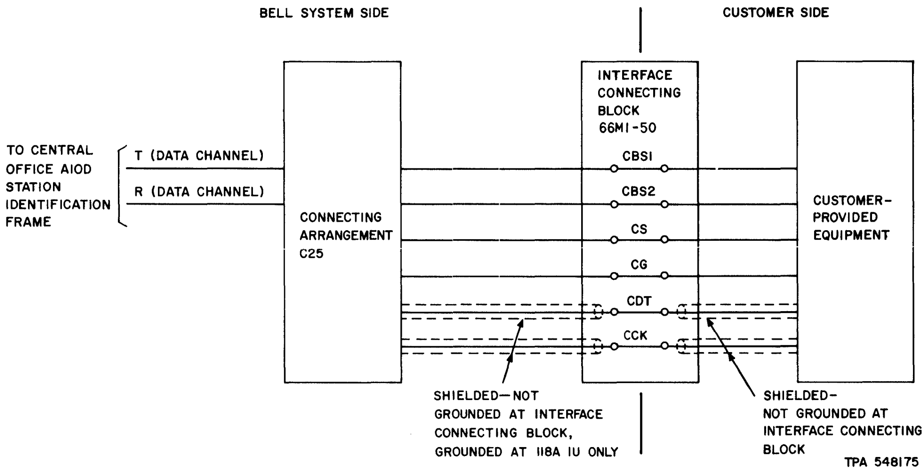
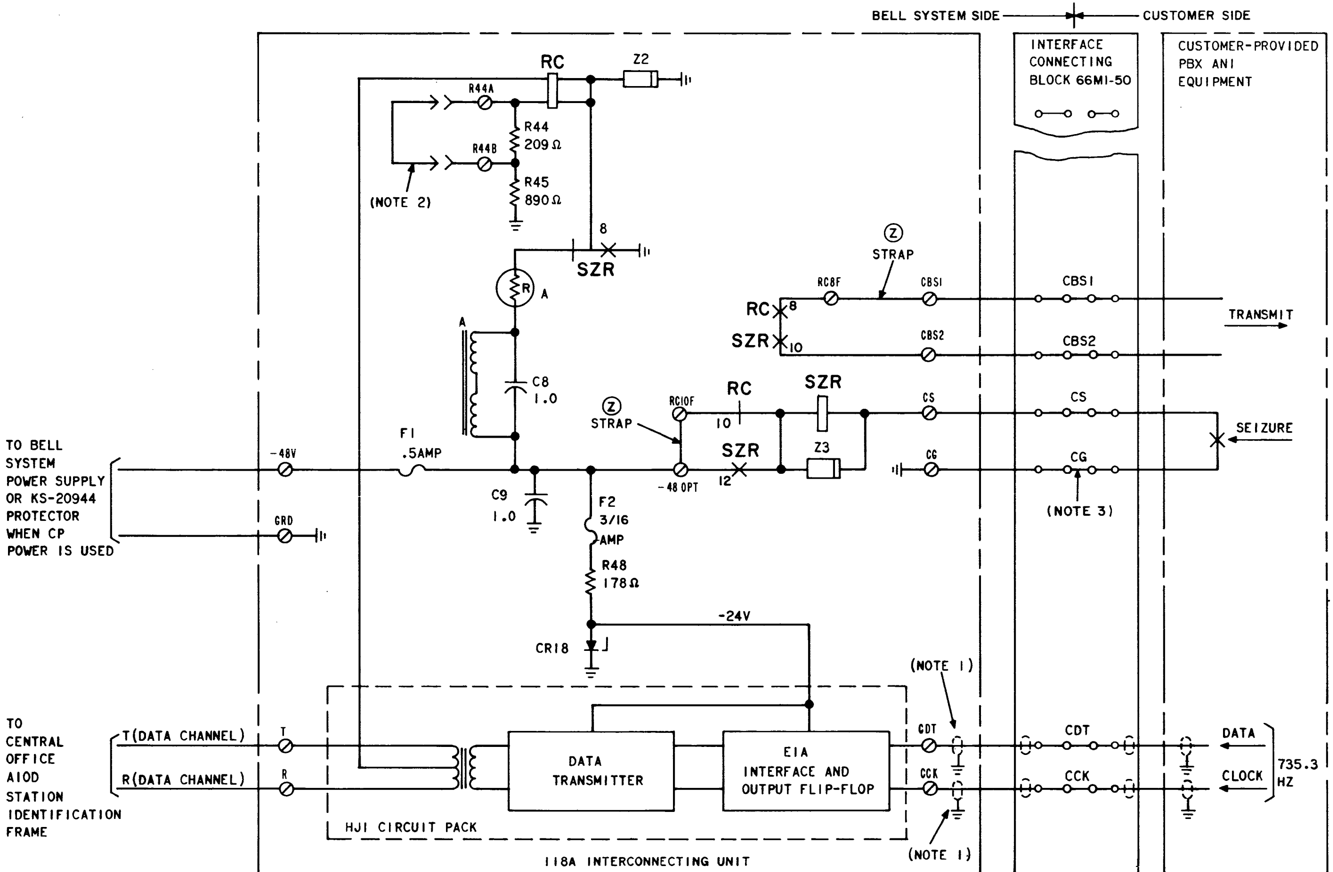


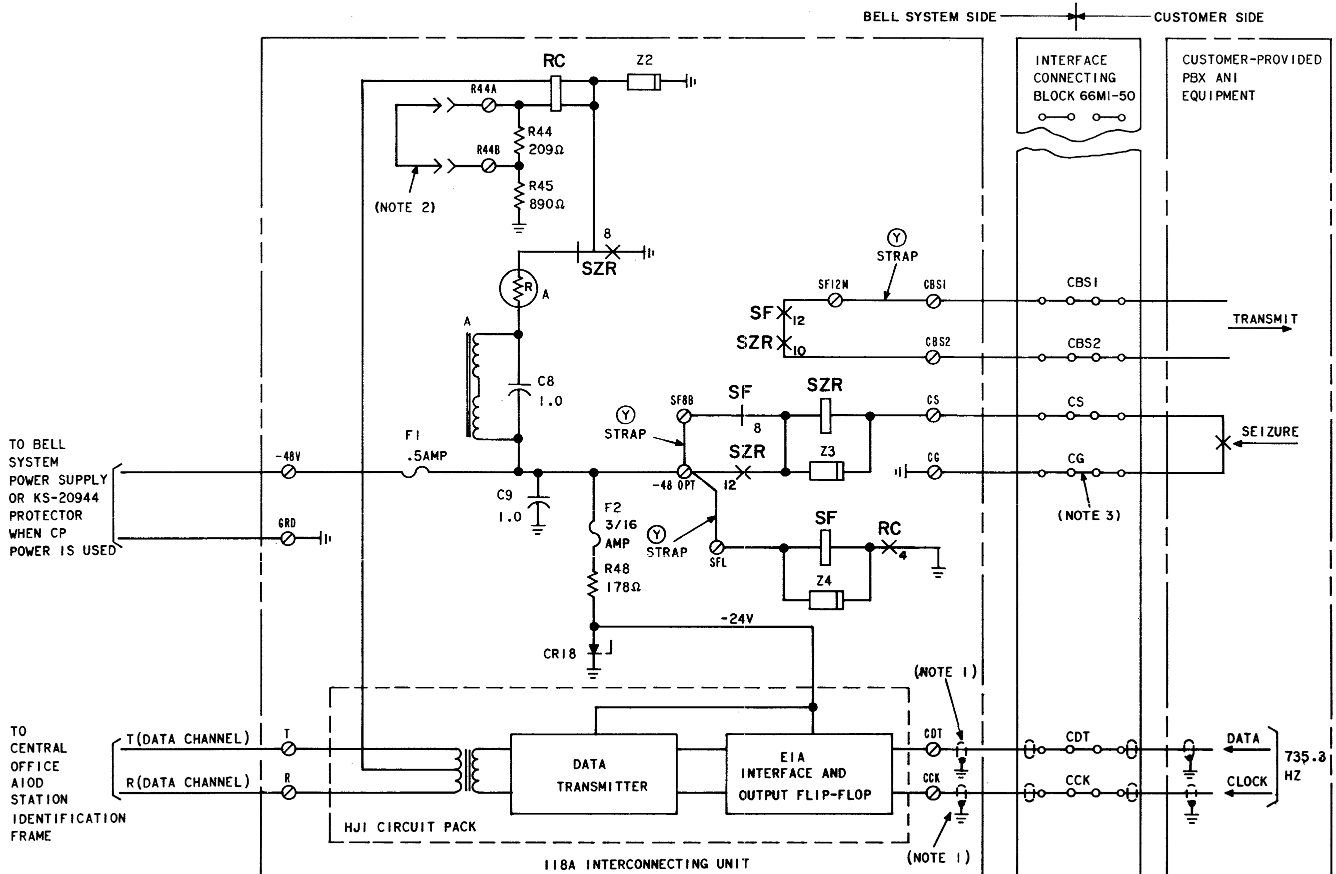
Fig. 5—Block Diagram—Voice Connecting Arrangement C25



NOTES:

1. CONNECT SHIELDS OF CDT AND CCK LEADS TO GRD TERMINAL ON 118A IU, DO NOT GROUND AT INTERFACE CONNECTING BLOCK.
2. PROVIDE STRAP FROM TERMINAL R44A TO R44B WHEN LOOP TO CENTRAL OFFICE IS 500 OHMS OR LESS.
3. B BRIDGING CLIP.

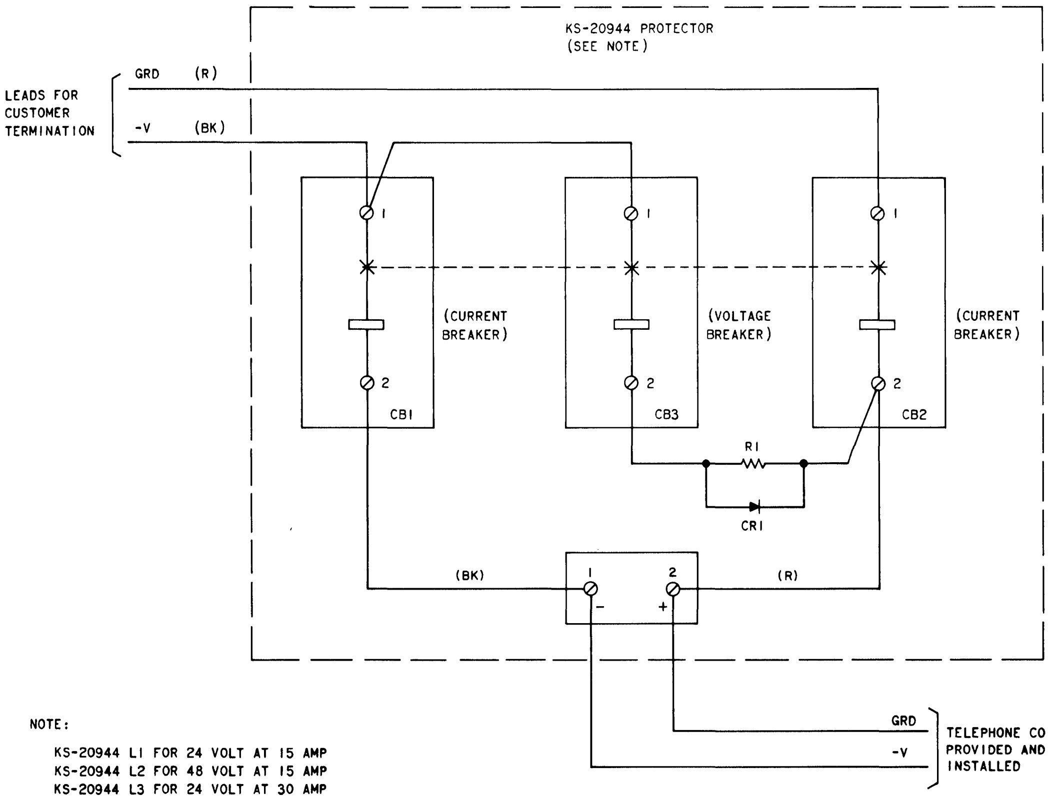
Fig. 6—Simplified Schematic and Connections, Connecting Arrangement C25, SF Signaling Not Provided Between PBX and Central Office Station Identification Frame (Option Z)



NOTES:

1. CONNECT SHIELDS OF CDT AND CCK LEADS TO GRD TERMINAL ON 118A IU, DO NOT GROUND AT INTERFACE CONNECTING BLOCK.
2. PROVIDE STRAP FROM TERMINAL R44A TO R44B WHEN LOOP TO CENTRAL OFFICE IS 500 OHMS OR LESS.
3. B BRIDGING CLIP.

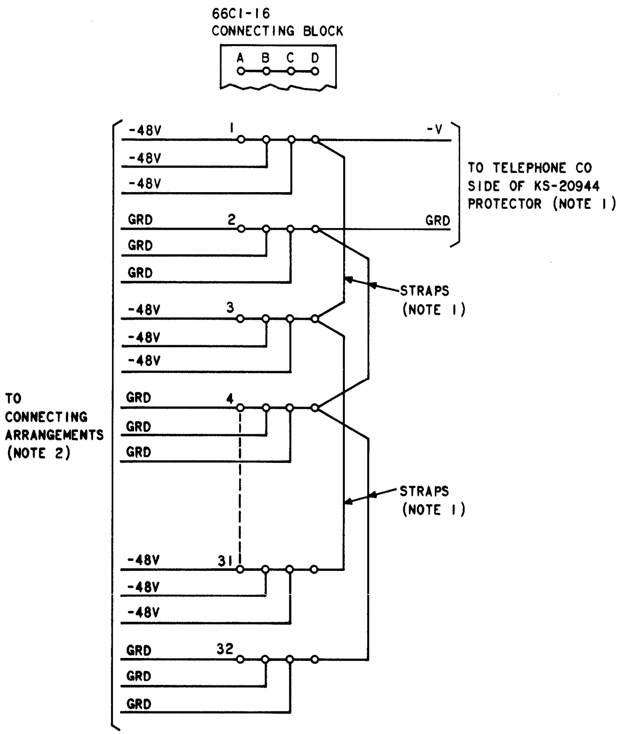
Fig. 7—Simplified Schematic and Connections, Connecting Arrangement C25, SF Signaling Provided Between PBX and Central Office Station Identification Frame (Option Y)



NOTE:

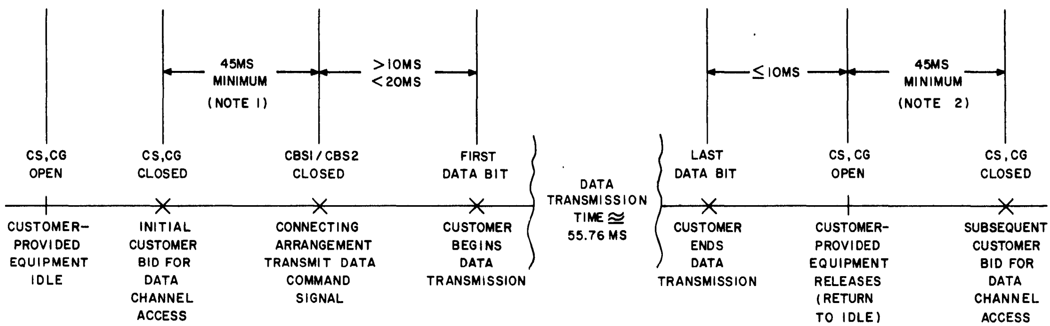
KS-20944 L1 FOR 24 VOLT AT 15 AMP
KS-20944 L2 FOR 48 VOLT AT 15 AMP
KS-20944 L3 FOR 24 VOLT AT 30 AMP
K2-20944 L4 FOR 48 VOLT AT 30 AMP
PROTECTORS WILL TRIP IN 25 MILLISECS (MAXIMUM):
ON OVERVOLTAGE OF 38 VOLTS (24 VOLT UNIT) AND 68 VOLTS (48 VOLT UNIT), ON OVERLOAD OF 18 AMPERES (15 AMP UNIT) AND 36 AMPERES (30 AMP UNIT), ON REVERSED POLARITY, OR AC VOLTAGE GREATER THAN 18 VOLTS, OR INCORRECT GRD.

Fig. 8—Schematic—KS-20944 Protector



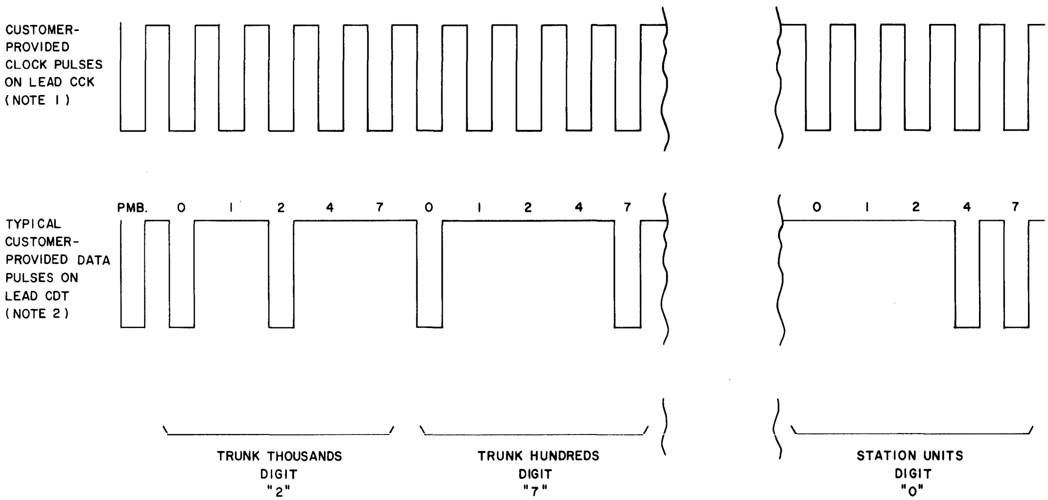
NOTES:
1. USE 14-GAUGE WIRE TO CONNECT FROM KS-20944 PROTECTOR TO CONNECTING BLOCK; PROVIDE MULTIPLE STRAPS AS DETERMINED BY NUMBER OF CONNECTING ARRANGEMENTS TO BE CONNECTED TO. USE SOLDER TO MAKE THE CONNECTION OF THE 14-GAUGE WIRE AND STRAPS TO THE CONNECTING BLOCK.
2. USE "D" INSIDE WIRE OR EQUIVALENT TO MAKE CONNECTIONS FROM CONNECTING BLOCK TO CONNECTING ARRANGEMENTS. EACH CONNECTING BLOCK PROVIDES MEANS FOR CONNECTING TO 48 CIRCUITS, HOWEVER, DO NOT EXCEED THE MAXIMUM CURRENT RATING OF THE KS-20944 PROTECTOR.

Fig. 9—Typical Power Distribution Connections Between KS-20944 Protector and Connecting Arrangements



NOTES:
1. A DELAY OF 3 SECONDS BETWEEN CUSTOMER BID AND RETURN OF TRANSMIT DATA COMMAND SIGNAL USUALLY INDICATES TROUBLE ON THE DATA LINE OR TEMPORARY TRAFFIC OVERLOAD IN CENTRAL OFFICE DATA PROCESSING EQUIPMENT.
2. THERE MUST BE A MINIMUM INTERVAL OF 45 MILLISECONDS BETWEEN CUSTOMER RELEASE OF CONNECTING ARRANGEMENT (RETURN TO IDLE CONDITION) AND SUBSEQUENT CUSTOMER BID FOR DATA CHANNEL ACCESS.

Fig. 10—Functional Sequence Diagram



NOTES:

1. CUSTOMER-PROVIDED CLOCK PULSES MUST BE CONTINUOUS NEGATIVE GOING PULSES WITH A REPETITION RATE OF 735.3 PPS ± 0.1 PERCENT, RISE TIME 2 MICROSECONDS, DURATION 30 MICROSECONDS.
2. CUSTOMER-PROVIDED DATA PULSES MUST BE NEGATIVE-GOING PULSES SYNCHRONIZED WITH REP RATE OF CLOCK PULSES; DATA PULSE MUST LEAD CLOCK PULSE BY A MINIMUM OF 3 MICROSECONDS AND LAG CLOCK PULSES BY A MINIMUM OF 3 MICROSECONDS.

Fig. 11—Typical Customer Clock and Data Pulses on Leads CCK and CDT

CONNECTING ARRANGEMENT C1Y

J92614E-1 INTERFACE UNIT

1. GENERAL

1.01 This section provides indentification, installation, operation, maintenance and connection information for Connecting Arrangement C1Y using the J92614E-1 interface unit to provide traffic usage data to customer-provided (CP) equipment.

1.02 The J92614E-1 interface unit (Fig. 1) is used to connect from 1 to 15 Bell System traffic data register circuits to CP monitoring equipment. One Connecting Arrangement C1Y is required for each circuit to be monitored.

1.03 The J92614E-1, List 1 provides assembly wiring and equipment for five inputs. The J92614E-1, List 2 provides for five additional inputs. A fully equipped mounting plate provides 15 inputs (one List 1 and two List 2).

1.04 If the customer wants a copy of theTechnical Reference which covers this interface specification, the customer should contact the local Telephone Company Business Office or the Marketing Representative.

1.05 This issue of the section is based on the following drawing:

SD-99400-01, Issue 5A

If this section is to be used with equipment or apparatus reflecting later issue(s) of the drawing(s), reference should be made to the SDs and CDs to determine the extent of the changes and the manner in which the section may be affected.

2. IDENTIFICATION

PURPOSE

- Connecting Arrangement C1Y provides for the connection of Bell System Force Administration Data System (FADS) traffic usage data circuits to CP monitoring equipment.
- To protect Telephone Company personnel and facilities from potentially hazardous voltages which may be applied to the connecting arrangement.

APPLICATION

- Bell System Automatic Call Distributing Systems (ACD) type 2A and 3A.

ORDERING GUIDE

- J92614E-1, L1 Interface Unit (five circuits).

Note: If more than five circuits are required, a J92614E-1,List 1 equipped with one or two J92614E-1, List 2 must be ordered.

Associated Apparatus (Order Separately)

- Block, Connecting, 66M1-50 (Fig. 2)
- Clip, Bridging, B (25 per pack, Fig. 2)
- Wire, "D" inside or equivalent (for cabling from J92614E-1 to 66M1-50 interface connecting block and to J92614C transfer unit).

DESIGN FEATURES

- Components mounted on a 189A (2-inch by 23-inch) mounting plate for use with a standard relay rack.
- Detects operation of the traffic register associated with a FADS installation.
- Provides a contact closure to CP equipment indicating a usage registration.
- Provides dc and ac isolation to CP equipment.
- Requires approximately 0.010 ampere at 48V direct current per input circuit.
- Maximum voltage and current on the relay contacts is 50V and 0.500 ampere.

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3. INSTALLATION

3.01 The J92614E-1 interface unit will usually be mounted on the same relay rack or in the same equipment cabinet that houses the associated 2A or 3A ACD FADS equipment.

3.02 The 66M1-50 interface connecting block may be wall-mounted and located at a convenient location to permit testing and connection to the CP equipment. The distance between the interface unit and interface connecting block should be kept as short as possible.

3.03 Connect R( ) input leads from J92614E-1 interface unit to J92614C transfer unit and terminate on D4A terminal strips using a hand-operated wire-wrap tool.

> ***Note:*** Do not connect the interface unit to leads going to the administrative cabinet as the transfer unit switches these leads every half-hour.

3.04 If the FADS installation does not include a transfer unit, the J92614E-1 interface unit may be connected to the output leads from the 3B traffic usage recorder (TUR) and KS-15947, List 2 totalizer. In this case, refer to the 3B TUR lead assignment sheet prepared by local engineering for connections.

3.05 Connect R( )A and R( )B output leads to D4A terminal strips on J92614E-1 interface unit using a hand-operated wire-wrap tool. Extend R( )A and R( )B output leads to 66M1-50 interface connecting block and terminate. Stencil lead designations on designation strip as shown in Fig. 2. The customer must terminate the CP equipment to the interface connecting block using the terminals stenciled on the customer side.

3.06 Refer to block diagrams shown in Fig. 3, 4, or 5 for basic ACD FADS System in use and follow the wiring plan shown in Fig. 6 and Table A.

3.07 Perform tests shown in Part 5 after installation.

4. OPERATION

4.01 ***General:*** The 3B TUR obtains the FADS usage data from ACD trunk circuits using the switch count method. This method involves repeated scanning of test terminals at 100 second intervals, which equates to 18 scans (cycles) per half-hour. The cumulative total of the number found busy (grounded) on each scan is recorded on registers in the FADS administrative cabinet. The 3B TUR records incoming trunk usage, incoming trunk waiting usage, transfer trunk usage, position manned usage, and position busy usage as 100 call second (CCS) registrations and cycle count as a peg count. The electronic totalizer sums position call counts as peg counts. This data is shown on registers in the administrative cabinet. Refer to Section 981-234-100 for a detailed description of FADS used with 2A and 3A ACD Systems.

4.02 Connecting Arrangement C1Y (Fig. 6) permits these traffic data circuits to be monitored directly by CP equipment. The R( ) relay is connected to the traffic measuring circuit of the FADS. Ground received on the R( ) lead from one of the traffic measuring circuits operates the R( ) relay momentarily providing a contact closure between the output leads R( )A and R( )B to the CP equipment to indicate a traffic registration. Removal of the ground on the R( ) lead releases the R( ) relay to open the contact closure between the R( )A and R( )B output leads. The 3,000-ohm resistor in series with the relay coil reduces the operate current and contact bounce. The 185A network provides protection to the make contact of the R( ) reed relay by reducing arcing and increasing contact life. The interface unit circuit does not provide for filtering of input or output signals. The output signal may contain irregularities (spurious or split pulses) requiring filtering by the CP equipment for proper operation.

5. MAINTENANCE (Fig. 6)

5.01 Check for blown fuses, loose or broken connections.

5.02 Precautions should be taken when performing the tests to avoid adversely affecting service to the customer. Local instructions should be followed for notifying the customer before performing tests and for recording and reporting any register operations caused by performing tests.

5.03 Open the output leads to the circuits under test by removing the B bridging clips (or wire straps) at the 66M1-50 interface connecting block. Make any test connections on the Telephone Company side of the connecting block, and perform the following tests: Connect an 81A or KS-16990, List 1 test set across R( )A and R( )B output terminals of the circuit under test. Set the test set to the continuity position (continuity should not be indicated). Momentarily apply ground (ground side of −48V supply) to the R( ) input lead at the D4 terminal strip of the circuit under test. R( ) relay should operate closing the contact to the R( )A and R( )B output terminals, and the test set should indicate continuity. Remove ground, releasing R( ) relay, and the test set should indicate an open circuit.

5.04 If all circuits test satisfactorily, restore circuits to normal by removing all test connections and replace the B bridging clips (or wire straps) on the 66M1-50 interface connecting block.

READ ***Do not attempt any tests or repairs to the CP equipment.***

6. CONNECTIONS

6.01 Refer to Fig. 1 and 6 and Table A for connections for Connecting Arrangement C1Y.

6.02 The −48V operating voltage for the J92614E-1 interface unit is obtained from the power supply for the FADS equipment. The −48V lead may be connected directly to the J58833A-2 fuse panel, to a separate 1-1/3 ampere fused circuit, or to a −48V terminal on the J92614C transfer unit through a separate fuse.

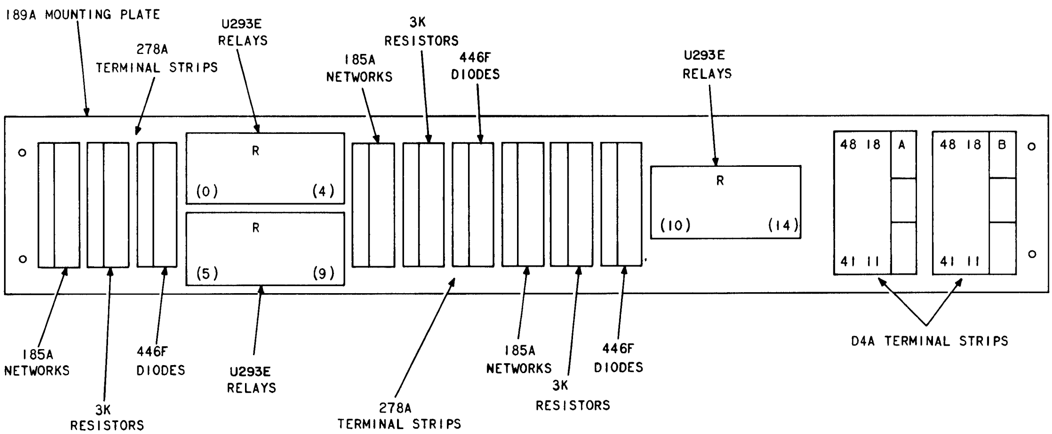


Fig. 1—J92614E-1 Interface Unit

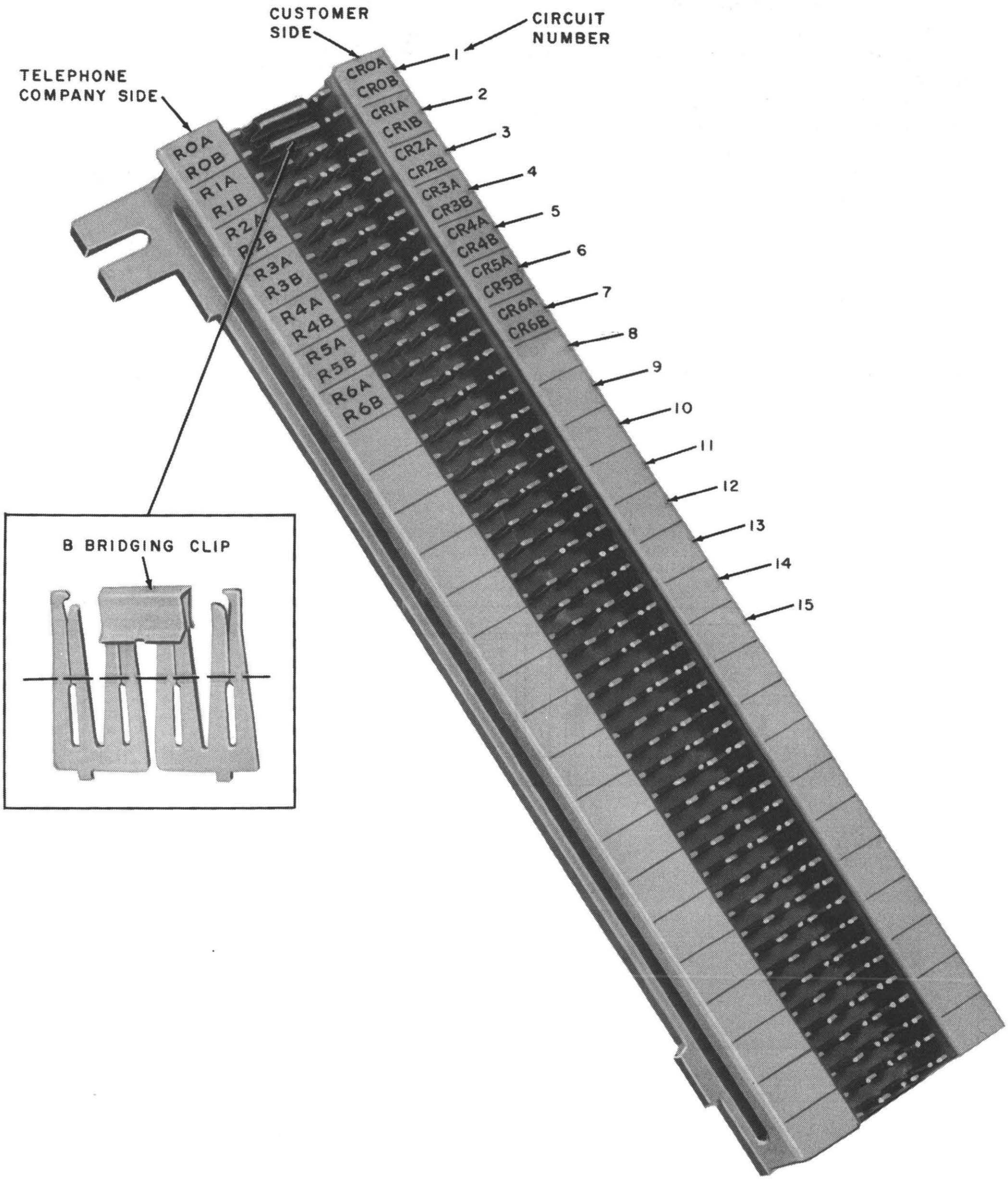


Fig. 2—66M1-50 Interface Connecting Block

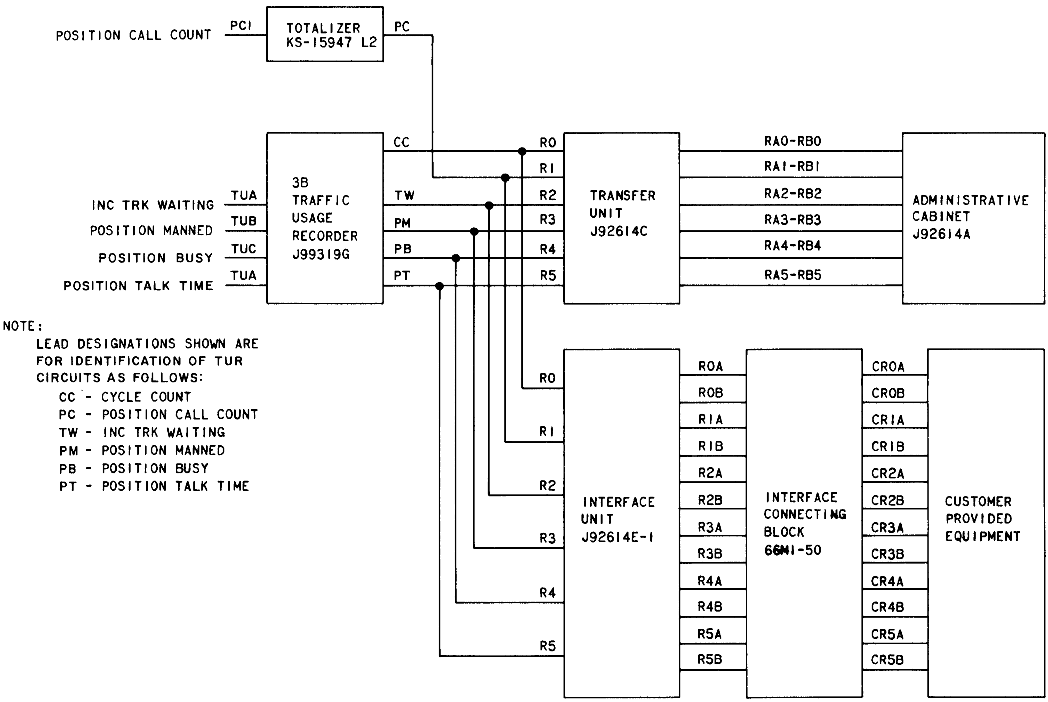
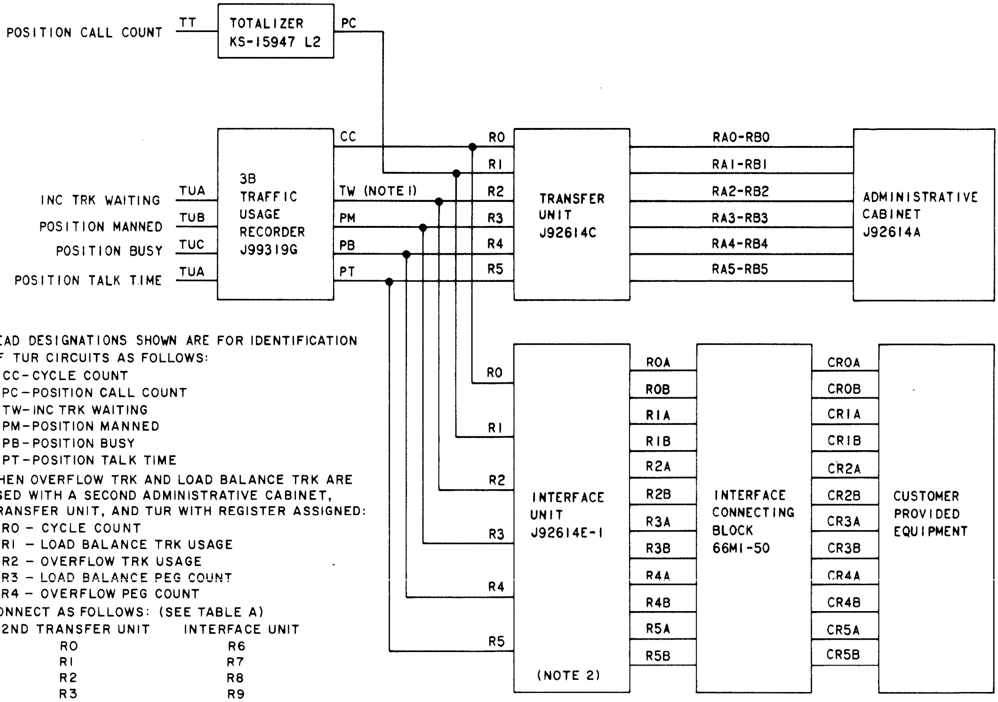


Fig. 3—Block Diagram of Connecting Arrangement C1Y With 2A ACD FADS



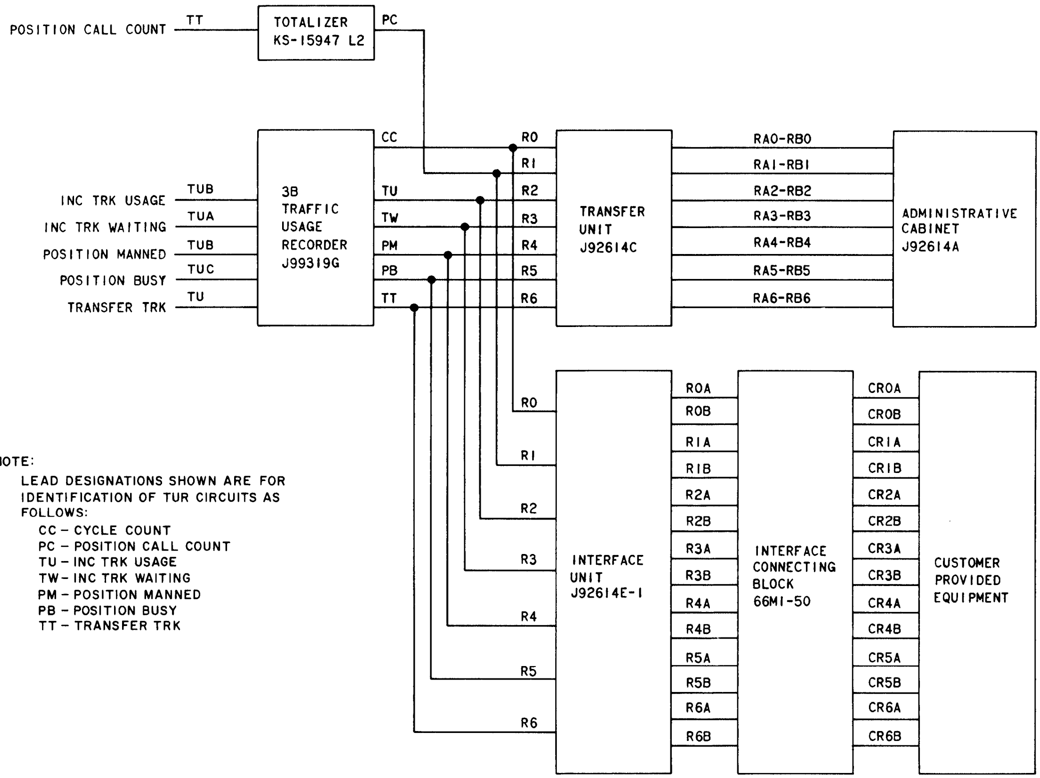
NOTES:

1. LEAD DESIGNATIONS SHOWN ARE FOR IDENTIFICATION OF TUR CIRCUITS AS FOLLOWS:
   CC-CYCLE COUNT
   PC-POSITION CALL COUNT
   TW-INC TRK WAITING
   PM-POSITION MANNED
   PB-POSITION BUSY
   PT-POSITION TALK TIME
2. WHEN OVERFLOW TRK AND LOAD BALANCE TRK ARE USED WITH A SECOND ADMINISTRATIVE CABINET, TRANSFER UNIT, AND TUR WITH REGISTER ASSIGNED:
   R0 - CYCLE COUNT
   R1 - LOAD BALANCE TRK USAGE
   R2 - OVERFLOW TRK USAGE
   R3 - LOAD BALANCE PEG COUNT
   R4 - OVERFLOW PEG COUNT

   CONNECT AS FOLLOWS: (SEE TABLE A)

2ND TRANSFER UNIT	INTERFACE UNIT
R0	R6
R1	R7
R2	R8
R3	R9
R4	R10

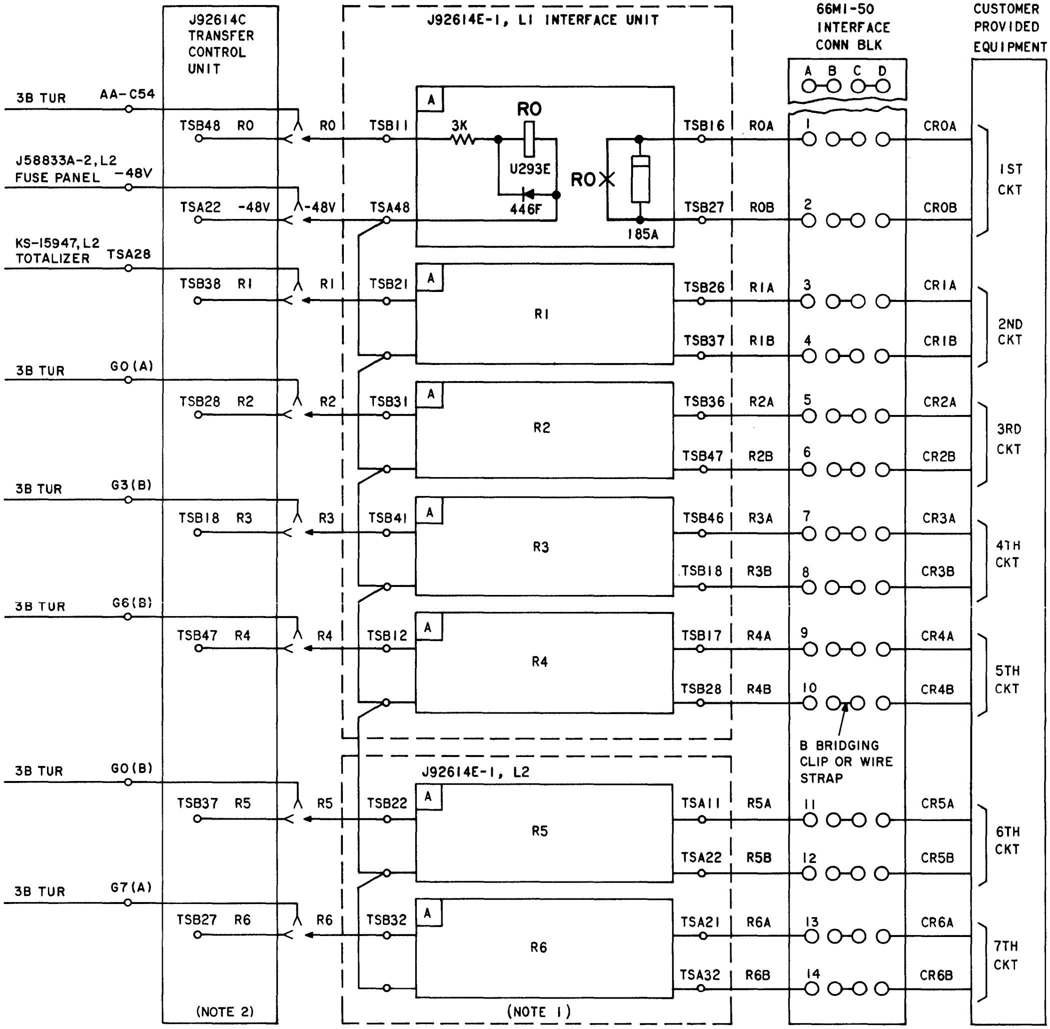
Fig. 4—Block Diagram of Connecting Arrangement C1Y With 3A ACD FADS



NOTE:
LEAD DESIGNATIONS SHOWN ARE FOR IDENTIFICATION OF TUR CIRCUITS AS FOLLOWS:

- CC – CYCLE COUNT
- PC – POSITION CALL COUNT
- TU – INC TRK USAGE
- TW – INC TRK WAITING
- PM – POSITION MANNED
- PB – POSITION BUSY
- TT – TRANSFER TRK

Fig. 5—Block Diagram of Connecting Arrangement C1Y With Optional (MD) 3A ACD FADS



NOTES:
1. UNIT MAY BE EQUIPPED WITH 15 CIRCUITS. REFER TO TABLE A FOR ADDITIONAL CIRCUIT CONNECTIONS.
2. IF TRANSFER UNIT IS NOT PROVIDED, CONNECT TO TUR AND TOTALIZER, REFER TO 3B TUR LEAD ASSIGNMENT SHEET PREPARED BY LOCAL ENGINEERING FOR CONNECTIONS.

Fig. 6—Connecting Arrangment C1Y-Connections

TABLE A

*J92614E-1 CONNECTIONS

CIRCUIT	DESIG	TERMINALS
0	R0	TSB11
	R0A	TSB16
	R0B	TSB27
	−48V	TSA48
1	R1	TSB21
	R1A	TSB26
	R1B	TSB37
2	R2	TSB31
	R2A	TSB36
	R2B	TSB47
3	R3	TSB41
	R3A	TSB46
	R3B	TSB18
4	R4	TSB12
	R4A	TSB17
	R4B	TSB28
5	R5	TSB22
	R5A	TSA11
	R5B	TSA22
6	R6	TSB32
	R6A	TSA21
	R6B	TSA32
7	R7	TSB42
	R7A	TSA31
	R7B	TSA42

CIRCUIT	DESIG	TERMINALS
8	R8	TSB13
	R8A	TSA41
	R8B	TSA13
9	R9	TSB23
	R9A	TSA12
	R9B	TSA23
10	R10	TSB33
	R10A	TSA33
	R10B	TSA44
11	R11	TSB43
	R11A	TSA43
	R11B	TSA15
12	R12	TSB14
	R12A	TSA14
	R12B	TSA25
13	R13	TSB24
	R13A	TSA24
	R13B	TSA35
14	R14	TSB34
	R14A	TSA34
	R14B	TSA45

*Unit arranged for maximum of 15 inputs (one List 1 and two List 2)

PROTECTIVE CONNECTING ARRANGEMENTS C1V, RCX, AND GC2

1. GENERAL

1.01 This section provides identification, installation, operation, maintenance and connection information for Protective Connecting Arrangements (PCA) C1V, RCX, and GC2. These connecting arrangements are used to indicate the dc supervisory and ringing condition of a telephone company central office (CO) line in the telecommunications network or tie line to customer-provided equipment (CPE).

1.02 This section is reissued to:

- Add two new tie line arrangements for PCA RCX (Fig. 11F and 11G)
- Change title of section
- Change Fig. 2 and 11.

1.03 If the customer wants a copy of the Technical Reference which covers these interface specifications, he should contact the local Telephone Company Business Office or the Marketing Representative.

1.04 This issue of the section is based on the following drawing:

SD-69633-01, Issue 7D—117A Interconnecting Unit and Protective Connecting Arrangement RCX, C1V, and GC2

If this section is to be used with equipment or apparatus reflecting later issue(s) of the drawing, reference should be made to the SDs to determine the extent of the changes and the manner in which the section may be affected.

2. IDENTIFICATION

A. PURPOSE

- PCA C1V using an 18D KTU provides a contact closure over leads CBS1 and CBS2 toward the CPE when the PBX or CO line is seized and maintains closure until the line becomes idle.
- PCA RCX using a 117A IU provides a contact closure over leads CDP1 and CDP2 toward the CPE when the PBX or CO line is seized. This contact closure opens with each dial pulse, and the contacts open when the line becomes idle.
- PCA C1V and RCX may be used together to provide both of the features explained above.
- PCA GC2 using a 15D KTU provides a contact closure over leads C1 and C2 toward the CPE when ringing is present on the line.

B. ORDERING GUIDE

Note: Equipment for these connecting arrangements may be mounted on existing relay racks or in equipment cabinets provided there is available space.

PCA C1V (Fig. 1)

- Unit, Telephone, Key, 18D
- Box, Apparatus, ♦105C♦
- Backboard, KS-5796, L7, L8, or L9 (if required)
- Block, Connecting, 66M1-50 (Fig. 2)
- Clip, Bridging, B
- Capacitor, KS-19524, L9, 60 μF, or equivalent (one per 18D KTU), required to prevent longitudinal imbalance.

NOTICE
Not for use or disclosure outside the
Bell System except under written agreement

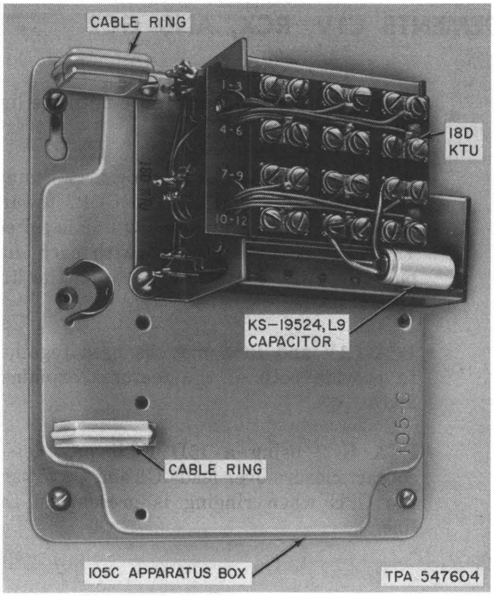


Fig. 1—Protective Connecting Arrangement C1V

PCA RCX (Fig. 3 and 4)

- Unit, Interconnecting, 117A—each unit provides four circuits when equipped with 303F relays (unit is shipped with ***one*** 303F relay provided)
- Relay, 303F—one per line as required
- Mounting, Apparatus, 15A—one per three 117A IUs
- Backboard, 173A
- Cover, 116A—includes two ▶811910082◀ (P-19A008) cover supports and screws that attach to the 15A apparatus mounting to support the cover
- Block, Connecting, 66M1-50 (Fig. 2)
- Clip, Bridging, B.

Associated Equipment for PCA RCX Only (Order Separately)

- Unit, Telephone, Key, 227B—one per three lines (Fig. 11C only)
- ▶Unit, Telephone, Key, 17B—one per line (Fig. 11F only)◀
- Unit, Telephone, Key, 25B—one per three lines (Fig. 11D and H only)
- Bracket, ▶813722048 (P-37B204)◀ —one per two ▶17B◀ or 25B KTUs
- Capacitor, KS-19524, L9, 60 μF—one per 25B KTU (required to prevent longitudinal imbalance)
- ▶Diode, 521D—one per Fig. 11G only.◀

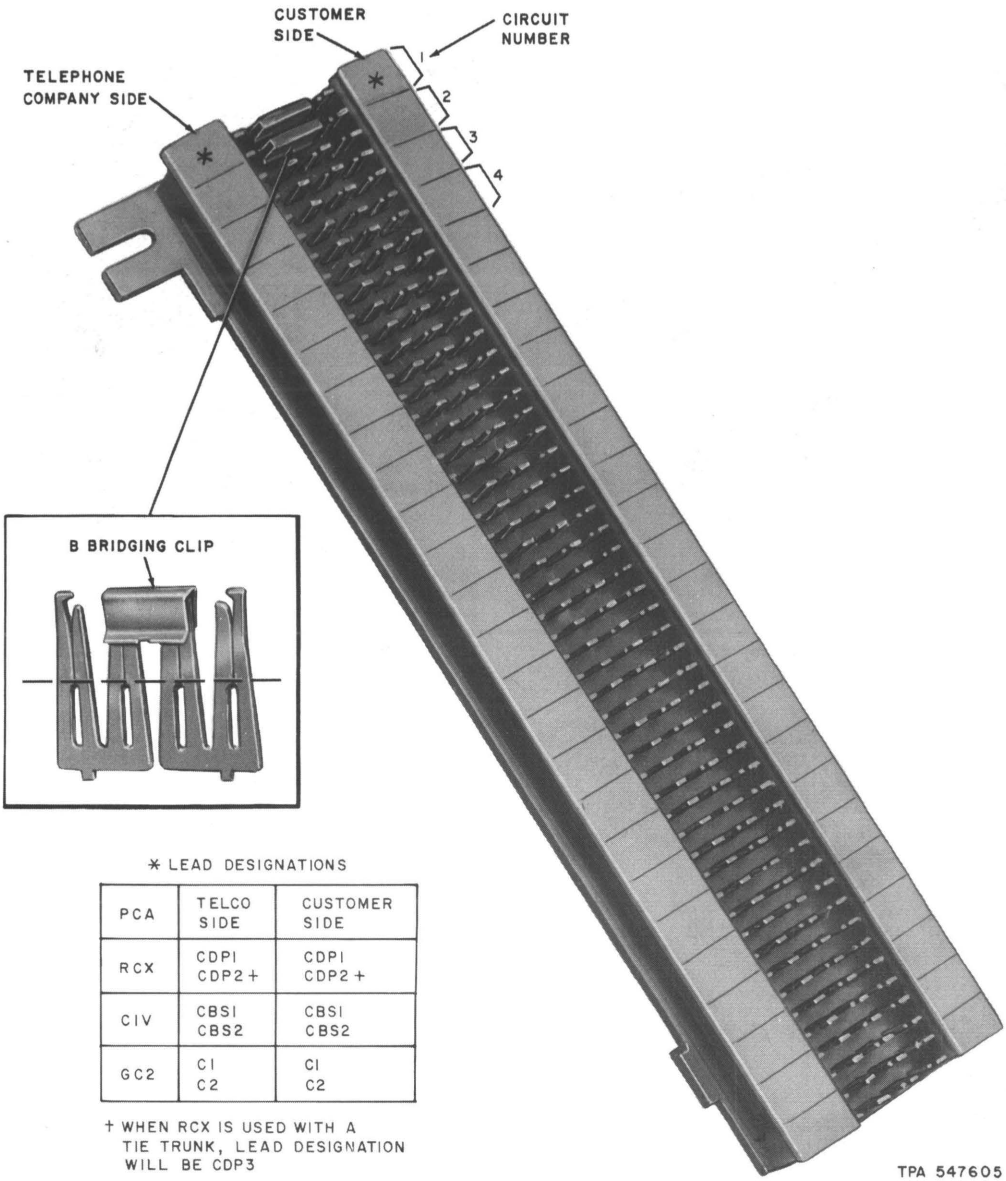
PCA GC2 (Fig. 5)

- Unit, Telephone, Key, 15D
- Box, Apparatus, ▶105C◀
- Backboard, KS-5796, L7, L8, or L9 (if required)
- Block, Connecting, 66M1-50 (Fig. 2)
- Clip, Bridging, B.

C. DESIGN FEATURES

PCA C1V

- Uses an 18D KTU.
- Screw terminals on front.
- The 105C apparatus box consists of a metal base with cover, cable rings, and dust guard. It will hold two 18D KTUs.
- Approximate dimensions of apparatus box: 7-1/2 inches high by 7 inches wide by 3-1/2 inches deep.
- B relay may follow dial pulses; SR relay not affected by dial pulses.



* LEAD DESIGNATIONS

PCA	TELCO SIDE	CUSTOMER SIDE
RCX	CDP1 CDP2 +	CDP1 CDP2 +
C1V	CBS1 CBS2	CBS1 CBS2
GC2	C1 C2	C1 C2

\+ WHEN RCX IS USED WITH A TIE TRUNK, LEAD DESIGNATION WILL BE CDP3

Fig. 2—66M1-50 Interface Connecting Block

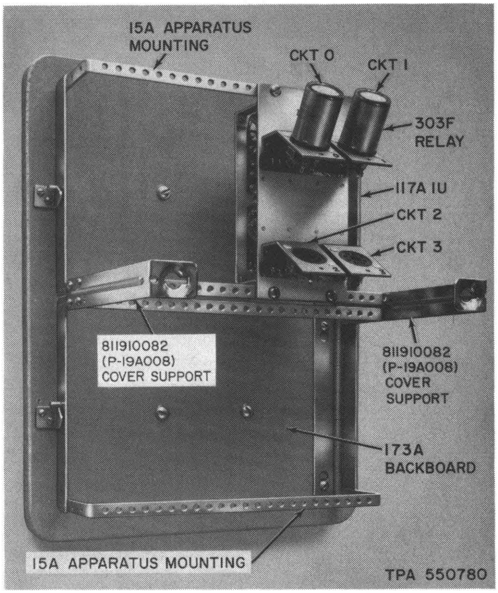


Fig. 3—Protective Connecting Arrangement RCX

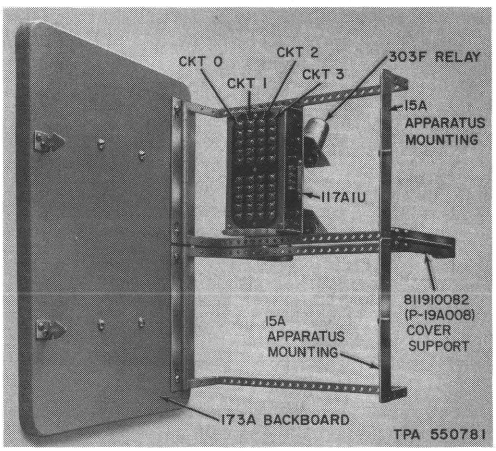


Fig. 4—Protective Connecting Arrangement RCX (Rear View)

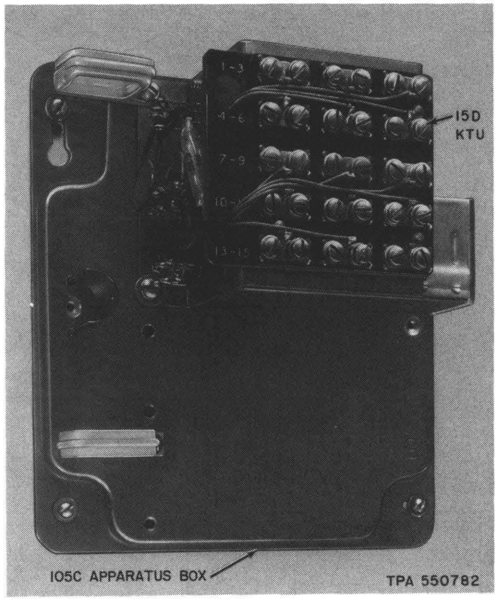


Fig. 5—Protective Connecting Arrangement GC2

PCA RCX

- Uses a 117A IU.
- Screw terminals on rear.
- 15A apparatus mounting will hold three 117A IUs (Fig. 3), or three 227B KTUs (Fig. 6), or four 25B KTUs mounted on two ▶813722048◀ (P-37B204) brackets.
- Approximate dimensions of mounting: 16-1/2 inches by 13 inches by 9 inches (with cover in place).
- 173A backboard mounts two 15A apparatus mountings.
- 116A cover encloses two 15A apparatus mountings—includes two ▶811910082◀ (P-19A008) cover supports and mounting screws.
- 117A IU is nonpolarized and contains four circuits for four 303F plug-in relays.

- DP relay is operated in the idle condition, except when connected to a tie trunk as shown in Fig. 11E only.

- DP relay follows dial pulses and ringing.

PCA GC2

- Uses a 15D KTU.

- Screw terminals on front.

- The 105C apparatus box consists of a metal base with cover, cable rings, and dust guard. It will hold two 15D KTUs.

- Approximate dimensions of apparatus box: 7-1/2 inches high by 7 inches wide by 3-1/2 inches deep.

- R relay operated by ringing voltage.

- Provides a contact closure toward the CPE over leads C1 and C2 when ringing is present on the line.

3. INSTALLATION

3.01 Refer to the following sections for detailed information on associated apparatus:

- Backboards—463-130-100

- Connecting blocks—461-604-102

- Apparatus mountings and apparatus boxes—463-140-100.

PCA C1V

3.02 The 105C apparatus box mounts on any flat surface. A backboard is not required except on damp surfaces or to facilitate mounting. A KS-5796, List 7, List 8, or List 9 backboard may be used to mount the 105C box, when required.

3.03 Connect the KS-19524, List 9, 60 μF capacitor between terminals 9 and 11 of the 18D KTU.

3.04 Mount the 18D KTU in the 105C apparatus mounting and make connections as shown in Fig. 8.

3.05 Perform tests in Part 5 after installation and connections have been completed.

PCA RCX

3.06 Attach the 173A backboard to the wall. Fasten the 15A apparatus mounting to the backboard and install the 117A IU(s) on the 15A apparatus mounting. The 117A IU may also be mounted on 23-inch relay racks with 67B mounting bars. Make connections as shown in Fig. 9.

3.07 When PCA RCX is used with ground start CO trunks associated with a 700-type PBX, mount an auxiliary 227B KTU on a 15A apparatus mounting (Fig. 6) or 23-inch relay rack with 67B mounting bars. Make connections as shown in Fig. 12.

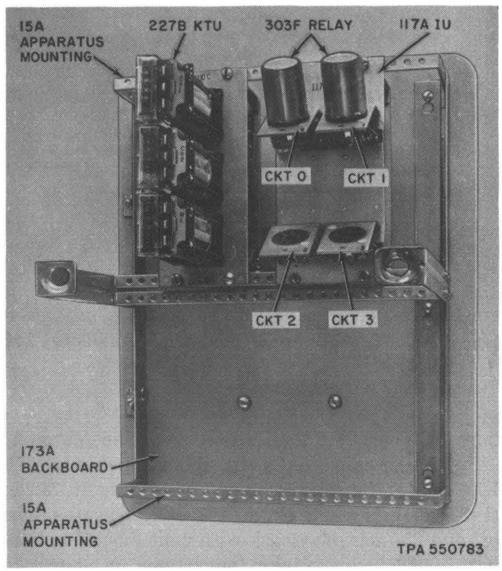


Fig. 6—15A Apparatus Mounting With 117A IU and Auxiliary 227B KTU

3.08 When PCA RCX is used with ground start CO trunks associated with an 800-type PBX, mount an auxiliary 25B KTU on a 15A apparatus mounting with an 813722048 (P-37B204) bracket, or in a 105C apparatus box (Fig. 7), or on a 23-inch relay rack with bent mounting bars per ED-69143-70. Connect the KS-19524, List 9, 60 μF capacitor between terminals 2 and 11 on the 25B KTU (see Fig. 7). Make connections as shown in Fig. 13.

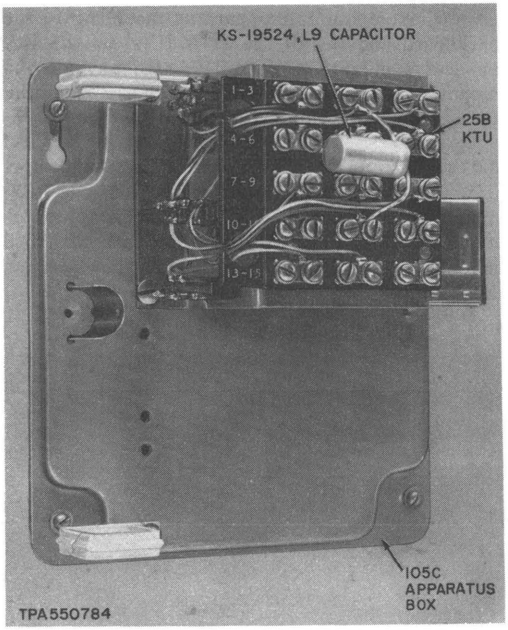


Fig. 7—105C Apparatus Box With Auxiliary 25B KTU

3.09 ➧When PCA RCX is used to provide outgoing supervision on a tie trunk, mount a 17B KTU on a 15A apparatus mounting with an 813722048 (P-37B204) bracket, or in a 105C apparatus box, or on a 23-inch relay rack with bent mounting bars per ED-69143-70. Make connections as shown in Fig. 11F.➧

3.10 Perform tests in Part 5 after installation and connections have been completed.

PCA GC2

3.11 The 105C apparatus box mounts on any flat surface. A backboard is not required except on damp surfaces or to facilitate mounting. A KS-5796, List 7, List 8, or List 9 backboard may be used to mount the 105C box, when required.

3.12 Mount the 15D KTU in the 105C apparatus mounting and make connections as shown in Fig. 10.

3.13 Perform tests in Part 5 after installation and connections have been completed.

4. OPERATION

4.01 ***PCA C1V (Fig. 8):*** This service requires an 18D KTU only. On seizure of the CO line by the telephone company station or PBX, B relay operates from CO line current. The B relay operated operates SR relay which provides a contact closure toward the CPE over leads CBS1 and CBS2. The SR relay (slow release) maintains the CBS1-CBS2 closure, while the B relay may follow dial pulses from the CO line. When the line is idle, both relays release.

4.02 ***PCA RCX:*** This arrangement is intended to provide an indication to CPE of outgoing calls and the digits dialed (rotary). In some applications of this arrangement, however, a ringing and/or off-hook indication will be present during incoming calls. For this reason, an explanation of the circuit operation on incoming calls is included for each application of the arrangement.

(a) ***Loop Start CO Trunks, PBX Lines, or CO Lines (Fig. 9, 11A or 11B):*** In this application the DP relay of the 117A IU is bridged directly across the tip and ring and held operated by CO battery and ground. The DP relay operated opens the CDP1 and CDP2 leads toward the CPE which indicates that the line is in an idle condition. When the station goes off-hook, the DP relay is shunted which causes it to release and provide a contact closure between the CDP1 and CDP2 leads toward the CPE to indicate line seizure. As the station dials, the DP relay operates and releases to open and close the contact between the CDP1 and CDP2 leads toward the CPE to indicate digits dialed. The contact closure toward the CPE will open when the line becomes idle. On incoming calls, depending on the ringing signal, the DP relay may or may not operate and release in unison with the ringing cycle, but the contact between the CDP1 and CDP2 leads toward the

CPE will be closed when the call is answered (off-hook indication).

(b) ***Ground Start CO Trunk on 700-Type PBX (Fig. 11C):*** In this application an auxiliary 227B KTU is used to connect the 117A IU across tip and ring of the CO line. When the line is seized, the ground contact closure on the B or SR lead from the PBX trunk operates the CA1 relay in the 227B KTU. The CA1 relay operated closes a contact between the CDP1 and CDP2 leads towards the CPE to indicate line seizure, and another contact connects the 117A IU across tip and ring of the CO line. The DP relay in the 117A IU remains released due to the shunting effect of the off-hook station. As the station dials, the DP relay operates and releases to open and close the contact between the CDP1 and CDP2 leads toward the CPE to indicate digits dialed. The contact closure toward the CPE will open when the line becomes idle. On an incoming call the DP relay may or may not operate and release in unison with the ringing cycle, but the contact between the CDP1 and CDP2 leads toward the CPE will be closed when the call is answered (off-hook indication).

(c) ***Ground Start CO Trunk on 800-Type PBX (Fig. 11D):*** In this application an auxiliary 25B KTU is used to connect the 117A IU across tip and ring of the CO line. When the station goes off-hook, the line current operates the L2 relay in the 25B KTU. The L2 relay operated provides a contact closure to operate the CT relay. CT relay operated provides a contact closure between leads CDP1 and CDP2 toward the CPE to indicate line seizure, and another contact closure bridges the 117A IU across tip and ring of the CO line. The DP relay in the 117A IU remains released due to the shunting effect of the off-hook station. As the station dials, the DP relay operates and releases to open and close the contact between the CDP1 and CDP2 leads toward the CPE to indicate digits dialed. The contact closure toward the CPE will open when the line becomes idle. On an incoming call the contact between the CDP1 and CDP2 leads toward the CPE will close when the call is answered (off-hook indication).

(d) ***Tie Trunk With E and M or DX Signaling (Fig. 11E):*** In this application the DP relay of the 117A IU is operated by a ground contact closure in the tie trunk. When the station goes off-hook, the dial pulsing contact in the tie trunk is closed operating the DP relay. The DP relay operated closes the contact between the CDP1 and CDP3 leads towards the CPE indicating line seizure. As the station dials, the DP relay operates and releases to open and close the contact between the CDP1 and CDP3 leads toward the CPE to indicate digits dialed. The contact closure toward the CPE will open when the line becomes idle. On an incoming call, there will not be a closure between the CDP1 and CDP3 leads toward the CPE until the call is answered by the PBX attendant.

(e) ➧***Tie Trunk—Outgoing Calls (Fig. 11F):*** This application requires a 17B KTU to connect the 117A IU across the tip and ring of the tie trunk. When the tie trunk is seized at PBX(A) on an outgoing call, the tie trunk supplies a ground to operate relay SW from PBX or local battery. Make contacts on relay SW connect relay DP in the 117A IU across the tie trunk circuit and provide a closure across CDP1 and CDP2 toward the CPE to indicate seizure. Relay DP does not operate due to the shunt of the off-hook station. When the station dials, relay DP follows the dial pulses to open and close the CDP1 and CDP2 contacts. When the station goes on-hook, the SW and DP relays release, removing the closure toward the CPE. On an incoming call, the closure between CDP1 and CDP2 occurs when the call is answered (off-hook indication).

Note: Unwanted pulses in addition to dial pulse information may appear on leads CDP1 and CDP2 during call process, depending on the associated PBX.

(f) ***Tie Trunk—Incoming Call (Fig. 11G):*** In an idle trunk condition, relay DP will be operated from the PBX battery on the tip and ring opening CDP1 and CDP2 to the CPE. When the trunk is seized on an incoming call, the tie trunk circuit (A) shunts relay DP which releases, providing a closure on CDP1 and CDP2 as a seizure indication. Relay DP will follow dial pulses from the distant end which opens and closes CDP1 and CDP2.

Note: Unwanted pulses in addition to dial pulse information may appear on leads CDP1 and CDP2 during call process, depending on the associated PBX.➧

(g) ***Station Line From 800-Type PBX (Fig. 11H):*** In this application an auxiliary 25B KTU is used to connect the 117A IU across tip and ring of the station. When the station goes off-hook, the line current operates the L2 relay in the 25B KTU. The L2 relay operated provides a contact closure to operate the CT relay. CT relay operated provides a contact closure between leads CDP1 and CDP2 toward the CPE to indicate line seizure, and another contact closure bridges the 117A IU across tip and ring of the station line. The DP relay in the 117A IU remains released due to the shunting effect of the off-hook station. As the station dials, the DP relay operates and releases to open and close the contact between the CDP1 and CDP2 leads toward the CPE to indicate digits dialed. The contact closure toward the CPE will open when the line becomes idle. On an incoming call the contact between the CDP1 and CDP2 leads toward the CPE will close when the call is answered (off-hook indication).

4.03 ***PCA GC2 (Fig. 10):*** This service requires a 15D KTU bridged across the CO or PBX line. R relay operates from ac ringing voltage and is not affected by the dc line voltage. When ringing voltage is on the line, the R relay will operate and provide a contact closure across the C1 and C2 leads toward the CPE. The R relay contact opens when ringing voltage ceases.

5. MAINTENANCE

5.01 Check CO pair and for blown fuses, loose or broken connections.

5.02 Open the leads to the circuit under test by removing the B bridging clips or wire straps at the 66M1-50 interface connecting block. Make all test connections on the telephone company side of the block. Perform the following tests:

(a) ***PCA C1V (Fig. 8):*** Connect an 81A or KS-16990, List 1 test set across terminals CBS1 and CBS2. Set the test set to the continuity position (continuity should not be indicated). At the connecting arrangement, connect a 1013A (or equivalent) hand test set across the T and R leads to the telephone company station or PBX. Push the TALK-MON switch of the hand test set to the TALK position. Dial tone should be heard, and the B and SR relays should operate and close the contact to terminals CBS1 and CBS2. The 81A or KS-16990, List 1 test set should indicate continuity. Dial "O" using the 1013A (or equivalent) hand test set. The 81A or KS-16990, List 1 test set should continue to indicate continuity while dialing. Remove the 1013A (or equivalent) hand test set, and the relays will release opening the leads to terminals CBS1 and CBS2.

(b) ***PCA RCX (Fig. 9):*** Connect an 81A or KS-16990, List 1 test set across the CDP1 and CDP2 terminals. Set the test set to the continuity position (continuity should not be indicated). At the connecting arrangement, connect a 1013A (or equivalent) hand test set across the T and R leads to the telephone company station or PBX. Push the TALK-MON switch of the hand test set to the TALK position. Dial tone should be heard and continuity shown at the CDP1 and CDP2 terminals. Dial "O" using the 1013A (or equivalent) hand test set. The 81A or KS-16990, List 1 test set should follow dial pulses. Remove the 1013A (or equivalent) hand test set, and the test set connected across the CDP1 and CDP2 leads should indicate open.

(c) ***PCA GC2 (Fig. 10):*** Connect an 81A or KS-16990, List 1 test set across the C1 and C2 terminals. Set the test set to the continuity position (continuity should not be indicated). At the connecting arrangement, connect a 1013A (or equivalent) hand test set across the T and R leads to the telephone company station. Push the TALK-MON switch of the hand test set to the TALK position. Dial tone should be heard and an open circuit indicated at C1 and C2 terminals. Dial the test desk and arrange to have ringing voltage applied to the line. Push the TALK-MON switch of hand test set to MON. The test set connected to the C1 and C2 terminals should indicate continuity during ringing.

Warning: Hold hand test set away from ear while ringing current is applied.

5.03 If the test results described are not obtained check wiring, battery, and ground to unit. If battery and ground are present and wiring is correct, replace the 18D KTU, 117A IU, or 15D KTU, and retest.

5.04 If test results are satisfactory, restore circuit to normal by removing all test connections,

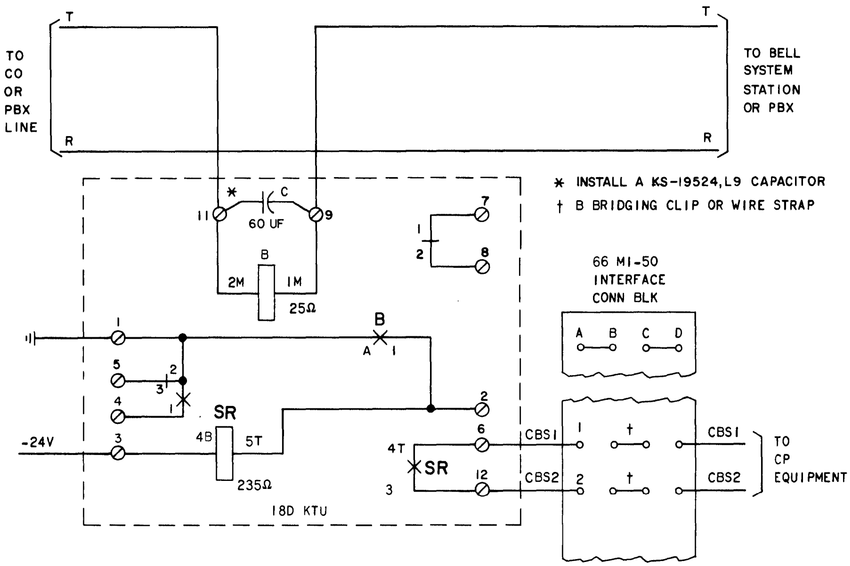


Fig. 8—Protective Connecting Arrangement C1V—Schematic

and replace the B bridging clips or wire straps on the 66M1-50 interface connecting block.

Do not attempt any tests or repairs to the CPE.

5.05 When trouble is suspected in the CPE, the Repair Service Bureau should be notified so that proper Maintenance of Service Charge billing can be initiated as outlined in BSP 660-101-312 entitled Maintenance of Service Charge on Service With Customer-Provided Equipment (CPE).

6. CONNECTIONS

Based on a maximum of 100 feet of 24-gauge conductor loop between the IU and the interface connecting block, the associated telephone company wiring will have a nominal 5-ohm dc resistance with the contacts closed.

6.01 For PCA C1V, refer to Fig. 1, 2, and 8.

6.02 For PCA RCX with loop start, refer to Fig. 2, 9, 11A, and 11B.

6.03 For PCA RCX with ground start CO trunk (700-type PBX), refer to Fig. 2, 9, 11C, and 12.

6.04 For PCA RCX with ground start CO trunk (800-type PBX), refer to Fig. 2, 9, 11D, and 13.

6.05 For PCA RCX with tie trunks or CO trunk with E and M signaling, refer to Fig. 2, 9, and 11E.

6.06 ➧For PCA RCX with dial repeating tie trunks, refer to Fig. 2, 9, and 11F or 11G.➧

6.07 For PCA RCX with station line from an 800-type PBX, refer to Fig. 2, 4, 7, 9, 11H, and 13.

6.08 For PCA GC2, refer to Fig. 2, 5, and 10.

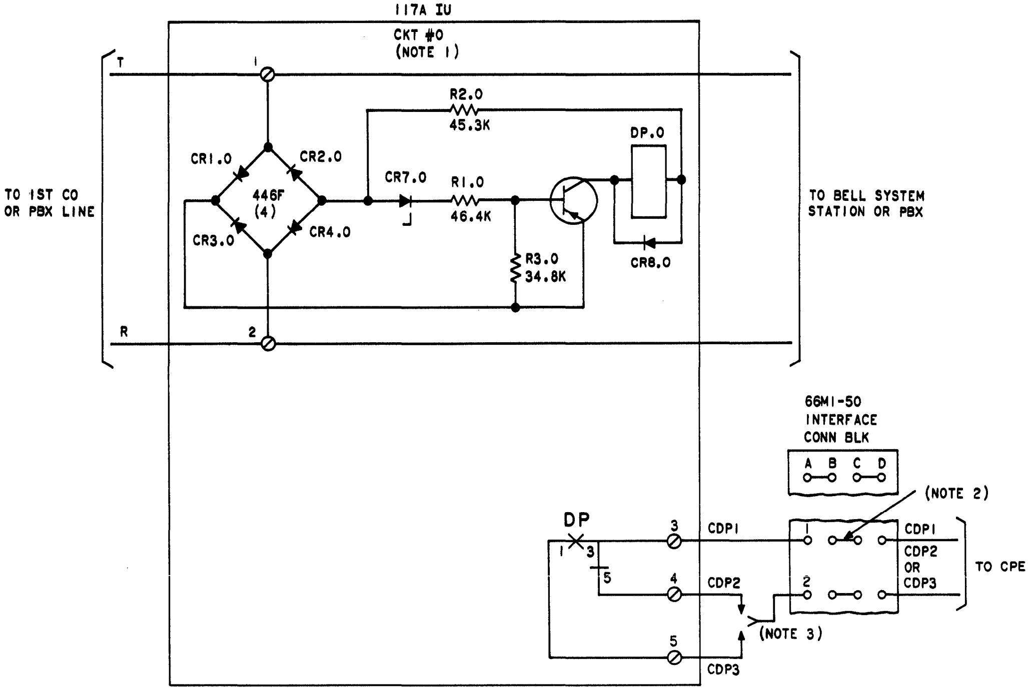


TABLE A

CONNECTIONS TO SCREW TERMINALS ON 117A IU					
CKT NO.	LEAD DESIGNATIONS				
	T	R	CDP1	CDP2	CDP3
0	1	2	3	4	5
1	11	12	13	14	15
2	21	22	23	24	25
3	31	32	33	34	35

NOTES:

1. 117A IU PROVIDES FOUR CIRCUITS WHEN EQUIPPED WITH FOUR 303F PLUG-IN RELAYS. SEE TABLE A FOR ASSOCIATED CIRCUIT AND TERMINAL NUMBERS.
2. B BRIDGING CLIP OR WIRE STRAP.
3. USE LEAD CDP3 ONLY WHEN RCX IS USED WITH A TIE TRUNK ARRANGEMENT AS SHOWN IN FIG. 11E. USE LEAD CDP2 IN ALL OTHER ARRANGEMENTS.

Fig. 9—Protective Connecting Arrangement RCX—Schematic

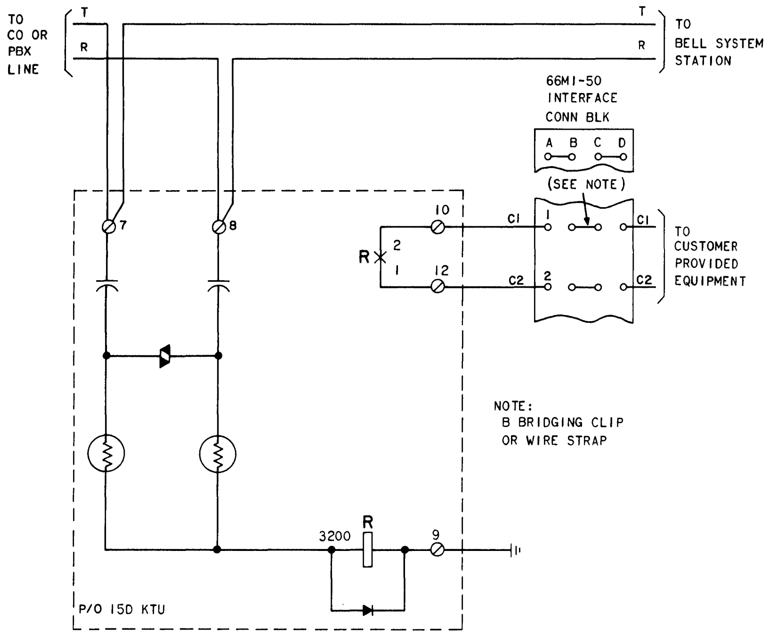
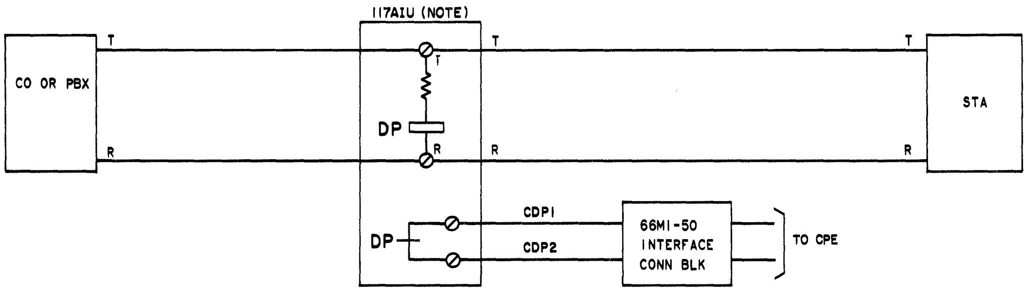
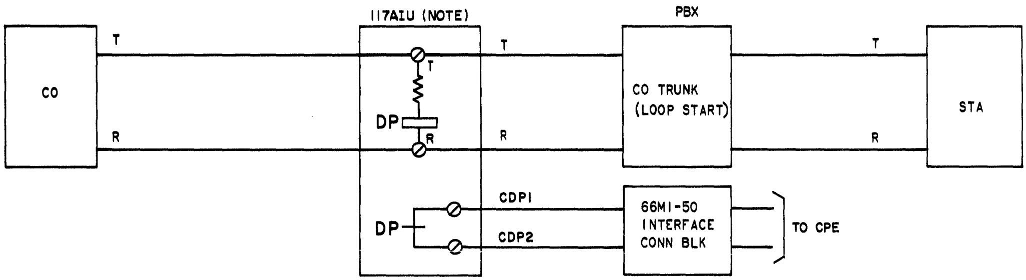


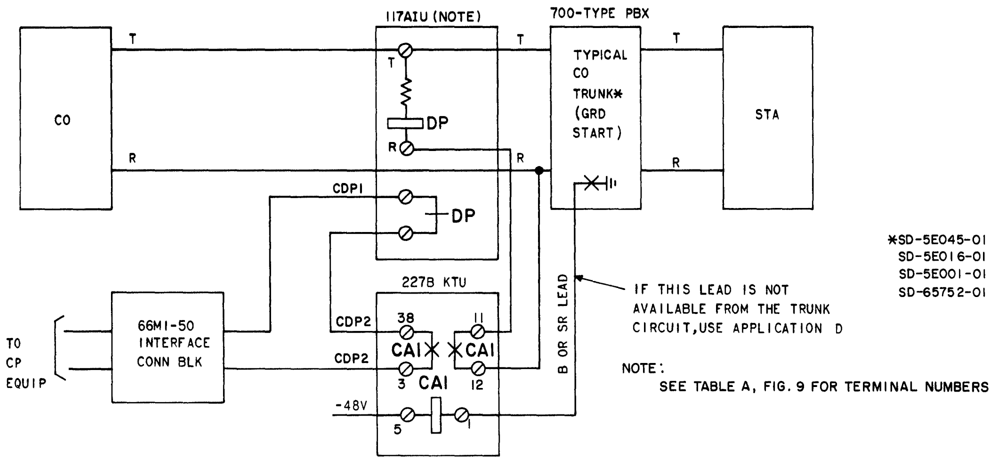
Fig. 10—Protective Connecting Arrangement GC2—Schematic



A. RCX WITH CO OR PBX LINE

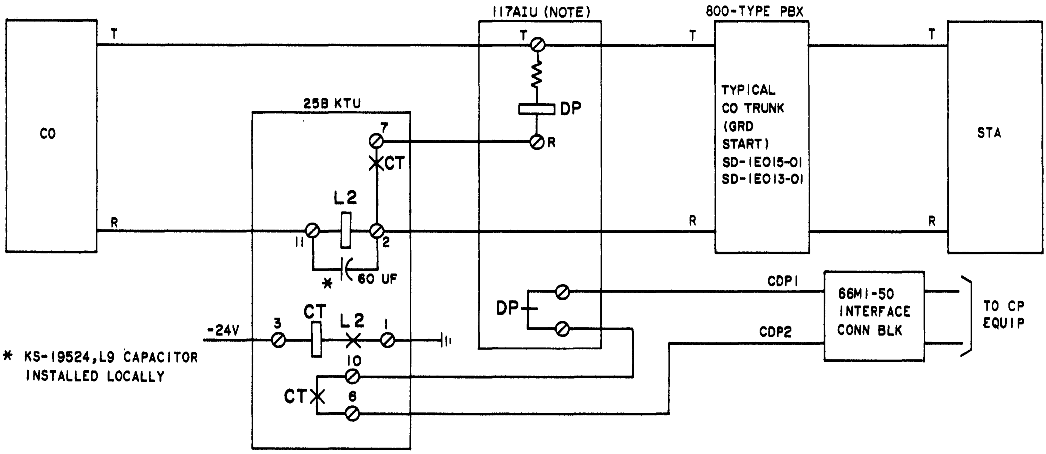


B. RCX WITH LOOP START CO TRUNK

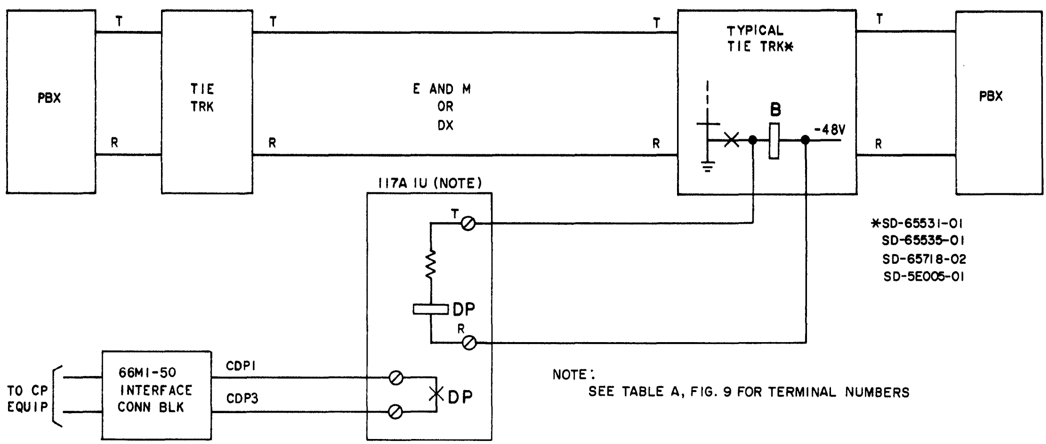


C. RCX WITH GROUND START CO TRUNK (700-TYPE PBX)

Fig. 11—Protective Connecting Arrangement RCX—Typical Circuit Applications (Sheet 1 of 3)

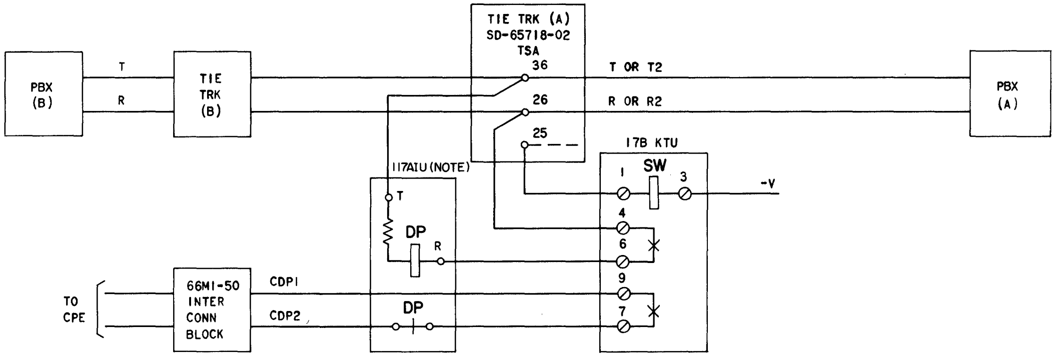


D. RCX WITH GROUND START CO TRUNK (800-TYPE PBX)

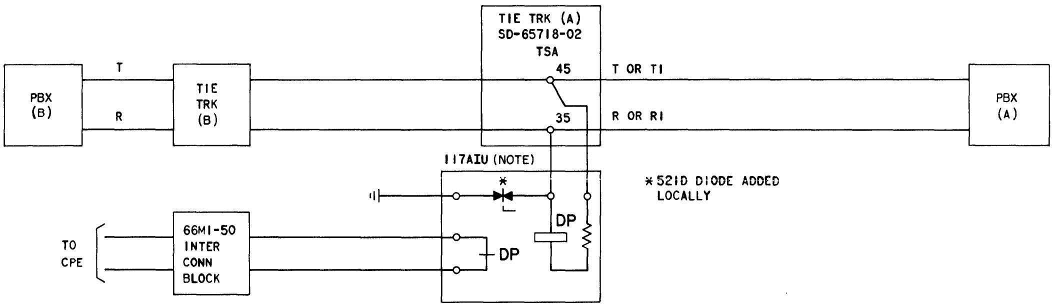


E. RCX WITH TIE TRUNK

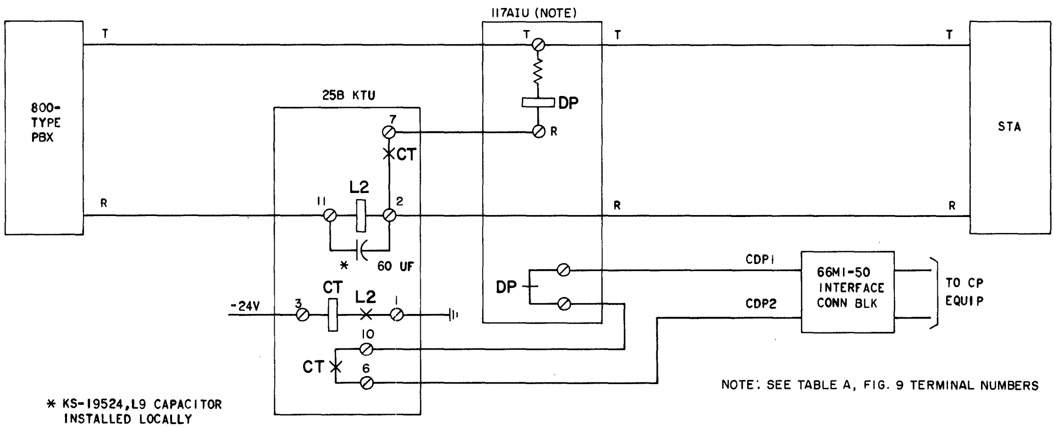
Fig. 11—Protective Connecting Arrangement RCX—Typical Circuit Applications (Sheet 2 of 3)



F. RCX WITH TIE TRUNK - OUTGOING CALLS

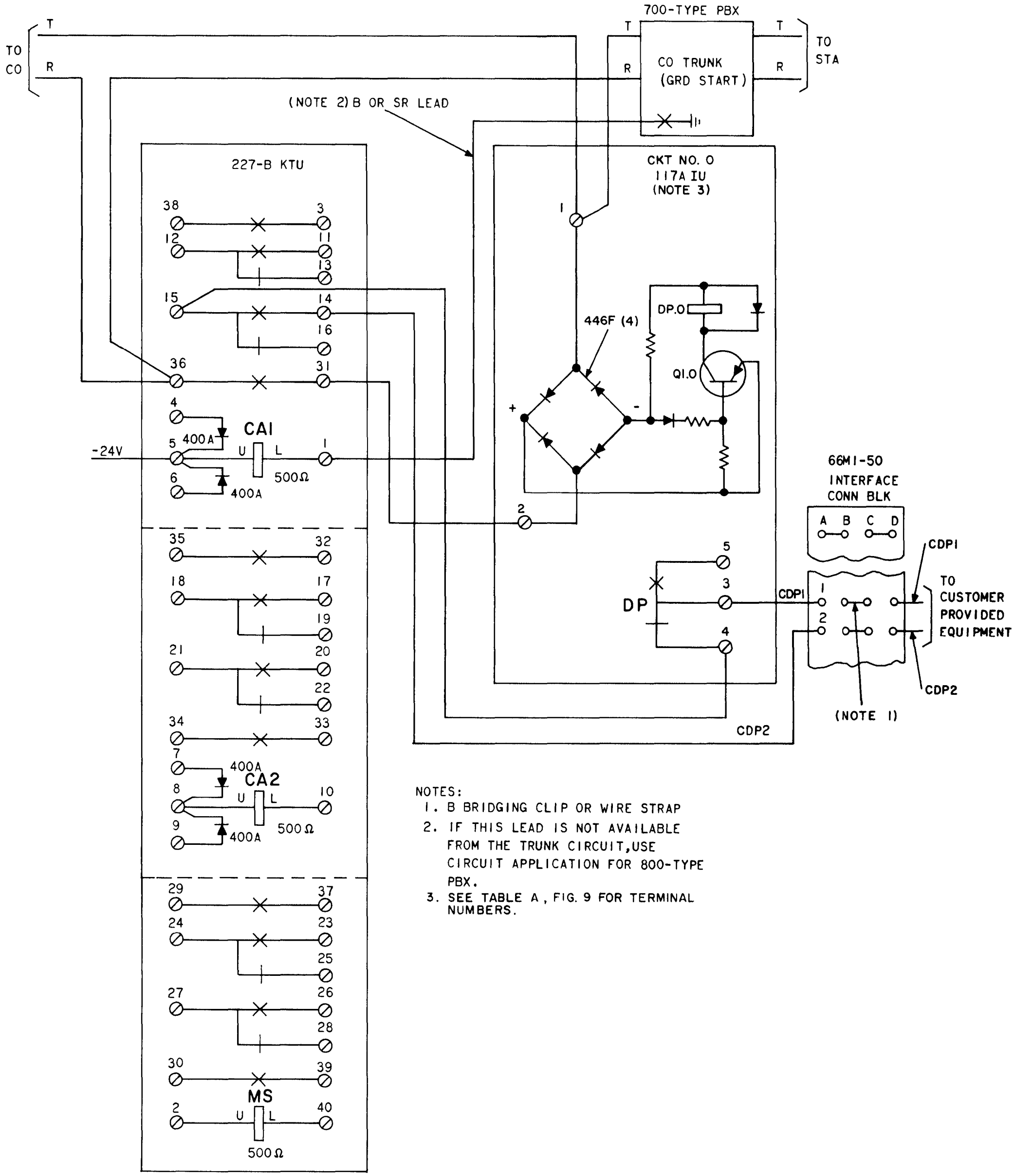


G. RCX WITH TIE TRUNK - INCOMING CALLS



H. RCX WITH STATION LINE FROM 800-TYPE PBX

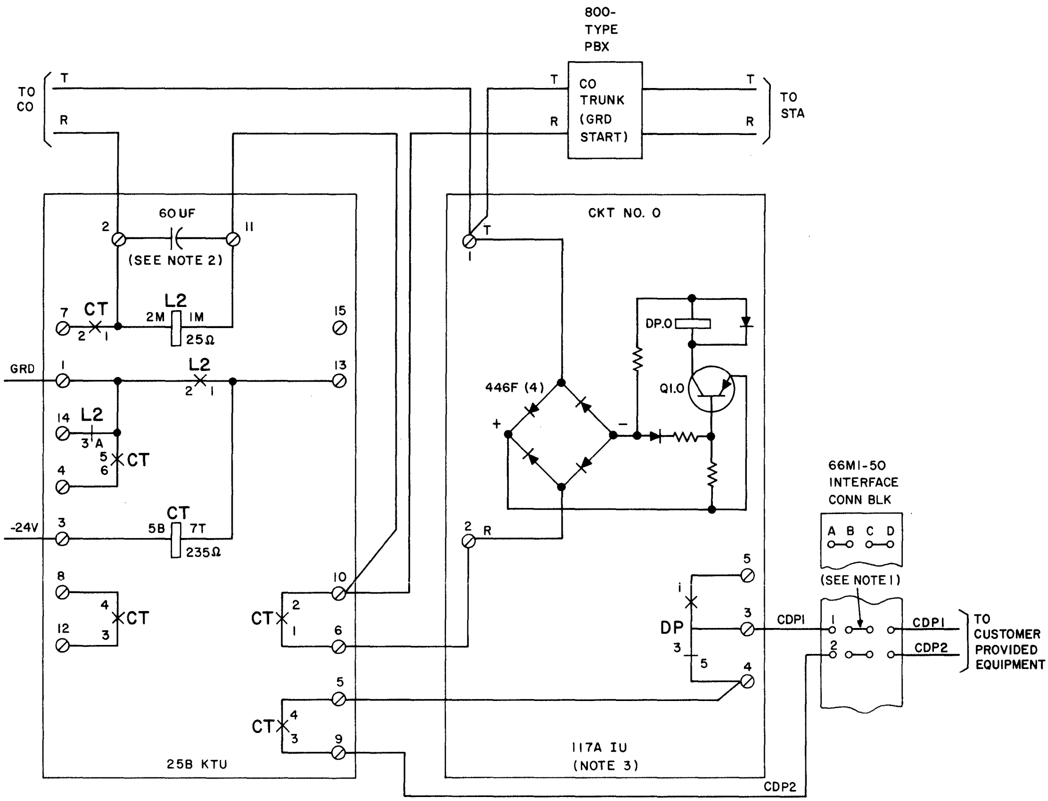
Fig. 11—Protective Connecting Arrangement RCX—Typical Circuit Applications (Sheet 3 of 3)



NOTES:

1. B BRIDGING CLIP OR WIRE STRAP
2. IF THIS LEAD IS NOT AVAILABLE FROM THE TRUNK CIRCUIT, USE CIRCUIT APPLICATION FOR 800-TYPE PBX.
3. SEE TABLE A, FIG. 9 FOR TERMINAL NUMBERS.

Fig. 12—Protective Connecting Arrangement RCX for Ground Start CO Trunks Associated With 700-Type PBX



NOTES:
1. B BRIDGING CLIP OR WIRE STRAP
2. INSTALL A KS-19524,L9 CAPACITOR
3. SEE TABLE A, FIG. 9 FOR TERMINAL NUMBERS

Fig. 13—Protective Connecting Arrangement RCX for Ground Start CO Trunks Associated With 800-Type PBX

CONNECTING ARRANGEMENT CTD

J53050G-TYPE INTERCONNECTING UNIT

1. GENERAL

1.01 This section provides identification, installation, operation, maintenance, and connecting information for Connecting Arrangement CTD. This connecting arrangement provides a means for connecting customer-provided (CP) toll diversion equipment to a Bell System central office (CO) trunk associated with a Bell System PBX.

1.02 This section is reissued to change designations on customer leads shown in Fig. 7.

1.03 When the customer-provided equipment (CPE) requires contact closures for off-hook indication and dc dial pulsing, Connecting Arrangement RCX must be used with Connecting Arrangement CTD. Information concerning Connecting Arrangement RCX is covered in Section 463-382-100.

1.04 One J53050G, List 1 (MD) interconnecting unit (IU), Fig. 1, equipped with six 7C timers provides six Connecting Arrangements CTD. One J53050G, List 2 IU (Fig. 2) equipped with four 7C timers provides four Connecting Arrangements CTD. (The 7C timers must be ordered separately—one per connecting arrangement.)

1.05 A block diagram of a typical Connecting Arrangement CTD, using a J53050G, List 2 IU, is shown in Fig. 3. A block diagram of a typical Connecting Arrangement CTD, using a J53050G, List 1 (MD) IU, is shown in Fig. 4. A block diagram of a typical Connecting Arrangement CTD used with a Connecting Arrangement RCX is shown in Fig. 5.

1.06 If the customer wants a copy of the Technical Reference which covers this interface specification, the customer should contact the local Telephone Company Business Office or the Marketing Representative.

This issue of the section is based on the following drawings:

CD-1E245-01, Issue 3, Appendix 1D

SD-1E245-01, Issue 4

If this section is to be used with equipment or apparatus reflecting later issue(s) of the drawing(s), reference should be made to the SDs and CDs to determine the extent of the changes and the manner in which the section may be affected.

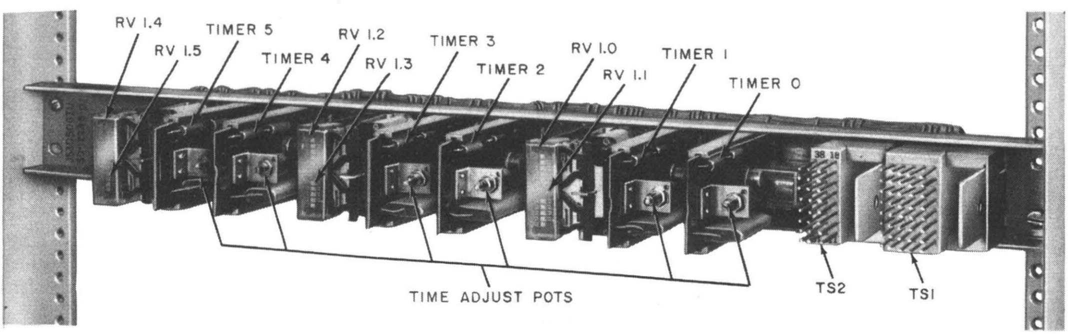


Fig. 1—J53050G, List 1 (MD) Interconnecting Unit Equipped With 7C Timers

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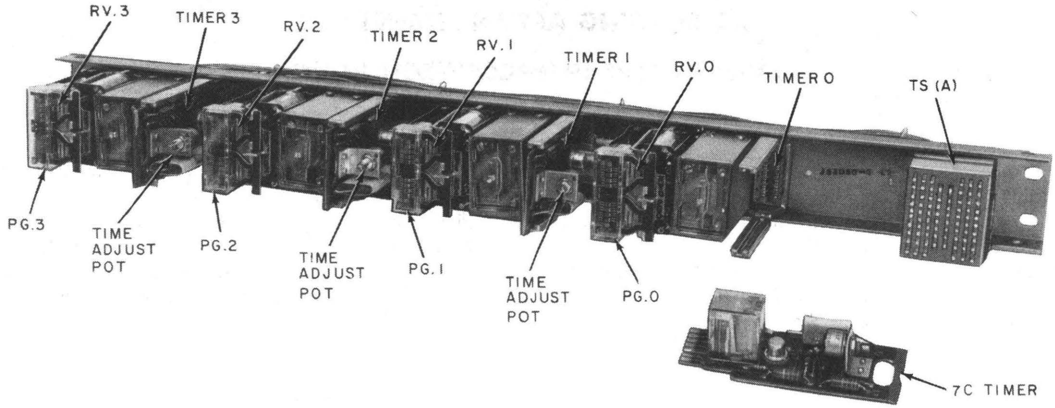


Fig. 2—J53050G, List 2 Interconnecting Unit Equipped With 7C Timers

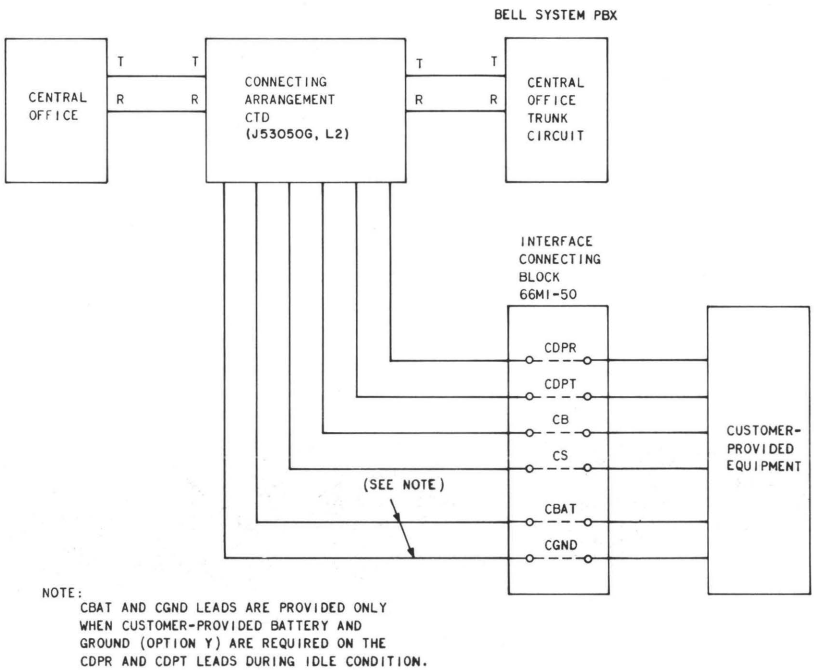


Fig. 3—Block Diagram—Typical Connecting Arrangement CTD—Using J53050G, List 2 IU

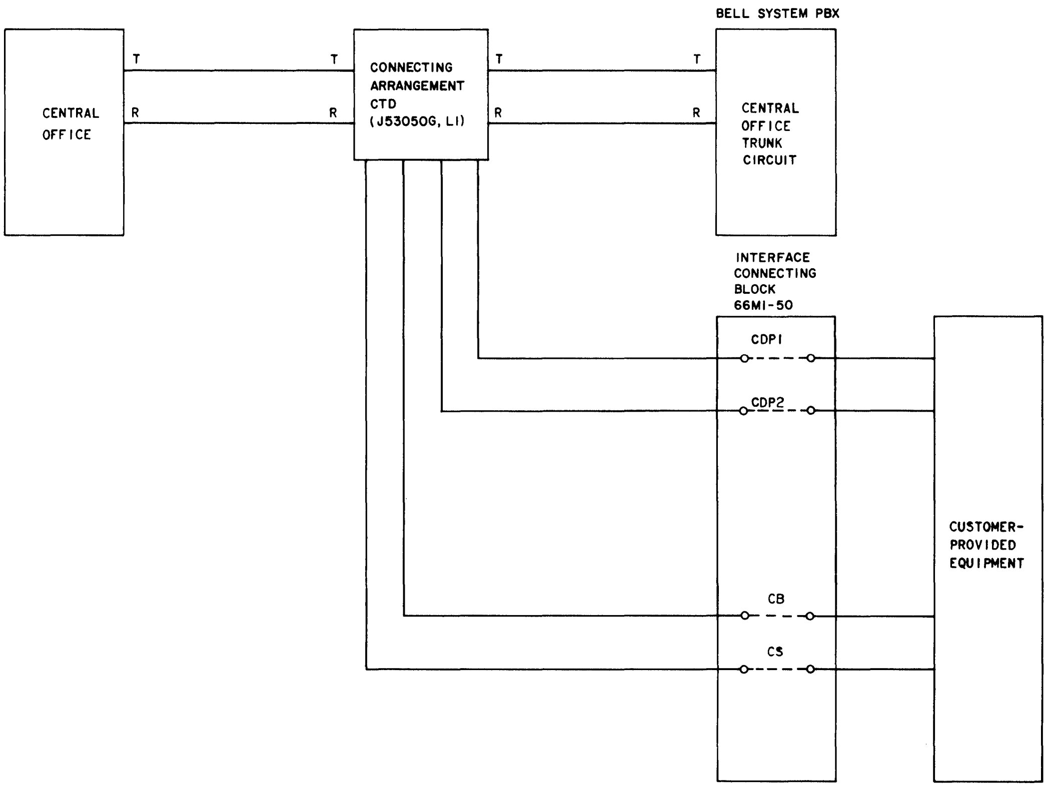
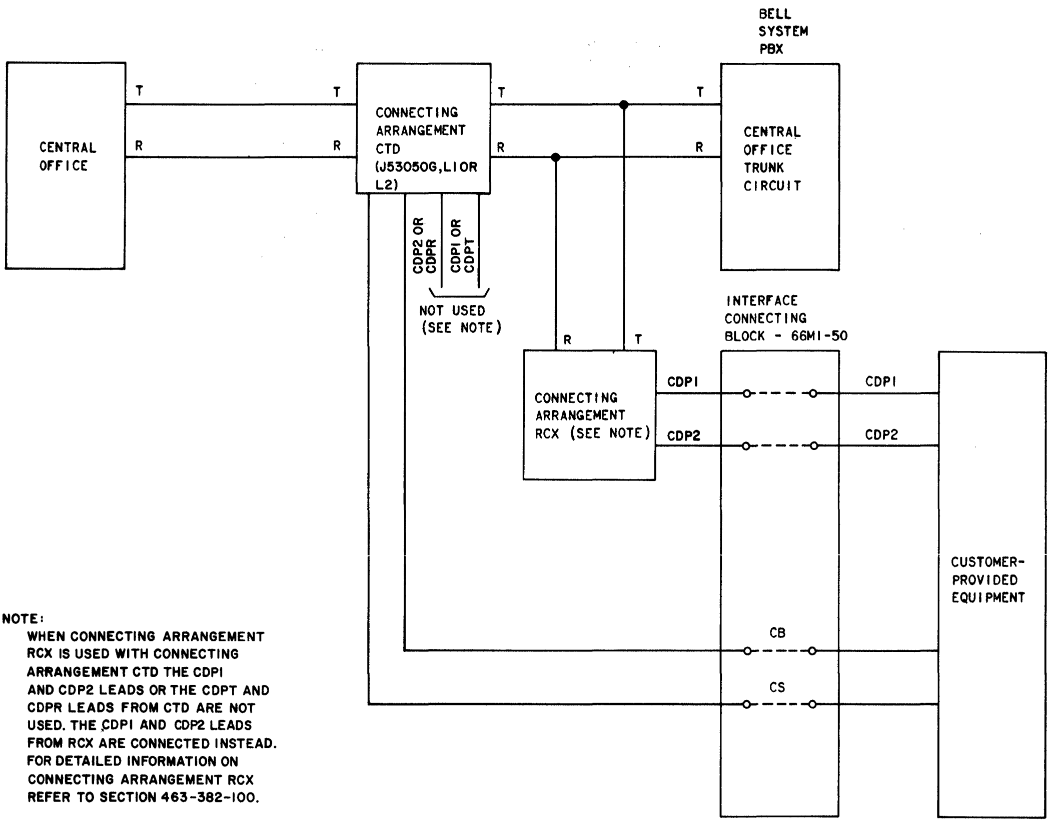


Fig 4—Block Diagram—Typical Connecting Arrangement CTD—Using J53050G, List 1 (MD) IU

2. IDENTIFICATION

PURPOSE

- To provide connection between CP toll diversion equipment and a Bell System CO trunk associated with a Bell System PBX.
- To provide a high resistance connection between the CPE and Bell System CO trunk circuit tip and ring conductors, over leads CDP1 and CDP2 (J53050G, L1) or leads CDPT and CDPR (J53050G, L2). This connection allows the customer to monitor the telephone line for dc supervisory information and dc and ac addressing information. When Connecting Arrangement CTD is used with Connecting Arrangement RCX, these connections are provided by Connecting Arrangement RCX. Connecting Arrangement RCX does not provide for monitoring ac addressing information.
- To recognize a contact closure from the CPE and reverse CO battery on leads T and R toward the Bell System PBX.



NOTE:
WHEN CONNECTING ARRANGEMENT RCX IS USED WITH CONNECTING ARRANGEMENT CTD THE CDP1 AND CDP2 LEADS OR THE CDPT AND CDPR LEADS FROM CTD ARE NOT USED. THE CDP1 AND CDP2 LEADS FROM RCX ARE CONNECTED INSTEAD. FOR DETAILED INFORMATION ON CONNECTING ARRANGEMENT RCX REFER TO SECTION 463-382-100.

Fig. 5—Block Diagram—Typical Connecting Arrangement CTD Used With Connecting Arrangement RCX

- To block any battery reversal which may come from the CO (J53050G, L2 only) that would result in a false signal to the PBX for toll diversion.
- To restore CO battery on leads T and R toward the PBX to the original polarity after a timed interval.

Note: The PBX must be wired for the toll diversion or toll denial feature. If the CO is wired or equipped in such a manner that battery reversal is ***not*** provided, the J53050G, List 1 (MD) ***may*** be used to implement the connecting arrangement. If the CO is equipped and wired in such a manner that battery reversal ***is*** provided, the J53050G, List 2 ***must*** be used.

APPLICATION

- 701A, 701B, 701PK, 702A, 711A, 740E, 756A, 800A PBXs or any PBX with reverse battery toll diversion or toll denial feature.

ORDERING GUIDE

- J53050G, List 2 Interconnecting Unit (one per ***four*** CO trunks)—***may*** be used in ***all*** installations, but ***must*** be used when the

CO is equipped and wired in such a manner that battery reversal ***is*** provided. Does not include 7C timers which must be ordered separately.

- J53050G, List 1 (MD) Interconnecting Unit (one per ***six*** CO trunks)—may be used when CO is equipped and wired in such a manner that battery reversal is ***not*** provided. Does not include 7C timers which must be ordered separately.

Note: Before using a List 2 in the place of a List 1 in an existing installation, the increased current drain should be considered. Typical current drain for one circuit (including a 7C timer) of a J53050G, L1 (MD) IU connected to a 48-volt power unit is 0.051 amperes; typical current drain for one circuit (including a 7C timer) of a J53050G, L2 IU connected to a 48-volt power unit is 0.103 amperes.

Associated Apparatus (Order Separately)

- Timer, 7C (one per CO trunk, maximum of four per List 2 IU and six per List 1 IU)

- KS-15620, List 22 Rectifier (required when PBX power supply is not used)

Note: This rectifier meets acceptable noise requirements as explained under Power Supplies in Section 332-104-102. Other rectifiers may be used when specified by local engineering.

- KS-14532 Power Cord (for use with KS-15620, List 22 Rectifier)

  List 1—10 ft

  List 2—2 ft

  List 3—15 ft

  List 4—20 ft

  List 5—25 ft

- Cable, Wiring, "D" Inside, or equivalent (for cabling from connecting arrangement to interface connecting block)

- Block, Connecting, 66M1-50 (Fig. 6 or 9)

Note: Other types of blocks may be used when specified by local engineering.

- Clip, Bridging, B (25 per pkg.)

DESIGN FEATURES

J53050G, List 2 Interconnecting Unit

- Mounts on a standard 23-inch relay rack, in an ED-91180-70 apparatus cabinet, or in a 16C apparatus mounting

- Size—2 by 23 inches

- Equipped with four 912A 14-pin connectors

- Designed to mount four 7C timers

- Provides for customer access to the telephone line, to detect trunk status information, through high resistance connection over leads CDPT and CDPR

- Provides circuitry for reversing CO battery toward Bell System PBX

- Provides polarity guard circuit to block battery reversals from the CO to prevent a false indication, or negation of an intended indication, to the PBX for toll diversion

- Provides options to allow one of three specific conditions on leads CDPT and CDPR during the idle condition (see 6.01)

- Provides wire-wrap terminals for option straps and for connection to Bell System and CPE.

J53050G, List 1 (MD) Interconnecting Unit

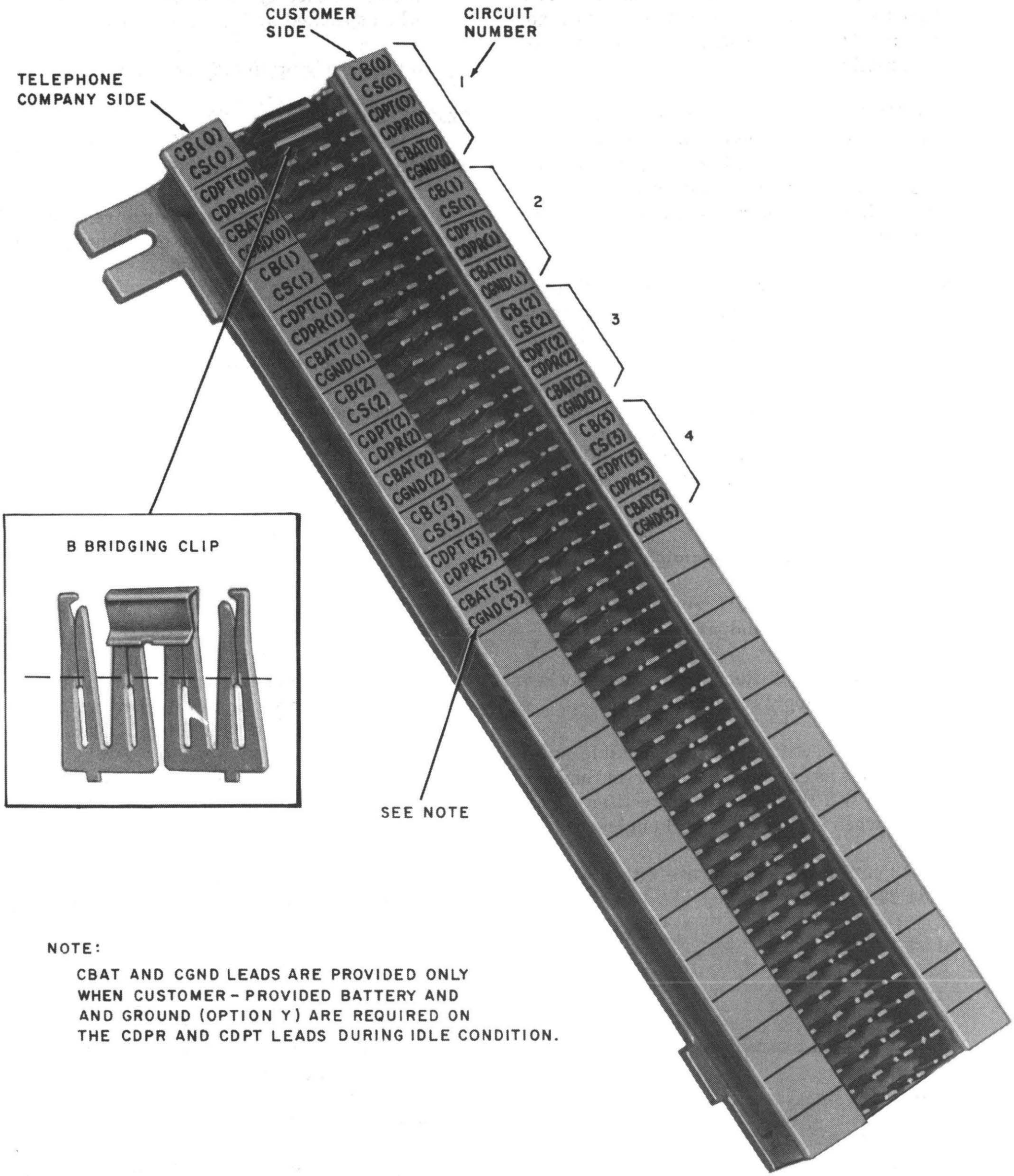
- Mounts on a standard 23-inch relay rack, in an ED-91180-70 apparatus cabinet, or in a 16C apparatus mounting

- Size—2 by 23 inches

- Equipped with six 912A 14-pin connectors

- Designed to mount six 7C timers

- Provides for customer access to the telephone line, to detect trunk status information,



NOTE:

CBAT AND CGND LEADS ARE PROVIDED ONLY WHEN CUSTOMER-PROVIDED BATTERY AND AND GROUND (OPTION Y) ARE REQUIRED ON THE CDPR AND CDPT LEADS DURING IDLE CONDITION.

Fig. 6—Typical Interface Connecting Block, Connecting Arrangement CTD Equipped With J53050G, List 2 IU

through high resistance connection over leads CDP1 and CDP2

- Provides circuitry for reversing CO battery toward Bell System PBX

- Provides wire-wrap terminals for connection to Bell System and CPE.

7C Timer

- Components are mounted on a 14-pin printed wiring board.

- Size—approximately 4-1/3 inches long by 1-1/3 inches deep by 1-3/4 inches wide.

- Provides circuitry to return CO battery toward the PBX to the original polarity, after a preset time-out interval (250 to 500 ms).

- Provides variable adjustment of time-out interval from approximately 100 ms to one second.

3. INSTALLATION

3.01 Locate the connecting arrangement in an area free of dampness and excessive dust or dirt, with adequate room for access to front and rear of equipment and connecting blocks. The equipment typically mounts on a standard 23-inch relay rack, in an ED-91180-70 apparatus cabinet, or in a 16C apparatus mounting. Installation of Connecting Arrangement RCX is covered in Section 463-382-100.

3.02 Use "D" inside wiring cable or equivalent to terminate the leads associated with the CPE on the interface connecting block. Stencil trunk number and lead designations on interface connecting block designation strip (see Fig. 6 or 9).

3.03 One 7C timer must be provided per CO trunk to be connected to the CPE (maximum of six per J53050G, List 1—maximum of four per J53050G, List 2). ***Adjust the timing potentiometer on the 7C timer (see Fig. 1 and 2) fully counterclockwise, then adjust it one-quarter turn clockwise.*** This provides the proper time-out interval (250 to 500 ms) for the operation of Connecting Arrangement CTD. Plug the 7C timer into the connector associated with the specific CO trunk being connected (see Fig. 7 and 10).

3.04 When the KS-15620, List 22 rectifier is used to power the connecting arrangement, the customer must provide a 117-volt, 60-Hz power outlet within power cord length of the customer-designated mounting location of the connecting arrangement (see Ordering Guide for cord lengths).

3.05 The power output supplying connecting arrangement(s) must not be under control of a switch and should be fused on a separately fused power circuit to prevent accidental loss of ac line voltage. Where local instructions permit, secure the power cord to the outlet with a power cord plug retainer assembly.

3.06 Refer to appropriate sections in Division 167 for proper grounding of power plants.

3.07 When installation is complete, perform tests given in Part 5.

4. OPERATION

> ***Note:*** The operational details for Connecting Arrangement CTD depend on the CPE with which it is used. If the CPE is arranged to detect line seizure and dial pulsing by contact closures from Bell System equipment rather than by means of the high resistance connection to the telephone line, Connecting Arrangement RCX must be used in conjunction with Connecting Arrangement CTD. Detailed information concerning Connecting Arrangement RCX is contained in Section 463-382-100.

4.01 ***Connecting Arrangement CTD, Using J53050G, List 2 IU (Fig. 7):*** When a Bell System PBX seizes a CO trunk for an outgoing call, CO line current causes relay L to operate. Relay L operated causes relay PG to operate. Relay PG operated connects the polarity guard in the transmission path between the CO and the Bell System PBX. The polarity guard isolates the PBX from any battery reversal from the CO, preventing a PBX wired for the toll diversion or toll denial feature from recognizing the battery reversal as an indication that the call should be denied or diverted. The polarity guard also prevents the reversal of polarity from the CO overriding a bona-fide signal from the CPE to restrict a call.

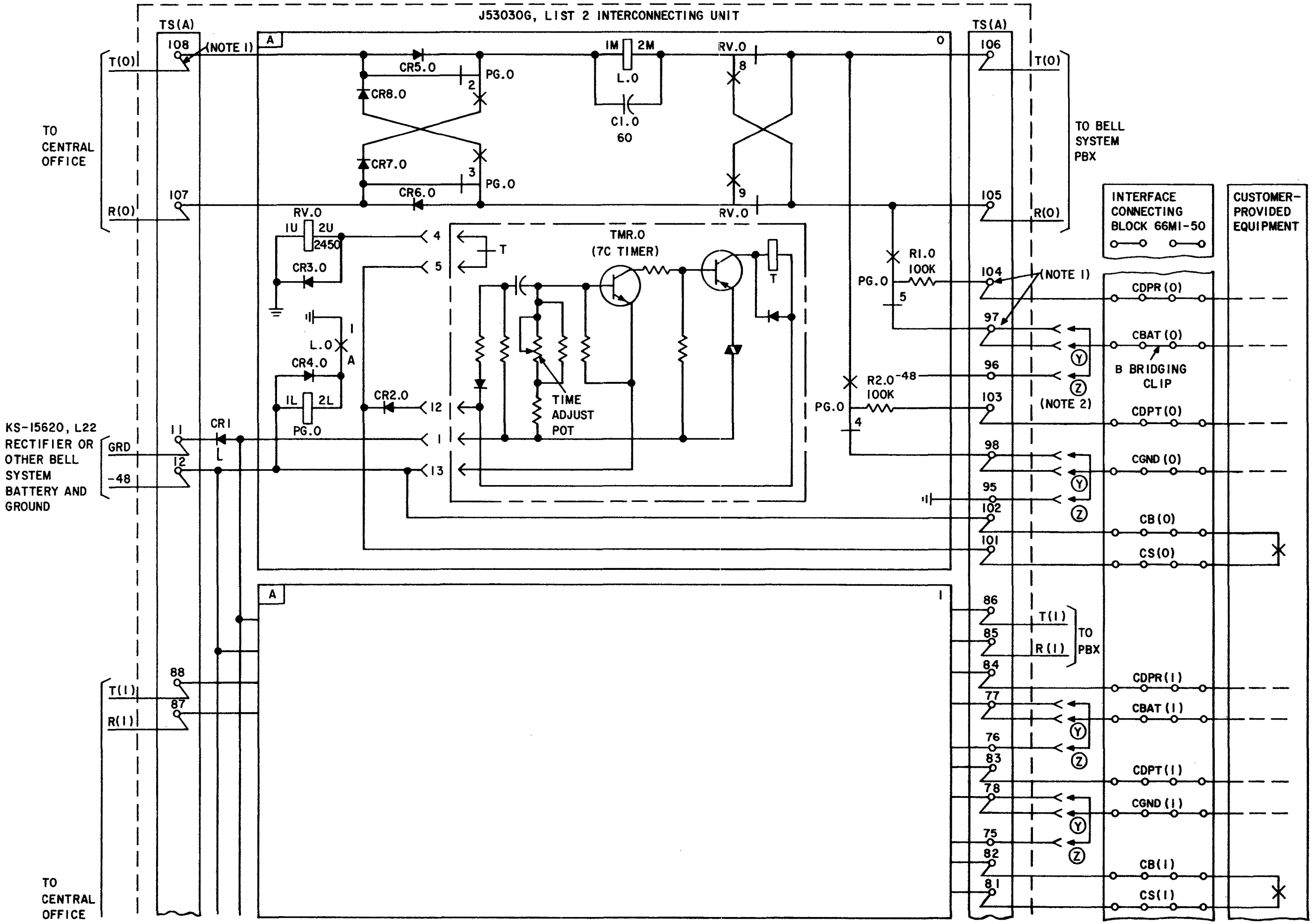
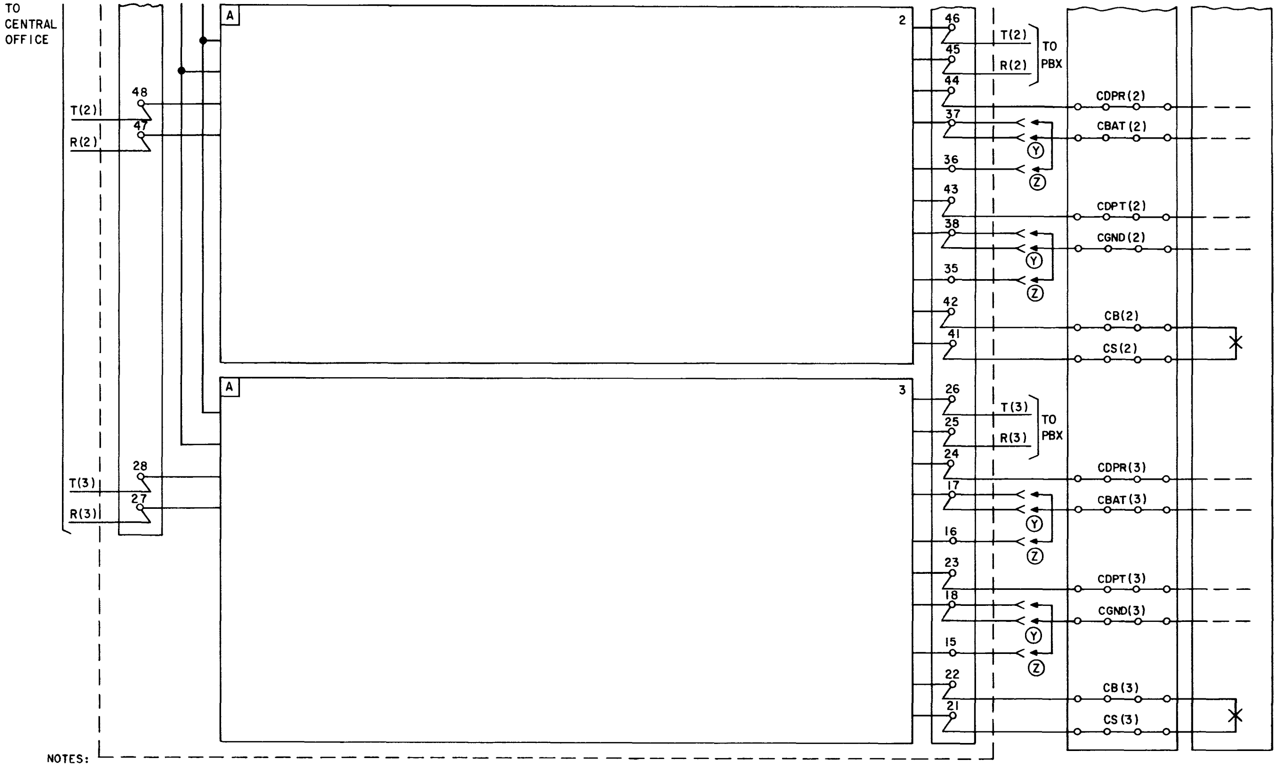


Fig. 7—Simplified Schematic and Connections—Connecting Arrangement CTD, Using J53050G, List 2 IU (Sheet 1)

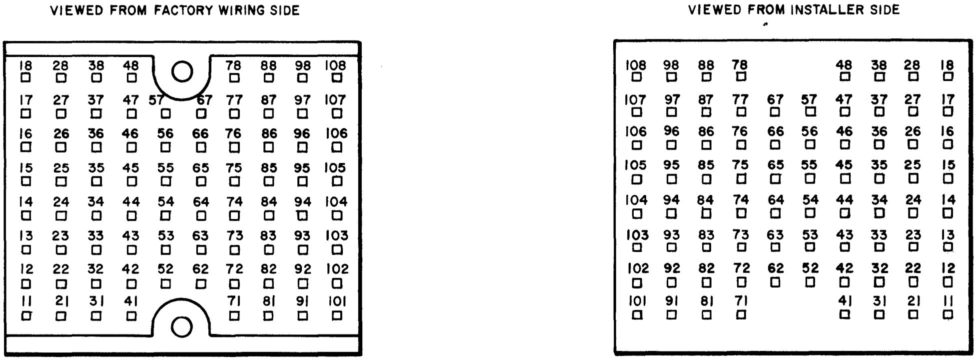


NOTES:

1. CONNECTIONS MUST BE MADE TO THE FACTORY WIRING SIDE OF TERMINAL STRIP TS(A). OPTION STRAPPING MAY BE PERFORMED ON THE INSTALLER WIRING SIDE OF TERMINAL STRIP TS(A). SEE FIG. 8 FOR TERMINAL STRIP NUMBERING PLAN.
2. IF THE CUSTOMER REQUIRES TELEPHONE COMPANY-PROVIDED BATTERY AND GROUND ON LEADS CDPR AND CDPT DURING THE IDLE CONDITION, PROVIDE OPTION Z. IF THE CUSTOMER USES CUSTOMER-PROVIDED BATTERY AND GROUND ON LEADS CDPR AND CDPT DURING THE IDLE CONDITION, PROVIDE OPTION Y. WHEN AN OPEN CIRCUIT IS REQUIRED ON LEADS CDPR AND CDPT DURING THE IDLE CONDITION, OPTIONS Z AND Y ARE NOT USED. WHEN OPTION IS NOT SPECIFIED, PROVIDE OPTION Z.

Fig. 7—Simplified Schematic and Connections—Connecting Arrangement CTD, Using J53050G, List 2 IU (Sheet 2)

342A TERMINAL BLOCK NUMBERING PLAN



SEE FIG. 7 FOR CONNECTIONS AND OPTION WIRING

Fig. 8—Terminal Block Numbering Plan for CTD, Using J53050G, List 2 IU

Relay PG operated also connects leads CDPT and CDPR to the line through 100K resistors. Connecting Arrangement CTD provides an off-hook indication and passes dialing to the CPE over leads CDPT and CDPR (if the CPE requires contact closures for off-hook indication and dial pulsing, these are provided by Connecting Arrangement RCX; leads CDPT and CDPR from Connecting Arrangement CTD are not used—see Fig. 5). When the station dials, relay L may follow dial pulses; however, relay PG is a slow release relay and will remain operated during dialing. If the CPE determines that the dialed number is to be denied completion, it places a contact closure of at least one second duration across leads CB, CS toward Connecting Arrangement CTD. The contact closure across leads CB, CS causes relay RV to operate (Fig. 7) and starts the 7C timer circuit associated with the CO trunk. The RV relay operated reverses the CO battery on leads T, R toward the PBX. Within approximately 250 to 500 ms after the closure across leads CB and CS, the T relay in the timer circuit operates (the Time Adjust Pot on the 7C timer covers a total interval of 100 to 1000 ms and must be set at one-quarter turn clockwise to produce the 250 to 500 ms interval). The T relay operated releases the RV relay which restores the CO battery, on leads T, R toward the PBX, to the original polarity. The T relay remains operated until the contact closure across leads CB, CS is removed by the CPE.

4.02 The PBX recognizes the reversal of CO battery during the timed interval (relay RV operated) and diverts the call in the normal manner to indicate to the calling station that the call has been denied. This will also cause the CO to abandon the call.

> ***Note:*** The PBX must be wired for the reverse polarity toll diversion or toll denial feature.

4.03 When the PBX diverts the call, relay L in the IU releases. Relay L released removes ground from relay PG, causing it to release; relay PG released removes the polarity guard and resistors R1 and R2 from the CO line and returns Connecting Arrangement CTD to the idle condition.

> ***Note:*** The polarity guard is connected in the transmission path during the interval that the associated station is off-hook, to block battery reversals coming from the CO when an outgoing call is originated. During the interval that the polarity guard is in the circuit (station off-hook), the PBX recognizes only the battery reversal provided by the IU as a legitimate signal to divert the call.

4.04 ***Connecting Arrangement CTD, Using J53050G, List 1 (MD) IU (Fig. 10):*** When a station on a Bell System PBX seizes a CO trunk for an outgoing call, Connecting Arrangement CTD

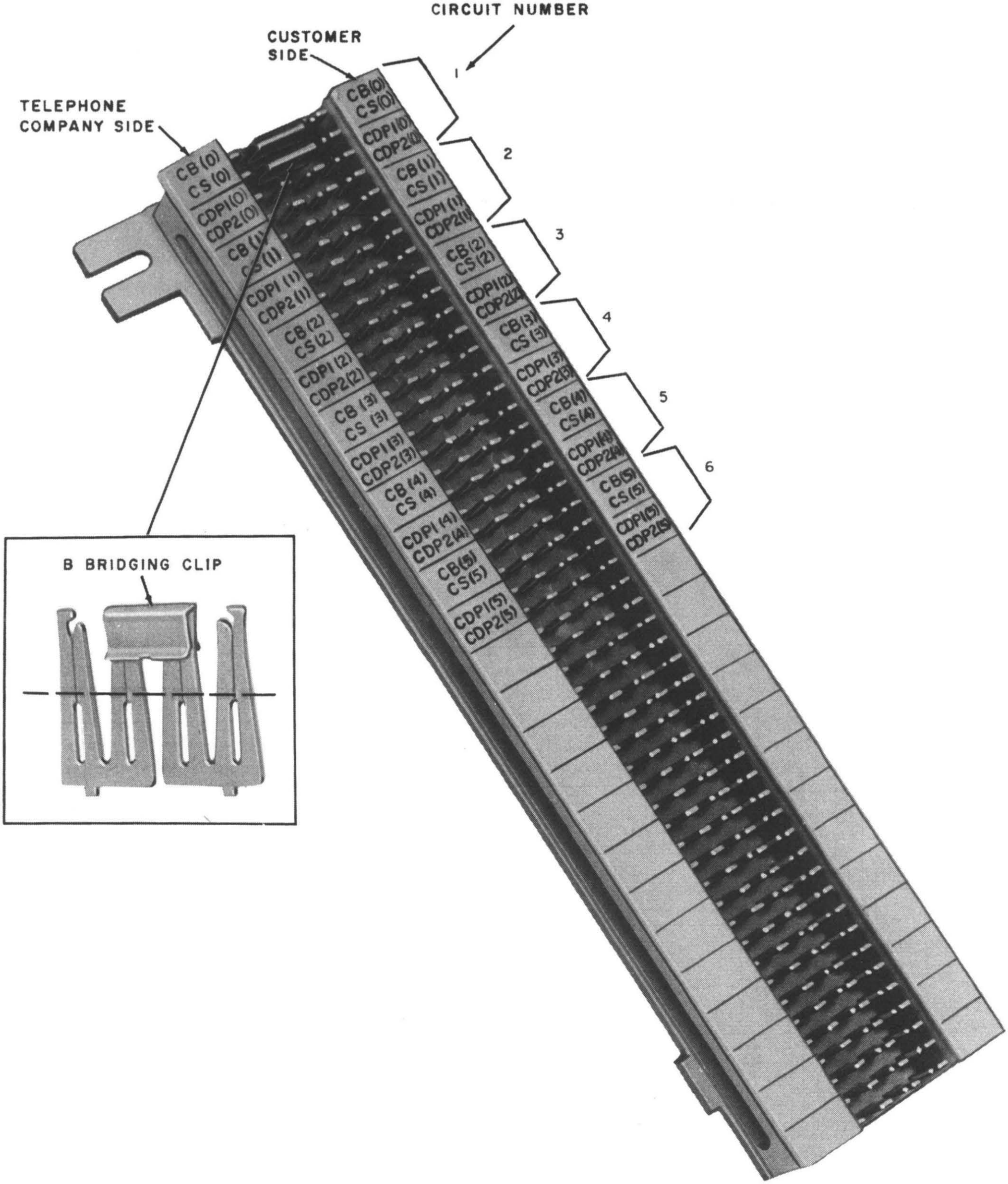
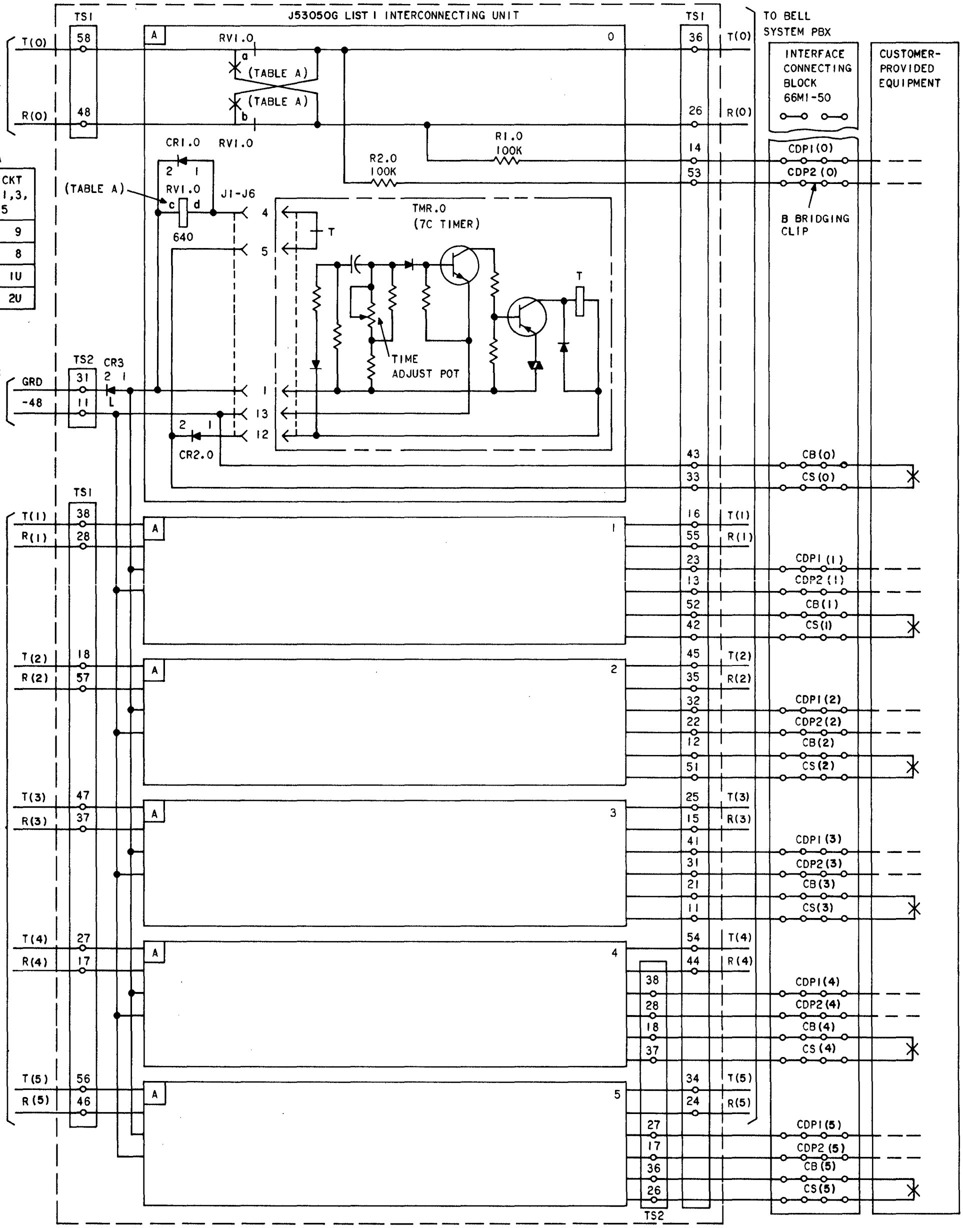


Fig. 9—Typical Interface Connecting Block, Connecting Arrangement CTD Equipped With J53050G, List 1 (MD) IU



CONT NO.	CKT 0,2,4	CKT 1,3,5
a	5	9
b	4	8
c	1L	1U
d	2L	2U

Fig. 10—Simplified Schematic and Connections—Connecting Arrangement CTD, Using J53050G, List 1 (MD) IU

provides an off-hook indication and passes dialing to the CPE over leads CDP1 and CDP2 (if the CPE requires contact closures for off-hook indication and dial pulsing, these are provided by Connecting Arrangement RCX; leads CDP1 and CDP2 from Connecting Arrangement CTD are not used—see Fig. 5). If the CPE determines that the dialed number is to be denied completion, it places a contact closure of at least one second duration across leads CB, CS toward Connecting Arrangement CTD. The contact closure across leads CB, CS causes relay RV to operate (Fig. 10) and starts the 7C timer circuit associated with the CO trunk. The RV relay operated reverses the CO battery on leads T, R toward the PBX. Within approximately 250 to 500 ms after the closure across leads CB and CS, the T relay in the timer circuit operates (the Time Adjust Pot on the 7C timer covers a total interval of 100 to 1000 ms and must be set at one-quarter turn clockwise to produce the 250 to 500 ms interval). The T relay operated releases the RV relay which restores the CO battery, on leads T, R toward the PBX, to the original polarity. The T relay remains operated until the contact closure across leads CB, CS is removed by the CPE, which returns Connecting Arrangement CTD to the idle condition.

4.05 The PBX recognizes the reversal of CO battery during the timed interval (relay RV operated) and diverts the call in the normal manner to indicate to the calling station that the call has been denied. This will also cause the CO to abandon the call.

> ***Note:*** The PBX must be wired for the reverse polarity toll diversion or toll denial feature and the CO must be wired or equipped in such a manner that battery reversal is ***not*** provided.

5. MAINTENANCE

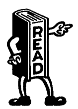
5.01 Where there is an indication of trouble in the connecting arrangement(s), the circuit at fault must be opened at the interface connecting block to verify in which direction the trouble exists. The circuit can be opened at the connecting block by removing the B bridging clip associated with each lead.

5.02 Precautions should be taken when performing tests to avoid adversely affecting service to the customer. Local instructions should be followed with reference to notifying the customer before performing the test.

TESTS—J53050G, LIST 2 INTERCONNECTING UNIT (FIG. 7)

> ***Note:*** −48 volt battery is present on the CB leads at the interface connecting block; and depending on the particular option of the circuit under test, −48 volt battery may be present on leads CBAT and/or CDPR. Precautions should be taken when performing tests to avoid shorting these leads to frame ground.

5.03 Open the leads of the circuit under test at the interface connecting block. Provide a short across the CB and CS leads of the circuit under test and observe that the associated RV relay operates and releases. If the RV relay of the circuit under test does not operate and release, replace the associated 7C timer with a timer known to be good (see Fig. 2 and 7).



The 7C timer must be adjusted to provide the proper time-out interval for the operation of Connecting Arrangement CTD—adjust the timing potentiometer on the 7C timer (see Fig. 2) fully counterclockwise, then adjust it one-quarter turn clockwise.

5.04 When option Z is provided, check for presence of −48 volts between lead CDPR of the circuit under test and ground. When option Y is provided, replace the B bridging clip, at the interface connecting block, associated with the CBAT lead of the circuit under test; then check for presence of CP voltage between lead CDPR of the circuit under test and ground.

> ***Note:*** Determine from the customer the amount and polarity of the CP voltage; observe the correct polarity and ascertain that the amount being measured does not exceed the capabilities of the meter being used.

5.05 Connect a 1013A (or equivalent) hand test set across leads T and R on the PBX side of the IU (if the trunk under test is a ground start trunk, momentarily ground lead R). Listen for dial tone; after obtaining dial tone, observe that relay PG of the circuit under test is operated.

5.06 On completion of tests, remove all shorting straps and replace the B bridging clips at the interface connecting block.

5.07 If trouble is indicated in the transmission path (tip and ring), use existing practices to perform normal circuit transmission tests.

TESTS—J53050G, LIST 1 (MD) INTERCONNECTING UNIT (FIG. 10)

> *Note:* −48 volt battery is present on the CB leads at the interface connecting block. Precautions should be taken when performing tests to avoid shorting these leads to frame ground.

5.08 Open the leads of the circuit under test at the interface connecting block. Provide a short across the CB and CS leads of the circuit under test and observe that the associated RV relay operates and releases. If the RV relay of the circuit under test does not operate and release, replace the associated 7C timer with a timer known to be good (see Fig. 1 and 10).

READ ***The 7C timer must be adjusted to provide the proper time-out interval for the operation of Connecting Arrangement CTD—adjust the timing potentiometer on the 7C timer (see Fig. 1) fully counterclockwise, then adjust it one-quarter turn clockwise.***

5.09 On completion of tests, remove all shorting straps and replace the B bridging clips at the interface connecting block.

5.10 If trouble is indicated in the transmission path (tip and ring), use existing practices to perform normal circuit transmission tests.

5.11 When in the repairman's judgment the trouble is located in the CPE, the Repair Service Bureau should be notified so that proper Maintenance of Service Charge billing can be initiated as outlined in Section 660-101-312 entitled Maintenance of Service Charge on Services With Customer-Provided Equipment (CPE).

READ ***Do not attempt any tests or repairs on the CPE.***

6. CONNECTIONS

6.01 ***Options—J53050G, List 2 IU:*** The J53050G, L2 IU may be arranged to allow three different conditions on leads CDPT and CDPR during the idle condition—CP battery and ground, telephone company provided battery and ground, or open circuit. When the customer requires his own battery and ground on leads CDPT and CDPR during the idle condition, provide option Y as shown in Fig. 7. When the customer requires telephone company provided battery and ground on leads CDPT and CDPR during the idle condition, provide option Z as shown in Fig. 7. When the customer requires an open circuit on leads CDPT and CDPR during the idle condition, do not provide either option.

6.02 For connecting information refer to Table A, Fig. 7 and 10.

TABLE A

CONNECTING ARRANGEMENT CTD CONNECTIONS FROM J53050G LIST 2 IU TO INTERFACE CONNECTING BLOCK

IU	CKT NO.	LEAD DESIG.*	IU TS(A) PIN NO.	25-PR CABLE COLOR†	66M1-50 INTERFACE CONN. BLOCK ROW NO.
FIRST J53050G LIST 2	1	CB(0)	102	W-BL	1
		CS(0)	101	BL-W	2
		CDPT(0)	103	W-O	3
		CDPR(0)	104	O-W	4
		CBAT(0)	97	W-G	5
		CGND(0)	98	G-W	6
	2	CB(1)	82	W-BR	7
		CS(1)	81	BR-W	8
		CDPT(1)	83	W-S	9
		CDPR(1)	84	S-W	10
		CBAT(1)	77	R-BL	11
		CGND(1)	78	BL-R	12
	3	CB(2)	42	R-O	13
		CS(2)	41	O-R	14
		CDPT(2)	43	R-G	15
		CDPR(2)	44	G-R	16
		CBAT(2)	37	R-BR	17
		CGND(2)	38	BR-R	18
	4	CB(3)	22	R-S	19
		CS(3)	21	S-R	20
		CDPT(3)	23	BK-BL	21
		CDPR(3)	24	BL-BK	22
		CBAT(3)	17	BK-O	23
		CGND(3)	18	O-BK	24
SECOND J53050G LIST 2	5	CB(4)	102	BK-G	25
		CS(4)	101	G-BK	26
		CDPT(4)	103	BK-BR	27
		CDPR(4)	104	BR-BK	28
		CBAT(4)	97	BK-S	29
		CGND(4)	98	S-BK	30
	6	CB(5)	82	Y-BL	31
		CS(5)	81	BL-Y	32
		CDPT(5)	83	Y-O	33
		CDPR(5)	84	O-Y	34
		CBAT(5)	77	Y-G	35
		CGND(5)	78	G-Y	36
	7	CB(6)	42	Y-BR	37
		CS(6)	41	BR-Y	38
		CDPT(6)	43	Y-S	39
		CDPR(6)	44	S-Y	40
		CBAT(6)	37	V-BL	41
		CGND(6)	38	BL-V	42
	8	CB(7)	22	V-O	43
		CS(7)	21	O-V	44
		CDPT(7)	23	V-G	45
		CDPR(7)	24	G-V	46
		CBAT(7)	17	V-BR	47
		CGND(7)	18	BR-V	48

*Stencil lead designations on fanning strip.

†If only one IU is to be installed, a 12-pair cable can be used.

PROTECTIVE CONNECTING ARRANGEMENT HZM

1. GENERAL

1.01 This section provides identification, installation, operation, maintenance, and connecting information for Protective Connecting Arrangement (PCA) HZM. PCA HZM provides a connection between customer-provided (CP) traffic measuring equipment and Bell System station lines, PBX central office (CO) trunks, and tie lines. Typical applications are shown in Fig. 1. This arrangement permits the CP equipment to detect on-hook, off-hook, dial pulse, TOUCH-TONE® signals, call progress tones, and ringing signals on the Bell System lines.

PCA HZM cannot be used for recording 2-way conversations. Recording of 2-way conversations is permitted only through PCA RCZ.

1.02 This section is reissued:

- To include information on the 125A interconnecting unit (IU) which replaces the J53050H, List 1 IU, now rated MD
- To show the 254J resistor replaced by the KS-21706 for all applications.

1.03 The equipment used to implement HZM is determined by the size of the specific installation. When the installation requires five or less arrangements, 42A connecting blocks may be used to provide the connecting arrangements as shown in Fig. 2; when more than five are required, the 125A IU (Fig. 3) should be used to provide the connecting arrangements. Each IU provides 25 circuits.

1.04 Information required for servicing existing installations using the J53050H IU (MD) has been retained in this section.

2. IDENTIFICATION

2.01 *Purpose:* PCA HZM provides the following:

- High-resistance dc and ac connection between CP traffic measuring equipment and the tip and ring conductors of Bell System station lines, tie lines, or PBX trunks (allows CP equipment to bridge across line)
- A high resistance connection to E and M leads of tie trunks such as SD-65718-01 or 02. (This connection is only provided when the tie trunk is installed so that the E and M leads appear on terminal blocks.)
- Protection against hazardous voltages and longitudinal imbalance
- An open condition between the CP equipment and Bell System lines if excessive current flows.

2.02 *Ordering Guide:*

(a) ***Basic Units***

(1) For small installations, nominally five circuits or less (see Fig. 2):

- Block, Connecting, 42A—two required per circuit
- ♦Resistor, KS-21706, 100,000 ohm, ±1%—two required per circuit.♦

The failure characteristics of the KS-21706 resistor meet the requirements of this arrangement. Do not substitute a resistor of different type or resistance.

(2) For large installations, nominally more than five circuits (see Fig. 3 and 4):

- Unit, Interconnecting, 125A—each unit provides 25 circuits.

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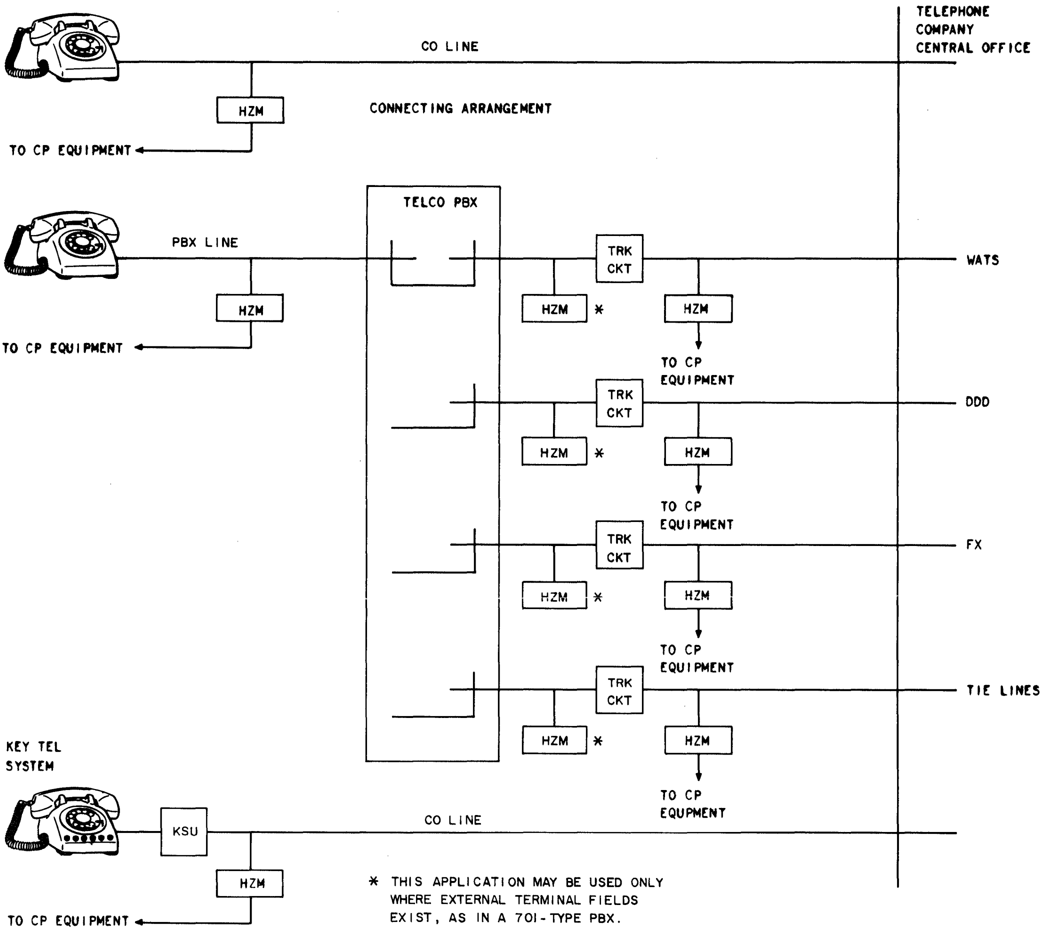


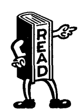
Fig. 1—▶Typical Applications of PCA HZM◀

(b) ***Associated Apparatus (Order Separately)***

- Wire, D station, or equivalent (for connecting PCA HZM using 42A blocks)
- ▶Cable, D inside wiring, or equivalent (for connecting PCA HZM using 125A IU).◀

(c) ***Replaceable Components***

- ▶Resistor, KS-21706, 100,000 ohm, $\pm 1\%$.◀



When replacing faulty 254J resistors in a J53050H IU, use KS-21706 resistors.

2.03 ▶***Design Features of 125A IU:***

- Consists of a 66R-type connecting block with all of the quick-clip connectors in columns C and D removed, a KS-21706 resistor connected between B and E in each row,

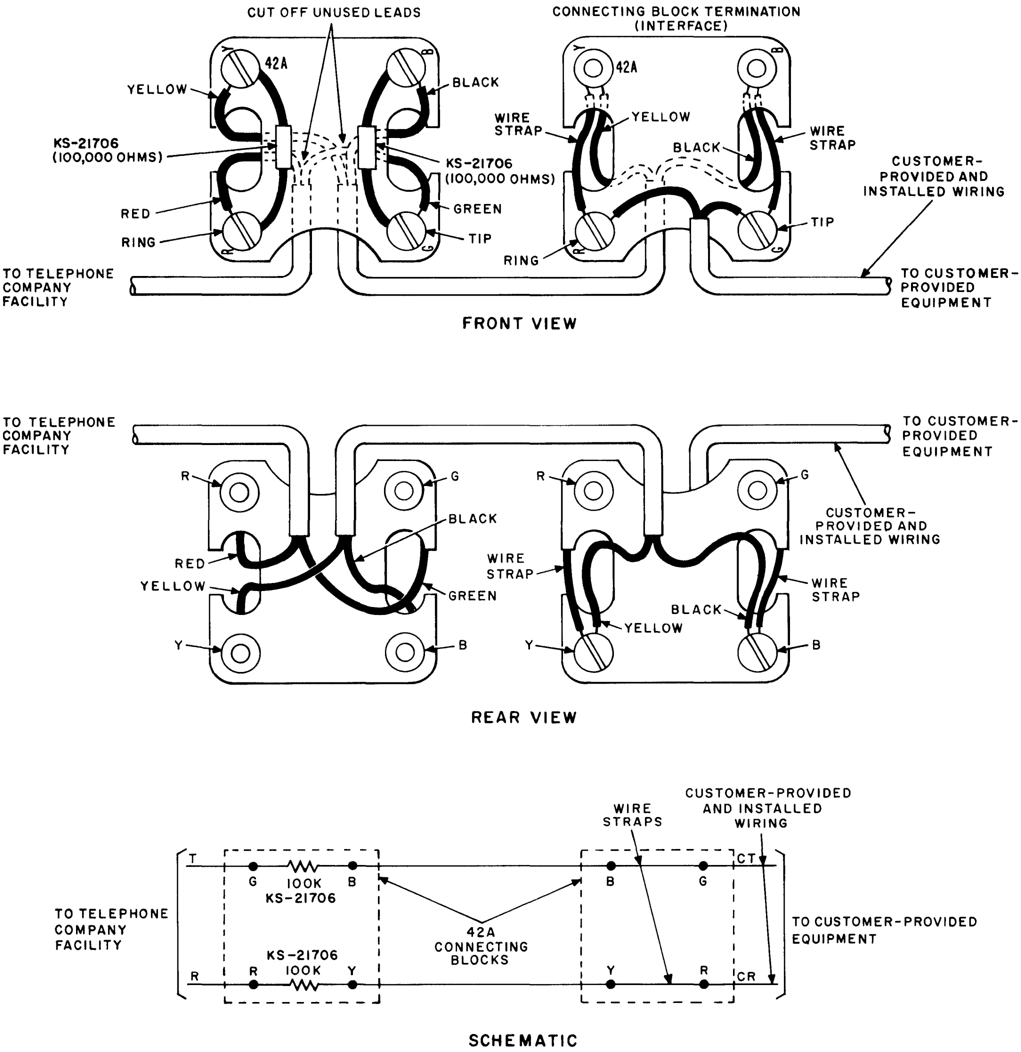


Fig. 2—◆PCA HZM for Small Installations (Five or Less) Using 42A Connecting Blocks◆

and a B bridging clip installed across columns F and G in each row

- Size: 13.4 inches high by 3.36 inches wide by 1.02 inches thick
- Intended for wall mounting
- No separate interface connecting block required
- Provides 25 circuits for connecting between CP traffic measuring equipment and Bell System station lines, PBX CO trunks, and station lines◆

- Permits CP equipment to detect on-hook, off-hook, dial pulse, ringing and TOUCH-TONE signals on the Bell System lines (***the resistors in this equipment present a high loss to voiceband signals such as TOUCH-TONE address signals. This loss can be up to 46 dB or more, depending on the characteristics of the CP equipment).***

The CP equipment must be capable of detecting line conditions through the high resistance connection of PCA HZM. Do not substitute lower value or different resistors to meet a special request.

3. INSTALLATION

3.01 Locate the connecting arrangement in an area that is clean and dry and where it is easily accessible. ▶Both the 42A connecting blocks, used for small locally constructed installations, and the 125A IU, used for installations with more than five circuits, can be mounted on a wall or other suitable flat surface.◀

3.02 ▶When wiring the PCA to the telephone company facilities, use a convenient cross-connect field for making the required connections. Do not go inside telephone sets or PBX equipment to find terminals. Do not wire onto relay plate apparatus or modify equipment in any way to bring out special signals requested by the customer or his representative. Use D station wire or D inside wiring cable for these connections.

3.03 When the 42A blocks are used, connect as shown in Fig. 2. Be sure to observe the proper color codes. One block is used to terminate the T and R leads from the telephone company facilities and to mount the line resistors, while the other block is used to interface with the CP equipment. Note that the screws in terminals Y and B are reversed in the block. Connections from the CP equipment are made directly to screw terminals G and R on the interface block.

3.04 When the 125A IU is used, terminate the leads from the telephone company facilities on the left side of the block (Fig. 3 and 4). Print or stencil the lead designations on each side of the IU. Connections from the CP equipment are made directly to the H column of connectors on the IU.

3.05 ***Show the customer where to connect the leads from his equipment.***◀

4. OPERATION

4.01 PCA HZM provides a high resistance dc and ac connection, typically between CP traffic measuring equipment and Bell System station lines, PBX CO trunks, and tie lines. The CP equipment uses this connection to monitor line condition. The CP equipment must be capable of detecting line conditions through the high resistance provided by this connecting arrangement.

5. MAINTENANCE

5.01 When there is an indication of trouble in the arrangement, the circuit at fault must be opened at the interface and tested to verify in which direction the trouble lies. ▶Procedures for testing the telephone company side of arrangements using the 125A IU, the J53050H IU (MD), or the 42A connecting blocks, respectively, are contained in 5.04, 5.05, and 5.06.◀

5.02 Precautions should be taken when performing tests to avoid adversely affecting service to the customer. Local instructions should be followed with reference to notifying the customer before performing the test.

5.03 ***Apparatus Required to Perform Test:***

(a) Volt-ohm-meter (VOM) capable of measuring 200,000 ohms

(b) Two test leads with clips for VOM

(c) 1013A (or equivalent) hand test set.

5.04 ▶***Tests—PCA HZM Using 125A IU (Fig. 3 and 4):***

(1) Open the CT and CR output leads of the circuit under test at the 125A IU by removing the B bridging clips for that circuit. Disconnect the corresponding T and R input leads from the telephone company side of the IU.

(2) Measure the resistance across the CT and CR leads at the IU by connecting the VOM to the column E or F connectors.

Requirement: VOM indicates an open circuit.

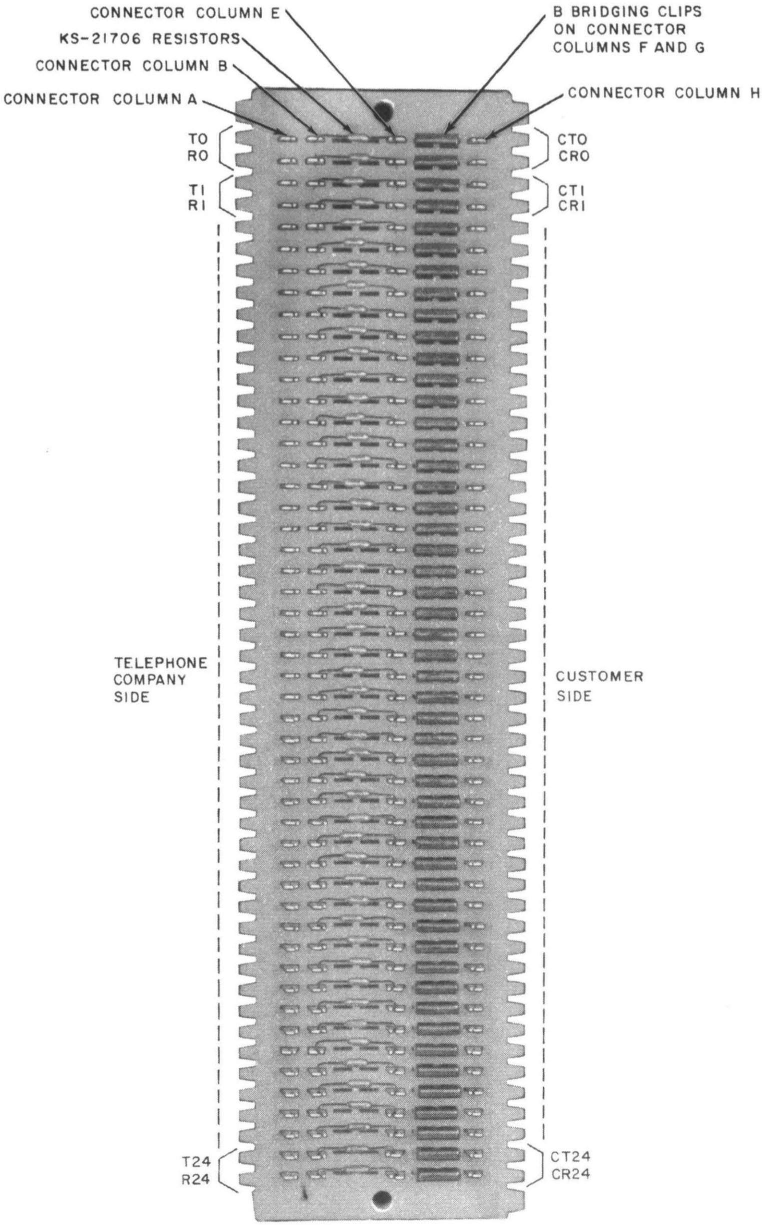

CONNECTOR COLUMN E
KS-21706 RESISTORS
CONNECTOR COLUMN B
CONNECTOR COLUMN A
B BRIDGING CLIPS ON CONNECTOR COLUMNS F AND G
CONNECTOR COLUMN H
TO
RO
TI
RI
CTO
CRO
CTI
CRI
TELEPHONE COMPANY SIDE
CUSTOMER SIDE
T24
R24
CT24
CR24

Fig. 3—125A IU

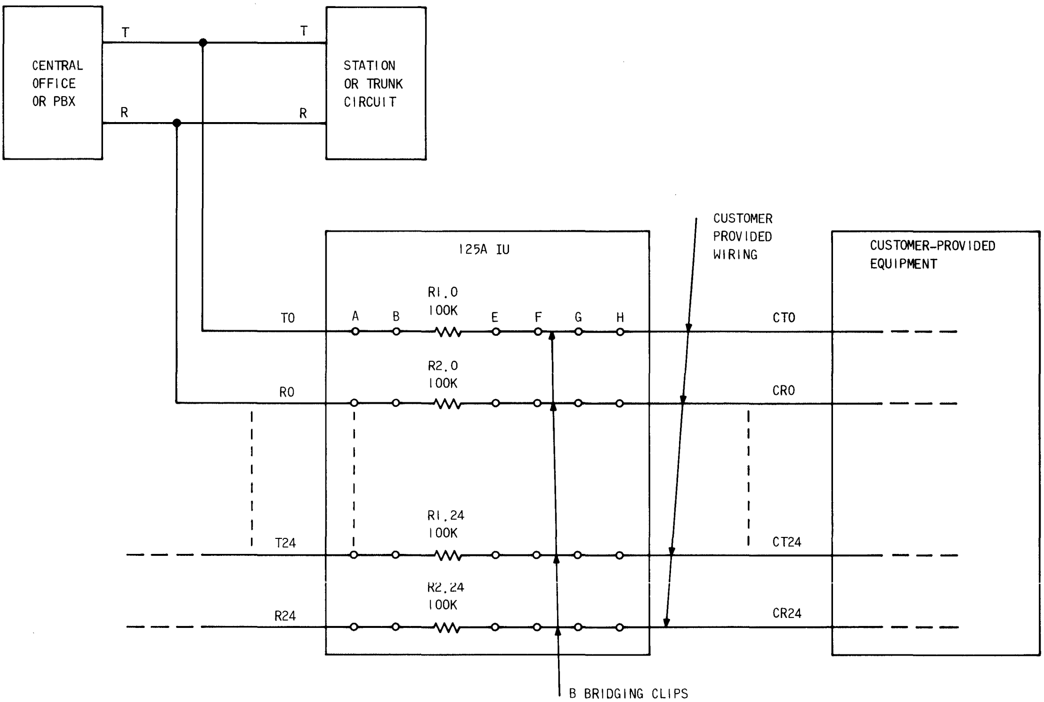


Fig. 4—PCA HZM, Using 125A IU

(3) Short the input to the IU by connecting a wire strap across the T and R terminals at column A.

Requirement: The meter connected across the CT and CR leads indicates approximately 200,000 ohms. (If requirement is not met, check the value of the two resistors in the circuit and the continuity of the quick-clip connectors.)

(4) If tests indicate that resistor replacement is required, use the type specified in 2.02. ***Do not substitute a resistor of different type or resistance.***

(5) To check the continuity of the transmission path into the IU, connect a 1013A (or equivalent) hand test set across the T and R leads previously disconnected from the telephone company side of the IU. Put the hand test set into the MON mode. Place a call on the line or trunk being tested.

Requirement: Voice signals are heard at normal volume.

READ

If E and M leads are connected to the IU, a different method must be used to check the continuity of the transmission path into the IU. Connect the VOM across the E and M leads. A voltage level should be present when the associated trunk is idle. When the trunk is seized, a voltage reversal should be observed.

(6) On completion of tests, remove the wire strap from the T and R terminals of the IU. Reconnect the T and R input leads to the IU, being careful not to reverse polarity. Replace

the B bridging clips on columns F and G for the circuit under test.◀

5.05 ▶***Tests—PCA HZM Using J53050H, List 1 IU (MD) (Fig. 5 and 6, Table A)***

(1) Open the CT and CR output leads of the circuit under test at the interface connecting block by removing the B bridging clips for that circuit. Disconnect the corresponding T and R input leads from the telephone company side of the IU.

(2) Measure the resistance across the CT and CR leads of the circuit under test by connecting the VOM to the connections on the telephone company side of the interface block.

Requirement: The VOM indicates an open circuit.

(3) Short the input to the IU by connecting a wire strap across the T and R terminals of the circuit under test at the IU terminal strip.

Requirement: The meter connected across the CT and CR leads indicates approximately 200,000 ohms. (If requirement is not met, check the value of the two resistors in the circuit and the continuity of the IU wiring.)

(4) If tests indicate that resistor replacement is required, use KS-21706 resistors to replace faulty 254J resistors.

(5) To check the continuity of the transmission path into the IU, connect a 1013A (or equivalent) hand test set across the T and R leads previously disconnected from the telephone company side of the IU. Put the hand test set into the MON mode. Place a call on the line or trunk being tested.

Requirement: Voice signals are heard at normal volume.

If E and M leads are connected to the IU, a different method must be used to check the continuity of the transmission path into the IU. Connect the VOM across the E and M leads. A voltage level should be present when the associated trunk is idle. When the trunk is seized, a voltage reversal should be observed.

(6) On completion of tests, remove the wire strap from the T and R terminals of IU. Reconnect the T and R input leads to the IU, being careful not to reverse polarity. Replace the B bridging clips on the interface block for the circuit under test.◀

5.06 ▶***Tests—Locally Constructed PCA HZM Using 42A Connecting Blocks (Fig. 2)***

(1) Open the CT and CR output leads of the circuit under test by removing the wire straps from terminals G and R of the interface connecting block. Disconnect the corresponding T and R input leads from terminals G and R of the block on which the resistors are mounted.

(2) Using the VOM, measure the resistance across terminals B and Y of the interface block.

Requirement: The meter indicates an open circuit.

(3) Short the input to the arrangement by connecting a wire strap across terminals G and R of the block on which the resistors are mounted.

Requirement: The meter connected across the B and Y terminals of the interface block indicates approximately 200,000 ohms. (If requirement is not met, check the value of the two resistors in the circuit and the continuity of the wiring of the blocks.)

(4) If tests indicate that resistor replacement is required, use the type specified in 2.02. ***Do not substitute a resistor of different type of resistance.***

(5) To check the continuity of the transmission path into the arrangement, connect a 1013A (or equivalent) hand test set across the T and R leads previously disconnected from terminals G and R. Put the hand test set into the MON mode. Place a call on the line or trunk being tested.

Requirement: Voice signals are heard at normal volume.

If E and M leads are connected to the IU, a different method must be used to check the continuity of the transmission path into the IU. Connect the VOM across the E and M leads. A voltage level should be present when the associated trunk is idle. When the trunk is seized, a voltage reversal should be observed.

(6) On completion of tests, remove the wire strap from terminals G and R of the first block. Reconnect the T and R leads, being careful not to reverse polarity. Replace the wire straps on the interface connecting block.

5.07 If trouble is indicated in the transmission path (tip and ring) of the Bell System line, use existing practices to perform normal circuit transmission tests.

5.08 When in the judgment of repair personnel the trouble is located in the CP equipment, the Repair Service Bureau should be notified so that proper Maintenance of Service Charge billing can be initiated as outlined in BSP 660-101-312 entitled Maintenance of Service Charge on Services With Customer-Provided Equipment (CPE).

Do not attempt any tests or repairs on the CP equipment.

6. CONNECTIONS

6.01 For connecting information on PCA HZM using the 42A connecting blocks, refer to Fig. 2.

6.03 For connecting information on PCA HZM using the 125A IU, refer to Fig. 3 and 4.

6.04 For connecting information or PCA HZM using the J53050H, List 1 IU (MD), refer to Fig. 5, 6, and 7, and Table A.

In dial tie trunk applications, PCA HZM may be connected in a variety of ways to permit detection of off-hook conditions and dialed numbers. When DX signaling is used, connection to the E and M leads may be appropriate. If the E and M leads are not available, connection to the A and B leads will permit the customer to detect supervisory and dialing conditions. Local engineering department should provide connections to the tie trunk. In general, the input to PCA HZM can come from tip, ring, E, M, A, or B leads at any point where they are readily accessible on a terminal punching. Relay terminals, back plane wiring, etc, are not acceptable connection points.

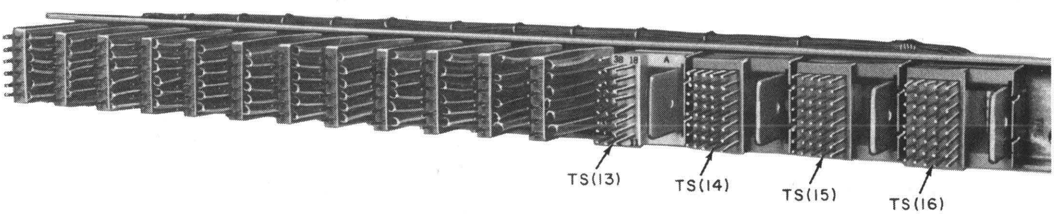
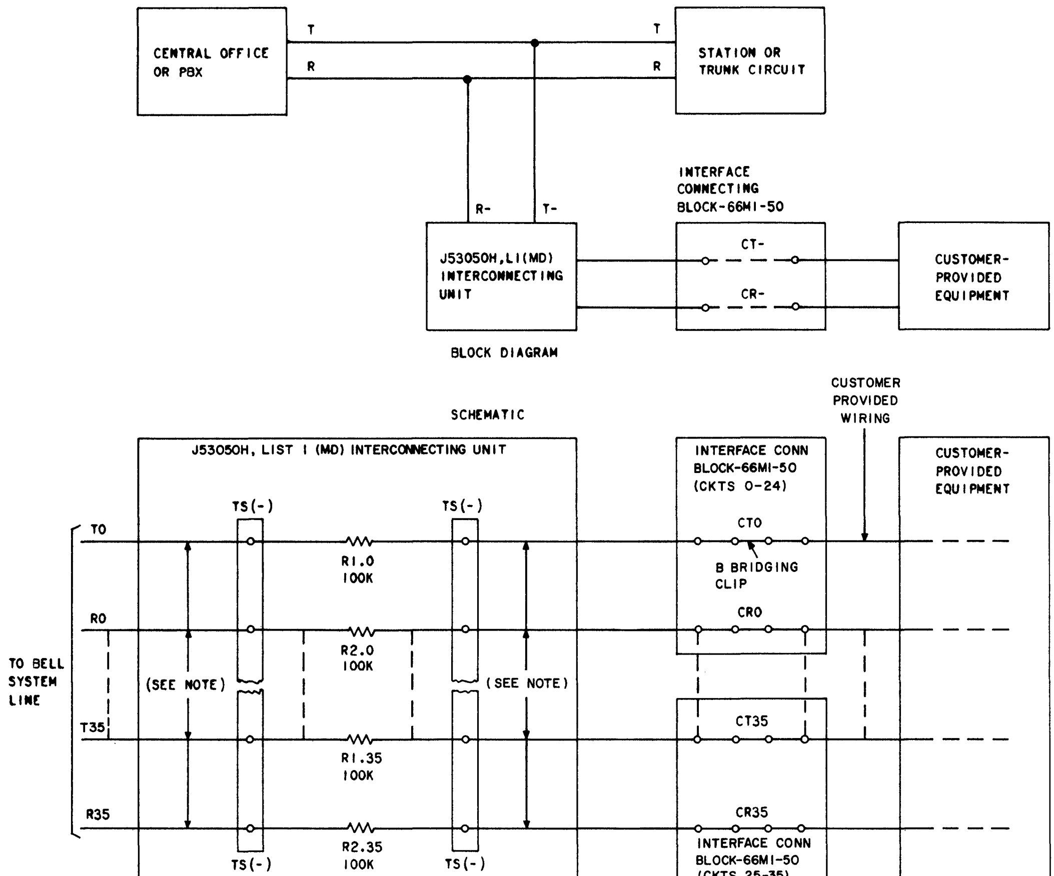


Fig. 5—J53050H, List 1 (MD) IU



NOTE:
SEE TABLE A FOR CONNECTIONS, TERMINAL STRIP DESIGNATIONS, AND TERMINAL NUMBERS.

Fig. 6—➧PCA HZM, Using J53050H, List 1 (MD) IU➧

TABLE A

LEGEND FOR FIG. 6

CKT NO.	LEAD DESIG	TS13 TERM. NO.	CKT NO.	LEAD DESIG	TS14 TERM. NO.	CKT NO.	LEAD DESIG	TS15 TERM. NO.	CKT NO.	LEAD DESIG	TS16 TERM. NO.
0	T0	38	6	T6	58	16	T16	58	26	T26	58
	R0	37		R6	57		R16	57		R26	57
	CT0	36		CT6	56		CT16	56		CT26	56
	CR0	35		CR6	55		CR16	55		CR26	55
1	T1	34	7	T7	54	17	T17	54	27	T27	54
	R1	33		R7	53		R17	53		R27	53
	CT1	32		CT7	52		CT17	52		CT27	52
	CR1	31		CR7	51		CR17	51		CR27	51
2	T2	28	8	T8	48	18	T18	48	28	T28	48
	R2	27		R8	47		R18	47		R28	47
	CT2	26		CT8	46		CT18	46		CT28	46
	CR2	25		CR8	45		CR18	45		CR28	45
3	T3	24	9	T9	44	19	T19	44	29	T29	44
	R3	23		R9	43		R19	43		R29	43
	CT3	22		CT9	42		CT19	42		CT29	42
	CR3	21		CR9	41		CR19	41		CR29	41
4	T4	18	10	T10	38	20	T20	38	30	T30	38
	R4	17		R10	37		R20	37		R30	37
	CT4	16		CT10	36		CT20	36		CT30	36
	CR4	15		CR10	35		CR20	35		CR30	35
5	T5	14	11	T11	34	21	T21	34	31	T31	34
	R5	13		R11	33		R21	33		R31	33
	CT5	12		CT11	32		CT21	32		CT31	32
	CR5	11		CR11	31		CR21	31		CR31	31
			12	T12	28	22	T22	28	32	T32	28
				R12	27		R22	27		R32	27
				CT12	26		CT22	26		CT32	26
				CR12	25		CR22	25		CR32	25
			13	T13	24	23	T23	24	33	T33	24
				R13	23		R23	23		R33	23
				CT13	22		CT23	22		CT33	22
				CR13	21		CR23	21		CR33	21
			14	T14	18	24	T24	18	34	T34	18
				R14	17		R24	17		R34	17
				CT14	16		CT24	16		CT34	16
				CR14	15		CR24	15		CR34	15
			15	T15	14	25	T25	14	35	T35	14
				R15	13		R25	13		R35	13
				CT15	12		CT25	12		CT35	12
				CR15	11		CR25	11		CR35	11

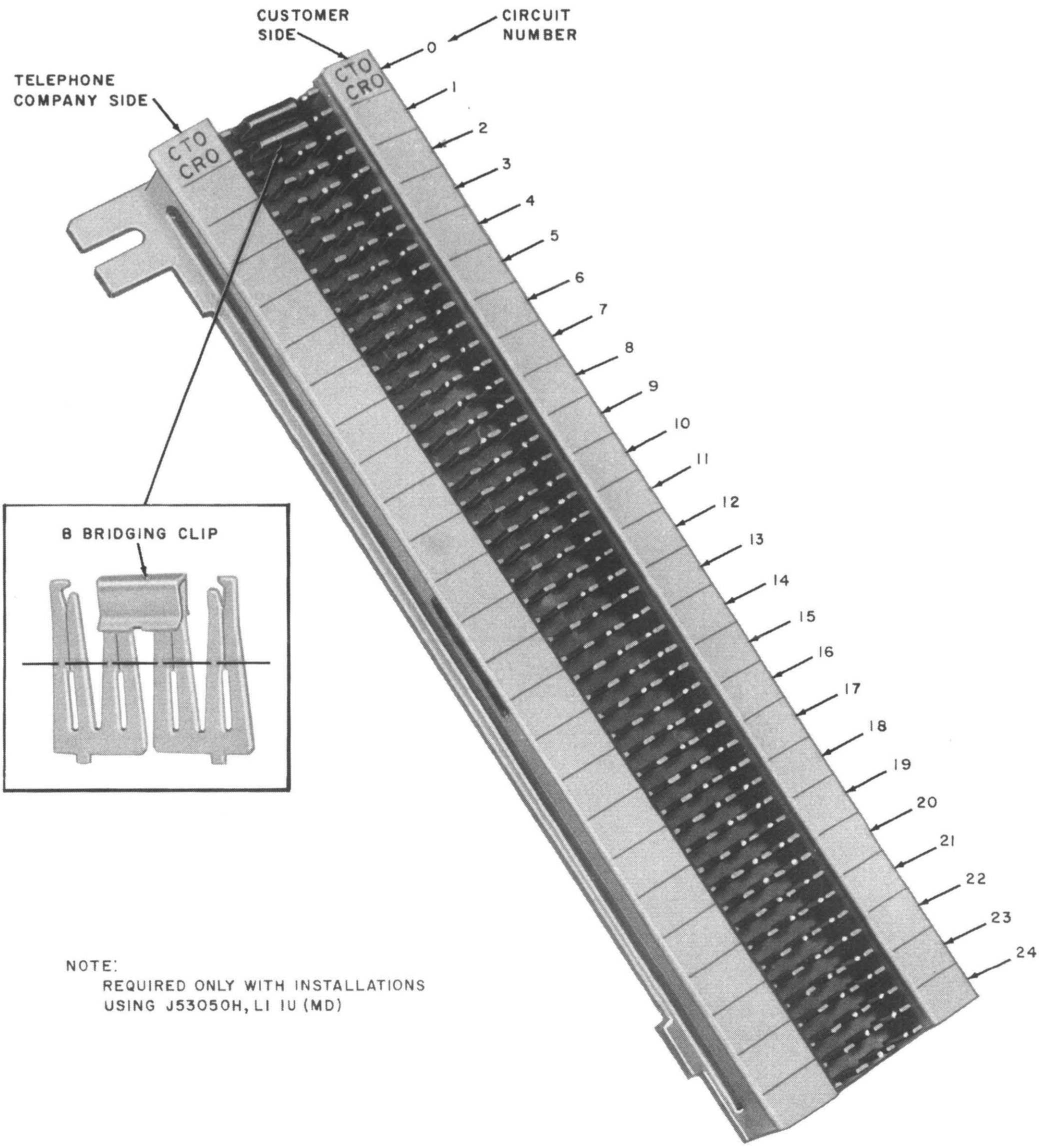


Fig. 7—66M1-50 Interface Connecting BLock

CONNECTING ARRANGEMENT CTH
J53050K INTERCONNECTING UNIT

1. GENERAL

1.01 This section provides identification, installation, operation, maintenance and connection information on the J53050K, List 1 Interconnecting Unit (IU) when used in Connecting Arrangement (CA) CTH. This CA provides a means for connecting customer-provided equipment (CPE), typically call restricting equipment, to a Bell System central office (CO) trunk associated with a Bell System PBX.

1.02 The J53050K IU is equipped with two circuits (for two CO trunks) to interface with CP call restricting equipment.

1.03 Connecting Arrangement CTH does not require the PBX trunk circuit to be equipped for the standard reverse-polarity toll diversion feature. Central office modifications or auxiliary equipment are not required.

1.04 If the customer wants a copy of the Technical Reference which covers this interface specification, the customer should contact the local Telephone Company Business Office or the Marketing Representative.

1.05 This issue of the section is based on the following drawings:

SD-1E259-01, Issue 2—J53050K IU

SD-99361-01, Issue 4B—Relay Delay Timer

If this section is to be used with equipment or apparatus reflecting later issues of the drawings, reference should be made to the SDs and CDs to determine the extent of the changes and the manner in which the section may be affected.

2. IDENTIFICATION

2.01 ***Purpose:*** Permits the CPE to monitor and restrict outgoing calls over a Bell System PBX CO trunk. The duration of the restrict mode is limited and can be overridden by an incoming call.

2.02 ***Application:*** On ground start trunks in the PBX's listed in Table B. May also be used with loop-start 2-way manual CO trunks, typically SD-66719-01 and SD-65781-01.

2.03 ***Ordering Guide:***

- J53050K-1, List 1 Interconnecting Unit (one per two CO lines, Fig. 1)

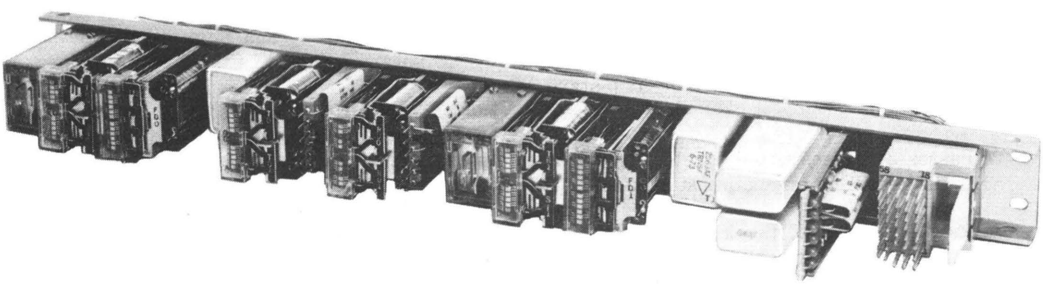


Fig. 1—J53050K Interconnecting Unit

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Associated Equipment (Order Separately)

- KS-15620, List 22 Rectifier (or equivalent) required when PBX power supply is insufficient. The rectifier can power a maximum of six IUs

- KS-14532 Power Cord (used with KS-15620 Rectifier)

  List 1—10 ft

  List 2—2 ft

  List 3—15 ft

  List 4—20 ft

  List 5—25 ft

- Cable, Wiring, "D" Inside, or equivalent (for cabling from CA to interface connecting block)

- Block, Connecting, 66M1-50 (Fig. 2)

Note: Other type blocks may be used when specified by local engineering.

- Clip, Bridging, B (25 per pkg.)

2.04 ***Design Features:***

- Mounts on standard 23-inch relay rack or in 16-type apparatus mounting

- Requires maximum of 500 ma at 52 volts or 340 ma at 48 volts dc

- Equipped with 2-circuit delay timer

- For use with ground-start or loop-start trunks

- Passes a call restricted tone (if provided) from the CPE to originating station

- Restores the PBX trunk for incoming or outgoing calls if the CPE does not remove the closure on the CS-CG leads after an originating station has been restricted. In this condition, outgoing calls cannot be restricted.

- Cuts an incoming call through to the PBX when in the restrict mode.

3. INSTALLATION

3.01 Mount the J53050K IU in an area free of dampness and excessive dust or dirt with adequate room for access to front and rear of equipment.

3.02 Locate the 66M1-50 interface connecting block within 25 feet of the J53050K IU. The CP call restricting equipment must be located so that the maximum loop resistance from the J53050K IU does not exceed 50 ohms.

3.03 The J53050K IU mounts on a standard 23-inch relay rack or 16-type apparatus mounting (or equivalent). Use existing rack space in PBX if possible.

3.04 Add straps as shown in Table A to provide circuit options required. Refer to Table B for relay disconnect timing options to match the PBX in use and strap the terminals shown. Refer to Fig. 3 and 4 for wiring connections.

3.05 Use "D" inside wiring cable, or equivalent, to terminate the leads associated with the CPE on the interface connecting block. The CDPT, CDPR, CS and CG leads are always used. If the CGRD and CBAT leads or CTS and CTG leads (options Q and T) are not used, do not run them to the interface block. Stencil lead designations on interface connecting block designation strip (see Fig. 2).

3.06 Use "D" station wire, or equivalent, to connect the tip and ring leads of the IU to the CO lines and the PBX CO trunks.

3.07 The KS-15620, List 22 rectifier will mount on a standard relay rack or in a 16-type apparatus mounting. Where possible mount adjacent to the J53050K IU. The customer must provide a 105- to 130-volt 60-Hz power outlet within reach of available power cords. (See ordering guide for cord lengths.) It is recommended that this outlet be separately fused and not under control of a wall switch. Where local instructions permit, secure the power cord to the outlet with a power cord plug retainer assembly.

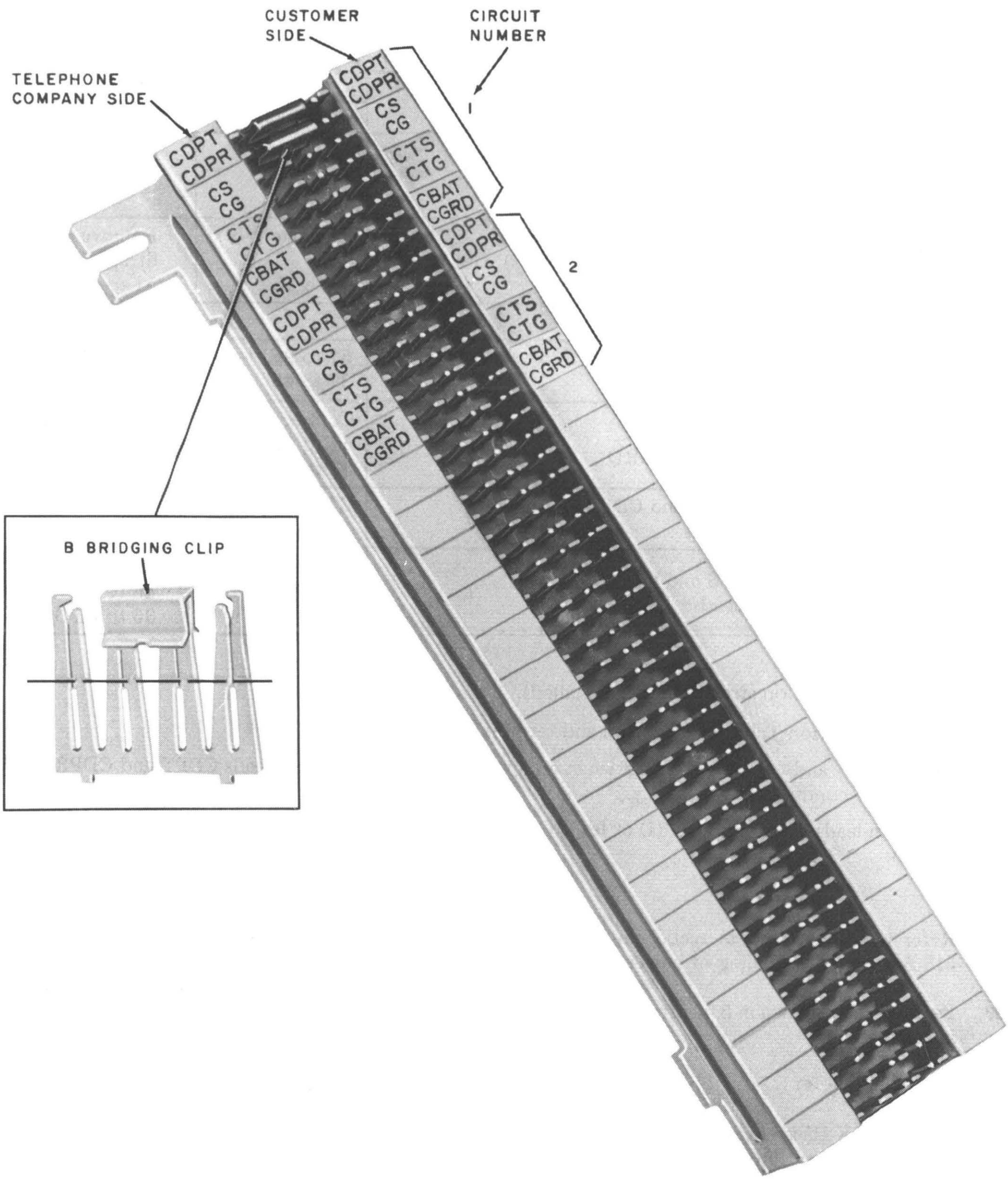


Fig. 2—66M1-50 Interface Connecting Block

TABLE A

CIRCUIT OPTIONS

FEATURE		OPTION	STRAP TERMINALS	
			CKT (0)	CKT (1)
J53050K IU VCA CTH	Connected to GRD Start PBX CO Trunk	V	35 to 45	51 to 12
	Connected to Loop Start PBX CO Trunk	Note 1	Remove Strap 35 to 45	Remove Strap 51 to 12
	Disconnect Time	Note 2		
CDPT and CDPR Leads in Idle Condition, Connected to	Local BAT and GRD	R	57 to 24 37 to 46	24 to 11 53 to 31
	CP Provided BAT and GRD*	Note 3 Q	Connect 57 to CGRD 37 to CBAT	Connect 24 to CGRD 53 to CBAT
Call Restrict Tone Signal From CP Equipment Transmitted on	CDPT and CDPR Leads	S	27 to 47 17 to 18	43 to 14 33 to 34
	CTS and CTG Leads*	T	Connect 27 to CTS 17 to CTG	Connect 43 to CTS 33 to CTG

Notes:

1. Remove V option straps (factory-installed).
2. See timing option Table B for option and terminals.
3. Options R and Q are not used when an open circuit is required on leads CDPT and CDPR during idle condition.

* Do not run leads CBAT and CGRD or leads CTS and CTG to interface block when not used (options R and S).

3.08 Refer to the appropriate section in Division 518 for proper grounding of power plants.

3.09 Perform tests shown in 5.04 after installation is complete.

4. OPERATION (Fig. 4)

4.01 The J53050K IU is equipped with two circuits designated circuit (0) and circuit (1) and provides two CTH connecting arrangements. When the CO trunk on the PBX is seized for an outgoing call, the CP call restricting equipment monitors the off-hook condition and dial pulses or TOUCH-TONE® signals on the line over the high resistance (100K) dc monitoring leads CDPT and CDPR. If the call is to be restricted, a contact closure on the call denial leads CS and CG causes the IU to open the line towards the CO thus releasing the CO connection and closing a transmission path to the CPE. The PBX CO trunk and station are held in the restrict mode for approximately 15 seconds. During this time, the CP call restricting equipment may transmit a call restricted tone to indicate to the originating station that the call has been restricted and should be terminated.

4.02 If an incoming call is present on the CO line during the restrict mode, the IU will detect ringing on the CO line and transfer the PBX CO trunk back to the CO line; and the incoming call will be cut through to the PBX. The IU has no

TABLE B

TIMING OPTIONS

PBX	ASSOCIATED 00 TRK CKT	PROVIDE OPTION	NOMINAL TIME (MS)	STRAP TERMINALS CKT (0)	STRAP TERMINALS CKT (1)
701	SD-65657-01	X	950	55 to 36 and 16 to 36	32 to 52 and 22 to 52
	SD-65850-01	X			
	SD-65895-01	X			
	SD-5E001-01	X			
	SD-5E045-01	X			
740	SD-5E001-01	X			
	SD-65657-01	X			
756	SD-65752-01	X			
757	SD-66749-01	X			
	SD-66750-01	X			
	SD-5E016-01	Y	1500	16 to 36	32 to 52
770	SD-1E340-01	Z	2300	55 to 36	22 to 52
800	SD-1E013-01	Y	1500	16 to 36	32 to 52
	SD-1E013-02	Y			
	SD-1E015-01	Y *			
	SD-1E015-01	X †	950	55 to 36 16 to 36	32 to 52 22 to 52
	SD-1E015-02	X			
801	SD-1E306-01	Y	1500	16 to 36	32 to 52
	SD-1E307-01	X	950	55 to 36 16 to 36	32 to 52 22 to 52
805	SD-1E213-01	W	600	26 to 36	42 to 52
812	SD-1E402-01	X	950	55 to 36 16 to 36	32 to 52 22 to 52
	SD-1E403-01	W	600	26 to 36	42 to 52

* Prior to Issue 14.
† Issue 14 and later.

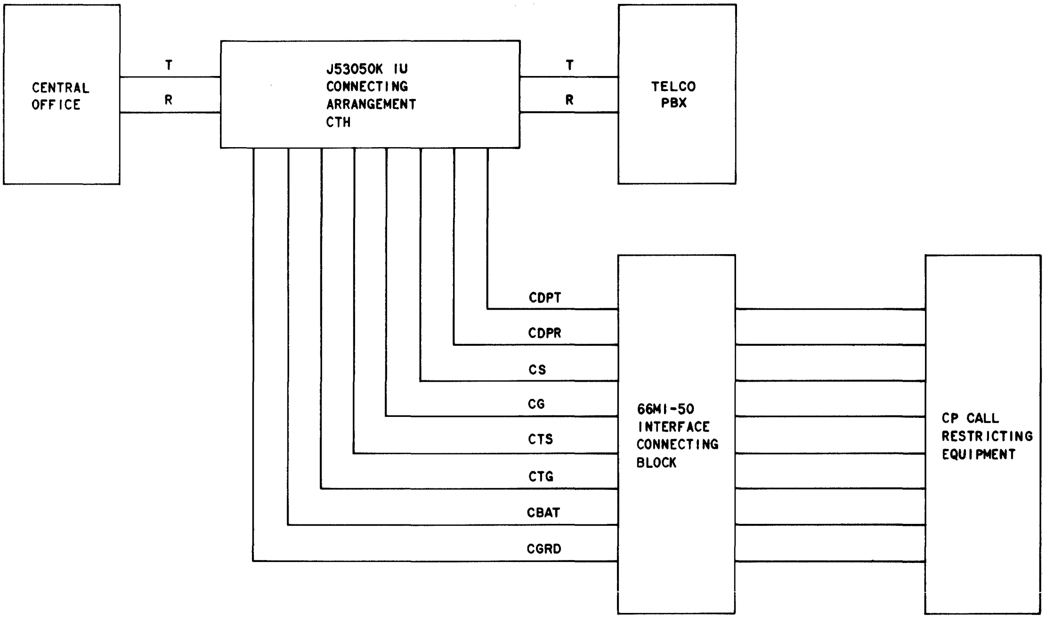


Fig. 3—Block Diagram—Connecting Arrangement CTH

effect on normal incoming calls or on nonrestricted outgoing calls.

4.03 ***Outgoing Call, "V" Option (Circuit 0):*** "V" option is used when the J53050K IU is connected to a ground-start CO line. When the CO trunk is seized by a station behind the PBX, the supervisory relay S operates from CO line current closing contact M1 to operate S1 relay through the 4B contact of the TO relay. S1 relay operated connects the CDPT and CDPR leads to the CO line through R7, EBM2 and R8, EBM3 contacts and closes contact M1 to prepare an operate path for the transfer relay TR over the CS lead. If the CPE does not provide a restrict signal, the S and S1 relays will remain operated until the call has been terminated.

4.04 If the CPE provides a restrict signal by a momentary contact closure (50 ms minimum) on the CS and CG leads, ground on the CS lead will operate the TR relay through EMB10 of the time-out relay TO and M1 of the S1 relay. The TR relay operated opens the loop to the CO and transfers the PBX T and R leads to the CPE with contacts EBM11 and EBM3 through transformer T1 and contact M12. Contact M9 of the TR relay connects the ringing bridge detector across the CO line to detect incoming calls. The TR relay also triggers the timing circuit with ground through contact M8, "V" option strap and contact EBM10 of the FD relay. During the 15-second timing interval, the originating station and PBX CO trunk are in the restrict mode and the CPE may transmit a call restricted tone or signal over the CTS-CTG leads (T option) or CDPT-CDPR leads (S option). After the 15-second time-out, the timing circuit operates the forced disconnect relay FD through contact EBM6 of the FD relay. The FD relay operated locks up to ground through its own M4 contact and contact M8 of the operated TR relay and recycles the time through contact EBM10 and contact B5 of S1 relay. FD relay opens the loop to the PBX CO trunk through contacts B5 and B7, disconnects transformer T1 from CTS and CTG by opening contact B2, and connects either W, X, Y, or Z timing option to the TMR timing circuit through contact EBM11. The open loop to the

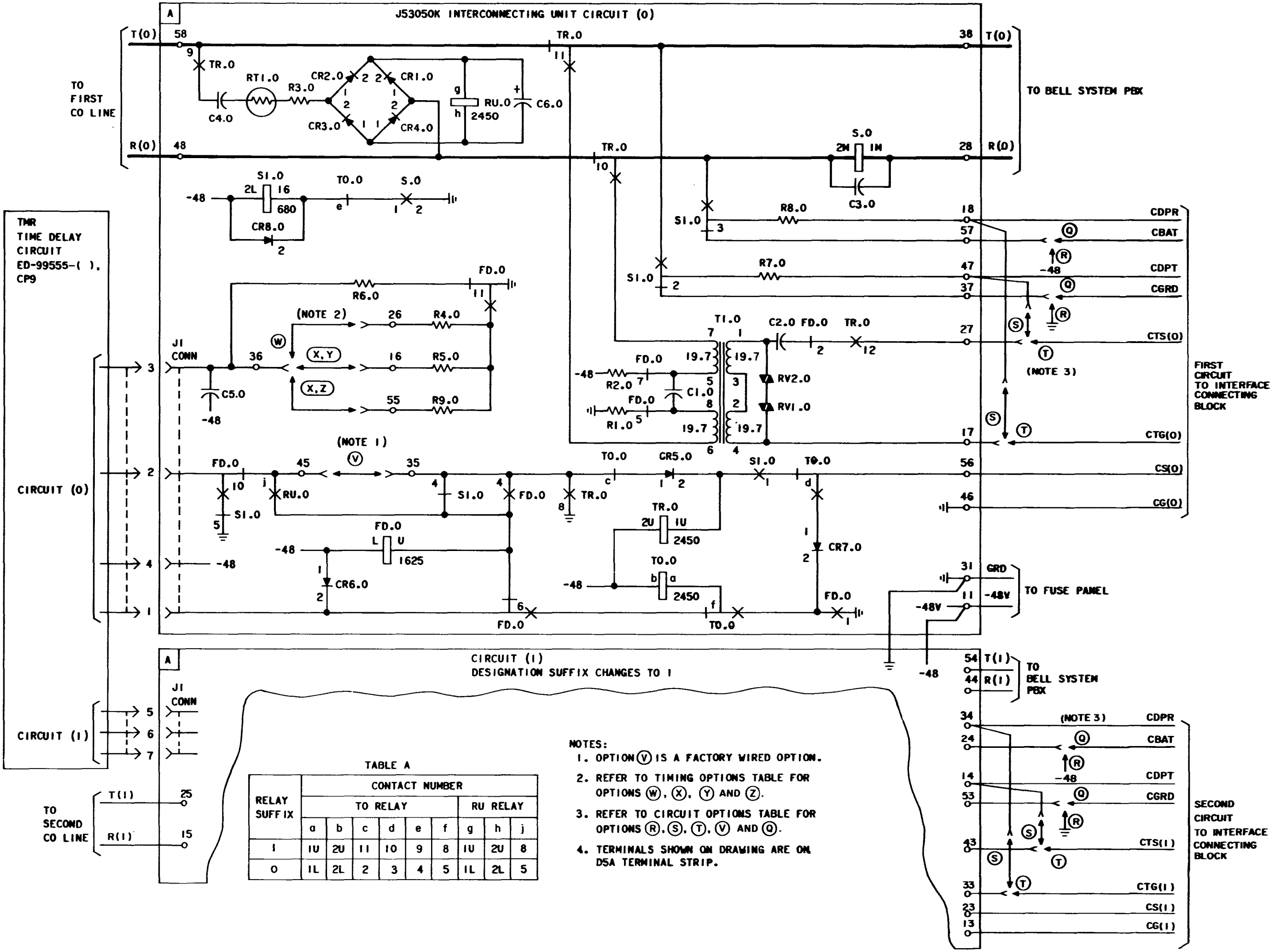


TABLE A

RELAY SUFFIX	CONTACT NUMBER: TO RELAY a	b	c	d	e	f	RU RELAY g	h	j
1	1U	2U	11	10	9	8	1U	2U	8
0	1L	2L	2	3	4	5	1L	2L	5

NOTES:

1. OPTION (V) IS A FACTORY WIRED OPTION.
2. REFER TO TIMING OPTIONS TABLE FOR OPTIONS (W), (X), (Y) AND (Z).
3. REFER TO CIRCUIT OPTIONS TABLE FOR OPTIONS (R), (S), (T), (V) AND (Q).
4. TERMINALS SHOWN ON DRAWING ARE ON D5A TERMINAL STRIP.

Fig. 4—Simplified Schematic and Connections—Connecting Arrangement CTH

PBX will release the S relay, which in turn will release the S1 relay. The S1 relay released will connect ground to the timing circuit to start the W, X, Y, or Z short cycle option timing interval which is necessary to bridge the PBX trunk release time. The S1 relay also disconnects the CDPT and CDPR leads from the line.

4.05 After the option timing interval is completed, the timer applies ground through contacts EBM6 of FD relay and EBM5 of TO relay to operate TO relay. TO relay locks up through contact M1 of FD relay and opens contact M11 to release the TR relay. TR relay released opens contact M9 to disconnect the ringing detector from the line, and reconnect the PBX CO trunk back to the CO line with contacts EBM10 and EBM11, and opens contact M8 to remove the holding ground from the FD relay. FD relay released removes the W, X, Y, or Z timing option and opens contact M1 to remove the holding ground from the TO relay. All relays are now released and the IU circuit is in the idle condition.

4.06 ***Incoming Call During Restricted Interval:*** During the 15-second restricted interval, the station and PBX trunk are connected to the CPE with the S, S1, and TR relays operated. Ringing from the CO will operate the RU relay in the ringing detector. RU relay operated closes contact M5 to apply ground to FD relay through contact M8 of operated TR relay. FD relay operates and cancels the 15-second timeout, disconnects the CTS-CTG leads, and opens the loop to the station and PBX CO trunk (the PBX trunk starts to release). S relay releases causing S1 relay to release. S1 relay released starts W, X, Y, or Z option timing and disconnects leads CDPT and CDPR from the line; the CPE opens leads CS-CG. After the option timing interval is complete, TO relay operates and TR relay releases; the PBX trunk is connected to the CO line to receive the incoming call. The FD, RU, and TO relays release, and the incoming call is completed in the normal manner.

4.07 ***Station Disconnect During Restricted Interval:*** The originating station may go on-hook during the 15-second timing interval, and open the loop on the PBX CO trunk. The open loop would cause the S relay to release. S relay released causes S1 relay to release. S1 relay released disconnects the CDPT and CDPR leads from the line with contacts EBM2 and EBM3 and closes contact M4 to operate the FD relay through contact M8 of the operated TR relay. The sequence that follows is the same as in 4.06 with the IU circuit returning to idle condition.

4.08 ***Disconnect With Permanent Restrict Signal:*** If the originating station has been restricted and the CPE does not remove the contact closure on the CS-CG leads before the 15-second time-out is completed, the sequence of operation takes place as in 4.04 and 4.05 except that the TO relay does not release. The TO relay will lock up to ground on the CS-CG lead through contact EBM10 of the TO relay, diode CR7, and contact EBM8 of the TO relay. All other relays in the circuit are released. This condition will allow outgoing calls to be originated, but not restricted, because the CP call restrictor is unable to detect dial pulsing since the S1 relay is not operated. Incoming calls are received in the normal manner.

4.09 ***Outgoing Call Without "V" Option:*** The "V" option strap is removed when the J53050K IU is connected to a loop start CO line. The sequence of operation is the same as before for originating an outgoing call, with the PBX CO trunk seized and the S and S1 relays operated. The CP call restictor monitors the dial pulsing over the CDPT and CDPR leads. If the call is to be restricted, the CPE provides a momentary contact closure on the CS-CG leads. Ground on the CS lead will operate the TR relay through EBM3 contact of the TO relay and M1 contact of the S1 relay. The TR relay locks up through its own M8 contact and the B2 contact of the TO relay; it also opens the loop to the CO and transfers the station to the CP call restricting equipment with contacts EBM11 and EBM10 through transformer T1 and contact M12. Contact M9 of the TR relay connects the ringing detector across the CO line to detect incoming calls. The station is now in the restrict mode connected to the CP call restricting equipment and will remain in this condition until the station goes on-hook.

4.10 When the station goes on-hook, the loop to the PBX CO trunk is opened and S relay releases. S relay opens contact M1 to release S1 relay. S1 relay released closes contact B4 to ground FD relay through M8 of the TR relay. With the FD relay operated, the sequence of operation is the same as in 4.06 with the IU circuit returning to the idle state.

5. MAINTENANCE

5.01 When trouble is reported, check for blown fuses, loose or broken connections, and check the CO pair to the IU.

5.02 Precautions should be taken when performing tests to avoid affecting service to the customer. Local instructions should be followed with reference to notifying the customer before performing tests.

5.03 Open the leads to the circuit under test by removing the B bridging clips at the 66M1-50 interface connecting block. Make all test connections on the Telephone Company side of the interface connecting block.

5.04 ***Tests:*** J53050K Interconnecting Unit

> ***Note:*** −48 volt battery may be present on the CBAT lead at the interface connecting block. Avoid shorting this lead to ground or other leads.

(a) Outgoing call—Connect a 1013A (or equivalent) hand test set to the T and R terminals to the PBX for the circuit under test (busy out trunk at PBX). Place the hand test set in the TALK position and relays S and S1 will operate (on ground start trunks S and S1 will not operate until ground in placed on ring and CO responds with ground on tip). Momentarily ground the ring side of the line (ground start trunk only) and dial tone from the CO will be received. Dial the test desk and request ringing voltage be applied to line.

(b) Restricted call and incoming call during restrict—Momentarily strap terminals CS and CG and relay TR will operate transferring the PBX trunk and 1013A hand test set from the CO line to the transmission path from the CPE. The ringup bridge will be connected across the T and R to the CO, and RU relay will operate from ringing voltage causing relay FD to operate, and the PBX trunk and 1013A hand test set will be transferred back to the CO line.

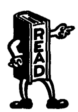
(c) Time-out during restricted call—Place a strap on terminals CS and CG and relay TR will operate to transfer PBX trunk and 1013A hand test set from CO line to the transmission path from the CPE. In approximately 15 seconds the timer will time out, the FD relay will operate to force disconnect, and the PBX trunk and 1013A hand test set will be transferred back to the CO line. The TO and S relays will be operated. All other relays will be released.

5.05 If tests are satisfactory, remove all test connections to return circuit to normal and replace B bridging clips on 66M1-50 interface connecting block.

5.06 When trouble is suspected in the J53050K IU, isolate the trouble and clear it using standard maintenance procedures.

5.07 When trouble is indicated in the transmission path (T and R), use normal practices to perform circuit transmission tests.

5.08 When in the repairman's judgment the trouble is located in the CPE, the Repair Service Bureau should be notified so that proper Maintenance of Service Charge billing can be initiated as outlined in Section 660-101-312 entitled Maintenance of Service Charge on Services With Customer-Provided Equipment (CPE).



Do not attempt any tests or repairs on the CPE.

6. CONNECTIONS

6.01 For connecting information refer to Fig. 4 and Tables A and B.

6.02 Four, six or eight leads may be run to the interface block depending on requirements of the CPE. The monitoring leads CDPT-CDPR and the call restricting leads CS-CG are always required. The restricted tone leads, CTS-CTG (option T), are provided when the CPE requires separate leads for returning the call restricted tone. The customer power leads CBAT and CGRD (option Q) are provided when the customer supplies battery to his CDPT and CDPR leads in the idle condition.

CONNECTING ARRANGEMENT KTX

1. GENERAL

1.01 This section provides identification, installation, operation, maintenance and connection information for the 122A interconnecting unit (IU) and 606A panel, when used as Connecting Arrangement (CA) KTX.

1.02 This CA provides a means for connecting customer-provided equipment (CPE), typically call restricting equipment, to a telephone company provided key telephone system (KTS).

1.03 CA KTX enables the CPE to provide a distinctive call restricting tone, or announcement, as a signal to the key station user that he has dialed a restricted call.

1.04 The 122A IU is equipped with two circuits (for two central office [CO] lines associated with the KTS) that interface with CP call restricting equipment.

1.05 If the customer wants a copy of the Technical Reference which covers this interface specification, the customer should contact the local Telephone Company Business Office or the Marketing Representative.

1.06 This issue of the section is based on the following drawing : SD-69659-01, Issue 2—122A IU. If this section is to be used with equipment or apparatus reflecting later issues of the drawing, reference should be made to the SD to determine the extent of the changes and the manner in which the section may be affected.

2. IDENTIFICATION

PURPOSE

- Provides access to a CO line for CP call restriction equipment to detect off-hook, on-hook and dialing signals on the line for an outgoing call.
- Transfers the originating station from the CO line to the CPE when signaled by the CPE (call restricted mode).
- Permits the CPE to provide a restricted tone to the originating station.
- Detects CO ringing when the circuit is in the call restricted mode.
- Forces cut-through of the station to the CO line on an incoming call, when the station is in the call restricted mode.

APPLICATION

- For use with telephone company KTS 1A1 or 1A2, CO or PBX line circuits.

ORDERING GUIDE

- Unit, Interconnecting, 122A (one per two CO lines, Fig. 1).

Associated Equipment (Order Separately)

Note: If a 23-inch relay rack is not provided on customer premises, order a 16C apparatus mounting, or equivalent.

- Panel, 606A (one per three 122A IUs, Fig. 2 and 3)
- Bracket, 99B (for mounting panel on rack or in 16C apparatus mounting)
- Block, Connecting, 66M1-50 (as required, Fig. 4)
- Block, Connecting,66B3-50 (as required, Fig. 5)
- Clip, Bridging, B (25 per pkg., Fig. 4)

Note: Other connecting blocks may be used when specified by local supervision.

- Cable, Connector, A25B (two per 606A panel)
- Cable, Inside Wiring, D, 16-Pair, or equivalent (for cabling from intermediate connecting block to KTS)

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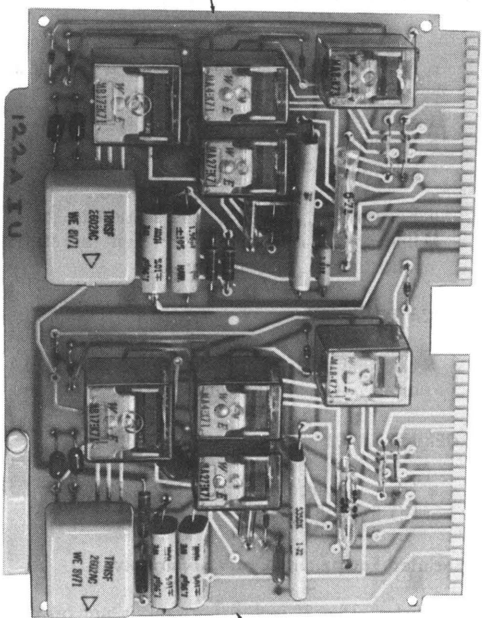


Fig. 1—122A Interconnecting Unit

- Cable, Inside Wiring, D, 25-pair, or equivalent (for cabling from intermediate connecting block to interface connecting block)
- Fuse, 24E, 1/2 ampere (eight per 606A panel)
- Unit, Power, 19C2 (or equivalent, if required, when KTS power supply is not sufficient)
- Cord, Power (for 19C2 power unit)

  P40J326 (1-1/2 feet)

  P40J327 (2 feet)

  P40J328 (4 feet)

  P40J329 (6 feet)

  P40J099 (12 feet)

DESIGN FEATURES

122A IU

- Components for two circuits mounted on 8-inch printed circuit board.
- Maximum current drain for each of the two circuits is 0.090 ampere at 26V.
- Typical current drain per circuit is 0.077 ampere at 24V or 0.154 ampere per 122A IU.
- Maximum dc loop resistance of leads CS and CG is 50 ohms.
- Maximum dc resistance of lead A between one circuit of the 122A IU and KTU line circuit is 150 ohms.

606A Panel

- Approximate size is 6 by 8 by 9 inches.
- Equipped with six 914A, 40-pin connectors wired to two KS-16671, List 1, 50-pin plugs.
- Mounts three 122A IUs (six CO lines).
- Fuse panel included (Fig. 3).
- Mounts on a 99B bracket, on a standard relay rack, or in a 16C apparatus mounting.

3. INSTALLATION (Fig. 5 and 6)

3.01 Locate the 606A panel close to the KTS equipment in an area free of dampness and dust and with adequate room for access to front and rear.

3.02 Mount the 606A panel on a 23-inch relay rack or 16C apparatus mounting using the 99B bracket for mounting. Remove the center mounting bar from the 16C apparatus mounting to provide adequate mounting space.

3.03 Mount the 66B3-50 intermediate connecting block within 25 feet of the 606A panel and close to the KTS line circuits. Mount the 66MI-50 interface connecting block close to the intermediate block and in a location mutually agreeable to the customer and with sufficient access for making

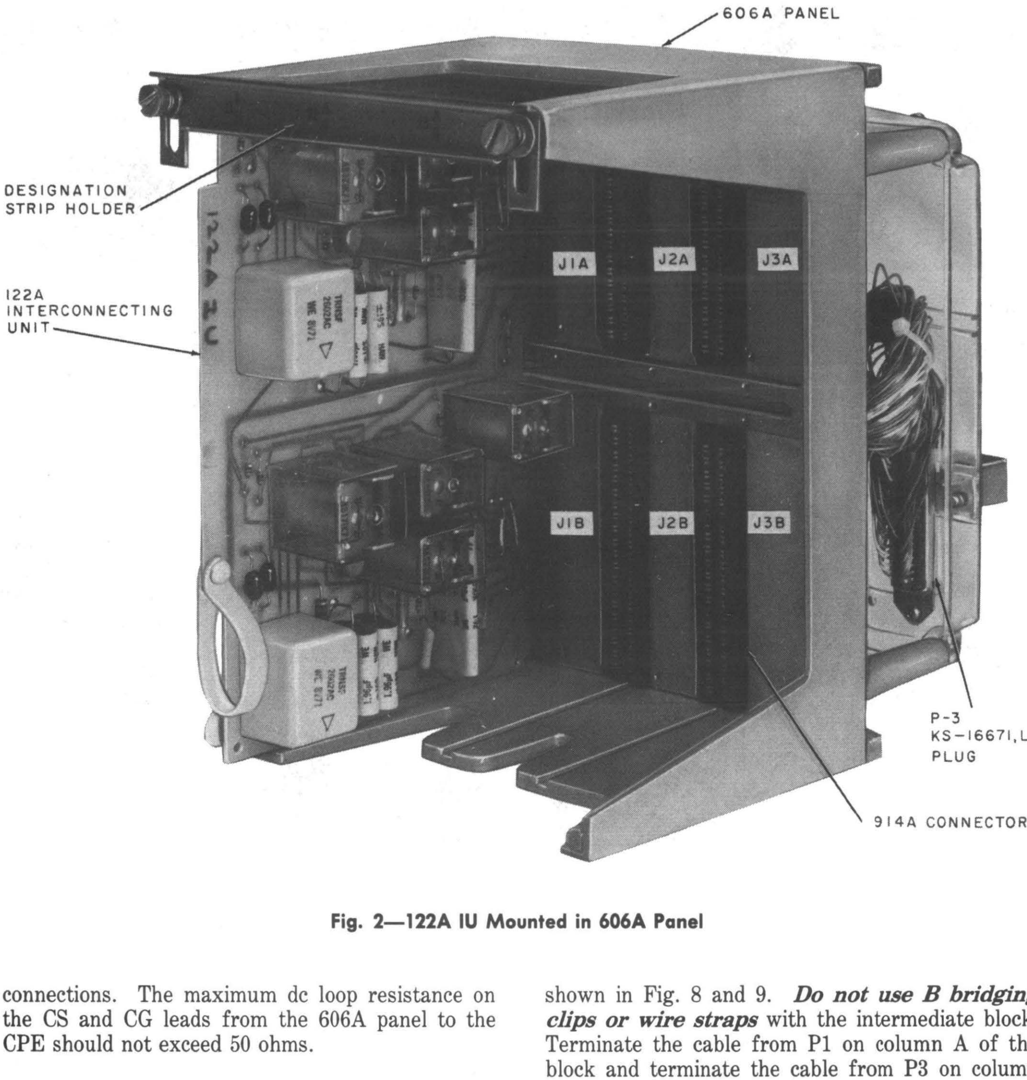


Fig. 2—122A IU Mounted in 606A Panel

connections. The maximum dc loop resistance on the CS and CG leads from the 606A panel to the CPE should not exceed 50 ohms.

3.04 Connect the two A25B connector cables to the two plugs, P1 and P3 (Fig. 3), on the rear of the 606A panel. P1 is wired to the three upper 914A connectors (J1A, J2A, J3A) and P3 is wired to the three lower 914A connectors (J1B, J2B, J3B). See Fig. 6 for connector and trunk arrangement in 606A panel. Terminate the raw ends of the two A25B connector cables on the 66B3-50 intermediate connecting block following the wiring plan shown in Fig. 5 and 6 and connections shown in Fig. 8 and 9. ***Do not use B bridging clips or wire straps*** with the intermediate block. Terminate the cable from P1 on column A of the block and terminate the cable from P3 on column F (Fig. 8). Stencil lead designations on fanning strip.

3.05 Use 16-pair "D" inside wiring cable to extend the T, R, and T, R, A leads from the intermediate block to the connecting block associated with the KTS line circuits.

3.06 Use 25-pair "D" inside wiring cable to extend the eight interface leads for each of six

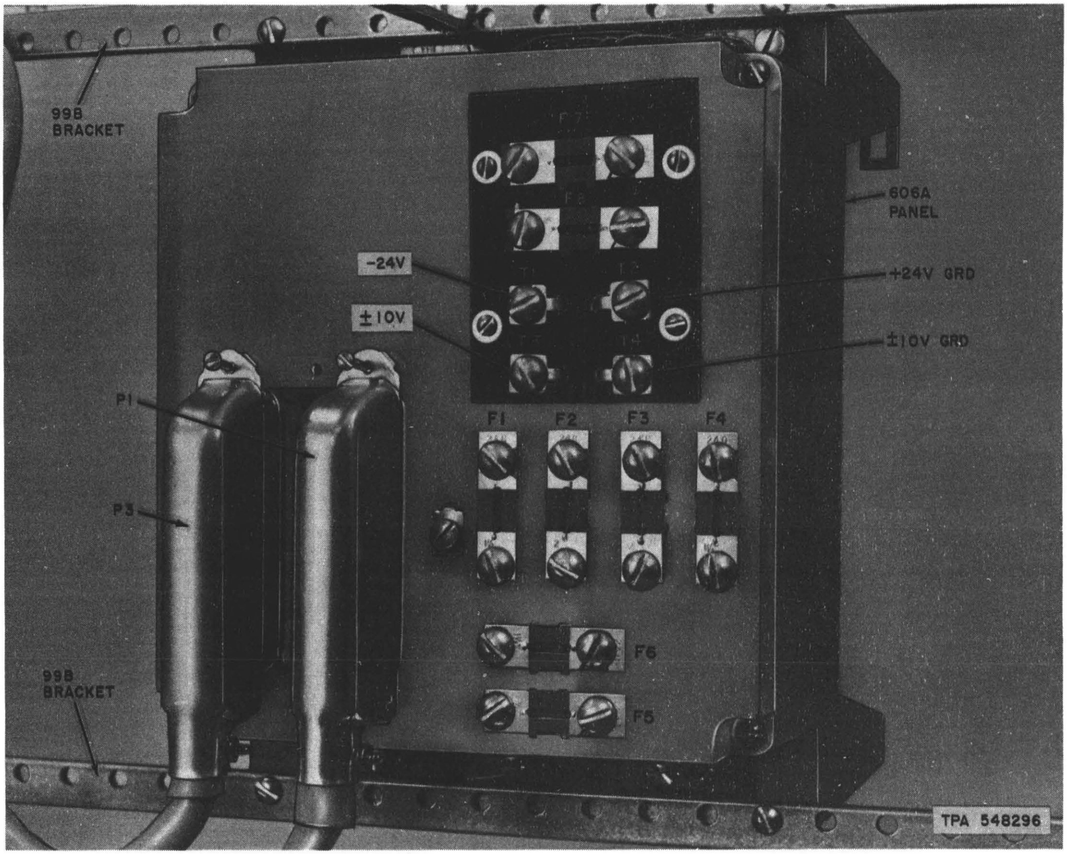


Fig. 3—606A Panel-Rear View

circuits from left and right sides of the 66B3-50 intermediate connecting block to 66M1-50 interface connecting block. Terminate by cutting cable down the interface block in standard even count code as shown by Fig. 9. Assign leads as required and shown in Fig. 9 for the 66B3-50 intermediate block. Refer to Fig. 5, 7, and 9 for options (see 6.02). Make all options on the intermediate block. If option Z is required, run −24V to the intermediate block and connect as shown in Fig. 9. Use B bridging clips to connect B and C columns together on interface block. Insulate and store unused leads at intermediate block. Stencil lead designations on fanning strip of interface block.

3.07 Raise the designation strip holder on the 606A panel to provide access to connectors. Align the 122A IU in the mounting guides and slide it in until the printed wiring board is properly seated in the connector of the 606A panel. Lower the designation strip holder to lock IUs in panel; tighten screws if necessary to increase pressure of holder against IUs.

3.08 Use D station wire, or equivalent, to connect the KTS power supply to terminals T1 (−24V) and T2 (GRD) and strap T2 and T4 on rear of 606A panel. (See Fig. 3.) If KTS power supply is insufficient, use 19C2 power unit (or equivalent)

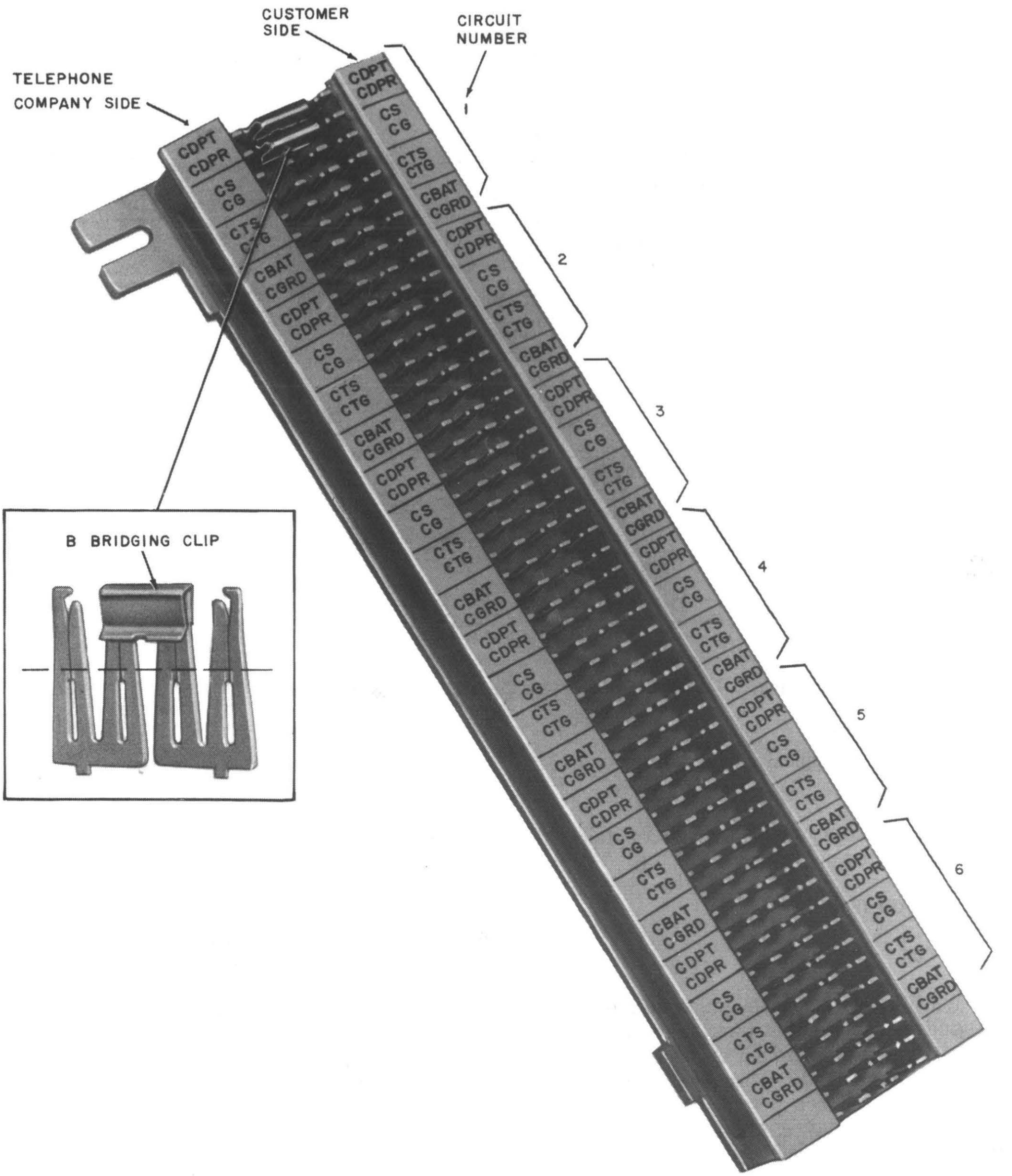


Fig. 4—66M1-50 Interface Connecting Block

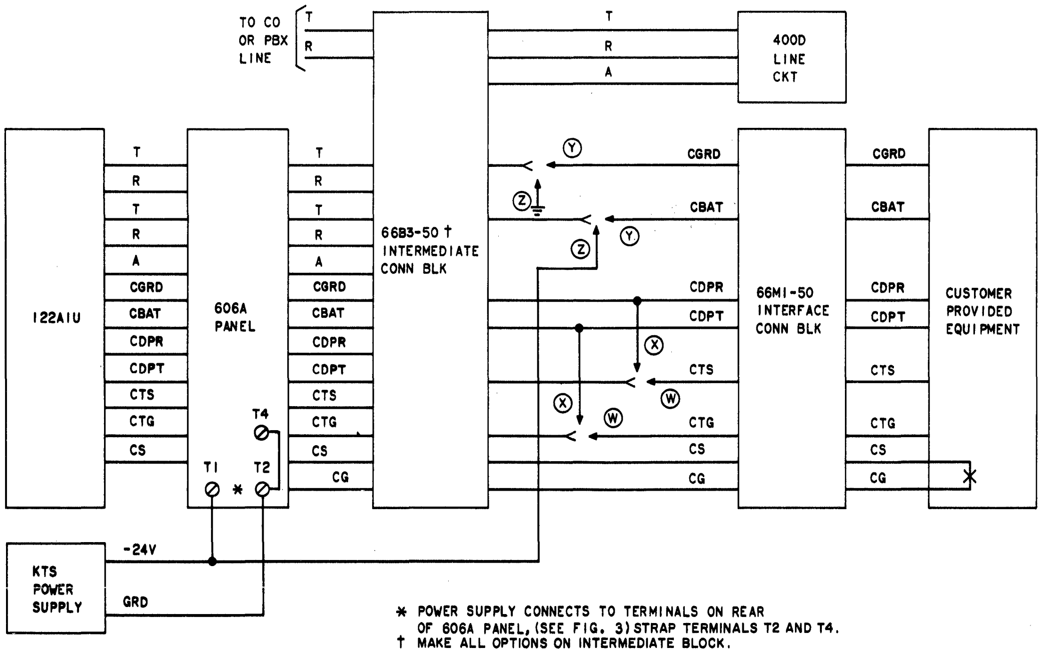


Fig. 5—Block Diagram-Voice Connecting Arrangement KTX

to supply power. Typical current drain is 0.154 ampere per 122A IU.

3.09 Perform tests shown in Part 5 after installation is completed.

4. OPERATION (Fig. 7)

Outgoing Call

4.01 When a key telephone station goes off-hook and seizes the CO line, the station set grounds the A lead. Ground on lead A operates the A relay through its EMB4 contact. Hold current for the A relay is then provided through diodes CR6 and CR7. Relay A operated connects the CDPT and CDPR leads to tip and ring of line through resistors R2 and R1. The CPE detects the off-hook condition and dial pulsing or TOUCH-TONE® address signals over leads CDPT and CDPR.

4.02 If the call is not to be restricted, the CPE provides no signal to the 122A IU in use. If the CPE determines that the number being dialed is to be restricted, a momentary contact closure (at least 50 ms) from the CPE is provided on leads CG and CS. This closure grounds lead CS to operate relay CR (call restrict) through contact 4B of relay CI (call incoming).

4.03 Relay CR is held operated from ground on lead A through diodes CR7, CR6, CR2, contact M1 of relay CR, and contact B4 of relay CI. Relay CR operated transfers the station T and R leads from the CO line to the CPE with contacts EMB2, EMB5, and M4 through transformer T1. It also connects the ring detector across the CO line with contact M3. The CPE may provide a tone or announcement on leads CTS and CTG (W option) or leads CDPT and CDPR (X option) to indicate to the station that the call has been restricted.

4.04 ***Incoming Call in Restricted Mode:*** An incoming call on the CO line, when the station is connected to the CPE, causes relay R (ring) to operate from the ringing signal. Contact M4 of

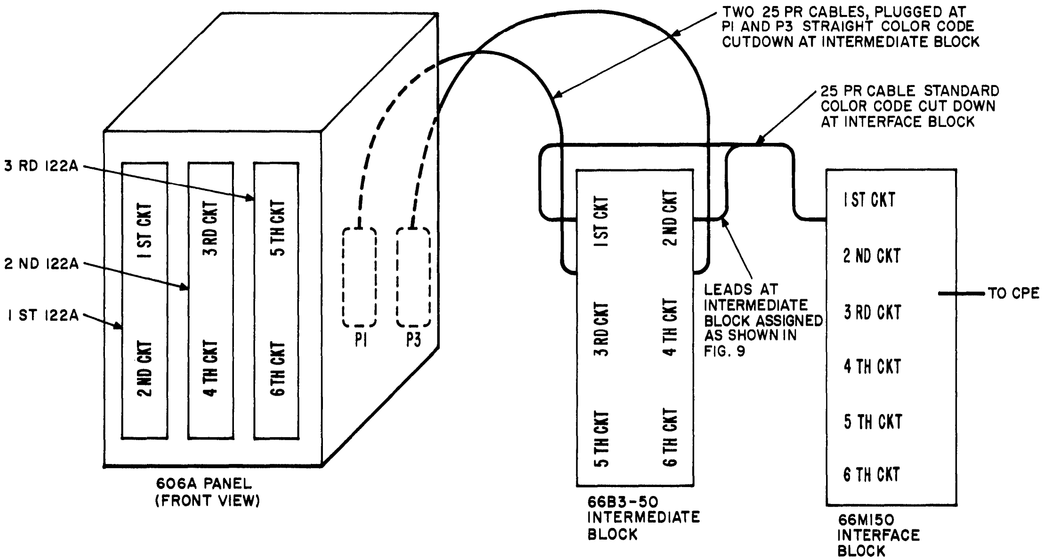


Fig. 6—Cabling Diagram—Voice Connecting Arrangement KTX

relay R operates relay CI from ground on lead A through diodes CR7, CR6, CR2 and contact M1 of operated relay CR. Relay CI holds operated through its own M1 contact to ground on lead A.

4.05 Relay CI operated opens the hold path to relay CR with contact B4 and releases it. Relay CR released opens contact M3 to disconnect the ring detector from the CO line, opens contact M1 to release relay CI and operates contacts EMB2 and EMB5 to transfer the station T and R leads back to the CO line. Since the station is off-hook, CO ringing is tripped and the incoming call is completed to the station. This feature is included to insure that incoming calls will not be affected by the CP call restriction equipment.

4.06 ***Station Disconnect in Restricted Mode:*** When the station is in the restricted mode, relays A and CR are operated. If the station goes on-hook, ground is removed from lead A and will cause relays A and CR to release. Relay A released disconnects the CDPT and CDPR leads from the station T and R leads. Relay CR released transfers the station T and R leads back to the CO line and the 122A IU returns to idle condition.

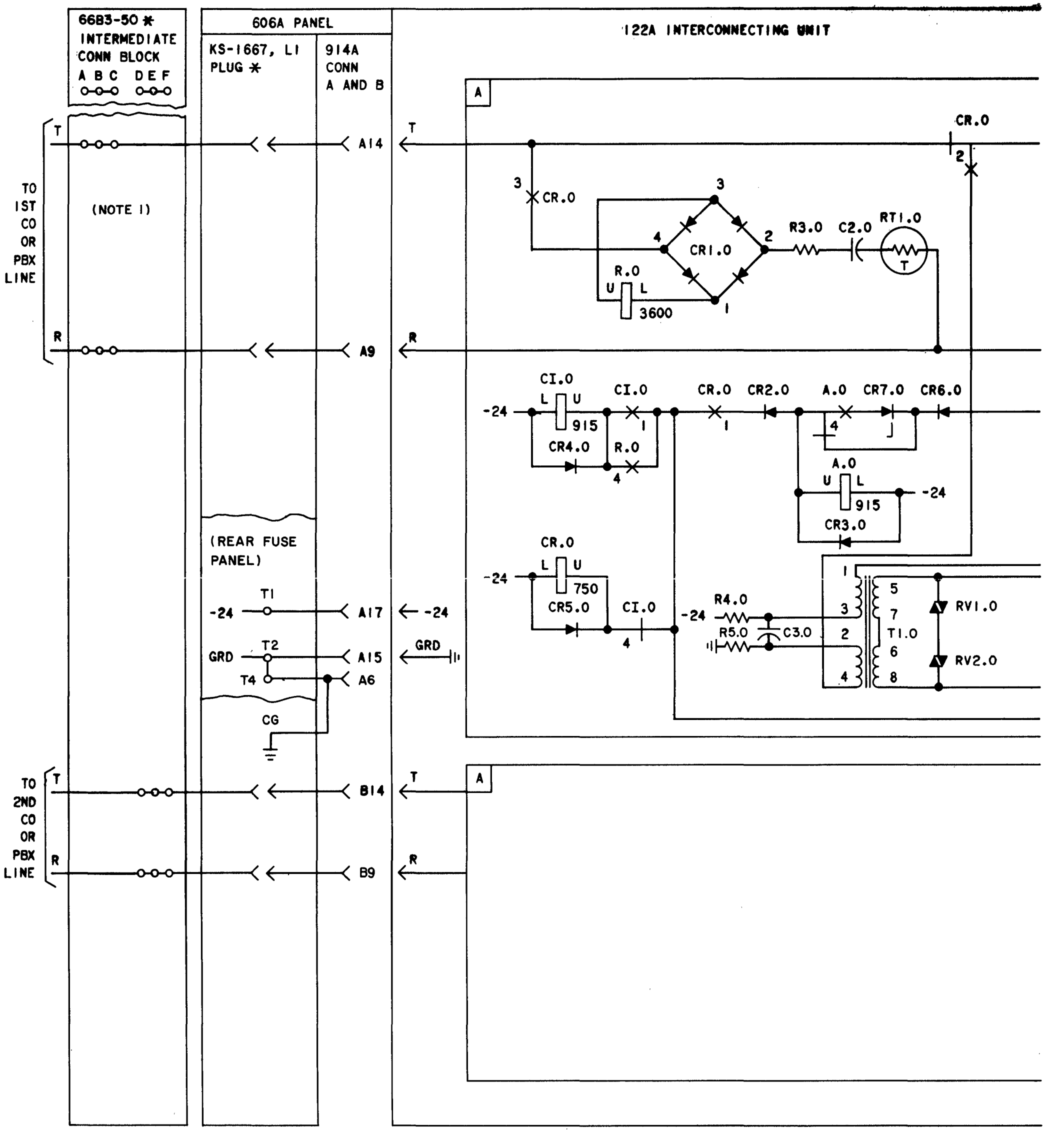
4.07 The 122A IU circuit in use and the associated key telephone line circuit (400D KTU) have a common A lead. When these two circuits have separate power supplies, a condition can occur where a maximum of 6 volts may develop across relays A, CI, and CR when the A lead ground is removed (station goes on-hook). Zener diode CR7 has a breakdown voltage of approximately 4 volts which insures that the relays release on disconnect.

5. MAINTENANCE

5.01 When trouble is reported, check for blown fuses, loose or broken connections and check the CO pair to the 122A IU in use.

5.02 Precautions should be taken when performing tests to avoid affecting service to the customer. Local instructions should be followed with reference to notifying the customer before performing tests.

5.03 Open the leads to the circuit under test by removing the B bridging clips (or wire straps) at the 66M1-50 interface connecting block.



* REFER TO FIG. 8 FOR PIN OR TERMINAL NUMBERS.

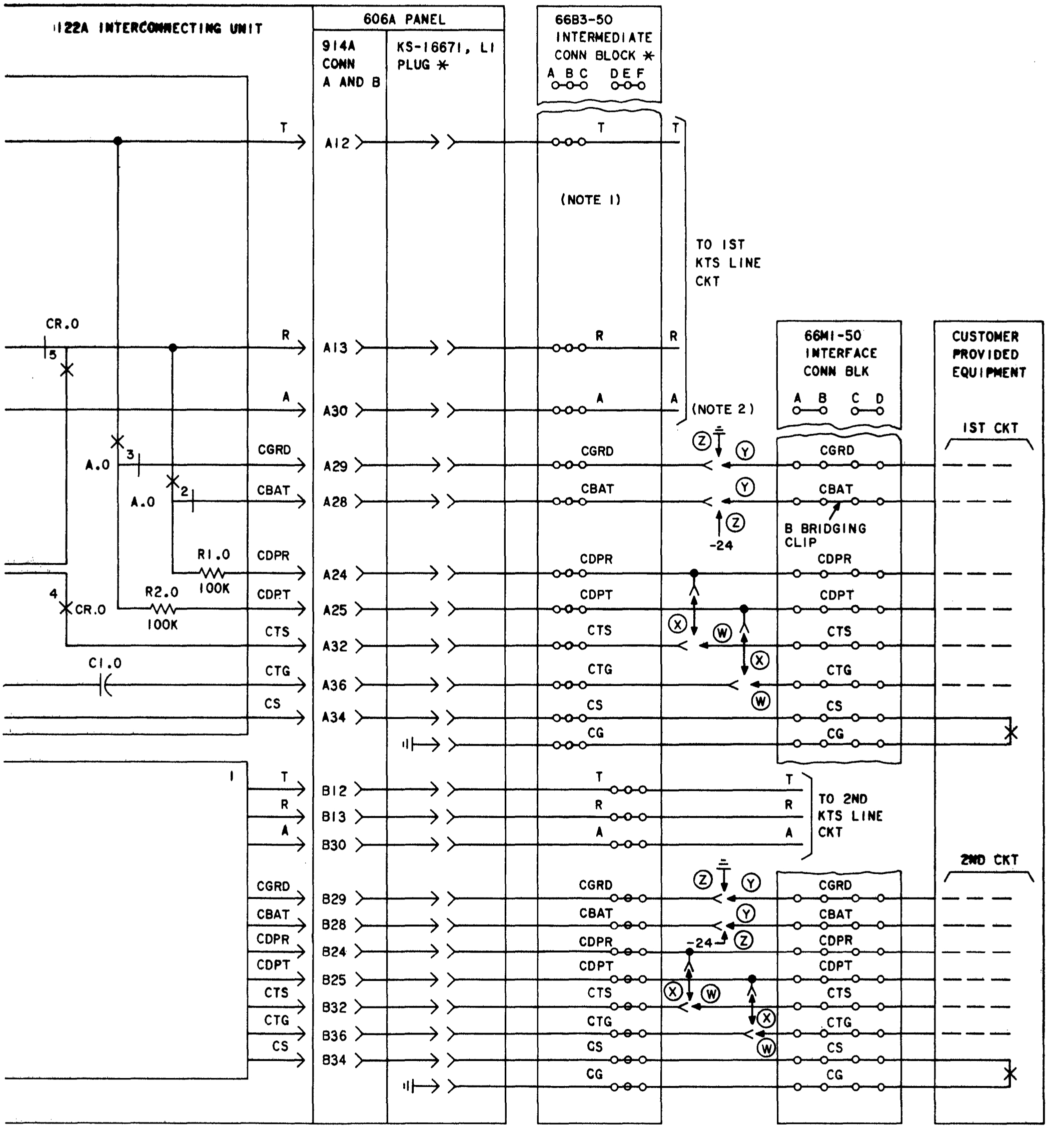
(W) CP CALL RESTRICTED TONE SIGNAL ON CTS AND CTG LEADS.

(X) CP CALL RESTRICTED TONE SIGNAL ON CDPT AND CDPR LEADS.

(Y) CP BAT AND GRD CONNECTED TO CDPT AND CDPR LEADS IN IDLE CONDITION.

(Z) LOCAL BAT AND GRD CONNECTED TO CDPT AND CDPR LEADS IN IDLE CONDITION.

Fig. 7—Schematic-Voice Connecting Arrangement KTX (Sheet 1 of 2)



NOTES:

1. DO NOT USE B BRIDGING CLIPS ON INTERMEDIATE BLOCK CIRCUITS 1, 3 AND 5 TERMINATE ON LEFT SIDE OF BLOCK, AND CIRCUITS 2, 4 AND 6 TERMINATE ON RIGHT SIDE OF BLOCK. SEE FIG. 9.
2. ALL OPTIONS ARE MADE ON INTERMEDIATE BLOCK

Fig. 7—Schematic-Voice Connecting Arrangement KTX (Sheet 2 of 2)

Make all test connections on the telephone company side of the interface connecting block.

5.04 Prepare circuit for test as follows:

Note: −24V battery is present on the CBAT lead at the interface connecting block. Avoid shorting this lead to ground or to other leads.

(a) Open the T, R, and A leads to the KTS line circuit. Connect a 1013A (or equivalent) hand test set to the T and R terminals to the KTS line circuit and connect a ground strap to the A lead terminal to be used later for grounding the A lead.

(b) Connect a strap to terminal CG, to be used later for momentary connection to CS.

(c) Connect a second 1013A (or equivalent) hand test set across terminals CT and CR; place test set in "MON" position.

5.05 Perform tests as follows:

(1) Place the switch of the first hand test set in the TALK position. After receiving dial tone, ground lead A and verify presence of −48V line voltage using a voltmeter across terminals CDPT and CDPR.

(2) Momentarily strap CS to CG and verify absence of dial tone on hand test set at T and R.

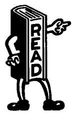
(3) Remove ground from lead A, receive dial tone, and dial the test desk and request ringing voltage be applied to line in 30 seconds. Ground lead A and momentarily strap CS to CG. The hand test set will be transferred to the CTS and CTG leads; when ringing voltage is received, the hand test set will be transferred back to the CO line.

5.06 If tests are satisfactory, remove all test connections, replace all disconnected leads to return circuit to normal, and replace B bridging clips on 66M1-50 interface connecting block.

5.07 When trouble is suspected in the 122A IU, exchange it with another unit known to be functioning properly.

5.08 When trouble is suspected in the transmission path (T and R) or KTS circuits, use normal practices to perform circuit transmission tests.

5.09 When in the repairman's judgment the trouble is located in the CPE, the Repair Service Bureau should be notified so that proper maintenance of service charge billing can be initiated as outlined in Section 660-101-312 entitled Maintenance of Service Charge on Services With Customer-Provided Equipment (CPE).



Do not attempt any tests or repairs on the CPE.

6. CONNECTIONS

6.01 For connecting information, refer to Fig. 3 through 9.

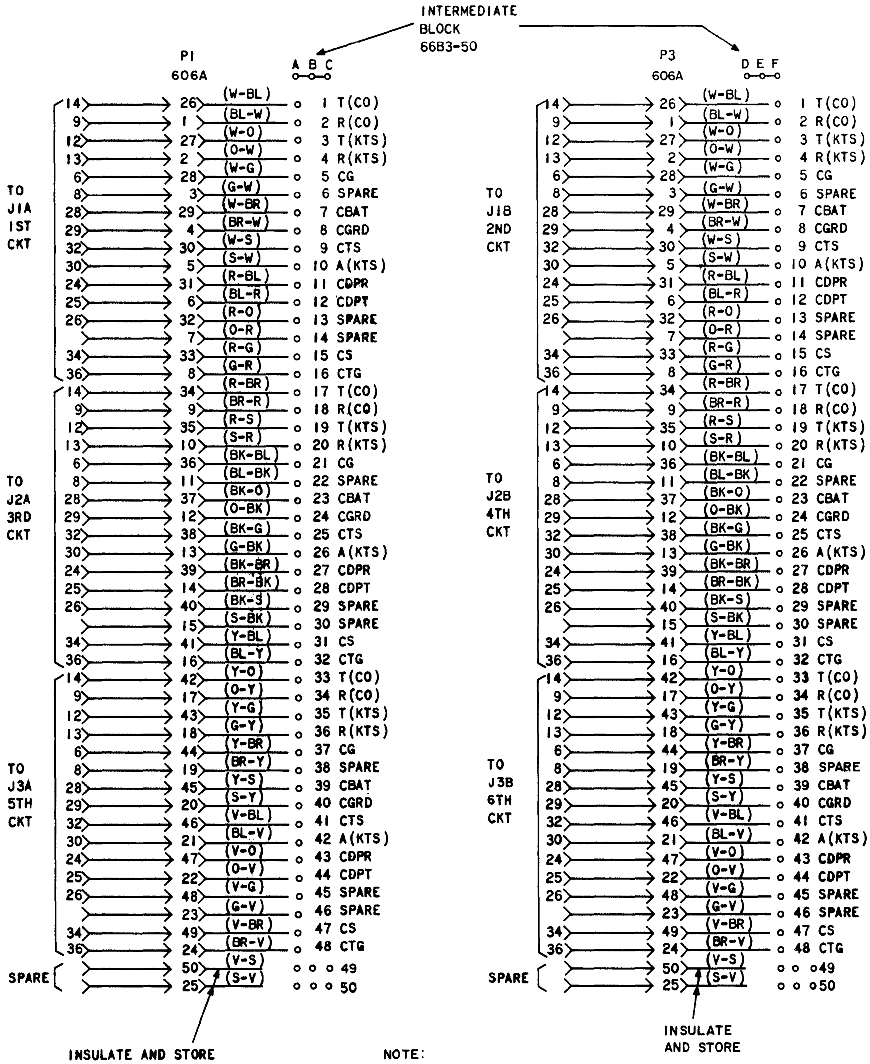
6.02 Four, six or eight leads of the eight leads run from the intermediate block to the interface block may be used depending on requirements of the CPE. The monitoring leads CDPT and CDPR and call restricting leads CS and CG are always required. The restricted tone leads CTS and CTG (option W) are used when the CPE requires separate leads for returning the call restricted tone. Option X is used when the restricted tone is returned on the CDPT and CDPR leads. The customer power leads CBAT and CGRD (option Y) are used when the customer supplies battery to his CDPT and CDPR leads in the idle condition. Option Z is used when local battery and ground are connected to the CDPT and CDPR leads. Options Z and Y are not used when an open circuit is required on leads CDPT and CDPR during idle condition.

6.03 Options W and Y do not require any special strapping; they are connected by the wiring between the connecting blocks. Refer to Fig. 9 for details of strapping options X and Z. Disconnect unused leads; insulate and store at intermediate block.

6.04 The following are typical connecting circuits:

(a) Key Telephone Systems No. 1A2—CO or PBX Line Circuits—SD-69513-01

(b) Key Telephone Systems No. 1A1—CO or PBX Line Circuit—SD-69270-01



NOTE:
SEE FIG. 9 FOR CONNECTION OF OPTIONS ON INTERMEDIATE CONNECTING BLOCK

Fig. 8—Connections for Plugs P1 and P3 to Intermediate Block

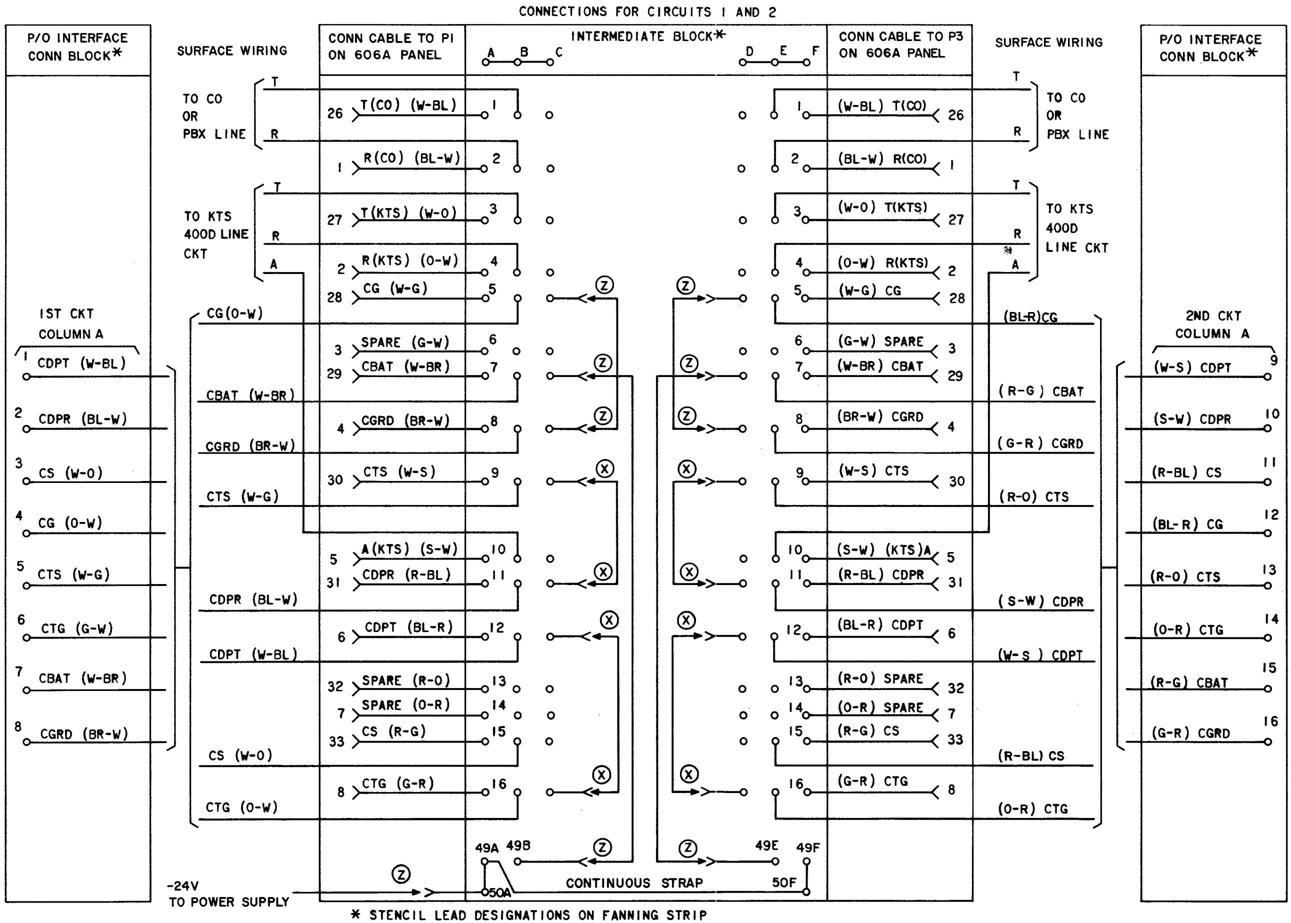


Fig. 9—Connections From Intermediate Connecting Block to Interface Connecting Block (Sheet 1 of 3)

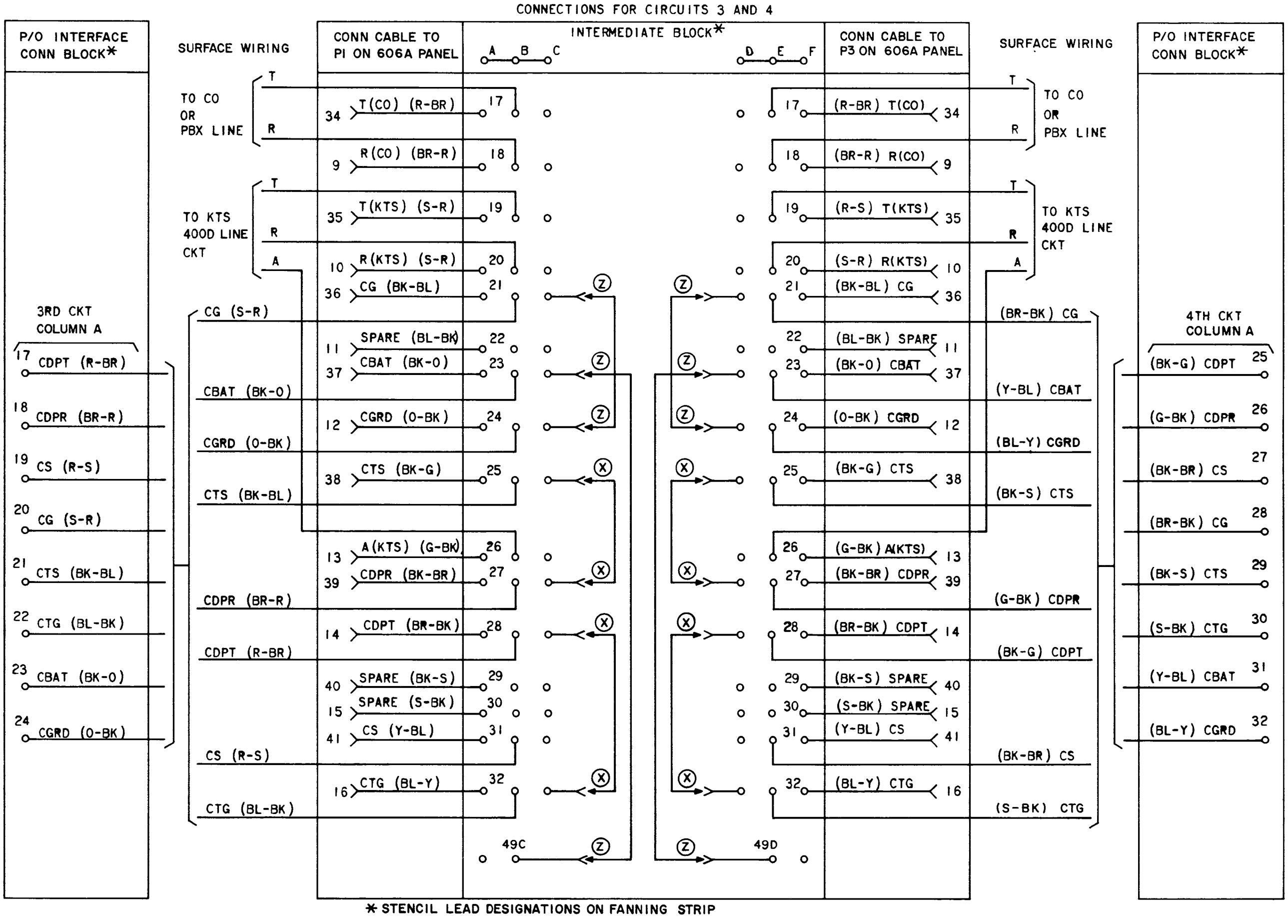
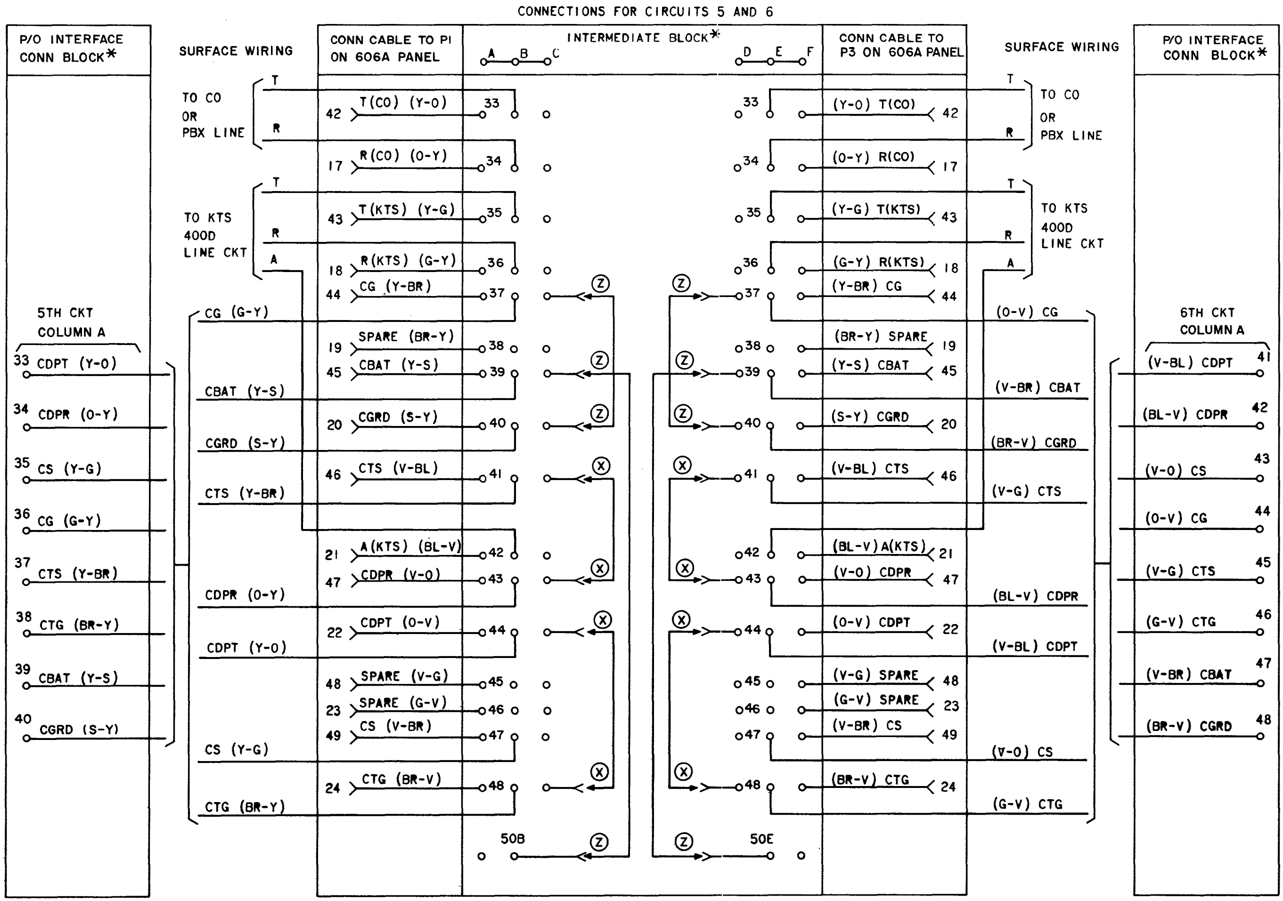


Fig. 9—Connections From Intermediate Connecting Block to Interface Connecting Block (Sheet 2 of 3)



* STENCIL LEAD DESIGNATIONS ON FANNING STRIP

Fig. 9—Connections From Intermediate Connecting Block to Interface Connecting Block (Sheet 3 of 3)

VOICE CONNECTING ARRANGEMENT

TSPZ1 AND TSPXY

1. GENERAL

1.001 This addendum supplements Section 463-382-105, Issue 1.

1.002 This addendum is issued to correct Table C and Fig. 6 with respect to option X to agree with SD-1E295-01, Issue 2.

2. CHANGES TO SECTION

ISSUE 1 CHANGES

2.001 On page 9, replace Table C.

2.002 On page 14, replace Fig. 6.

TABLE C

OPTION TABLE

USOC CODE	FEATURE OR OPTION	OPTION	STRAP TERMINALS		
			CKT 1	CKT 2	CKT 3
TSPZ1 or TSPXY	SXS Type CO	V	TS B 18 to 28	TS B 16 to 26	TS B 14 to 24
	Panel, Crossbar or No. 1 ESS Type CO	W*	TS B 28 to 38	TS B 26 to 36	TS B 24 to 34
TSPXY	TOUCH-TONE® Dialing to CO from CPE with IU in Split Mode	X	NONE†		
	Rotary Dialing to CO from CPE with IU in Split Mode	Y	NONE†		
TSPZ1	Rotary or TOUCH-TONE Dialing to CO from PBX Station with IU in Cut-Through Mode	Z*	TS A 27 to 37 TS B 17 to 27 37 to 47	TS A 25 to 35 TS B 15 to 25 35 to 45	TS A 23 to 33 TS B 13 to 23 33 to 43

* Z and W options are factory-wired.
† Customer provides this wiring option at the interface block.

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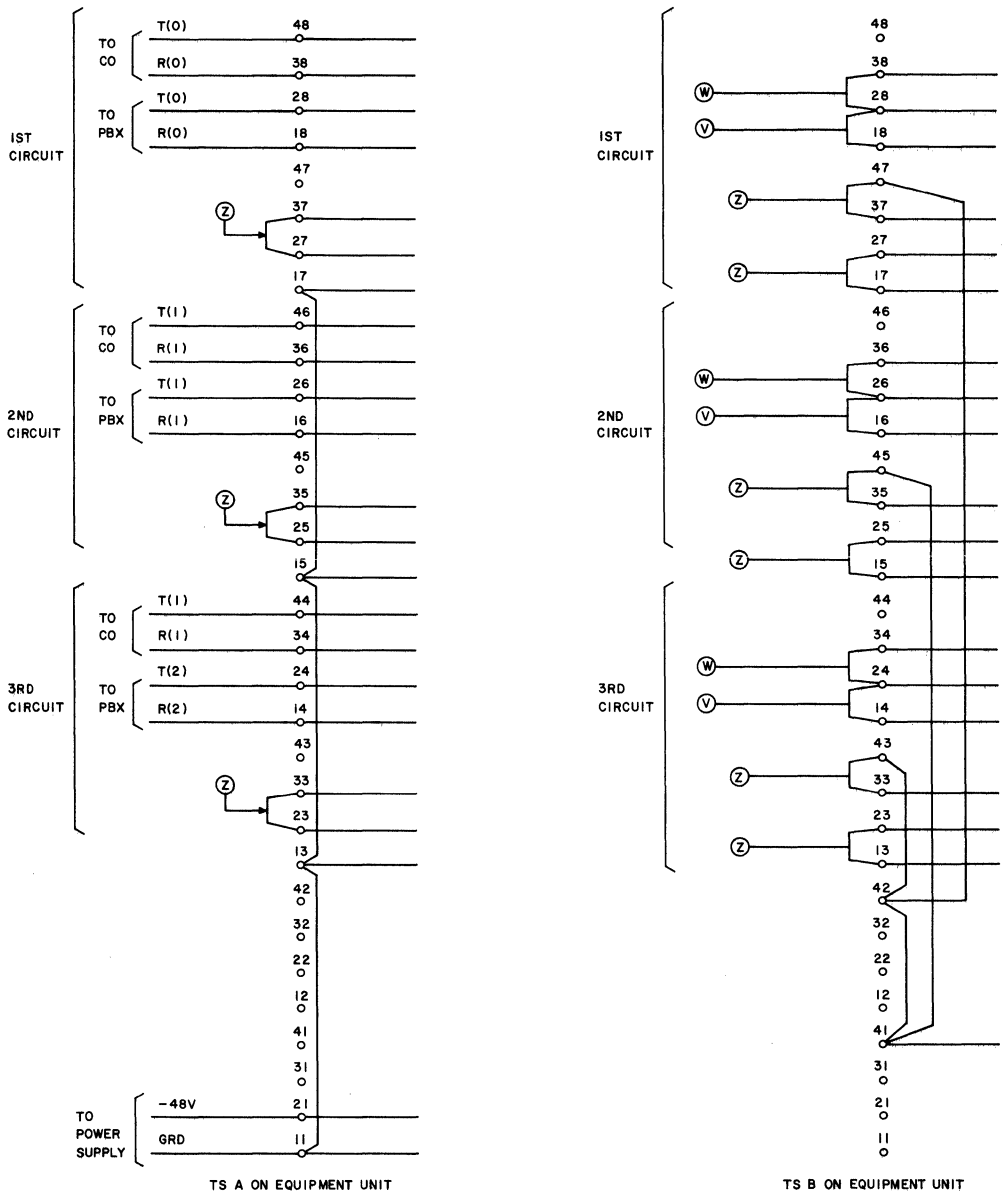

Fig. 6—Voice Connecting Arrangement TSPXY and TSPZ1—Connections

VOICE CONNECTING ARRANGEMENTS TSPZ1 AND TSPXY

1. GENERAL

1.01 This section provides identification, installation, operation, maintenance, and connection information for the J53050L interconnecting unit (IU) when used to provide Voice Connecting Arrangements (VCAs) TSPZ1 and TSPXY. VCAs TSPZ1 and TSPXY provide a means for connecting customer-provided equipment (CPE), station message detail recording equipment, to a telephone company PBX central office (CO) trunk.

1.02 Whenever this section is reissued, the reasons for reissue will be listed in this paragraph.

1.03 The VCA TSPXY permits the CPE to seize the CO line for dialing while the circuit is in the split mode, after the originating PBX station has been connected to the CPE.

1.04 The VCA TSPZ1 permits the CPE to cut through the originating PBX station and automatically seize the CO line to allow the station to dial on the CO line.

1.05 The J53050L IU is a unit which is wired in series with the trunk to the CO. This unit, under customer control, can split the connection to allow the PBX station user to dial additional digits. The IU also permits the customer to optionally dial into the CO and then cut the station through.

1.06 This circuit is limited to use on ground-start one-way outgoing PBX CO trunks only.

1.07 If the customer wants a copy of the technical reference which covers this interface specification, the customer should contact the local Telephone Company Business Office or Marketing Representative.

1.08 This issue of the section is based on the following drawing:

SD-1E295-01, Issue 2 (J-53050L IU)

If this section is to be used with equipment or apparatus reflecting a later issue(s) of the drawing, reference should be made to the CDs and SDs to determine the extent of the changes and the manner in which the section may be affected.

2. IDENTIFICATION

PURPOSE

- Connects the PBX CO trunk to the CPE when seized for an outgoing call
- Provides a voice grade transmission path from PBX to CPE
- Provides dial pulse or TOUCH-TONE® signals from PBX station to CPE
- Provides trunk busy or idle status to CPE
- Provides cut-through or split indication to CPE
- Permits CPE to seize CO line while circuit is in a split condition
- Cuts PBX station through to CO line on signal from CPE
- Provides a metallic cut-through to the CO when customer equipment is disconnected or exhibits detectable failure indication.

APPLICATION

- For use on ground-start one-way outgoing PBX CO trunks only.

ORDERING GUIDE

- J53050L, List 1 Interconnecting Unit (Fig. 1 and 2)
- KS-15620, List 23 Rectifier (or equivalent, if required where PBX power supply is

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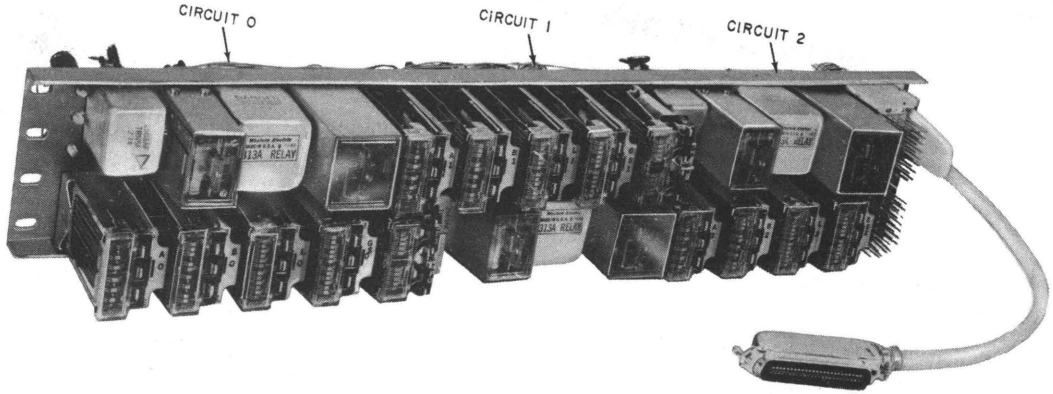


Fig. 1—J53050L Interconnecting Unit (Front View)

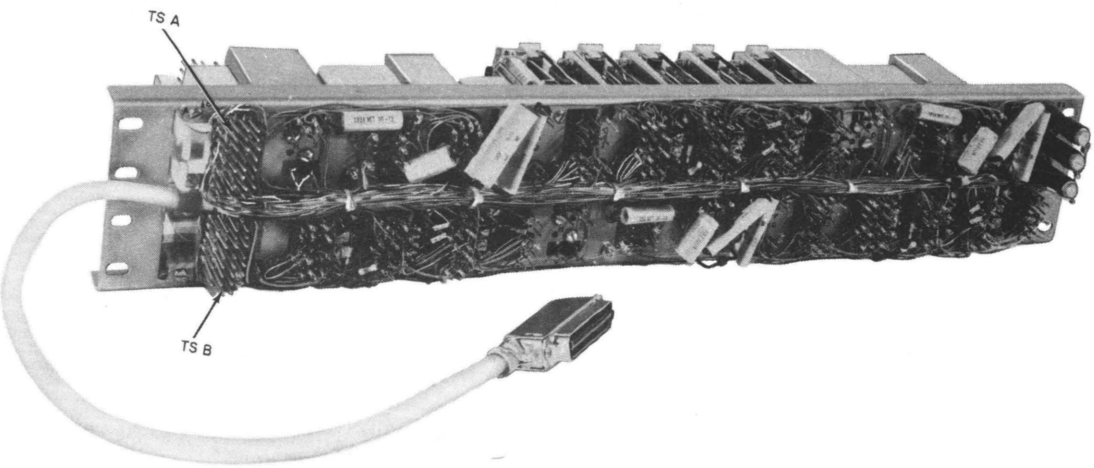


Fig. 2—J53050L Interconnecting Unit (Rear View)

insufficient). Can power a maximum of eight IUs.

Note: This rectifier meets acceptable noise requirements as explained under power supplies in Section 332-104-102. Other rectifiers may be used when specified by the local telephone company engineering department.

- ED-90273-70, Group 33, Adapter (two required), for mounting 19-inch rectifier on relay rack
- Adapter, 840573612 (two required), for mounting J53050L IU for 770 and 812A PBX cabinets
- ED-92868-70, Group G3, Adapter (two required) and Adapter, 840573638, (two required) for KS-15620, List 23 power supply in the 770 and 812A PBX cabinets
- KS-14532 Power Cord (or equivalent)

  List 1—10 ft.

  List 2—2 ft.

  List 3—15 ft.

  List 4—20 ft.

  List 5—25 ft.
- Cable, Connector, A25B
- Cable, Wiring, D Inside, 6 pair or equivalent (for cabling tip and ring connections from IU to PBX)
- Block, Connecting, 66M1-50 (Fig. 3)

Note: Other type blocks may be used when specified by local supervision.

- Clip, Bridging, B (25 per pkg).

DESIGN FEATURES

- 4-inch by 23-inch panel, mounts on a standard relay rack.
- Three circuits per unit.
- Provides D4A terminal strip for T and R connections.
- Provides plug-ended cable for connections to the interface connecting block.
- Provides option strapping terminals.
- Maximum current drain per circuit is 0.267 ampere at 48 volts.
- Typical current drain for one circuit is 0.138 ampere at 48 volts.
- Return to cut-through mode when power is interrupted or lead CSP is open.

3. INSTALLATION

3.01 Locate the J53050L IU in an area free of dampness and excessive dust, with adequate room for access to front and rear of equipment. The J53050L IU typically mounts on a standard 23-inch relay rack or may be wall mounted in a 16-type apparatus mounting (or equivalent). Use existing rack space in PBX or equipment room if available.

3.02 The IU is inserted in the transmission path between the CO line and the PBX trunk circuit (Fig. 4). Terminate one end of the 6-pair IW cable of the D4A terminal strip (TS A) per Table A using wire-wrap tools. The other end of the cable is terminated depending on the PBX distributing frame at the access points where the CO lines are strapped to the PBX trunks involved. Where necessary, use a 66M1-50 connecting block as a tie point for the IW cable from the IU and the cross-connect wiring from the PBX equipment.

3.03 Mount the 66M1-50 interface connecting block within 25 feet of the J53050L IU. Use an A25B connector cable to extend the leads associated with the CPE to the interface block. Connect the connector cable to the plug on the J53050L IU and terminate the stub end on the interface block (on the telephone company side) according to the even count color code. Stencil circuit numbers and lead designations on interface block designation strip (see Fig. 3 and Table B).

3.04 Place proper option straps per Table C using wire-wrap tools and 24-gauge wire. Options Z and W are factory-wired. Z option is used when

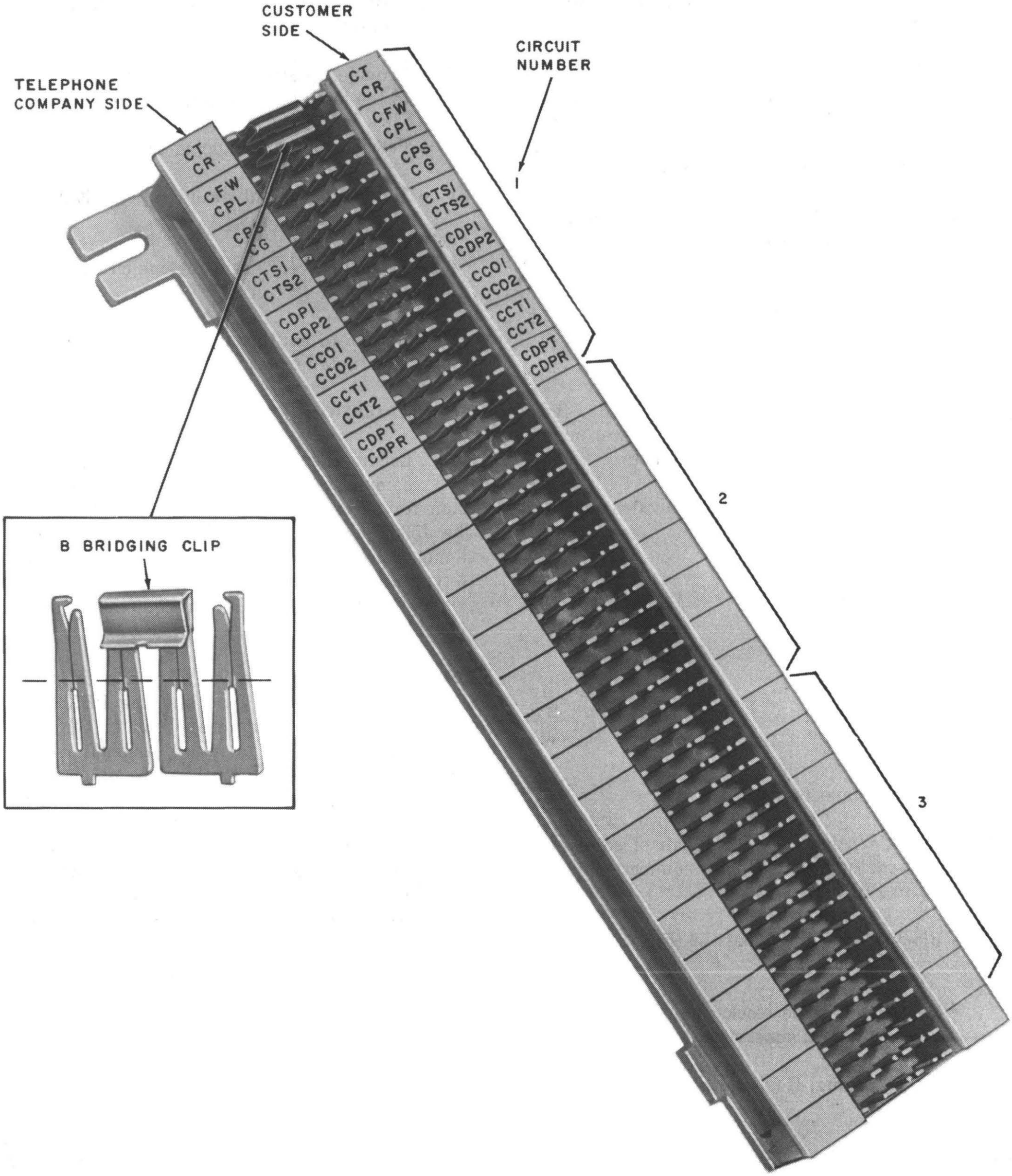


Fig. 3—66M1-50 Interface Connecting Block

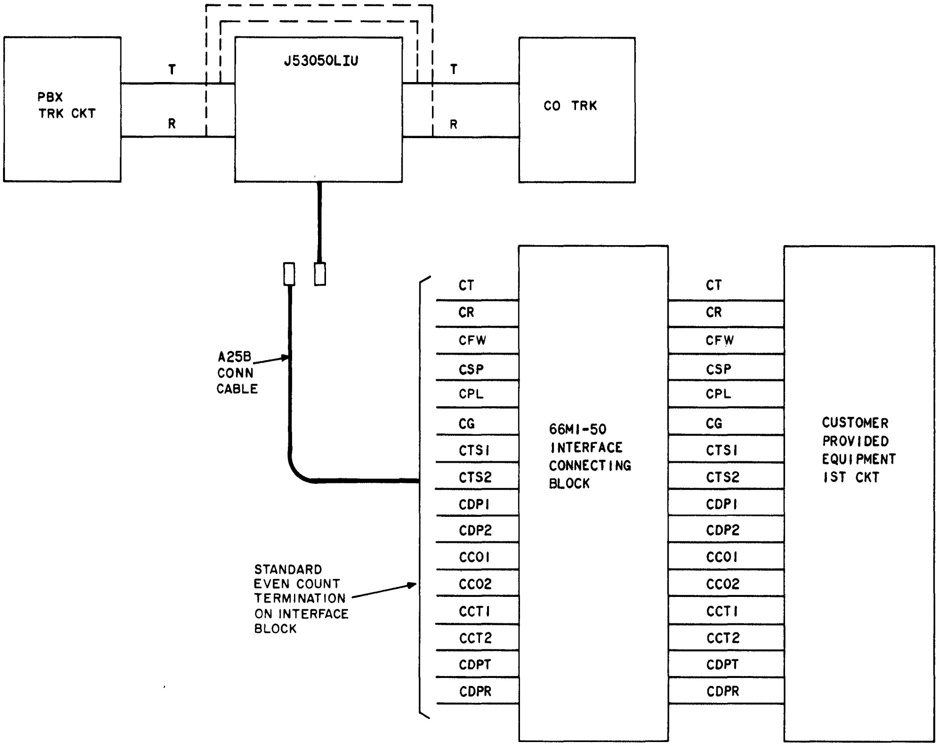


Fig. 4—Block Diagram—Voice Connecting Arrangement TSP

TSPZ1 is ordered. X and Y options are used when TSPXY is ordered. Check continuity of option straps after placing.

3.05 Battery and ground are obtained from the power supply for the PBX. The −48V lead may be connected to the PBX fuse panel to a separate 1-1/3 ampere fused circuit, or to a −48V terminal through a separate fuse. Use 22-gauge cross-connect wire twisted pair for power supply leads and connect −48 volts to terminal 31 and ground to terminal 11 on TS A using wire-wrap tool. (See Table D.)

3.06 If the PBX reserve power is insufficient to supply the J53050L IUs, provide a separate power unit of sufficient capacity for the number of IUs being installed. Connect power through a separately fused lead to each IU as above.

3.07 When using separate power units, the customer must provide a separately fused (15-ampere) 105- to 130-volt 60-Hz outlet for each power unit within reach of the power cords (see ordering guide for cord lengths). The outlet should not be under control of a wall switch. Refer to the appropriate section in Division 518 for proper grounding of power plants. Grounding of power unit and equipment is important to prevent damage from lightening surges on both the tip and ring and power connections.

3.08 Perform the operating tests shown in Part 5 after installation.

TABLE A

LINE CONNECTIONS

LINE NO.	LEAD DESIG	TS A TERM. NO.
1	T(CO)	48
	R(CO)	38
	T(PBX)	28
	R(PBX)	18
2	T(CO)	46
	R(CO)	36
	T(PBX)	26
	R(PBX)	16
3	T(CO)	44
	R(CO)	34
	T(PBX)	24
	R(PBX)	14

4. OPERATION (Fig. 5)

GENERAL

4.01 When a PBX station seizes a CO trunk for an outgoing call, the IU circuit, if in the split mode, will connect the PBX station and the CO line to the CPE. A transmission path is provided between the CPE and the PBX station. The transmission path between the PBX station and CO line is open. Line status and trunk seizure information is provided to the CPE. When the CPE receives the call information from the PBX station, it signals the IU to cut the PBX station through to the CO line (Z option). The station receives dial tone and the call is completed in the normal manner. When option X or Y is used, the CPE may seize the CO line and dial the destination code before requesting the IU to cut the station through to the CO line. When cut through, the CPE may signal the IU to revert back to the split mode and disconnect the call. The IU is normally held in the split mode by the CPE during idle condition but will revert to the cut-through mode during power failure permitting outgoing calls from the PBX in the normal manner until power is restored.

VOICE CONNECTING ARRANGEMENT TSPXY

Outgoing Call (Option X or Y)

4.02 During idle condition the trunk is normally split with relay SP operated by ground on lead CSP. When the PBX trunk is seized by a PBX station, the trunk places ground on the R lead. The A relay operates from this ground and operates P and B relays. B relay operated connects the secondary winding of A relay to lead T to return ground to the PBX CO trunk. The A relay will remain operated from loop current. B relay also connects resistor R1 and R2 to the T and R leads to indicate line status to the CPE. Contact M8 of B relay closes the CTS1 and CTS2 leads to indicate trunk seizures to the CPE and also prepares an operate path for GS relay. The PBX station now has a 2-way transmission path to the CPE through transformer T1 and the CT and CR leads.

CPE Seizes CO Line (Split Mode)

4.03 After receiving the administrative information and destination code from the PBX station, the CPE provides a momentary contact closure between the CG and CFW leads. GS relay operates from ground on the CFW lead and disconnects transformers T1 from the PBX CO trunk and holds the A relay operated. The GS relay also connects ground to the R lead to seize the CO line. The CO returns ground on the T lead to operate the H relay through its primary winding. H relay operated operates L relay to close the loop to the CO. The S relay operates from loop current and provides a lockup path for the L relay. L relay operated releases H relay and provides a closure on the CCO1 and CCO2 leads to indicate CO line seizures to the CPE. The CO line is now connected to the CPE through transformer T1, and CO dial tone is present on the CT and CR leads. The CPE may then pulse the destination code into the CO with TOUCH-TONE® signaling on the CT and CR leads (X option) or with rotary dial pulsing on the CPL lead (Y option, lead CPL closed to ground).

CPE Requests Station Cut-Through

4.04 After signaling is completed, the CPE requests PBX station cut-through by opening the contact closure on the CSP and CG leads. When ground is removed from the CSP lead, the SP relay and the GS relay will release. SP relay released connects the PBX station directly to the

TABLE B

CONNECTIONS FOR PLUG TO CPE

CIRCUIT NO.	LEAD DESIG*	CONN PIN NO.	CONN CABLE COLOR	66MI-50 INTERFACE CONN BLK ROW NO.
1	CT	26	W-BL	1
	CR	1	BL-W	2
	CFW	27	W-O	3
	CSP	2	O-W	4
	CPL	28	W-G	5
	CG	3	G-W	6
	CTS1	29	W-BR	7
	CTS2	4	BR-W	8
	CDP1	30	W-S	9
	CDP2	5	S-W	10
	CCO1	31	R-BL	11
	CCO2	6	BL-R	12
	CCT1	32	R-O	13
	CCT2	7	O-R	14
	CDPT	33	R-G	15
	CDPR	8	G-R	16
2	CT	34	R-BR	17
	CR	9	BR-R	18
	CFW	35	R-S	19
	CSP	10	S-R	20
	CPL	36	BK-BL	21
	CG	11	BL-BK	22
	CTS1	37	BK-O	23
	CTS2	12	O-BK	24
	CDP1	38	BK-G	25
	CDP2	13	G-BK	26
	CCO1	39	BK-BR	27
	CCO2	14	BR-BK	28
	CCT1	40	BK-S	29
	CCT2	15	S-BK	30
	CDPT	41	Y-BL	31
	CDPR	16	BL-Y	32

TABLE B (Cont)

CIRCUIT NO.	LEAD DESIG*	CONN PIN NO.	CONN CABLE COLOR	66MI-50 INTERFACE CONN BLK ROW NO.
3	CT	42	Y-O	33
	CR	17	O-Y	34
	CFW	43	Y-G	35
	CSP	18	G-Y	36
	CPL	44	Y-BR	37
	CG	19	BR-Y	38
	CTS1	45	Y-S	39
	CTS2	20	S-Y	40
	CDP1	46	V-BL	41
	CDP2	21	BL-V	42
	CCO1	47	V-O	43
	CCO2	22	O-V	44
	CCT1	48	V-G	45
	CCT2	23	G-V	46
	CDPT	49	V-BR	47
	CDPR	24	BR-V	48
	SPARE	50	V-S	49
		25	S-V	50

* Stencil lead designations on fanning strip.

TABLE C

OPTION TABLE

USOC CODE	FEATURE OR OPTION	OPTION	STRAP TERMINALS		
			CKT 1	CKT 2	CKT 3
TSPZ1 or TSPXY	SXS Type CO	V	TS B 18 to 28	TS B 16 to 26	TS B 14 to 24
	Panel, Crossbar or No. 1 ESS Type CO	W*	TS B 28 to 38	TS B 26 to 36	TS B 24 to 34
TSPXY	TOUCH-TONE® Dialing to CO from CPE with IU in Split Mode	X	TS A 27 to 37 TS B 17 to 27	TS A 25 to 35 TS B 15 to 25	TS A 23 to 33 TS B 12 to 23
	Rotary Dialing to CO from CPE with IU in Split Mode	Y		NONE†	
TSPZ1	Rotary or TOUCH-TONE Dialing to CO from PBX Station with IU in Cut-Through Mode	Z*	TS A 27 to 37 TS B 17 to 27 37 to 47	TS A 25 to 35 TS B 15 to 25 25 to 45	TS A 23 to 33 TS B 13 to 23 33 to 43

* Z and W options are factory-wired
† Customer provides this wiring option at the interface block.

TABLE D

POWER CONNECTIONS

−48V	TS A 31
GRD	TS A 11

CO line to remove the split condition and closes a break contact on the CCT1 and CCT2 leads to indicate to the CPE that the IU is cut through to the CO line. The SP relay also opens the PBX loop to release the A relay. The A relay released will release B relay which will release the P relay. The GS relay released disconnects transformer T1 from the CO line. While cut through, the CFW lead must be open so that the circuit can return to the split mode on disconnect or request by the CPE.

CPE Requests IU to Split After Cut-Through

4.05 When the CPE desires to have the trunk split after cut-through, it closes the contact on leads CSP and CG. Ground on lead CSP operates SP relay through CR2. The SP relay operated opens the loop to the CO and the S relay releases. The SP relay opens the CCT1 and CCT2 leads to indicate to the CPE that the trunk is split. SP relay also connects the PBX CO trunk to the A relay and primary winding of transformer T1 to maintain battery on the PBX trunk and prevent it from releasing. The A relay operates from loop current and operates the B and P relays. B relay operated maintains continuity on the T lead with contact M1 after L relay releases. The PBX station is now connected to the CPE through transformer T1 and the CT and CR leads. S relay previously released opens its M3 contact to release L relay. Contact M7 of L relay opens to indicate to the CPE that the CP line is released.

Disconnect After Cut-Through

4.06 When a call is established and the station is cut through, the L and S relays are operated. When the PBX station or CO disconnects and opens the loop, the S relay releases and causes L relay to release. L relay released opens contact M7 on the CCO1 and CCO2 leads to indicate that

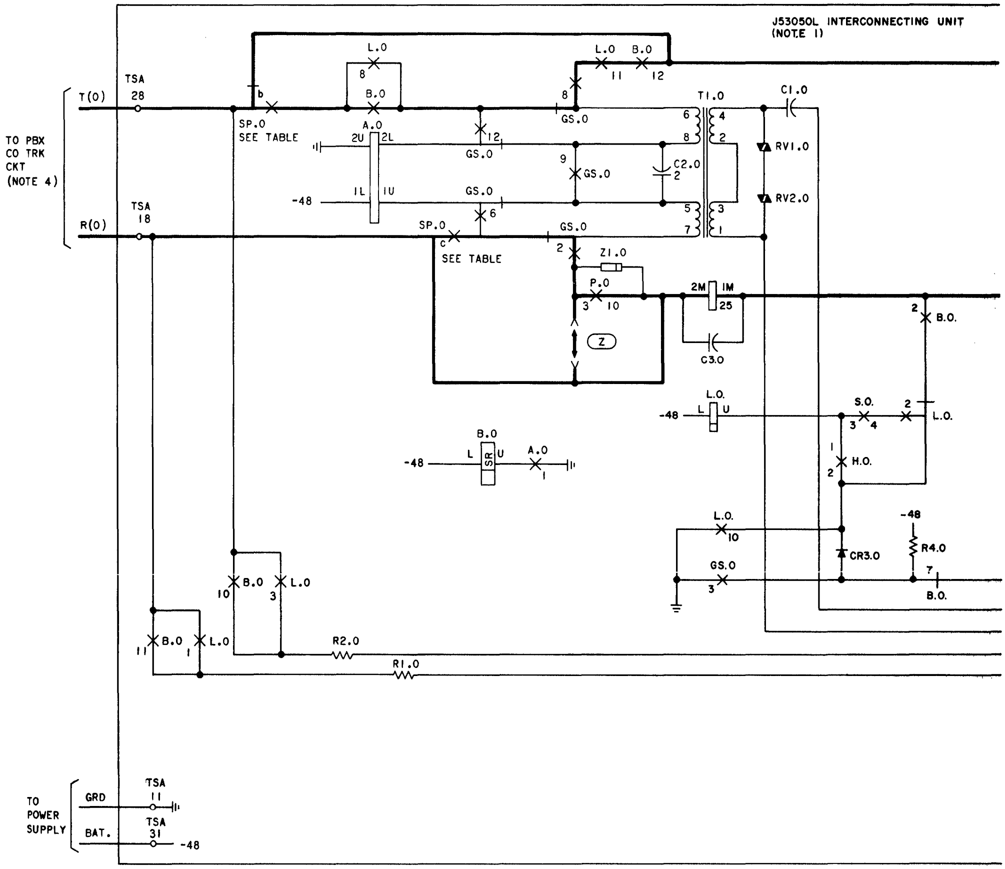


TABLE (SEE NOTE 1)

CONT DESIG	CKT 0	CKT 1	CKT 2
a	1	12	1
b	2	11	2
c	3	10	3
d	4	9	4
e	5	8	5

Fig. 5—Schematic Diagram-Voice Connecting Arrangement TSP (Sheet 1)

the CO line is disconnected. If the CPE provides a contact closure on the CSP and CG leads, the SP relay will operate to split the trunk and the IU is then idle. If the CPE does not provide a contact closure on the CSP and CG leads, the IU will remain in the cut-through mode in the idle condition. In this case, if the PBX CO trunk is seized, it will be connected directly to the CO line instead of the CPE. If the CO disconnects first and the PBX station remains off-hook, it will receive PBX dial tone.

CPE Fails to Open Contact on the CFW Lead After Cut-Through

4.07 When the CPE provides a contact closure on the CSP and CG leads to split the trunk and has not removed the CO seizure closure on

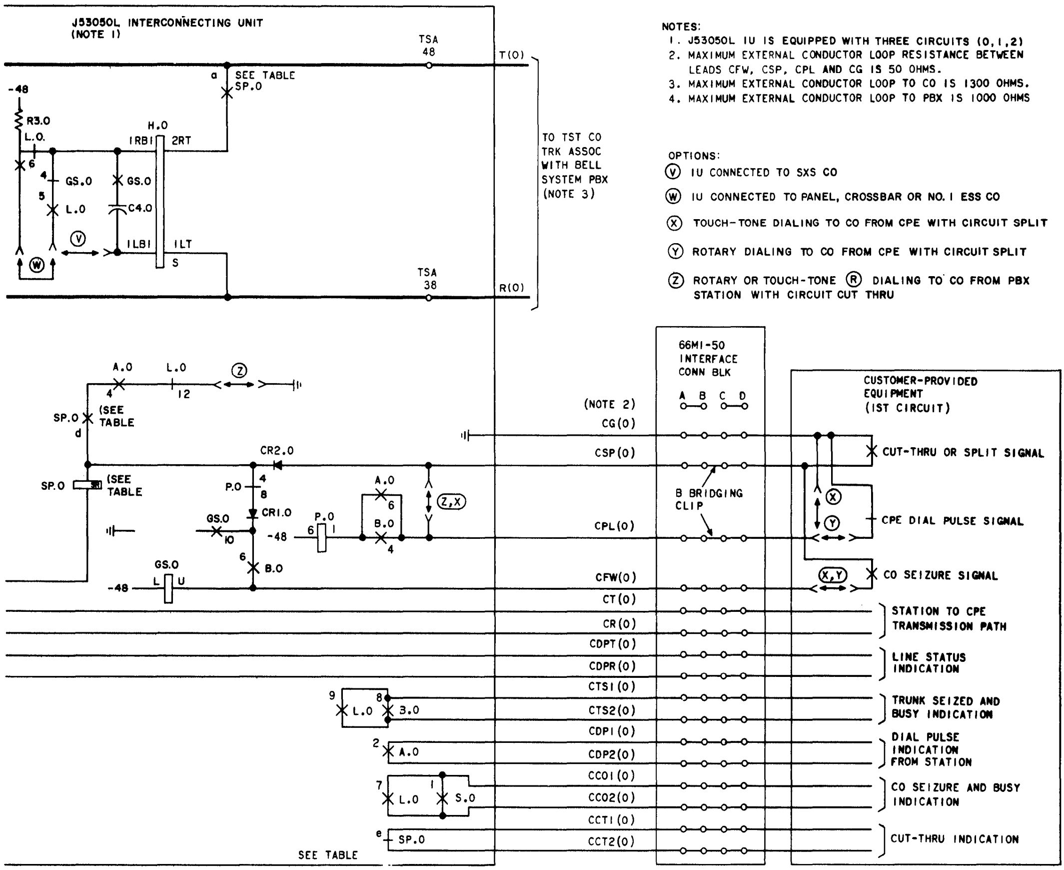


Fig. 5—Schematic Diagram-Voice Connecting Arrangement TSP (Sheet 2)

the CFW and CSP leads, the GS relay operates from ground on the CSP lead and connects ground to resistor R4 through contact B7 of the unoperated B relay. This will shunt the winding of SP relay. The CPE contact closure on the CSP and CG leads cannot operate the SP relay and the IU will remain cut through. If the PBX station or CO disconnects, the circuit will revert to the idle condition and remain cut through until the contact closure on the CFW lead is removed.

VOICE CONNECTING ARRANGEMENT TSPZ1

Outgoing Call (Z Option)

4.08 The sequence of events for trunk seizure is the same as in 4.03. After receiving the administrative information from the PBX station, the CPE opens the contact closure on the CSP and CG leads, and the P relay releases (fast release). The P relay released operates the GS relay from ground through diode CR1. The GS relay operated connects ground to the R lead to the CO, and the CO returns ground on the T lead to operate the H relay and GS relay locks up to ground through its own contact M10. The H relay operated closes contact M1 to operate L relay from ground. The L relay operated closes contact M11 to connect the primary winding of T1 to the CO line, opens the hold path to the SP relay, and removes ground from the R lead. S relay operates from CO line current and closes contact M1 on the CCO1 and CCO2 leads to indicate CO line seizure to the CPE. The S relay also provides a lock up path for the L relay through its M3 contact. The SP relay released cuts through the PBX station to the CO line and provides a closure on the CCT1 and CCT2 leads to the CPE to indicate the split has been removed. The SP relay released causes the A relay to release. The A relay releases B relay. B relay released causes the GS and P relays to release. The PBX station receives CO dial tone and may proceed to dial. If the CPE should request the IU to split after cut-through, the sequence of events would be the same as in 4.05.

Power Failure and CPE Out of Service

4.09 When the trunk is split and a power failure occurs or the CPE is out of service and the CSP and CG leads are open, the SP relay will release. The SP relay released connects the T and R leads from the PBX CO trunk circuit directly to the CO line. This will permit outgoing calls during the power failure condition. A request signal from the CPE to split the trunk will have no effect until power is restored. If a call is in progress and power is restored and the CSP and CG leads are closed, the SP relay will operate causing the CO to disconnect and the PBX station will receive PBX dial tone.

4.10 ***Interface Lead Designations and Functions:***

(1) The CT and CR leads provide a transmission and TOUCH-TONE® signaling path from the CPE to either the PBX station or the CO. Excessive transmission levels will be limited by RV1 and RV2 across T1.

(2) The CFW and CG leads provide a ground start signal to the IU when requested by the CPE. The CPE contact closure on these leads is normally open and is closed when the CPE desires to seize the CO line in the split mode. This contact must close and then open after cut-through. If this contact is not opened after cut-through, the circuit will remain cut through.

(3) The CSP and CG leads provide the split or cut-through signal from the CPE. The CPE contact closure on these leads is a normally open contact and is closed in the idle or split condition and opened to cause cut-through.

(4) The CPL and CG leads are used for rotary dialing from CPE to CO.

(5) The CTS1 and CTS2 leads provide a contact closure to the CPE to indicate that the PBX CO trunk has been seized and is busy.

(6) The CDP1 and CDP2 leads provide a contact closure to the CPE to indicate dial pulsing from the PBX station while in the split mode.

(7) The CCO1 and CCO2 leads provide a contact closure to the CPE to indicate that the associated CO line has been seized and current is flowing in the loop to the CO.

(8) The CCT1 and CCT2 leads provide a contact closure to the CPE to indicate that the PBX CO trunk has been cut through and the split condition is removed.

(9) The CDPT and CDPR leads provide line status information (busy, dial pulsing, TOUCH-TONE® signaling, etc) when the circuit is in the split or cut-through condition.

5. MAINTENANCE

5.01 When trouble is reported, check for blown fuses, loose or broken connection.

5.02 Precautions should be taken when performing tests to avoid affecting service to the customer. Local instructions should be followed with reference to notifying the customer before performing tests.

5.03 Open the 16 leads to the circuit under test by removing the B bridging clips at the 66M1-50 interface connecting block. Make all test connections on the telephone company side of the interface connecting block.

5.04 ***Tests—J53050L Interconnecting Unit:*** (See Fig. 6)

(a) Outgoing call—If necessary, arrange PBX so that trunk under test will be first choice. From a PBX station, dial the access code for the one-way outgoing trunk. Dial tone should be received from the CO. If not, check trunk circuit and connections to IU. If dial tone is received, dial 1000-Hz test tone and verify satisfactory transmission. Check that continuity is present between leads CCT1 and CCT2 and leads CCO1 and CCO2 at the interface connecting block.

(b) Restricted call—Strap leads CSP and CG at the interface block. SP relay will operate transferring the PBX CO trunk and 1013A hand test set from the CO line to the CT and CR leads. Continuity should be present between leads CDP1 and CDP2 and leads CTS1 and CTS2.

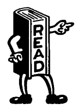
(c) CO seizure—Strap leads CFW and CG at the interface block. GS relay will operate to ground the ring side of the CO line, and CO dial tone will be heard on the CT and CR leads at the interface block. Continuity should be present between leads CCO1 and CCO2 at the interface block and 48V line voltage present on the CDPT and CDPR leads. If CPE is using rotary dialing (option Y), momentarily strap leads CPL and CG. P relay will operate to break dial tone and CO dial tone will no longer be heard on the CT and CR leads. If CPE is using TOUCH-TONE dialing (option X), tests can be made on the CR and CT leads to see if tone address signals are being passed from the CPE to the CO. If dialing to the CO from the PBX station with the IU in the cut-through mode (option Z), remove strap between the CSP and CG leads. The PBX CO trunk is connected to the CO line. Leads CCT1 and CCT2 will provide a closure to the CPE to indicate the circuit is in the cut-through mode.

5.05 If tests are satisfactory, remove all test connections to return the circuit to normal and replace the B bridging clips on the 66M1-50 interface connecting block.

5.06 When trouble is suspected in the J53050L IU, isolate the trouble and clear it using standard maintenance procedures.

5.07 When trouble is indicated in the transmission path to CO or PBX, use normal practices to perform circuit transmission tests.

5.08 When in the judgment of the repairman the trouble is located in the CPE, the Repair Service Bureau should be notified so that proper maintenance of service charge billing can be initiated as outlined in Section 660-101-312 entitled Maintenance of Service Charge on Services With Customer-Provided Equipment (CPE).



Do not attempt any tests or repairs on the CPE.

6. CONNECTIONS

6.01 For connecting information refer to Fig. 4 and Tables A, B, and D.

6.02 The CPE should always have CPL connected to CG in the idle condition.

6.03 The following are typical one-way outgoing CO trunk circuits.

PBX	TRUNK CIRCUIT
701 and 740 PBX	SD-5E001-01 and SD-65657-01
756 PBX	SD-65752-01
770 PBX	SD-1E340-01
800A PBX	SD-1E013-01 and SD-1E013-02 SD-1E015-01 and SD-1E015-02
801A PBX	SD-1E306-01
805A PBX	SD-1E213-01
812A PBX	SD-1E402-01

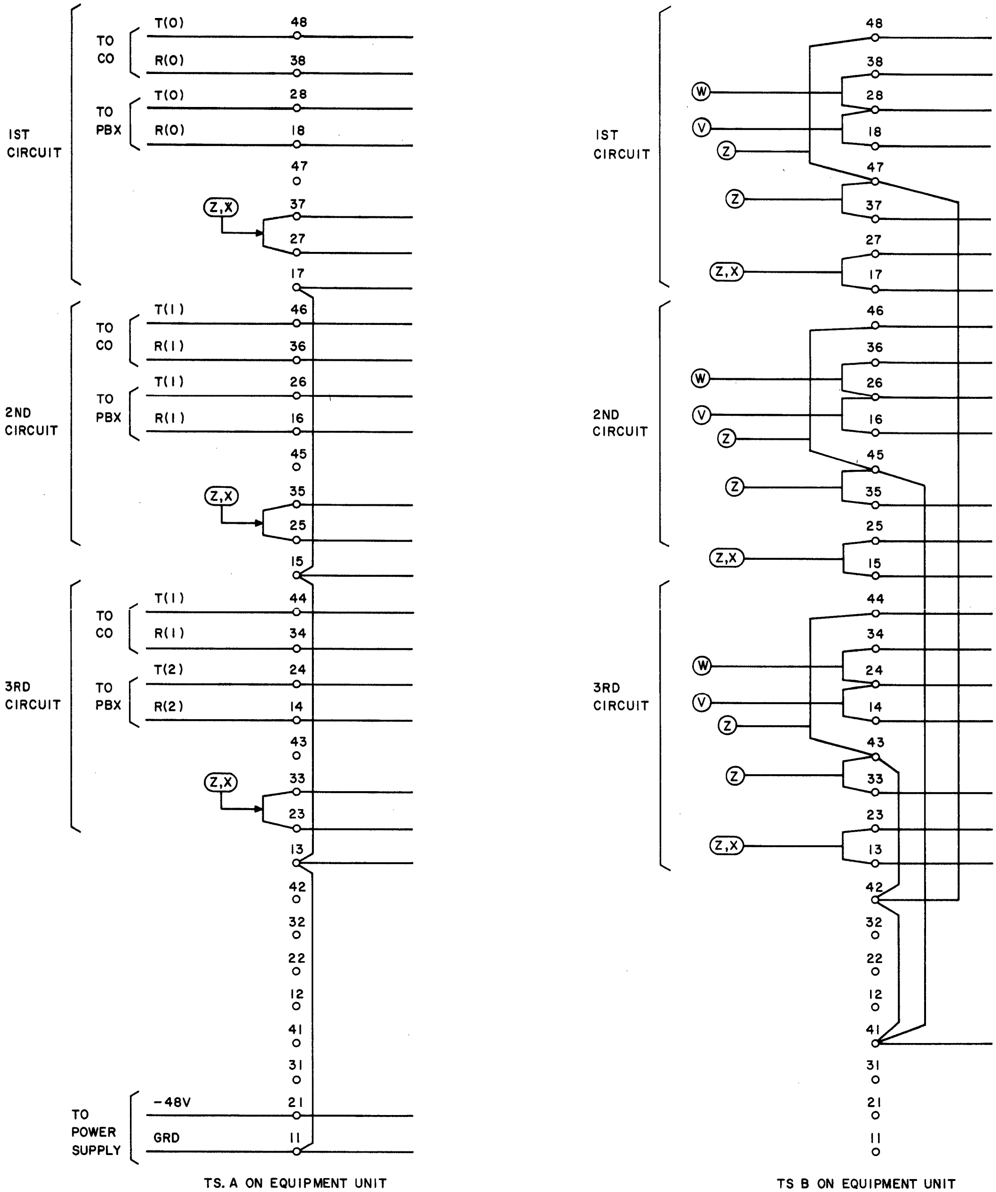


Fig. 6—Voice Connecting Arrangement TSPXY and TSPZ1—Connections

1000A DATA COUPLER
DESCRIPTION, INSTALLATION, MAINTENANCE, AND TESTS

CONTENTS PAGE

1. GENERAL

1.01 This section contains information required for installing and maintaining 1000A data coupler (Fig. 1). Detailed information is contained in SD- and CD-1D205-01.

1.02 This section is reissued to:

- Include information concerning the 503C-61 and 2503C-61 telephone sets.
- Delete the information in the test procedures dealing specifically with a VTVM.

1.03 The 1000A data coupler is a line-powered unit which permits customer-provided data apparatus to be connected to the switched telecommunications network for data and voice communications. The unit plus an associated telephone set provides the data access arrangement (DAA) as described in appropriate tariffs. The uniform service order code (USOC) for the coupler is CDT.

1.04 The coupler has the following provisions:

- Restricts customer data signals automatically to a prescribed maximum signal power
- Permits alternate data and voice transmission
- Protects customer from metallic and longitudinal line surges in excess of 50 volts
- Protects telephone company personnel and equipment from hazardous voltages applied from the customer-provided equipment
- Provides longitudinal isolation of the telephone plant from customer-provided equipment
- 2-wire bi-directional operation
- Test circuitry for manually operated remote testing.

1.05 The data coupler provides the interface for connecting the customer equipment directly to local loop facilities, key telephone system station lines, or to PBX station lines.

1.06 The service offering in which the data coupler is used provides the customer with essentially the same end-to-end transmission performance characteristics as are provided in DATA-PHONE® service. Because the customer apparatus over which the Bell System has no control may contribute significantly to error performance, the Bell System cannot assume responsibility for the accuracy of the transmitted data. The end-to-end facilities, including the local loop, will be engineered and maintained to the equivalent DATA-PHONE service requirements. These requirements are specified in Section 314-205-501 for local loops, and Section 314-205-500 for the DDD network.

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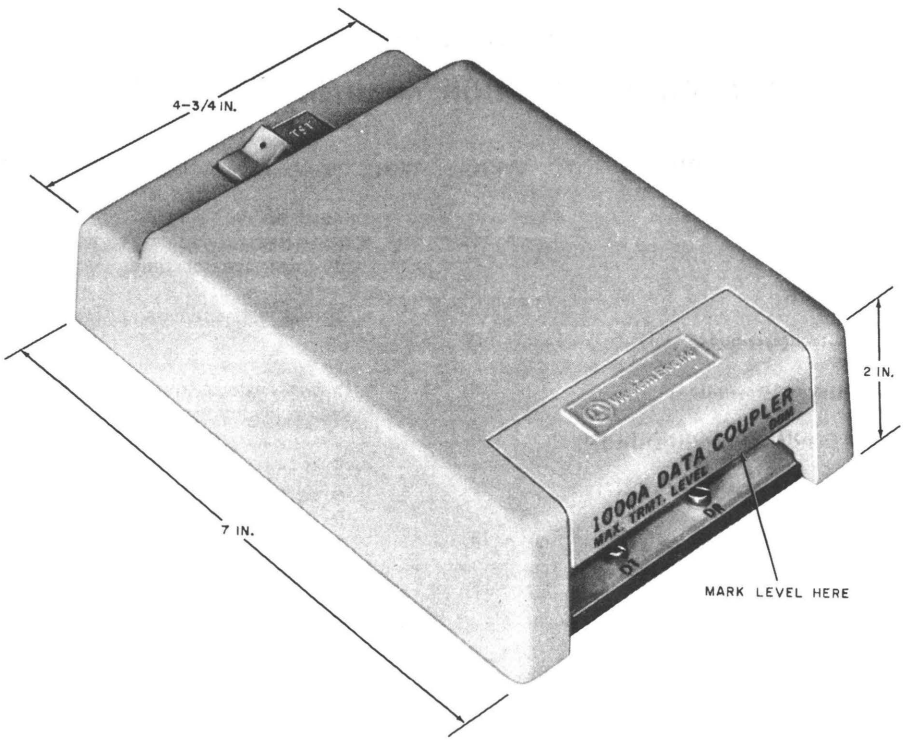


Fig. 1— ♦1000A Data Coupler♦

2. DESCRIPTION

A. Physical Description

2.01 The data coupler is a wall-mounted unit which weighs approximately 1-1/2 pounds and is 4-3/4 inches wide, 7 inches high, and 2 inches deep.

2.02 The coupler consists of a printed circuit pack mounted on a dark gray plastic base, enclosed by a light gray plastic cover assembly. Two screw terminals are provided under the hinged portion of the cover for the interface connection to the customer apparatus or equipment. Two additional screw terminals are provided on the circuit pack for connection to the associated telephone apparatus. Two holes are provided in the base for mounting the coupler on a wall or other vertical surface.

2.03 The data coupler will operate properly with all standard central offices over a range of 20° to 120°F and with a relative humidity of up to 95 percent.

2.04 A test key is provided at the top of the coupler for testing the unit and line. The test oscillator, in conjunction with the level control circuit, will hold its output to ± 1 dBm over the temperature range of 20° to 120°F.

2.05 Terminals located on the printed circuit pack are strapped by the installer for adjusting the operation level of the data coupler.

2.06 ♦A 502A/B or 558F telephone set, hereafter referred to as tel set, is available with the coupler as a standard option. A 503C-61 tel set is available as an option which must be specified.

2.07 The 503C-61 tel set provides the customer with a mode indication of the telephone line (voice or data) and the means to audibly monitor the data transmission. The TOUCH-TONE® version of the 503C-61 tel set is coded 2503C-61. Both sets are in light gray housing; however, they may be enclosed in standard 500- or 2500-type housings if another color is required. These sets are intended for use on individual lines only.

B. Functional Description

2.08 *General:* The data coupler is a bi-directional, network protective unit designed to interface a customer-provided data modem. The coupler protects the telephone network by limiting the total customer data signal power to a prescribed maximum limit. To determine when the limiting function is required, the coupler continuously monitors the output level of the customer equipment. Whenever the total signal power averaged over any 3-second interval exceeds the maximum limit, a limiting circuit is activated and a loss is automatically inserted in the transmission path to attenuate the signal to the prescribed limit. The loss inserted in the transmission path will attenuate the customer signals in both directions of transmission, and the distortion introduced is negligible. The limiting circuit is activated as long as the rms output from the customer equipment exceeds the permissible level.

2.09 The customer must be informed at the time the coupler is installed of the prescribed maximum permissible signal power output for his data equipment. The maximum output level may vary between 0 and −10 dBm, in 1-dB steps, depending upon the 1000-Hz loss of the local loop including the nominal 2-dB insertion loss presented by the coupler. The output level of the customer-provided equipment is the power measured at the customer interface into a 600-ohm resistive load.

> ***Note:*** The prescribed maximum limit must be marked on the data coupler at the time of installation.

2.10 The telephone line interface of the data coupler is a standard, common battery loop-current termination that can be associated with standard network control signaling arrangements. The network control functions may be provided for the coupler by an associated tel set or key telephone equipment. The associated apparatus is used to manually originate, answer, and disconnect calls, and to provide the data key through which the coupler connects to the telephone line. The data key may be an exclusion switch on the telephone set or a designated key associated with the key telephone equipment, and is used to transfer between the talk and data modes of operation. Either the coupler or the associated network controlling apparatus must always be on-line to hold the connection.

2.11 The data coupler provides two modes of operation: a data mode and a test mode. A functional diagram of the coupler is shown in Fig. 2. The following describes the interconnecting effect between each functional block within the two operating modes.

2.12 *Data Mode:* In response to incoming ringing or the desire to initiate a call, the customer must establish the connection using the associated apparatus. When ready to transmit or receive data, the external data key is operated to place the coupler in the data mode.

READ

When the exclusion key on an associated telephone set is used as the data key, the telephone handset must remain off-hook when the coupler is in the data or test mode.

2.13 A transformer couples the data signals to the telephone line and provides a protective function in both directions (ie, hazardous voltages, surge protection, and longitudinal isolation). The signals are coupled through one of two secondary windings on the transformer.

2.14 A level-adjusting network is connected across the signal output and produces an input to the buffer amplifier whenever the signal exceeds the preset level. An input to the amplifier activates the limiting circuit of the coupler.

2.15 The step-up transformer increases the output of the amplifier to drive the full-wave rectifier and rms network. The rectifier and network develop a voltage proportional to the rms value of the signal. The rms voltage is averaged over any 3-second interval by the integrator. If the average exceeds the permissible level, the output of the integrator activates the current amplifier, which in turn conducts current through the other secondary winding of the coupling transformer and a series-connected thermistor.

2.16 The line signal is the difference of the signals on the two opposing secondary windings.

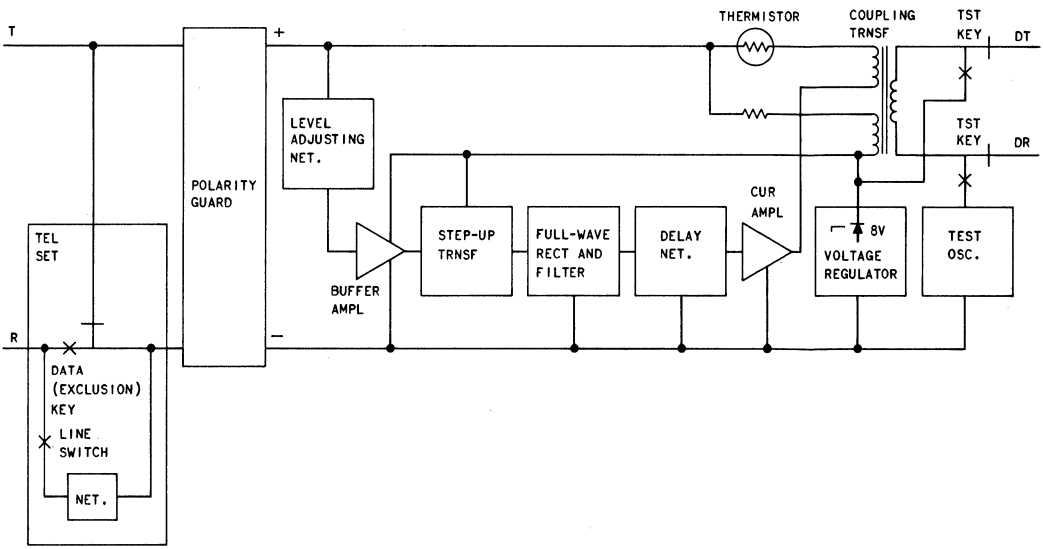


Fig. 2—1000A Data Coupler, Functional Schematic

When the limiting function is not activated, the thermistor permits very little signal to flow through the second winding. As the current amplifier conducts, the thermistor heats up and decreases in resistance. This permits the opposing signal current to flow through the winding. The overall line current begins to reduce and, in turn, the signal level decreases. The signal is thus reduced to a level which is just sufficient to maintain the limiting circuit at the threshold voltage.

2.17 At the completion of data transmission, restoring the data key returns the operation to the talk mode (the coupler returns to an idle state).

2.18 ***Test Mode:*** A test circuit provides the means for applying a tone to the line through the coupling transformer. This permits testing of the data coupler and/or the local loop. The coupler may be remotely tested from the serving central office or tested locally on customer premises. The test circuit consists of a tone oscillator and a TST key.

2.19 The tone is applied to the line when the TST key is operated and the coupler is connected to the telephone line. The tone is a 2800-Hz signal with a constant level that exceeds the maximum power level allowed. This causes the limiting circuit to activate whenever the coupler is in the test mode. Measuring the oscillator output provides a reasonable check of the operating condition of the data coupler and local loop.

READ

Accidental or intentional operation of the TST key while transmitting data will interrupt the data signals.

2.20 Restoring the TST key removes the test oscillator from the circuit and returns the coupler to the data mode.

3. INSTALLATION AND CONNECTIONS

3.01 The data coupler may be used with various types of central office lines, key telephone systems, or PBX lines that provide access to the DDD network facilities.

3.02 Verify that the assigned loop facilities meet the transmission requirements for the specific data service before proceeding with the installation.

The general requirements for DAA are covered in Section 314-205-501. The requirements for the 1000A data coupler are as follows:

(a) ***Loop Loss:*** Maximum 1000-Hz insertion loss is 10 dB excluding the coupler.

(b) ***Set Classification:*** The installation measurements to be made should have been determined by the design engineer from the type of data modem information provided by the customer and specified on the service order. When the modem type cannot be determined, high-speed requirements should be specified. When type of modem can be obtained from customer, the following guidelines should be used:

(1) For all analog modems, high-speed requirements should be specified.

(2) For all other modems, requirements based on speed of modem (same as for DATA-PHONE service) should be specified.

(3) If the type of modem is known to be similar to a Bell System DATA-PHONE data set, use the requirements for that particular data set.

3.03 When test or demonstration calls are made at the time of installation, refer to Section 010-250-001 for proper procedure for crediting charges.

3.04 The installation of the coupler should comply with general practices to ensure an orderly station arrangement.

3.05 The location of the coupler shall be determined by the following conditions:

- The coupler should normally be mounted vertically on the wall or other smooth vertical surface.

- The coupler must be within range of the interface cord supplied by the customer.

- The location of the coupler should provide easy access for operation of the test key by the customer attendant.

Note: In general, there is no restriction on the length of the customer interface cord providing the transmission path between the data apparatus and the coupler. The Bell System responsibility terminates at the interface terminals of the coupler. The inside wiring connection between the coupler and the telephone line connecting block is restricted only to the presentation of a neat station appearance.

3.06 The data key or associated telephone set should be positioned so the operator can easily operate the key and the controls on the customer apparatus.

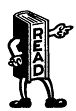
3.07 ▶Install the coupler on the wall or vertical surface as follows:

(1) Remove the tape securing the cover to the base pan. Retain the screw envelope that is secured under the tape.

(2) Remove the snap-off cover assembly from the coupler and lift up the circuit board from the base pan.

(3) Position the base pan vertically against the wall with the keyhole slot end up and at least 3 inches above the top of the baseboard or other obstruction which will be below the unit. Secure the base with two screws.

(4) Route the inside wiring through the slots and pins on the base as shown in Fig. 3. Attach the circuit pack to the base using the four screws provided. Connect the two leads to terminals T and R on the printed wiring board.◀



Care should be taken not to overtighten screw terminals or stripping will result.

Note: Do not replace cover at this time.

3.08 ▶When a tel set is associated with the coupler, the exclusion key leads in the set must be rewired to provide the necessary control functions of the data key. Typical wiring diagrams in Fig. 4, 5, and 6, show rewiring and connections required when using the 502A/B, 503C, or 558F tel set. The rewiring permits the tel set to control the line. Location of the terminals on the coupler is shown in Fig. 3.

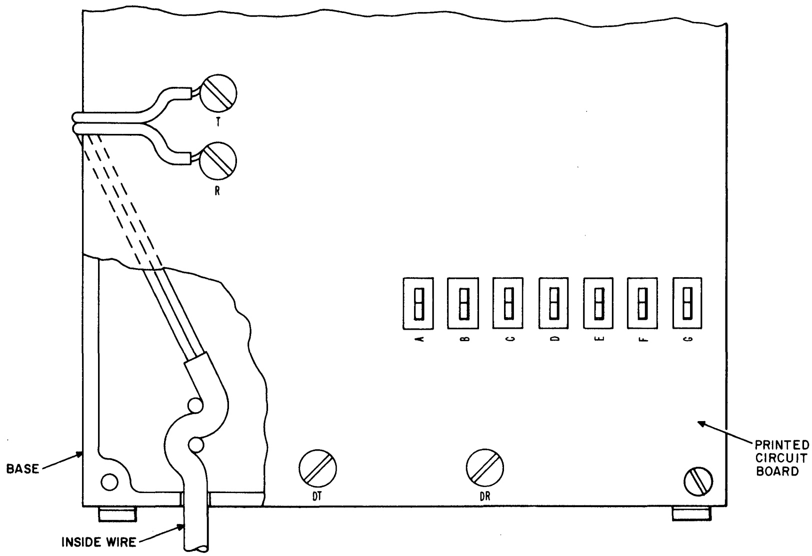


Fig. 3—Route of Station Wiring and Location of Terminals

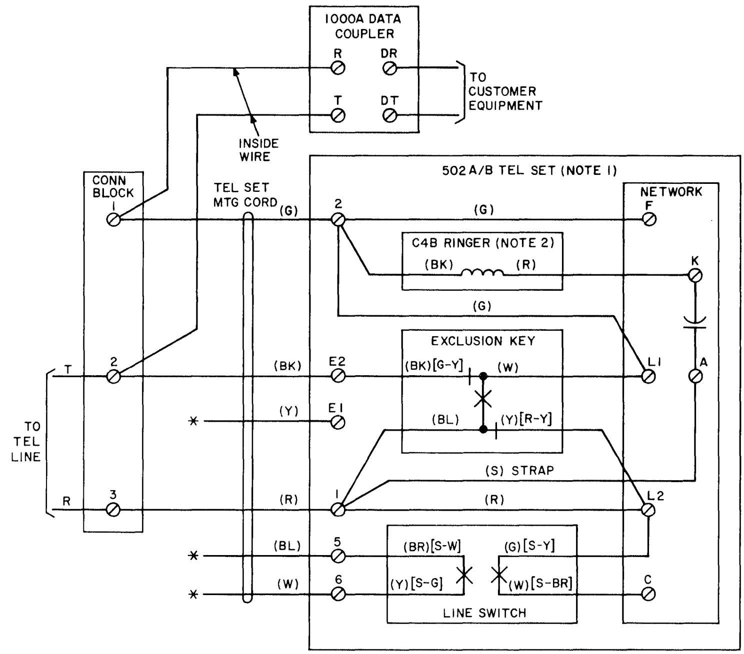
3.09 A separate connecting block must be installed with the coupler when the 503C-type tel set is used to furnish a telephone mode indication. A connection is made between a set of the exclusion key contacts in the tel set and two terminals on the connecting block. The exclusion key contacts are closed when the line is connected to the tel set. The customer may monitor the terminals on the connecting block and obtain an indication of the mode in which the tel set is operating (closed—voice, open—data).◀

3.10 For key telephone system application, an auxiliary relay is required to switch the line to the coupler. A line key on a key telephone set is used as the data key to operate and hold the auxiliary relay. The telephone handset must be off-hook during a data call. A partial schematic of a typical key telephone arrangement is shown in Fig. 7. Use Table A with Fig. 7 for the required connections to the key telephone units that may be used as line circuits and auxiliary relays for a key telephone system.

> ***Note:*** The 1A telephone set wiring will differ from that shown in Fig. 7. The SG lead replaces the A1 lead and is used to operate the line circuit and auxiliary relays. The set must also be wired for station busy lamp. Refer to appropriate section for the tel set being used. A 15D KTU may be used with a 1A system for incoming call detection.

3.11 When the connections are completed, the data coupler must be adjusted to limit the customer signal power to a level which will not exceed a −12 dBm signal level at the serving central office. To arrive at the maximum allowable customer level, perform the insertion loss test and the impedance-matching test as outlined in Part 4.

3.12 When the two tests are completed, refer to Table B which shows the level option terminals (A through G) that may be strapped for a particular installation. The total loss of the loop and coupler measured in the insertion loss test determines the ***row*** to use in Table B under the INSERTION LOSS column. The value obtained from the impedance-matching test determines the ***column*** to use under LIMITER OPTION TERMINALS in Table B. The intersection of the ***row*** and ***column***



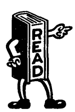
* TAPE AND STORE
( ) CURRENT COLOR CODE
[ ] MD COLOR CODE

NOTES:

1. REWIRE TEL SET EXCLUSION KEY AS FOLLOWS:
   (a) REMOVE (BL) LEAD FROM TERM. E1 AND CONNECT TO TERM. 1.
   (b) REMOVE (W) LEAD FROM TERM. E2 AND CONNECT TO NET. TERM. L1
   (c) REMOVE (BK) LEAD FROM NET. TERM. L1 AND CONNECT TO TERM. E2.
2. IF C4A RINGER IS USED, REMOVE (S) STRAP BETWEEN TERM. 1 AND NET. TERM. A AND WIRE RINGER AS FOLLOWS:
   (a) CONNECT (BK) LEAD TO TERM. 2.
   (b) CONNECT (R) LEAD TO TERM. 1.
   (c) CONNECT (S) LEAD TO NET. TERM. K
   (d) CONNECT (S-R) LEAD TO NET. TERM. A

Fig. 4—Typical Connections for 1000A Data Coupler With 502A/B Tel Set

determines the proper strapping for the option terminals.



Tools such as a 714B, 756B2, etc, should not be used to install the straps or damage to the option terminals may result.

3.13 The locations of the level option terminals are shown in Fig. 3. Cut a piece of insulated, 24-gauge, solid wire to fit between appropriate terminals. Strip the insulation from the wire ends and, using long-nose pliers, firmly seat the ends into the terminals to ensure good contact. Example of strapping: when the measured combined loss of the loop and coupler is 7.8 dB and a measured value of ➧ −4.2 ➧ dBm is obtained from the impedance-matching test, one strap should be placed between terminals B and C and another strap between terminals D and G. Do not permit the bare wire portion of the straps to touch any other terminal.

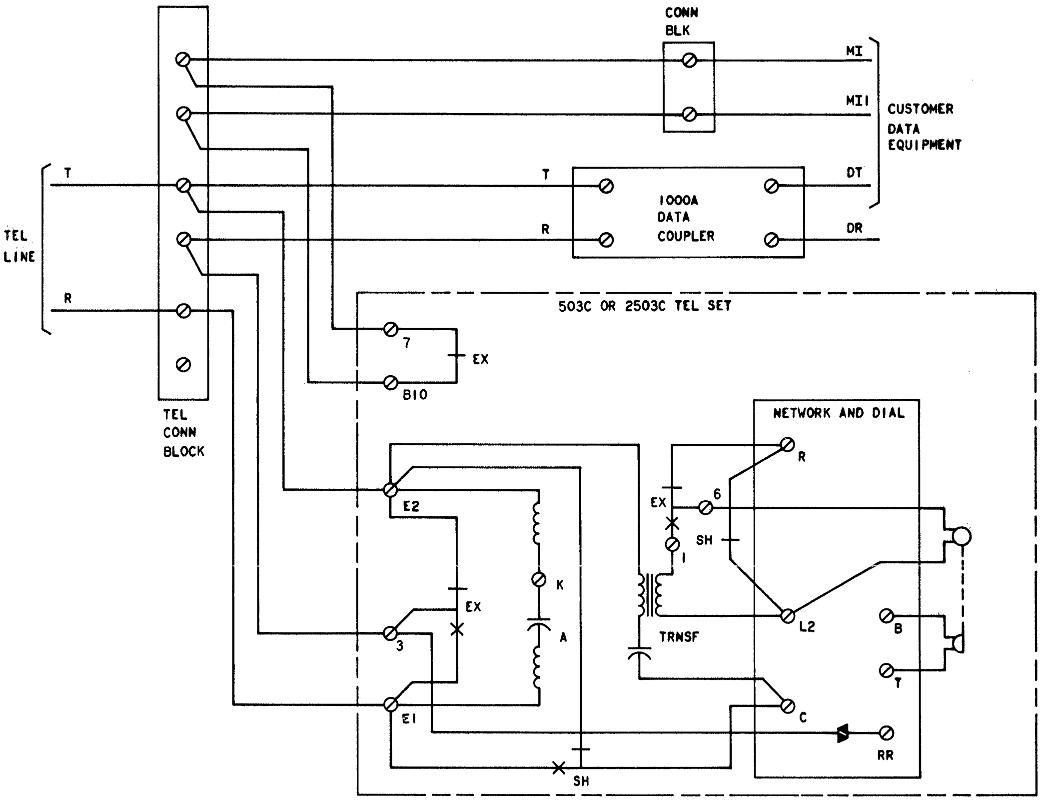
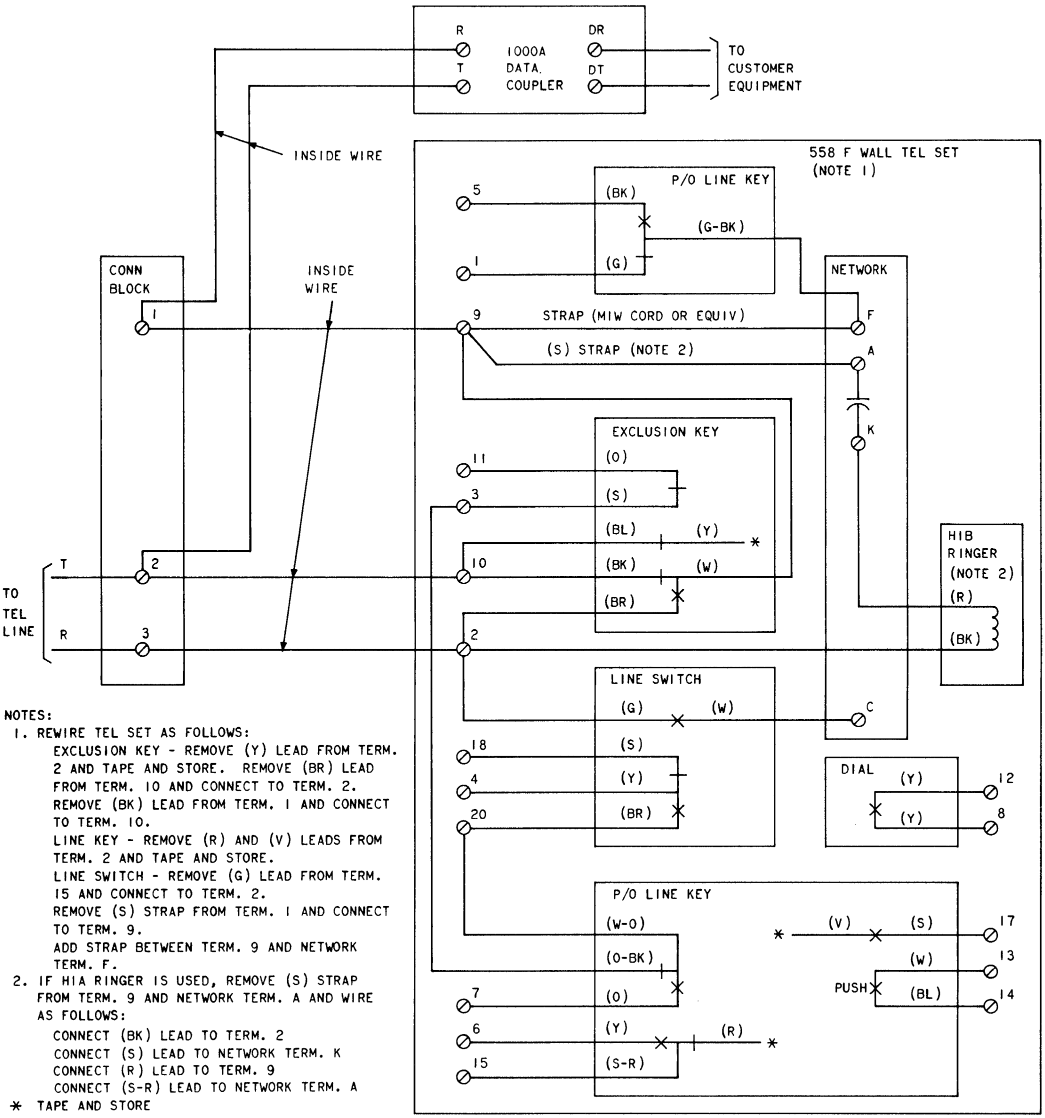


Fig. 5—Typical Connections for 1000A Data Coupler With 503C or 2503C Tel Set



NOTES:

1. REWIRE TEL SET AS FOLLOWS:
   EXCLUSION KEY - REMOVE (Y) LEAD FROM TERM. 2 AND TAPE AND STORE. REMOVE (BR) LEAD FROM TERM. 10 AND CONNECT TO TERM. 2. REMOVE (BK) LEAD FROM TERM. 1 AND CONNECT TO TERM. 10.
   LINE KEY - REMOVE (R) AND (V) LEADS FROM TERM. 2 AND TAPE AND STORE.
   LINE SWITCH - REMOVE (G) LEAD FROM TERM. 15 AND CONNECT TO TERM. 2.
   REMOVE (S) STRAP FROM TERM. 1 AND CONNECT TO TERM. 9.
   ADD STRAP BETWEEN TERM. 9 AND NETWORK TERM. F.
2. IF HIA RINGER IS USED, REMOVE (S) STRAP FROM TERM. 9 AND NETWORK TERM. A AND WIRE AS FOLLOWS:
   CONNECT (BK) LEAD TO TERM. 2
   CONNECT (S) LEAD TO NETWORK TERM. K
   CONNECT (R) LEAD TO TERM. 9
   CONNECT (S-R) LEAD TO NETWORK TERM. A

* TAPE AND STORE

Fig. 6—Typical Connections for 1000A Data Coupler With 558F Wall Tel Set

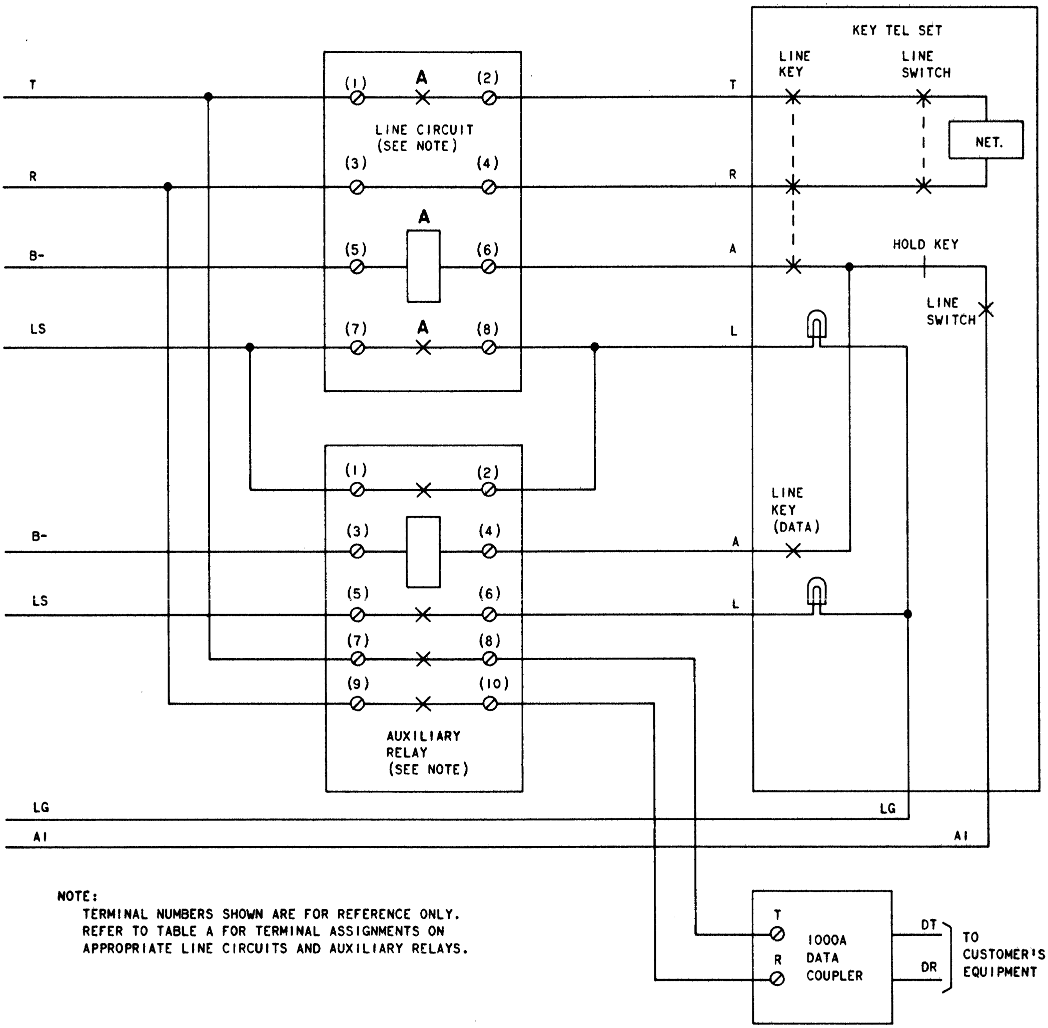


Fig. 7—Partial Schematic Connections for Key Telephone System Arrangements

3.14 The maximum allowable customer signal level is determined by the appropriate column in Table B. Record the value with pencil or ball point pen on the cover label of the coupler (Fig. 1). Using the example in 3.12, "−5" would be marked on the label.

3.15 In the event the appropriate ac power source required for the test sets is not available at the customer location for performing the installation tests, the installer must provide a data coupler that has been properly tested and known to be in good working condition. Add the 2-dB insertion

TABLE A

KEY TELEPHONE SYSTEM TERMINAL ASSIGNMENTS

KEY TELEPHONE SYSTEM		REFERENCE TERMINALS SHOWN IN FIG. 7									
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1A2	400D Line Circuit	9	13	14	12	17	16	4	8	—	—
1A2	421A Auxiliary Relay	12	16	17	1	8	13	35	23	37	27
1A1	202D Line Circuit	7	1	8	2	26	3	29	5	—	—
1A1	or 239A Line Circuit	A	E	B	F	Y	H	T	G	—	—
1A1	229B Auxiliary Relay	14	4	20	10	13	3	12	2	11	1
1A	29A Line Circuit	1	4	12	15	7	9	2	5	—	—
1A	29A Auxiliary Relay	1	4	7	9	2	5	3	6	14	11

loss of the coupler to the estimated measured loss (EML) of the assigned loop. This combined loss of the loop and coupler is used with the NOMINAL column in Table B to determine the proper level option terminals to be strapped. Strap the appropriate terminals as indicated in 3.13.

3.16 Install cover assembly by hooking bottom end (end with small hinged cover) to base, swinging cover up and over the TST key, and pressing until cover snaps into place.

3.17 The installer should instruct the customer to raise only hinged portion of cover to gain access to interface terminals DT and DR. Also caution customer that overtightening screw terminals may cause stripping. The installer ***will not*** connect the interface leads to the coupler unless requested by, and under the direction of, the customer.

3.18 After the installation has been completed, perform the remote test outlined in Part 4. The value obtained determines the basis upon which future operative conditions of the coupler and local loop may be checked. If the coupler fails to meet the test requirements, either replace the coupler or request new facilities as determined appropriate.

3.19 All level measurements and test results made during installation must be recorded on a line history card, or equivalent, to assist in analyzing future trouble and to detect gradual degradation of the service. The installer shall telephone the test results to the plant service center (PSC), or equivalent test location, prior to leaving the customer location. The circuit design engineer should be advised when the actual measured loss (AML) of the loop deviates from the estimated measured loss (EML) by more than ± 1 dB.

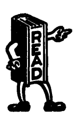
➧TABLE B ➧

LEVEL OPTION TERMINALS FOR 1000A DATA COUPLER

INSERTION LOSS (INSERTION LOSS TEST) DB			MAXIMUM ALLOWANCE	LIMITER OPTION TERMINALS LEVEL MEASURED IN IMPEDANCE-MATCHING TEST (DBM)			
LOOP LOSS	COUPLER LOSS	TOTAL OR MEASURED LOSS	CUSTOMER LEVEL DBM	0 TO − 3.6	− 3.7 TO − 4.6	− 4.7 TO − 5.6	− 5.7 OR BELOW
0-0.9	2	2- 2.9	−10	AD, EF	AF	AF	AF
1-1.9	2	3- 3.9	−9	AC, DF	AD, EF	AF	AF
2-2.9	2	4- 4.9	−8	AC	AC, DF	AF	AF
3-3.9	2	5- 5.9	−7	AB, CD, EF	AC	AD, EF	AF
4-4.9	2	6- 6.9	−6	BC, DG	AB, CD, EF	AC, DF	AF
5-5.9	2	7- 7.9	−5	BD, EF	BC, DG	AC	AD, EF
6-6.9	2	8- 8.9	−4	BC, DE	BD, EF	AB, CD, EF	AC, DF
7-7.9	2	9- 9.9	−3	CD, EF	BC, DE	BC, DG	AC
8-8.9	2	10-10.9	−2	EF	CD, EF	BC, EF	AB, CD, EF
9-9.9	2	11-11.9	−1	None	EF	BC, DE	BC, DG
10 or more	2	12 or more	0	None	None	CD, EF	BC, EF

4. MAINTENANCE AND TESTS

4.01 The maintenance and testing procedures described in this part are to assist the employee during installation and troubleshooting visits to a data coupler station. Several of the tests contained in this part will require disconnection of customer equipment from the interface in order to make the tests and/or to replace a defective coupler. The following precautions must be taken.



Permission to disconnect the interface leads from the customer must be obtained from the customer.

A. Maintenance

4.02 All repair forces should be familiar with the tariff provisions which generally provide for a "Maintenance Service Charge" for each customer-requested repair visit to a data access arrangement installation that is terminated with an FOK (found OK) condition. When a customer requests such a repair visit and it is subsequently determined that the trouble is ***not*** in the telephone company equipment, the employee should advise the customer and notify the PSC to fill out Form E-5855 in conformance with Section 660-101-312.

4.03 Maintenance of the coupler on the customer premises should be limited to local tests, testing with serving or test offices, or replacing a defective unit.

Note: Do not attempt individual component repair or replacement on the printed circuit pack.

4.04 Customers using data couplers are instructed, when a trouble condition is experienced, to perform the necessary testing to sectionalize the problem. If the results of the tests indicate the trouble is in Bell System equipment, the condition should be reported to the designated PSC or equivalent testing bureau. All available information concerning the failure mode should be provided to the PSC.

4.05 The PSC must analyze the information provided by the customer to determine if a trouble condition does exist and the most probable cause. Available tests (ie, normal dc loop test and remote test of coupler) should be performed to determine if a craft employee must be dispatched to customer premises. The conditions which could warrant a maintenance visit and the efforts which lead to each are shown in Fig. 8.

4.06 On a maintenance visit, the employee should proceed to perform the most likely necessary tests or evaluations to isolate and clear the trouble within the station as directed by the PSC. The employee may begin with the steps shown in Fig. 8 when the test results and analysis received from the PSC lead to that particular activity. If a trouble report is not available or if the report is inconclusive, it is recommended that the employee follow the suggested sequence of activities as illustrated in Fig. 9 and described in the following.

(1) The employee must be properly equipped with information (BSP documentation, line card details, etc), spare coupler and other parts, test equipment, etc, for locating trouble and effecting repairs at customer premises.

(2) Upon arrival at the coupler station, the employee will question the customer to obtain any information relating to the trouble. The employee will then proceed to perform a visual and mechanical inspection of the installation. Check for disconnected or broken cords, inside wiring, or drop wire. Check for broken components or any other possible trouble causes. If defects are not found, make a remote test (Step 7).

(3) If any component is found defective or marginal during check of the installation, or as directed by the PSC, the employee will repair or replace the component (ie, replacing ringer, dial, handset, etc, on associated tel set when provided).

(4) After making the necessary repairs, the employee will request the customer to verify service restoral (ie, try to exchange data with station that caused him to report the trouble).

(5) When the customer is satisfied with the service, the employee will notify the PSC to close the trouble report.

(6) If the customer cannot exchange data or is not satisfied with the service, the employee will proceed with the investigation (Step 7).

(7) If the installation appears to be in order after the visual inspection, the employee will make the necessary preparations to have the local test desk or equivalent test location equipped for ac testing, such as a data test center, to make the remote test of the coupler as outlined in 4.12.

(8) If the results of the coupler remote test are ***not*** satisfactory, the employee will replace the coupler with one known to be operating properly. Refer to Part 3 for the installation and connection procedures for the new coupler. Ensure that all level measurements made during the required installation tests are properly recorded on the line history card.

(9) After the coupler has been replaced, the employee will prepare to have the remote test outlined in Part 4 made on the new unit.

(10) If the results of the new coupler remote test are ***not*** satisfactory, the employee will notify the PSC of the repair work that has been completed and request instructions before continuing investigating efforts.

(11) If the results of the new coupler remote test are satisfactory, the employee will request the customer to verify service restored

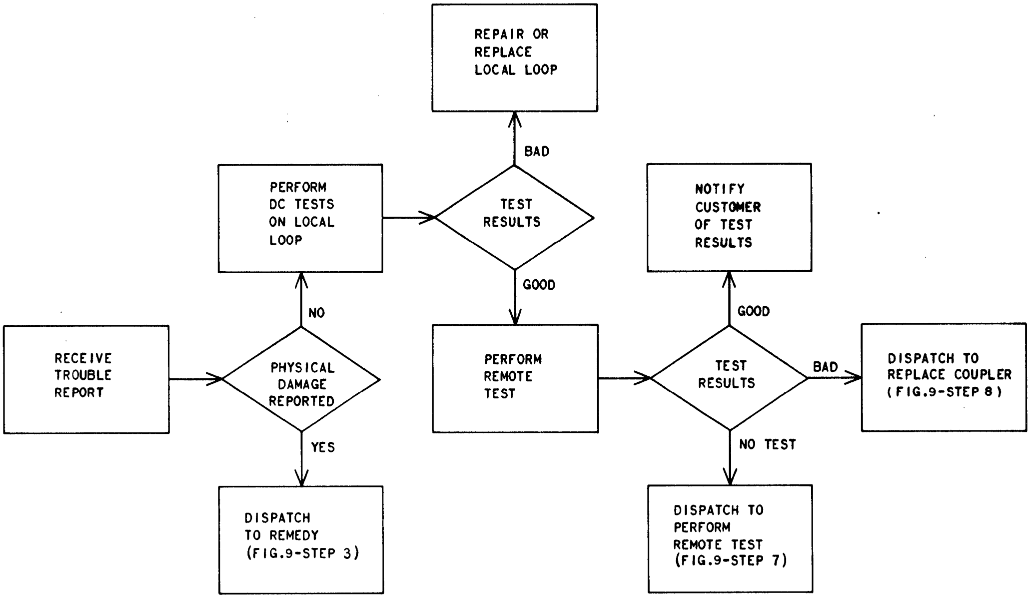


Fig. 8—Basic Activities Prior to Dispatching Employee

(ie, try to exchange data with the station that caused him to report the trouble).

(12) When the customer is satisfied with the service, the employee will notify the PSC to close the trouble report.

(13) If the customer cannot exchange data or is not satisfied with the service, the employee must continue the investigation to locate additional trouble. Proceed to Step 14.

(14) If the results of the coupler remote test are satisfactory or when replacement of the coupler does not restore service, the employee will disconnect the coupler and prepare the test equipment for a complete transmission test of the local loop.

(15) Refer to Section 314-205-501 for requirements and perform transmission test on the local loop.

(16) If the results of the loop test are satisfactory, the employee will notify the PSC that the results of the coupler and local loop tests are satisfactory and will wait for further instructions.

Note: The preceding investigation has eliminated the coupler and local loop as possible trouble; therefore, attention must be directed to the data terminal or facilities. The PSC will notify the employee if further investigation is required at this time.

(17) If the results of the loop test are ***not*** satisfactory, the employee will arrange with the PSC to have the loop repaired or changed. The repaired or changed loop should meet requirements outlined in Section 314-205-501.

(18) After changing the defective loop, the employee will reconnect the coupler to the telephone line. The insertion loss and impedance-matching tests outlined in 4.09 and 4.10, respectively, must be performed to determine if maximum allowable customer level has been changed. Employee will notify customer of level change and then request customer to verify

service restoral (ie, try to exchange data with the station that caused him to report the trouble).

(19) When the customer is satisfied with the service, the employee will notify the PSC to close the trouble report.

Note: Prior to leaving customer premises, the remote test outlined in 4.12 must be performed and the new level recorded on the line history card.

(20) If the customer cannot exchange data or is not satisfied with the service, trouble may still exist in another component of the system or in the data terminal and further investigation must be pursued. The employee will notify the PSC of the repair work that has been completed and wait for further instructions.

B. Tests

4.07 The following tests are required to ensure the proper installation of the data coupler and to determine the operating condition of the unit during a maintenance visit:

- Insertion Loss Test
- Impedance-Matching Test
- Remote Test
- ➧503C or 2503C Tel Set Test.➧

4.08 The following test equipment is required for the tests:

- 600-ohm resistor
- ➧KS-16979-L1 volt-ohm-milliammeter (VOM), or equivalent➧
- KS-19353-L4 oscillator, or equivalent.

4.09 ***Insertion Loss Test:*** The insertion loss test is required to measure the combined loss of the loop and coupler. The results of the test are used to determine the level option terminals which must be strapped in the coupler. The customer apparatus must be disconnected from the coupler in accordance with procedures outlined in 4.01. The coupler must be connected to the telephone line through the data key. Proceed with the test as follows:

(1) Locate and remove any existing straps on level option terminals A through G (Fig. 3).

(2) Connect the 600-ohm resistor across terminals DT and DR.

(3) Use the associated network control signaling apparatus (tel set, key telephone equipment, etc) and dial the milliwatt supply (1000 Hz) of the serving central office.

(4) When the tone is heard, operate the data key associated with the coupler.

Note: When an exclusion key on a tel set functions as the data key, the telephone handset must remain off-hook during the test.

(5) Measure the level (in dBm) of the signal across the 600-ohm resistor with the VOM.

(6) The loss in dB of the loop and coupler is determined by this measurement. Record the loss and add 0.5 dB, or the value specified on the circuit layout card, to correct the milliwatt test tone loss to the −12 dBm point (eg, if the measurement is −6.3 dBm, the corrected combined loss of the loop and coupler is 5.8 dB). The requirements are specified in Table B (3.12).

(7) Disconnect the test equipment and restore the connection to normal. Proceed to impedance-matching test.

4.10 ***Impedance-Matching Test:*** The impedance-matching test is necessary to determine if the particular line impedance will require that a change be made in the nominal strapping of the level option.

4.11 This test will generally follow the insertion loss test on either an installation or maintenance visit; therefore, the level option terminals should ***not*** be strapped at this time. Ensure that the customer apparatus is disconnected from the data coupler in accordance with procedures outlined in 4.01. The coupler must be connected to the

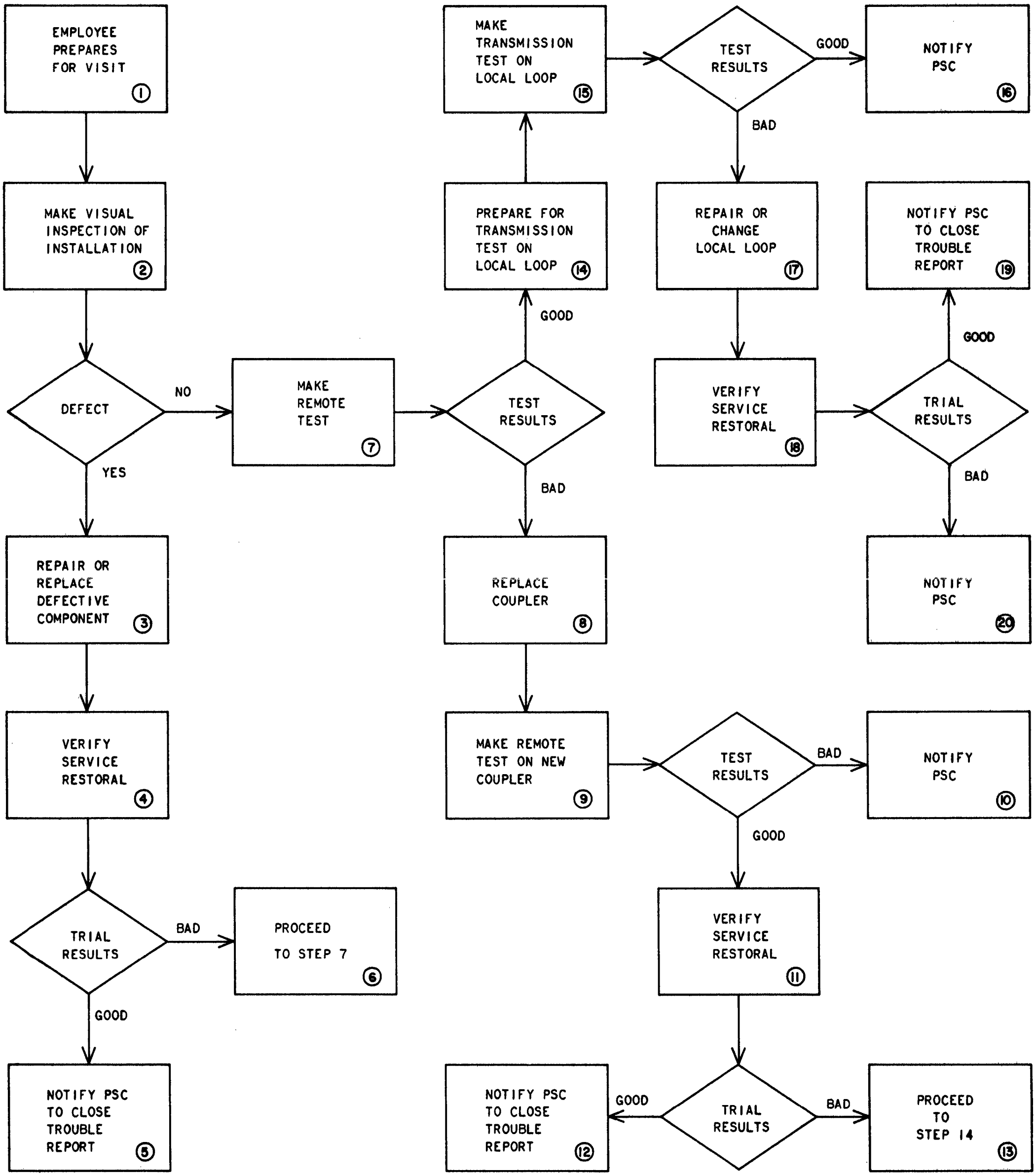


Fig. 9—Activities for Clearing or Troubleshooting Trouble at a Coupler Station

telephone line through the data key. Proceed with the test as follows:

(1) Set the oscillator for a 1000-Hz frequency and a 600-ohm output impedance.

(2) ➧Select the proper scale on the VOM to measure −5 dBm.

(3) Connect the oscillator output to the VOM input with the 600-ohm resistor bridged across the VOM input.➧

(4) Adjust the oscillator output level to obtain a ➧−5 dBm indication on the VOM. Remove the 600-ohm resistor and connect the VOM and oscillator as shown in Fig. 10.➧

Note: After the indication is obtained, do not change the frequency or level setting on the oscillator.

(5) Use the associated network control signaling apparatus (tel set, key telephone equipment, etc) and dial a quiet battery termination at the serving central office.

(6) After the connection is completed, operate the data key associated with the coupler.

Note: When exclusion key on a tel set functions as the data key, the telephone handset must remain off-hook during the test.

(7) Use the VOM to again measure the signal level (in dBM). This value is used in 3.12 to derive the level option strapping from Table B.

(8) Disconnect the test equipment and restore the connection to normal.

4.12 ***Remote Test:*** The remote test is required to measure the test signal of the coupler at the local serving office. The test signal provides a check of the local loop and the limiting function of the coupler. The initial reading can then be compared with subsequent readings for indications of service degradation.

4.13 The data coupler must be connected to the telephone line through the data key for this test. Proceed with the test as follows.

(1) Use the associated network control signaling apparatus (tel set, key telephone equipment, etc) and contact a test employee at the local test desk. If the local test desk is not equipped for ac testing, contact a remote test location that is equipped or a data test center (see Step 5).

(2) Request the employee to call the coupler and to measure the level of the coupler test tone (2800 Hz) at the test desk.

(3) Agree upon length of time required to perform the test, and when instructed by test employee, operate the data and TST keys.

Note: When an exclusion key on an associated tel set functions as the data key, the telephone handset must remain off-hook during the test.

(4) After the agreed interval, restore the TST and data keys and request the level reading from the test employee. This level indicates the loss of the loop plus the coupler at 2800 Hz. When the test is made at time of installation, the actual value of the loss ***must*** be recorded on the line history card for comparison against measurements made in subsequent tests. If the level of the 2800-Hz signal on subsequent tests varies by more than 2 dB from the original

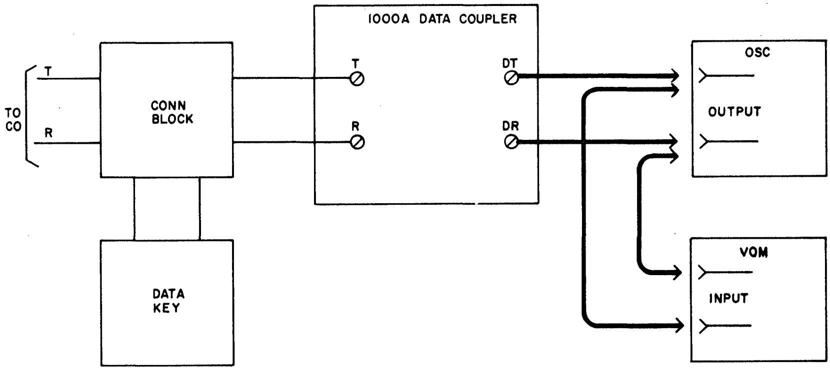


Fig. 10—♦Test Equipment for Impedance-Matching Test♦

value, it is an indication of possible trouble in either the loop or coupler.

(5) If the test tone must be measured at a remote test desk or data test center over facilities of unknown or varying loss, a successful receipt of the tone indicates there is ac continuity in the loop and coupler. This is estimated to provide an 80 percent confidence level that the coupler and loop facilities are operating satisfactorily.

(6) Restore the telephone connection to normal.

4.14 ♦***503C or 2503C Tel Set Test:*** This test verifies that the tel set mode indication and audible monitor features are operating properly. The requirements of this test are based on the logic sense which gives a contact closure when the tel set is connected to the line. In all other cases, the mode indication will be open.

This test can be performed without disconnecting the customer interface, in which case the necessary precautions should be taken to ensure that the customer does not receive inadvertent signals.

(1) Use the VOM to measure the resistance between the two terminals on the connecting block (described in 3.09.) The VOM should indicate continuity.

(2) Lift the telephone handset and measure the resistance between the two terminals on the connecting block. The VOM should indicate continuity.

(3) Operate the exclusion key to place the tel set in the data mode, then measure the resistance between the two terminals. The VOM should indicate an open circuit.

(4) Operate the exclusion key to place the tel set in the voice mode and dial the local milliwatt supply.

(5) When the 1000-Hz tone is heard in the handset, operate the exclusion key to data. The tone should still be heard in the handset.

(6) Return the equipment to normal.♦

1001A DATA COUPLER

DESCRIPTION, INSTALLATION, MAINTENANCE, AND TESTS

CONTENTS PAGE

1. GENERAL

1.01 This section contains the information required for installing and maintaining 1001A data couplers (Fig. 1).

1.02 This section is reissued to indicate that the KS-16886-L2 transformer, the 1044A connecting block, and the resistor be replaced by the standard KS-20426-L1 transformer. This eliminates a problem of overheating and provides a simpler installation. Since this reissue constitutes a general revision, arrows generally used to indicate changes have been omitted.

1.03 The data access arrangement (DAA) includes both the data coupler and telephone set as described in appropriate tariffs. The 1001A [rated Manufacture Discontinued (MD)] is an automatic data coupler which provides the means for connecting customer-provided, automatic data equipment to the switched network for data and voice communications. The uniform service order code (USOC) for this coupler is CBS.

1.04 The 1001A data coupler provides the following:

- Interface control lead voltages as specified in Electronic Industries Association (EIA) Standard RS-232-B.

NOTICE
Not for use or disclosure outside the
Bell System except under written agreement

- *A* lead control for operation with key telephone equipment.

- Capability of operation with data auxiliary set (DAS) 801-type automatic calling unit (ACU).

1.05 Additional telephone functions, such as alternate voice service, may be provided with an associated telephone set as a standard option. Audible monitoring of data transmission and mode indication through switch contacts are provided by 503C and 2503C telephone sets.

1.06 The data coupler may interface customer equipment directly to local loop facilities, key telephone system station lines, or to private branch exchange (PBX) station lines.

1.07 At installations where TOUCH-TONE® calling service has been ordered, the customer may generate tone signals for originating calls through the transmission interface leads of the coupler.

1.08 The service offering in which the data coupler is used provides the customer with end-to-end transmission performance characteristics comparable to DATA-PHONE® service on the switched telecommunications network. Because customer equipment, over which the Bell System has no design control, may contribute significantly to error performance, the Bell System cannot assume responsibility for the accuracy of transmitted data. End-to-end facilities, including the local loop, will be engineered and maintained to equivalent DATA-PHONE service requirements. These requirements are specified in Section 314-205-501 for local loops and Section 314-205-500 for the switched network.

2. DESCRIPTION

A. Physical Description

2.01 The 1001A data coupler is a wall-mounted unit measuring 9 inches wide, 11 inches high, and 2-1/4 inches deep. The coupler weighs approximately 2-1/2 pounds and is enclosed in a gray plastic housing. The housing consists of a dark gray base and a light gray cover which snap together. Two keyhole slots and one screw hole are provided on the base for mounting the unit on a wall or other vertical surface. ***The coupler must be vertically mounted to allow proper operation of the mercury relay.***

> *Note:* Three No. 6 by 3/8-inch pan-head metal screws and three No. 6 by 1/2-inch wood screws are shipped with each data coupler repaired and returned to the field for service. Use of larger screws will short circuit printed paths on the circuit pack.

2.02 Circuitry for the coupler is mounted on a single printed CP. Eight screw terminals at the lower end of the CP provide the interface for connection to customer equipment (Fig. 2). Two additional unmarked terminals are open-ended (not connected) on the board and provide extra tie points when required. Interface control leads use EIA RS-232-B voltage levels. See Table A for lead designations. The cord required for connecting the customer modem to the interface must be supplied by the customer.

2.03 Eight screw terminals at the upper left and right sides of the printed CP provide the interface for connecting the telephone line and associated apparatus to the coupler. The housing cover must be removed to make connections within the coupler. To remove, lift cover up from the bottom to relieve tension on mounting lips, then pull cover out at the top. Use D station wire to terminate the connections. The following pairs of leads terminate on this interface:

- T and R—Telephone line transmission pair

- KA and KA1—Key system *A* lead control contacts to indicate the off-hook condition to associated key telephone equipment

- A and A1—Extension of associated telephone set switchhook (line switch) to terminal equipment

- P1 and P2—Low-voltage ac leads from external transformer to internal power supply. Terminals 3 and 4 of transformer KS-20426-L1 are wired to P1 and P2 screw terminals.

2.04 Two locking switches and associated lamps (TST and ANS) are located at the top of the coupler to provide control and indication of test mode conditions. The two lamps glow dimly when the unit is not in test mode.

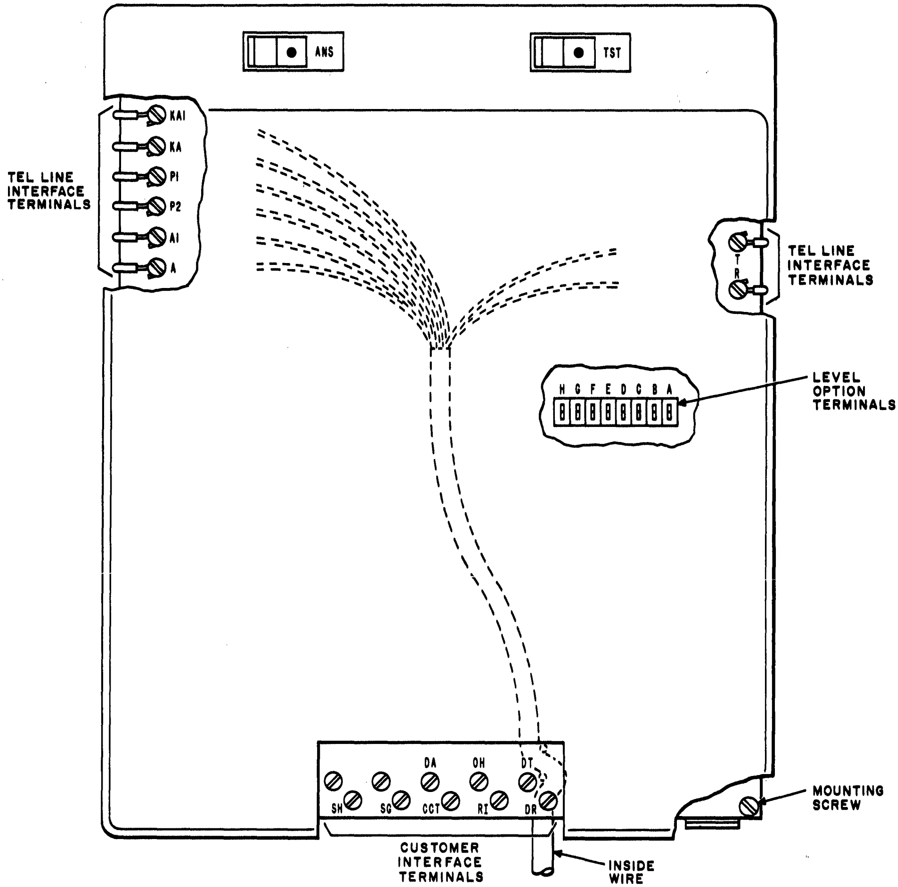


Fig. 2—Route of Station Wiring and Location of Terminals

2.05 Level option terminals located on the CP are strapped by the installer for adjusting the power threshold of the automatic level control (ALC) (limiter) circuit of the coupler.

2.06 The data coupler is designed to operate over a range of 0 to 120°F, with a relative humidity of up to 95 percent.

2.07 One external transformer (KS-20426-L1) is required with each coupler to step down the standard 117-Vac to 23.6 Vac. The internal rectifier provides the dc supply to all the coupler circuitry except to the ALC circuit which is powered directly from telephone line current.

B. Functional Description

2.08 ***General:*** The data coupler is a network protective unit designed to interface with a customer-provided automatic data terminal. The coupler provides signals to the data terminal to indicate the detection of ringing signals. In response to the signals, the data terminal provides signals which cause the coupler to seize the line, trip ringing, and cut through the transmission path.

TABLE A

CUSTOMER INTERFACE LEAD DESIGNATIONS FOR 1001A DATA COUPLER

TERMINAL DESIGNATION	FUNCTION	
DT	Data Tip	600-Ohm Transmission Leads
DR	Data Ring	
OH	Off-On Hook Control	
DA	Request Data Transmission Path Cut-Through	
RI	Ring Indication	
CCT	Coupler Cut-Through	
SH (or MI)*	Switchhook Status of Associated Tel Set	
SG	Signal Ground	

* This terminal is redesignated MI when the coupler is installed with a 503C or 2503C telephone set.

Prior to the transmission path cut-through, a 2-second delay is provided to allow proper operation of automatic message accounting equipment. A polarity guard, ALC, and a coupling transformer are provided to protect the telecommunications network, coupler, and customer equipment. In addition, the coupler circuitry permits the data terminal to originate and terminate data calls automatically.

2.09 ***Coupler Transmission Path:*** The coupler transmission path primarily consists of a coupling transformer, an ALC circuit, and a polarity guard (Fig. 2). The transformer terminates the telephone loop and provides a 2-way protective function (ie, hazardous voltages, surge protection, and longitudinal isolation). The ALC circuit prevents the customer signal level from exceeding the prescribed maximum limit. The polarity guard maintains the polarity of the line current and voltage required by the ALC circuit.

2.10 The ALC circuitry continuously monitors the output of the data signals. Option strapping on the level-adjusting network determines the proper power level (threshold) at which the circuit operates to control the output signal.

2.11 The signal power level is continuously averaged by the detector and integrator. When the averaged signal level exceeds the threshold during any 3-second interval, current is driven through the thermistor. The thermistor heats up, decreases in resistance, and since the thermistor shunts the transmission path, reduces the signal level to the threshold value.

Data Mode

2.12 ***Ring Detection:*** The ring detector (Fig. 3) is activated when 20-Hz ringing signal is present on the line, indicating an incoming call. The R relay, part of the ring detector, operates and releases in response to each half cycle of ringing current. Contact closures of the R relay contact are used to drive the ring integrator (RI) circuit. After approximately 2 cycles of 20-Hz ringing signal are detected by the RI circuit, it operates to reset the 2-second call timer through inverter Q15 and to operate the Q18 interface driver.

> ***Note:*** When dial pulsing through certain 1001A couplers into a No. 5 crossbar or a step-by-step central office, sharp pulses are generated which cause capacitor C8 to discharge

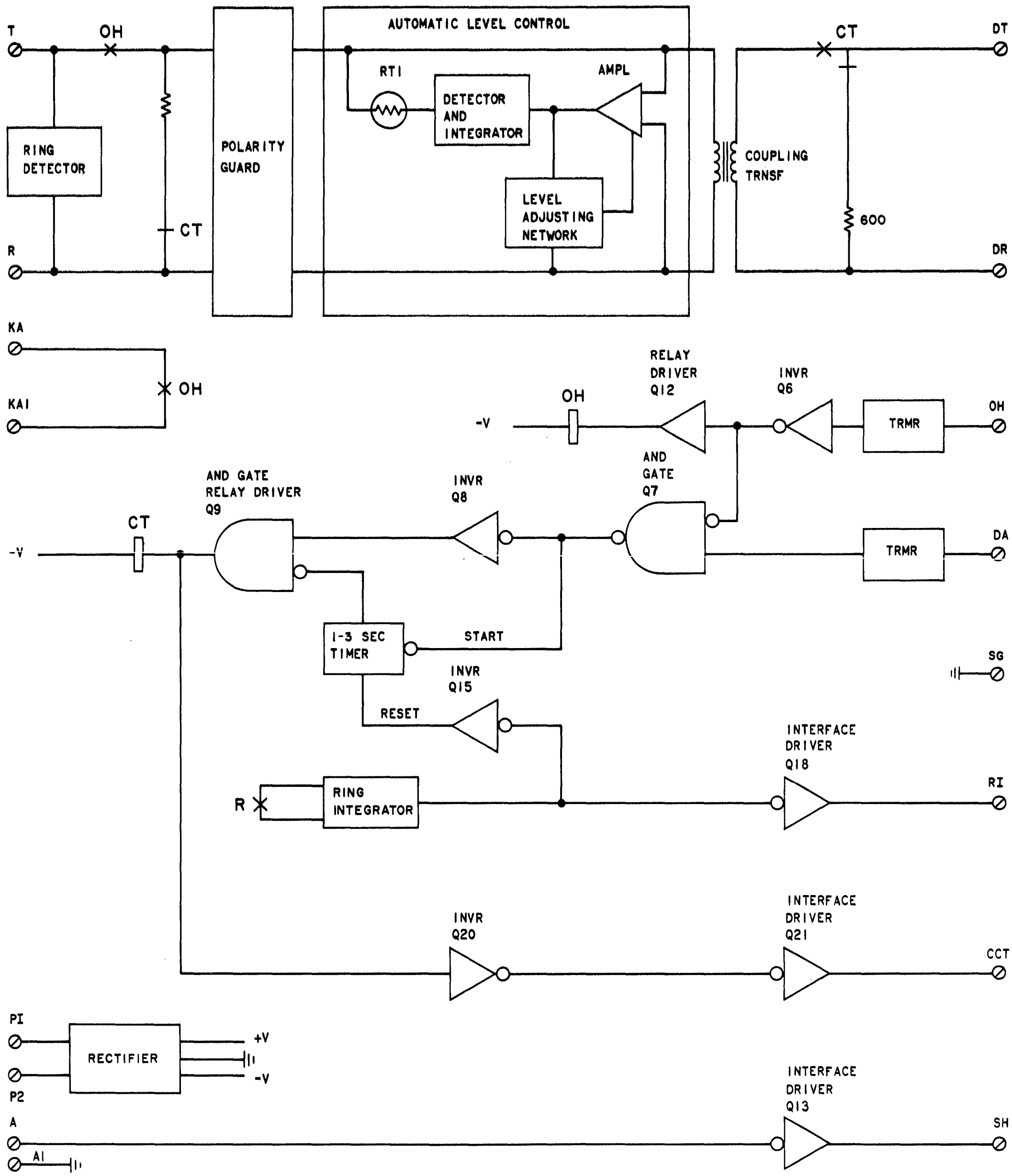
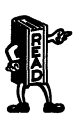


Fig. 3—Functional Schematic of 1001A Data Coupler—Data Mode

into the R relay. This causes the R relay to operate momentarily, and may result in the RI circuit being activated during dialing. This condition can be corrected by the addition of a 458A, 458C, KS-21222, or equivalent diode (50-volt 1-amp silicon junction, such as a 1N4001). This diode is connected between the collector of transistor Q12 and the negative side of capacitor C13. Connect the cathode of the diode to the capacitor. If the diode is installed incorrectly (reversed), the RI circuit will be activated permanently and the OH relay will operate erratically. This diode may be installed by the employee during a maintenance visit. When a coupler is returned to the repair facility, the diode is installed. This reduces the RI positive-to-negative transition to less than 10 ms from approximately 100 ms. Some customer terminals will not operate correctly with the short interval and may require that the diode be removed.

2.13 ***Answering Incoming Calls:*** When a positive input is applied through the inverter (Q15), the timer resets for a timing cycle and removes an input from the Q9 AND gate. When OH and DA are turned ***on***, a negative input causes the timer to start the 2-second timing interval. This timing interval is required by the serving central office billing equipment. At the end of the interval, a positive input is applied to the Q9 AND gate which remains constant until the timer is reset (ie, the coupler responds to another incoming call). This removes the timer from the circuit except on incoming calls.

2.14 When Q18 operates, a positive voltage is applied to the RI interface lead to inform the data terminal of the incoming call. In response, the data terminal applies voltages to the OH and DA interface leads.



An EIA ON voltage is a voltage more positive than +5 volts. An EIA OFF voltage is a voltage more negative than -5 volts.

2.15 The voltage on the OH lead applies an input to the Q6 AND gate and operates the OH relay. Performing the off-hook function, the OH relay closes the loop to trip ringing and closes the KA lead to signal the associated key telephone equipment or ACU, if provided.

2.16 The voltage on the DA lead supplies an input to the Q7 AND gate. The output of the AND gate starts the timer circuit and applies an input to the Q9 AND gate relay driver. At the end of the timing interval, the second input (from timer) to the Q9 AND gate operates the CT relay and the Q21 interface driver.

2.17 The CT relay removes the terminating resistor (R) from the loop and connects the data terminal to the telephone line through the ALC circuit.

2.18 The Q21 interface driver applies a voltage to the CCT interface lead to inform the data terminal that the data terminal is now connected to the local telephone loop through the coupler.

> ***Note:*** The presence of the ON voltage on the CCT lead does not imply that an end-to-end connection has been established.

2.19 The data coupler contains no circuitry to generate or detect answer tone signals. The customer must provide or detect answer tone when required.

2.20 ***Automatic Answer:*** The customer can provide automatic answer of incoming calls by providing a positive ON voltage to the OH interface lead in response to a positive RI interface lead output. The customer must hold OH input positive to remain in data mode. Also, the exclusion key option must provide for the coupler to control the line (option A).

2.21 ***Call Origination (Dial-Pulsing):*** The customer can originate a call by dial pulsing (rotary dial) or tone-address signaling (eg, TOUCH-TONE). A positive (ON) voltage applied to the OH interface lead, either as a call origination or as a transfer from a manually originated call, will cause the OH relay to provide the off-hook function as previously described. A negative (OFF) voltage applied to the lead causes the OH relay to drop and open the telephone loop. Also, the circuit between the KA lead and the KA1 lead is opened. This sequence of operation permits the data terminal to generate dial pulses for call origination when dial tone is present. The pulsing sequence and timing requirements are as follows (Fig. 4):

(1) The OH lead is closed.

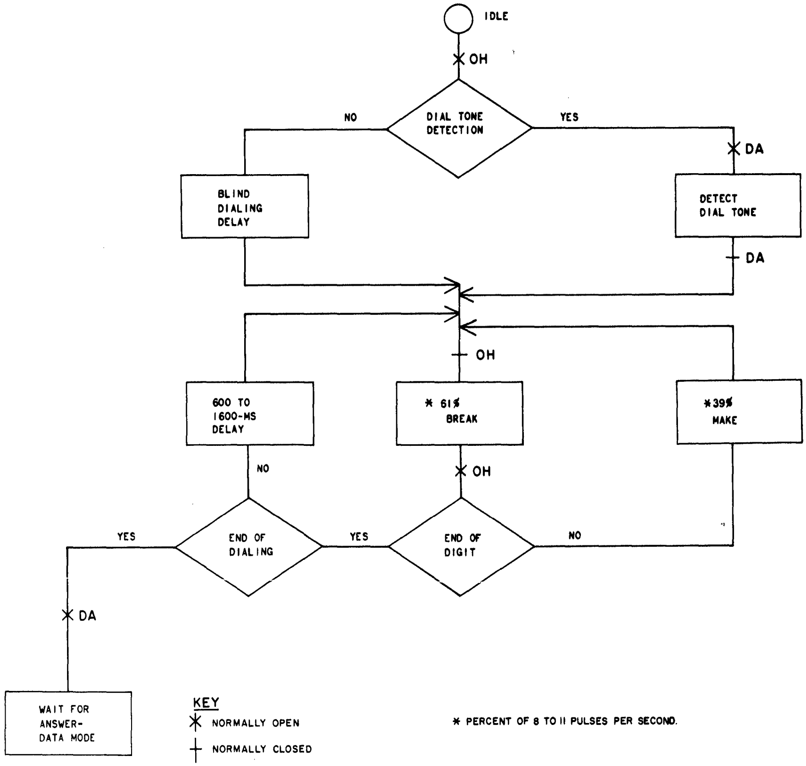


Fig. 4—Customer Automatic Calling Sequence Diagram—DC Dial Pulsing

Note: The DA lead may be closed to detect dial tone or, after an interval, the presence of tone may be assumed and blind dialing initiated. The DA lead must be released for the remainder of the dialing sequence after tone is detected. The dialing rate is 8 to 11 pulses per second.

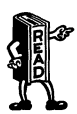
(2) The OH lead is opened for 61-percent break interval.

(3) The OH lead is closed for 39-percent make interval.

(4) Steps (2) and (3) above are repeated for the number of pulses required, eg, a total of five releases of the OH lead for the digit 5.

(5) After the last pulse of a given digit, a 600- to 1600-ms delay occurs and the first pulse of the next digit is started.

(6) After all digits have been generated, the DA lead is closed.



In the event the local loop is 800 ohms or more and DA is ON before OH, insufficient line current may be drawn to hold the line. In this case, a 2A range extender must be installed at the serving central office (SCO).

2.22 Operation of the DA lead, either for the detection of dial tone or after the dialing sequence is completed, causes the circuit to function the same as on incoming calls when combined with the operation of the OH lead. The CT relay operates to connect the data terminal to the telephone line, and the Q21 interface driver turns ***on*** the CCT lead to inform the terminal equipment that the coupler has closed the transmission path to the local loop.

> ***Note:*** Since there is no ringing signal present on an outgoing call, the 2-second timer is not reset and CCT turns ***on*** immediately after OH and DA are turned ***on.***

2.23 ***Call Origination (Tone-Address Signaling):*** Figure 5 shows the call origination sequence for tone-address signaling. As previously stated, turning ***on*** the OH and DA leads causes the coupler to go off-hook and provide a transmission path between the data terminal and the telephone line. When dial tone is present, multifrequency signals are generated to access the switched network. The customer may then wait for answer tone or a verbal answer before transmitting data.

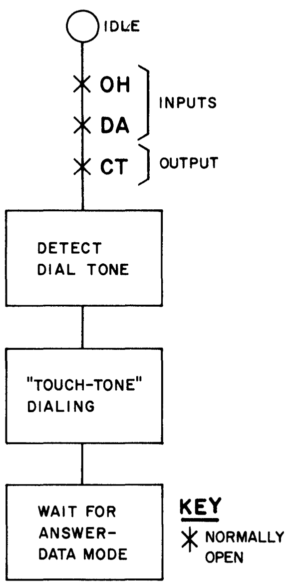
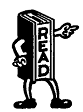


Fig. 5—Customer Automatic Calling Sequence Diagram—TOUCH-TONE Dialing

2.24 ***Call Termination:*** When data transmission is complete, the data coupler does ***not*** provide automatic disconnect. ***The data terminal must recognize the end of the call and must turn OFF the OH interface lead.*** In turn, the OH and CT relays drop to open the telephone loop and to disconnect terminal equipment from the coupler. The coupler returns to idle state. A line current status indicator (LCSI) may be installed with the coupler on an optional basis to aid the customer in recognizing end of call. The LCSI is further described in 3.11 through 3.14.

Test Mode



Operation of the TST switch while transmitting data will interrupt the data signals.

2.25 A test circuit provides the means for applying a test tone to the line through the ALC circuit (Fig. 6). This permits testing the level control, the local loop, and certain logic control functions of the coupler. The circuit is designed to be remotely tested from the local test desk (LTD), although a data test center (DTC) or other designated test location may perform the test.

2.26 The test circuit consists of a test oscillator, test (TE) relay, and two switches (TST and ANS) with associated lamps. The TST switch is used to initiate the test mode. The switch operates the test relay and causes the TST lamp to light. Operation of the test relay (1) removes the transmission path from customer equipment and connects the output of the test oscillator to the customer side of the transformer, (2) removes the interface leads from the customer equipment to prevent false operation and connects the leads in the test configuration, (3) enables the ANS lamp to light on incoming ringing, and (4) connects the DA and OH functions to the ANS switch.

2.27 The data coupler detects incoming ringing signals, which causes the ANS lamp to light (ie, 2 seconds ON and 4 seconds OFF). When the ANS switch is operated, the coupler answers the call and the following occurs: (1) the OH relay operates to trip ringing, (2) the timer starts, (3) the TST and ANS lamps go off, and (4) at the end of the timer interval, the CT relay operates to couple the oscillator output through the ALC to

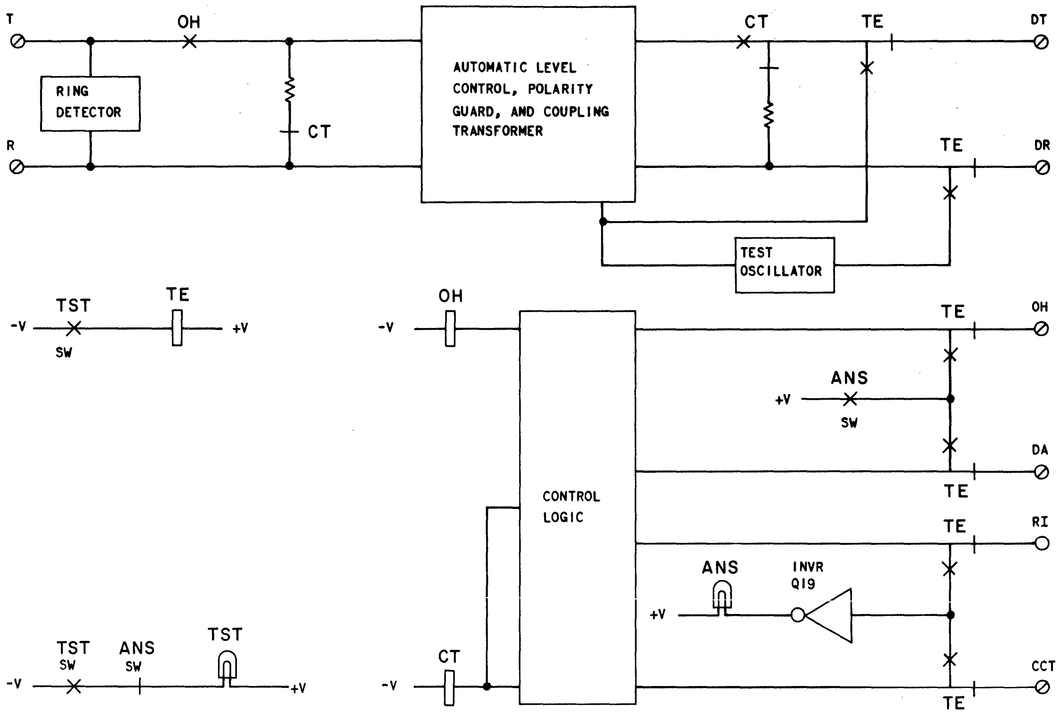


Fig. 6—Functional Schematic of 1001A Data Coupler—Test Mode

the telephone line and to cause the ANS lamp to relight.

2.28 The test circuit generates a 2800-Hz signal at a level which exceeds the maximum power level allowed for any coupler installation. This level causes the ALC circuit to operate and reduce the signal level to the value specified at time of installation.

2.29 Restoring the TST and ANS switches releases the coupler from test mode. ***The TST and ANS switches must both be restored for proper operation of the coupler.***

3. OPTIONS

A. Telephone Sets

3.01 An associated telephone set is a standard option with the data coupler. The coupler SH and SG interface leads provide the customer with the status of the line switch on an associated telephone set when used with the data coupler. The coupler can be installed without a telephone set for fully automatic operation. When a telephone set is provided, the exclusion key and telephone set ringer wiring options must be specified on the service order. The exclusion key options provide for either the coupler or the telephone set to control the line. Telephone set ringer options provide the desired ringing features for each of the two line control options. A description of these options is included in the following paragraphs.

(a) ***Option A—Coupler Controls Line (Automatic Operation)***

(b) ***Option B—Telephone Set Controls Line***

(c) ***Option C—With Ringer Connected on Telephone Set Side of Exclusion Key:***

(1) When coupler controls line

When the exclusion key ***is not operated,*** the coupler RI interface lead can be activated but the telephone set cannot ring.

When the exclusion key ***is operated,*** the telephone set cannot ring and the coupler RI interface lead cannot be activated (since handset must be lifted to operate exclusion key and this causes dial tone).

(2) When telephone set controls line

When the exclusion key ***is not operated,*** the telephone set can ring but the coupler RI interface lead cannot be activated.

When the exclusion key ***is operated,*** the coupler RI interface lead can be activated but the telephone set cannot ring.

(d) ***Option D—With Ringer Connected on Telephone Line Side of Exclusion Key:***

(1) When coupler controls line

When the exclusion key ***is not operated,*** the coupler RI interface lead can be activated and the telephone set can ring.

When the exclusion key ***is operated,*** the telephone set cannot ring and the coupler RI interface lead cannot be activated (since handset must be lifted to operate exclusion key and this causes dial tone).

(2) When telephone set controls line

When the exclusion key ***is not operated,*** the telephone set can ring but the coupler RI interface lead cannot be activated.

When the exclusion key ***is operated,*** the telephone set can ring and the coupler RI interface lead can be activated.

3.02 Options specified in 3.01 apply to the standard [502A/B or 2502B (Section 502-501-102 or 502-503-102)] as well as the multifunction telephone (MFT) [503C or 2503C (Section 502-501-120 or 502-503-120)] when used with the 1001A data coupler. Connections for these options using the 502- and 2502-types are shown in Fig. 7. Additional options are available using the MFT, and are discussed in 3.03 and shown in Fig. 8 and 9. Wall-mounted telephones are not recommended and should not be used.

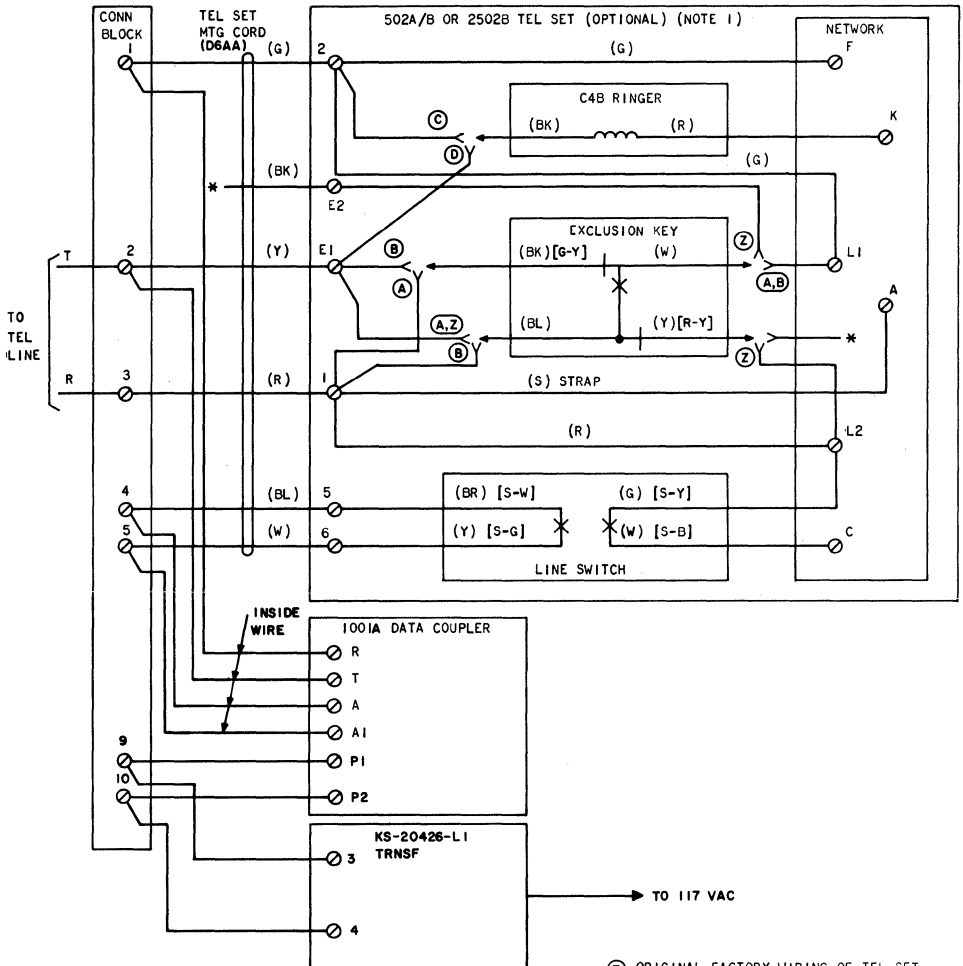
3.03 The 503- (rotary dial) and the 2503-type (TOUCH-TONE dial) telephone sets furnish the customer the following additional options:

- Allows monitoring of data transmission and voice answer-back signals through the telephone handset as used in digital inquiry voice answer-back (DIVA) applications.

- Provides an indication of whether telephone line is connected to telephone set or data coupler, or it may be used to provide an indication of SH (ie, on-hook or off-hook).

These additional features provided by the 503C (or 2503C) telephone set necessitate the use of a triple transfer exclusion key and a high-impedance bridging transformer in the telephone set. One set of the exclusion key contacts switches the line between the telephone and the coupler. The second set switches the monitoring circuit, and the third set provides the mode indication. The high-impedance transformer allows the attendant to monitor data transmission with the telephone handset. Both telephone sets are provided in a light gray housing; however, they may be enclosed in standard 500- or 2500-type housings of another color if desired.

3.04 In a multiple data coupler installation, it is often desirable to associate several data couplers with one telephone set. Key telephone sets are available in 6-, 10-, 18-, and 30-key sizes. Key telephone sets can connect to one of several different lines. The auxiliary key contact for each line, designated the A lead, is used to operate associated circuitry. The A lead may also be used to operate a relay which transfers a line from the data coupler to the telephone set as shown in Fig. 10. The function of the exclusion key is replaced by the line pickup key on the key telephone set. Note, however, that the coupler is never disconnected from the line when wired as shown in Fig. 10. The switchhook indicator function (SH lead) is not available with key telephone set installations unless auxiliary key telephone units (KTUs) are used. The coupler is assumed to be the primary station. Data calls can be originated and answered without interference from the telephone set. To indicate activity of the data coupler, the OH contact is used to connect the winking lamp



NOTES:

1. EXCLUSION KEY AND RINGER MUST BE REWIRED FOR DESIRED OPTION
2. IF C4A RINGER IS USED, WIRE AS FOLLOWS:
   (BK) TO 2 OR E1, DEPENDING ON OPTION USED
   (S) TO K OF NETWORK
   (S-R) TO A OF NETWORK
   (R) TO 1 OF TERMINAL STRIP

Ⓩ ORIGINAL FACTORY WIRING OF TEL SET
* INSULATE AND STORE
( ) CURRENT COLOR CODE
[ ] MD COLOR CODE

EXCLUSION KEY OPTION	WIRING OPTION
COUPLER CONTROLS LINE	A
TEL SET CONTROLS LINE	B

RINGER OPTIONS	WIRING OPTION
RINGER ON TEL SET SIDE OF EXCLUSION KEY	C
RINGER ON TEL LINE SIDE OF EXCLUSION KEY	D

Fig. 7—Typical Connections for 1001A Data Coupler With 502A/B or 2502B Telephone Set

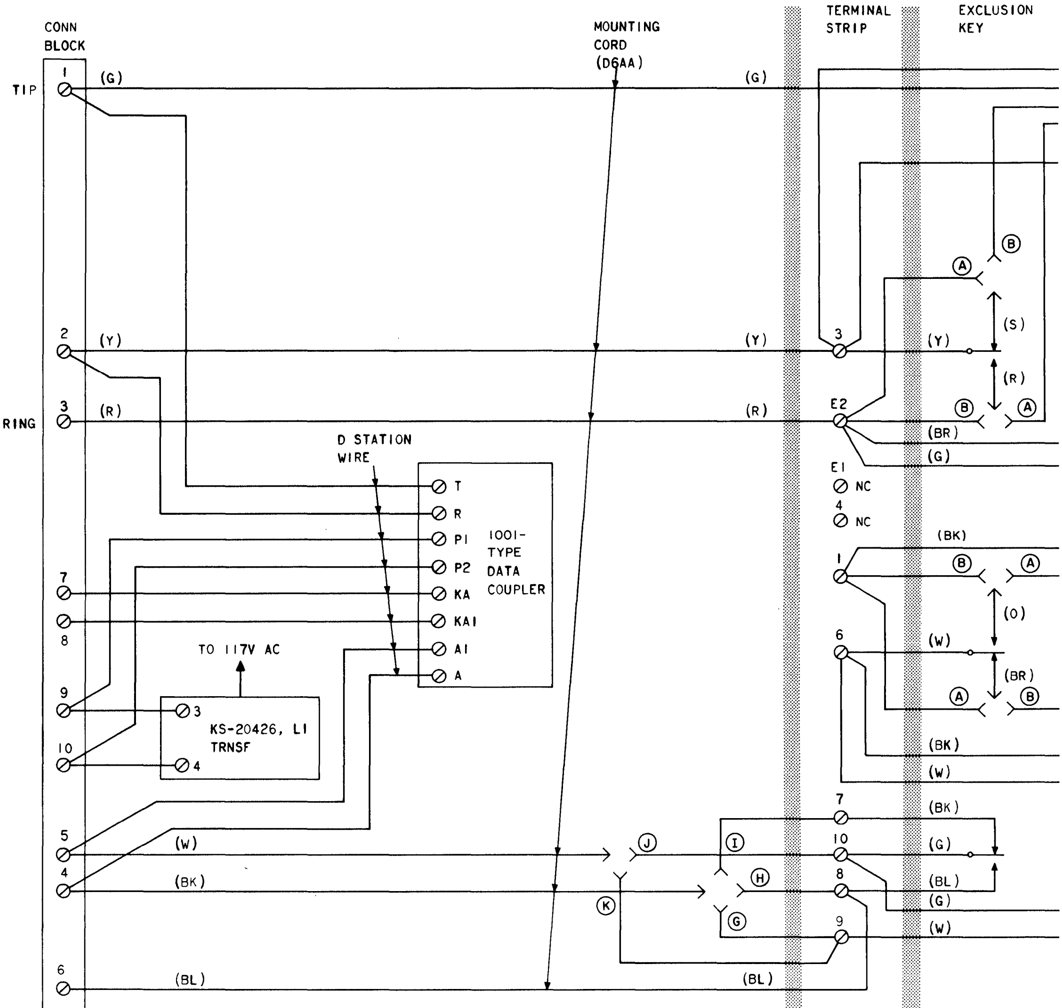
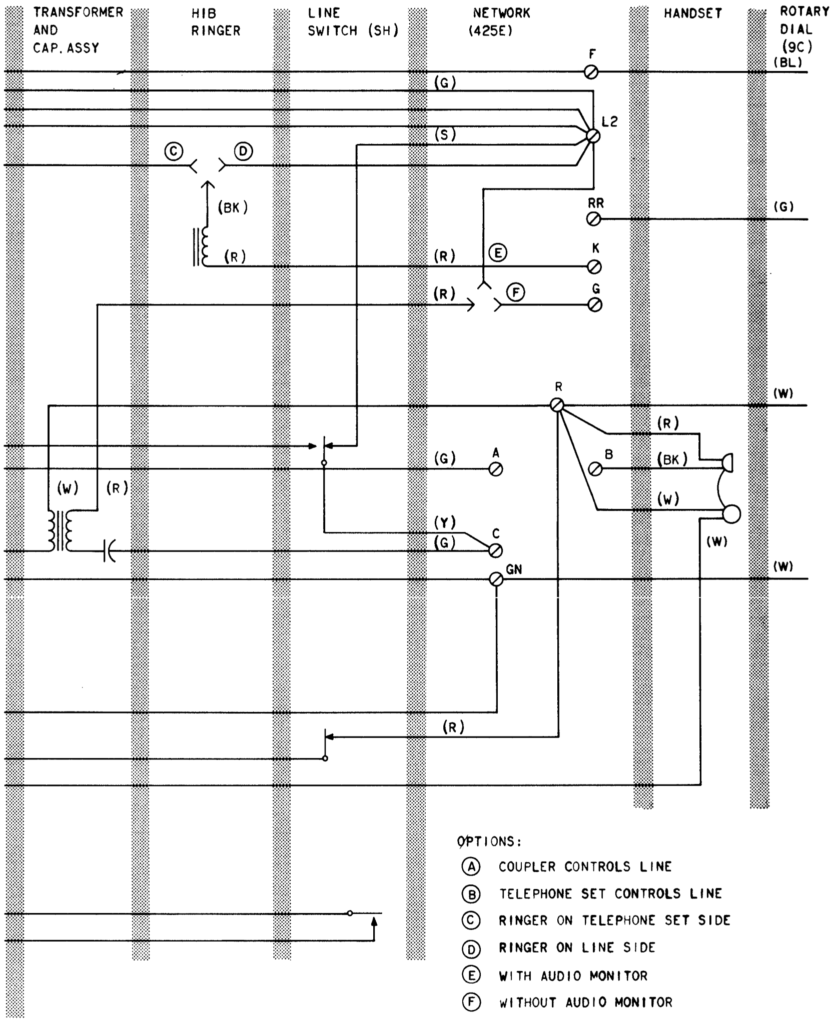


Fig. 8—Typical Connections for 1001A Data Coupler With 503C Rotary Dial Telephone Set (Sheet 1 of 2)



OPTIONS:

- Ⓐ COUPLER CONTROLS LINE
- Ⓑ TELEPHONE SET CONTROLS LINE
- Ⓒ RINGER ON TELEPHONE SET SIDE
- Ⓓ RINGER ON LINE SIDE
- Ⓔ WITH AUDIO MONITOR
- Ⓕ WITHOUT AUDIO MONITOR

INDICATOR	ADDITIONAL OPTIONS WITH	
	OPTION A	OPTION B
VOICE MODE	H, K	I, K
DATA MODE	I, J	H, K
SWITCHHOOK	G, J	G, J

Fig. 8—Typical Connections for 1001A Data Coupler With 503C Rotary Dial Telephone Set (Sheet 2 of 2)

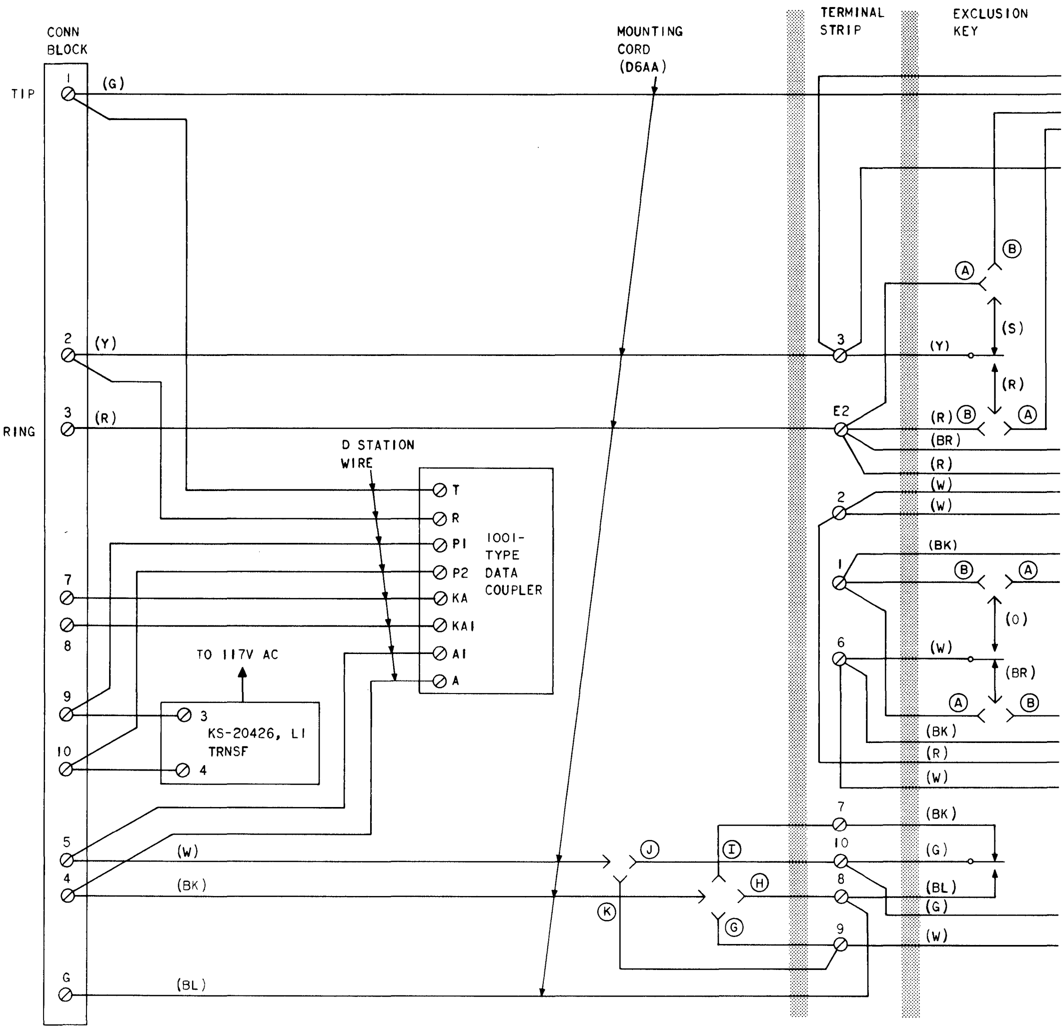
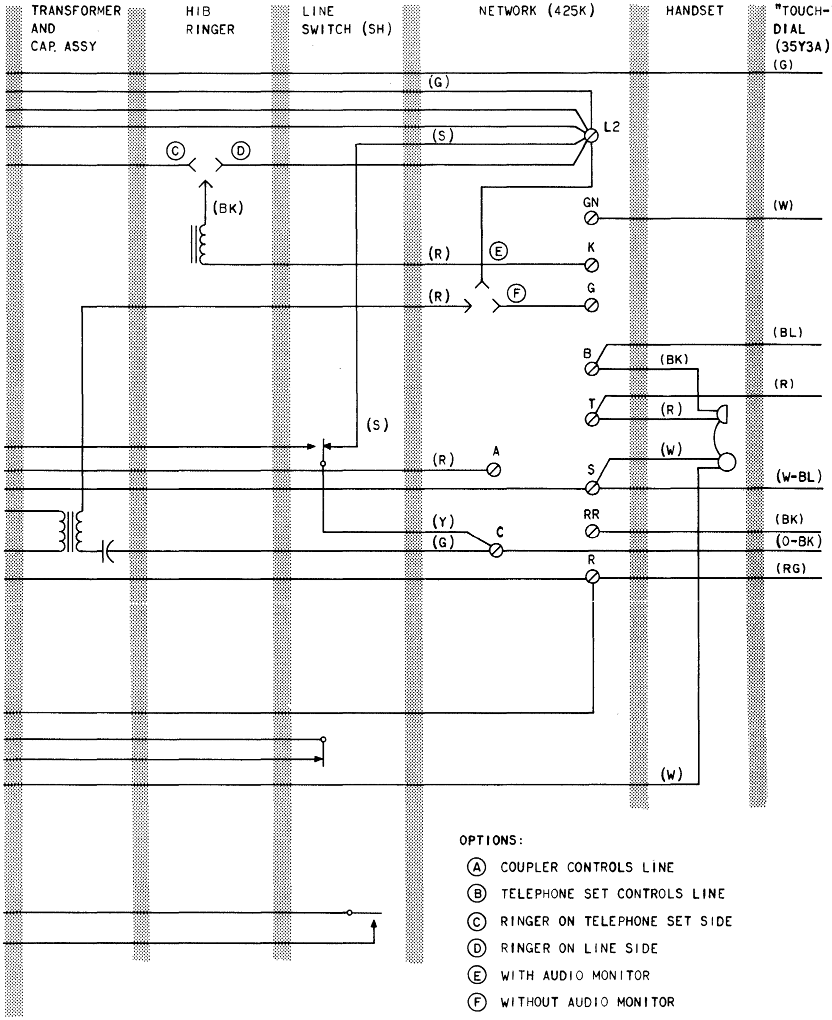


Fig. 9—Typical Connections for 1001A Data Coupler With 2503C TOUCH-TONE Dial Telephone Set (Sheet 1 of 2)



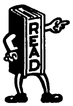
OPTIONS:

- Ⓐ COUPLER CONTROLS LINE
- Ⓑ TELEPHONE SET CONTROLS LINE
- Ⓒ RINGER ON TELEPHONE SET SIDE
- Ⓓ RINGER ON LINE SIDE
- Ⓔ WITH AUDIO MONITOR
- Ⓕ WITHOUT AUDIO MONITOR

INDICATOR	ADDITIONAL OPTIONS WITH	
	OPTION A	OPTION B
VOICE MODE	H, K	I, K
DATA MODE	I, J	H, K
SWITCH HOOK	G, J	G, J

Fig. 9—Typical Connections for 1001A Data Coupler With 2503C TOUCH-TONE Dial Telephone Set (Sheet 2 of 2)

supply to the telephone set. The lamp under the key designated for the line assigned to this coupler winks when the data coupler is on-line and off-hook.

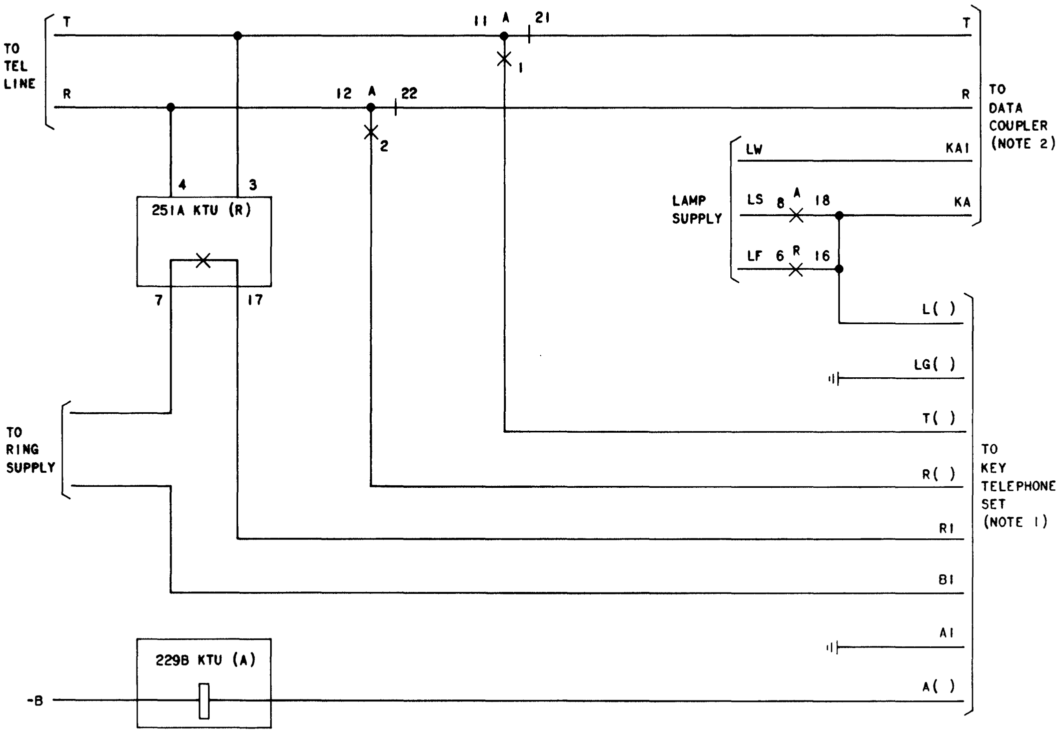


To prevent damage to the data coupler, each coupler must be powered by an individual transformer.

3.05 Apparatus necessary for providing telephone service for automatic data couplers consists of a key telephone set with enough capacity for the lines involved, a transfer relay for each line involved, and a ringup relay for each line that requires manual answering as a service feature. Figure 10 shows the connections for a representative type of KTU. Other types of KTUs that provide the required features may be used at the discretion of the telephone company. Additional features, such as common pickup of a single group of lines from any of several telephone sets, may be supplied by bridging key telephone sets and adding additional KTUs. Any service commonly offered in a local area should be provided according to local practices.

B. ACU Application

3.06 The data coupler is designed to operate with automatic data terminals which can generate dial pulses for automatic calling. The coupler will



NOTES:
1. THE KEY TELEPHONE LEADS FOLLOWED BY A PARENTHESIS ARE ASSIGNED TO THE SAME LINE.
2. TRANSFORMER CONNECTIONS NOT SHOWN.

Fig. 10—Key Telephone Unit Connections With a 1001A Data Coupler

also operate with a DAS 801-type ACU to provide the automatic calling function on either TOUCH-TONE or dc dial pulse lines. A partial schematic of a coupler/ACU connection is shown in Fig. 11, and a description of operational sequences is provided in the following paragraphs. A diagram for connecting the ACU to the coupler is shown in Fig. 12.

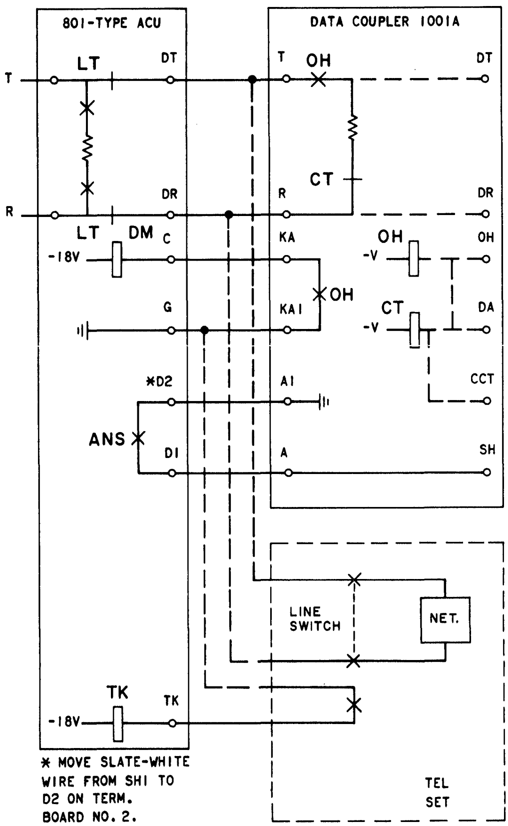


Fig. 11—Partial Functional Schematic—ACU Applications With 1001A Data Coupler

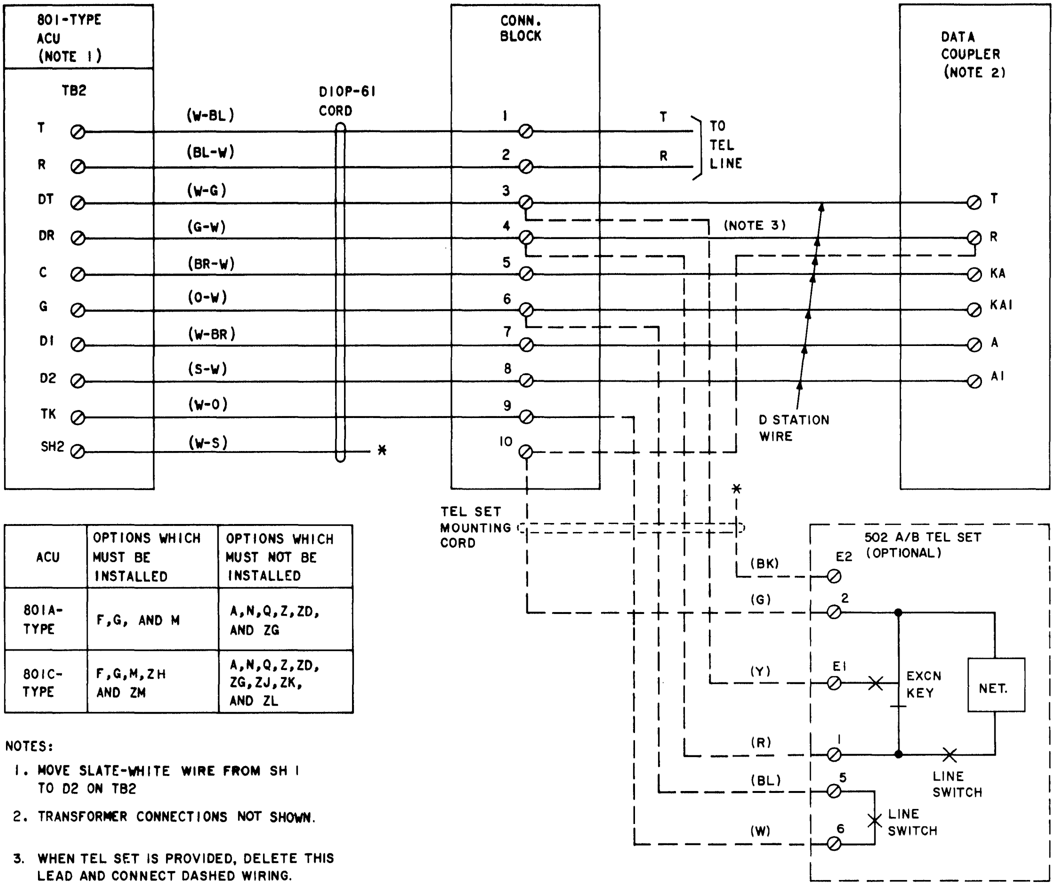
Note: When an optional 801-type ACU is provided for automatic call origination, install the unit in accordance with the section covering that unit.

3.07 ***Call Origination:*** Call origination with an ACU can be based on end-of-number (EON) operation or on answer-tone detection by the ACU.

3.08 To originate a call by using ***EON operation,*** the control leads to the coupler interface are in the ***off*** condition (the DA lead may be turned ***on*** permanently when all call originations are via the ACU). The ACU transfers the line from the coupler to the ACU in response to the call request (CRQ) signal from the data terminal. The normal dial sequence is presented to the ACU followed by the EON code. When the EON code is received, the ACU operates the ANS relay which causes the SH lead on the coupler to turn ***on***. The previously operated LT relay in the ACU drops to return line control to the coupler. The data terminal responds to the ***on*** condition of the SH lead by turning ***on*** the OH lead on the coupler. Operation of the OH relay drops the ANS relay which turns the SH lead ***off***. The OH relay operates to close and hold the loop and to supply the required supervisory contact closure to the ACU. The ACU turns ***on*** the DSS lead, and the customer terminal should respond by turning ***off*** circuit CRQ. The data terminal turns ***on*** the DA lead (if not permanently ***on***) and looks for the CCT lead to indicate that the terminal has been cut through to the local telephone line. The data terminal should wait for answer tone or other signal from the called station before attempting to send data.

3.09 To originate a call by using the ***answer-tone detection operation,*** the control leads to the coupler interface are in the ***off*** condition (the DA lead may be turned ***on*** permanently when all call originations are via the ACU). The ACU transfers the line from the coupler to the ACU in response to the CRQ signal from the data terminal and accepts the normal dial sequence as presented. After dialing is completed, the ACU waits for detection of answer tone (2025 or 2225 Hz) from the called station. When the answer tone is detected, the ACU operates the ANS relay, which causes the SH lead on the coupler to turn ***on***. The previously operated LT relay drops in the ACU to transfer line control back to the coupler. The sequence of operation now follows the same as for EON operation.

3.10 ***Call Termination:*** The data terminal terminates a call by turning ***off*** the OH lead to the coupler. The OH relay drops to open the



ACU	OPTIONS WHICH MUST BE INSTALLED	OPTIONS WHICH MUST NOT BE INSTALLED
801A-TYPE	F,G, AND M	A,N,Q,Z,ZD, AND ZG
801C-TYPE	F,G,M,ZH AND ZM	A,N,Q,Z,ZD, ZG,ZJ,ZK, AND ZL

NOTES:

1. MOVE SLATE-WHITE WIRE FROM SH 1 TO D2 ON TB2
2. TRANSFORMER CONNECTIONS NOT SHOWN.
3. WHEN TEL SET IS PROVIDED, DELETE THIS LEAD AND CONNECT DASHED WIRING.

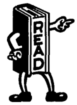
* TAPE AND STORE.

Fig. 12—1001A Data Coupler Connections With 801-Type ACU

loop-holding path and to inform the ACU that the data line is idle. The data terminal must monitor the DLO interface lead from the ACU to determine when the next call may be originated.

C. Line Current Status Indicator (LCSI)

3.11 An LCSI may be installed with the coupler on an optional basis to aid the customer in recognizing end of call. The LCSI will not work on facilities served by certain central offices and it performs differently with some of the central offices that it *will* work with. Refer to Table B to determine the applicability to a particular installation.



Caution should be exercised in using the LCSI to indicate a far-end disconnect. Momentary line current interrupts occur during call setup. They can be up to 400 ms long and can occur 10 seconds after dialing is completed and, at the called end, 500 ms after answering a call. In response to far-end disconnect, some switching offices

TABLE B

LINE CURRENT STATUS INDICATOR APPLICATION*

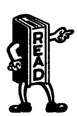
OFFICE SERVING OFF-HOOK END	END OFF-HOOK	END ON-HOOK	MIN CURRENT INTERRUPT	RELATED TO DIAL TONE	USE OF LCSI FOR DISCONNECT
ESS	Called	Calling	12 ms	Before	Okay
ESS	Calling	Called	37 ms	Before	Okay
No. 5 X-Bar	Called	Calling	10 ms	Before	Okay
No. 5 X-Bar	Calling	Called	32 ms	After	Discourage
No. 1 X-Bar	Called	Calling	0.4 sec	After	Discourage
No. 1 X-Bar	Calling	Called	0.4 sec	After	Discourage
SXS	Called	Calling			Discourage
SXS	Calling	Called			Discourage

* The use of dial long line circuits and carrier facilities on local loops will isolate station equipment from central office dc interrupts.

interrupt line current, but it is important to note that some do not. When such interrupts do occur, the LCSI contact will open momentarily. To avoid misinterpretation of momentary opens, it is recommended that an open should not be interpreted as an indication of far-end disconnect unless it is greater than 5 ms in duration. Customers should verify disconnect arrangements with the local telephone service organization before relying on the LCSI for that function.

3.12 The LCSI can be arranged to present an EIA voltage with a parallel indication to SH contact closure spare leads (option Z) ***or*** a contact closure (option Y) to the customer as an indication of line current. The EIA voltage is derived from the SH driver circuit in the data coupler under control of the switchhook or the LCSI. If no associated telephone set is used, the indication is LCSI only. The LCSI indication will be a voltage on the SH lead at the customer interface. The contact closure option is a set of the LCSI relay contacts connected to two terminals on a separate connector block.

3.13 The LCSI (Fig. 13) must be made locally. It consists of a dry reed relay and two varistors on a 74B-49 connecting block measuring 2.75 inches wide, 4 inches long, and 1.6 inches high. The relay is in series with the coupler and gives a contact closure at the customer interface or the input to the coupler SH driver circuit when at least 20 mA of line current is flowing through the relay and coupler. The two varistors are used to provide a low-impedance transmission path to the coupler.



If the customer uses the contact closures directly, current through the terminals should be limited to less than 10 mA. The customer circuit must also be noninductive with an open circuit voltage less than 50 Vdc. The maximum length of the loop over which the coupler can operate is reduced by

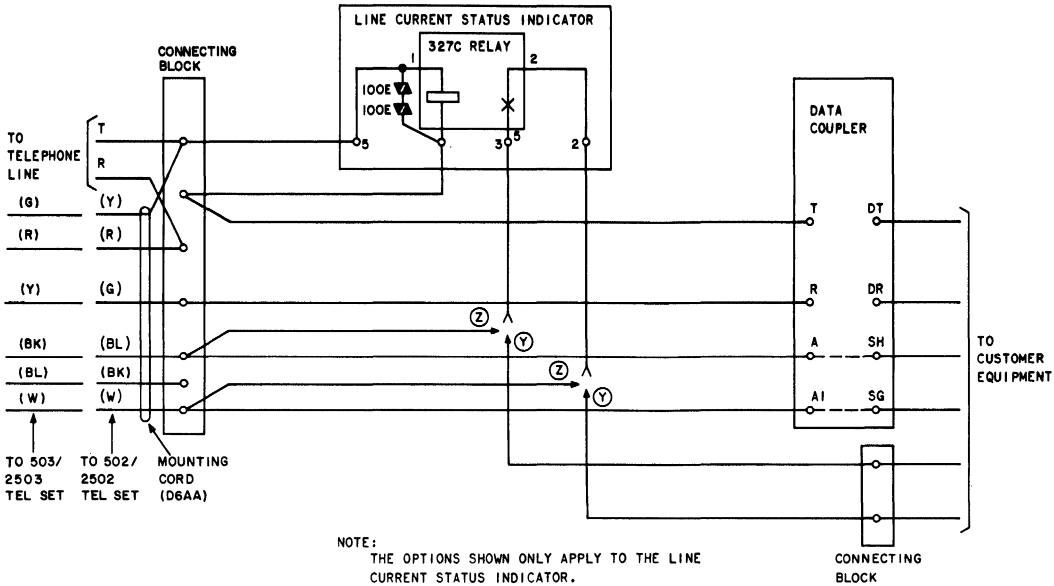


Fig. 13—Line Current Status Indicator Connection Diagram

approximately 800 feet if an LCSI is used.

3.14 Assemble the LCSI in accordance with the following procedures:

(1) Remove cover from the 74B-49 connecting block.

(2) Remove the 426A electron tube assembly, including mounting screw, and discard.

Warning: The adhesive used in (3) sets quickly and should not be allowed to come in contact with anything (especially the skin of the installer) except the relay, the applicator, and the connecting block base.

(3) Apply adhesive (Eastman 910 or equivalent) in the area to be occupied by the 327C relay.

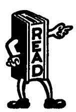
(4) Place relay on baseplate, topside down.

(5) Remove and discard the lower screws from terminal strip eyelets in positions 2, 3, 4, and 5.

(6) Wire the LCSI in accordance with Fig. 13.

4. INSTALLATION AND CONNECTIONS

4.01 The 1001A data coupler may be used with various types of SCO lines, key telephone systems, or PBX lines that provide access to the switched network.



All installation connections and tests must be performed prior to the customer making any connections to the interface.

4.02 Verify that the assigned loop facilities meet the transmission requirements for the specific data service before proceeding with the installation. General requirements for DAA are covered in

Sections 314-205-500 and -501. Requirements for the 1001A data coupler are as follows:

(a) ***Loop Loss:*** Maximum 1000-Hz insertion loss (including coupler loss of 2 dB) is 11 dB.

(b) ***Set Classification:*** Installation measurements to be made should have been determined from the type of data modem information provided by the customer and specified on the service order. When the modem type cannot be determined, Type II requirements should be specified. When the type of modem can be obtained from the customer, the following guidelines should be used.

(1) For all analog modems, Type II requirements should be specified.

(2) For all other modems, requirements based on speed of modem (same as for switched DATA-PHONE service) should be specified.

(3) If the type of modem is known to be similar to a Bell System DATA-PHONE data set, use the requirements for that particular data set.

4.03 Installation of the coupler should comply with general practices to ensure an orderly station arrangement. Information relating to selection of type of connecting block and electrical code requirements is given in Section 590-010-200. See Fig. 14 for typical interconnection block diagram.

4.04 When test or demonstration calls are made, refer to Section 010-250-001 for proper procedure for crediting charges.

4.05 Location of the coupler shall be determined by the following conditions:

- ***The coupler must be mounted vertically*** on a wall or other vertical surface with the TST and ANS switch at the top, to ensure proper operation of OH mercury relay.

- The coupler must be within range of the interface cord supplied by the customer. This cord should not exceed approximately 50 feet to meet EIA RS-232-B voltage specifications.

- Location of the coupler should provide easy access for viewing and operating the TST and ANS switches by the customer attendant.

A. Installation of Data Coupler

4.06 Install the coupler on a wall or vertical surface as follows:

(1) Remove the tape securing the cover to the base pan. Retain the envelope which contains screws for mounting CP to the base pan and screws for mounting the base pan. The envelope is located between the tape and cover.

(2) Remove the snap-off cover assembly from the coupler.

(3) Position the coupler base pan vertically against the wall with the keyhole slots narrow end up and the slots not less than 11 inches above the top of the baseboard or other obstruction which will be below the unit. Secure the base with three No. 6 by 1/2-inch wood screws for porous surfaces, or No. 6 by 3/8-inch pan-head type AB self-tapping screws for metal surfaces; the screws are supplied with the coupler.

(4) Route the D station wire through the slots and pins on the base as shown in Fig. 2. Attach the CP to the base pan by using the six self-tapping screws that are in the envelope. Connect the leads as required to the terminals on each side of the printed wiring board. ***Care should be taken not to overtighten screws or stripping of the base pan screw holes will result.***

4.07 When the coupler installation does not include an associated telephone set, tip and ring of the telephone line may be connected directly to terminals T and R, respectively, on the coupler instead of to terminals on an associated connecting block shown in Fig. 7, 8, and 9. See 3.01 through 3.05 for information on installing an optional telephone set.

B. Installation of Power Transformer

4.08 The 1001A data coupler is powered by a wall-mounted KS-20426-L1 low-voltage transformer supplied with each coupler. The KS-20426-L1 transformer provides two primary terminals in the form of parallel blades for use in

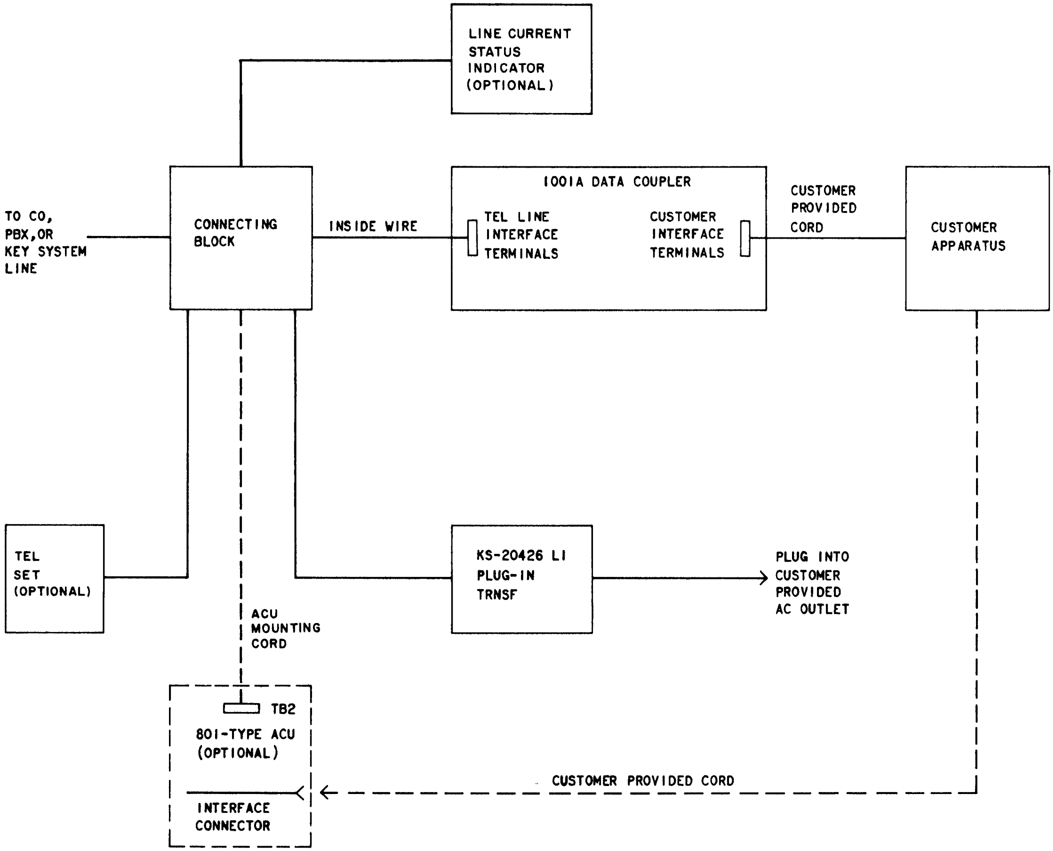
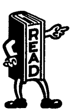


Fig. 14—Block Diagram of Typical 1001A Data Coupler Installation

a standard 2-pole, 3-wire grounded receptacle which serves as the mounting device. Two recessed screw terminals provide the means for connecting the transformer secondary. Connections from the transformer are made ***directly to the coupler*** or to an associated connecting block (Fig. 7). The furnished clamp must be used to hold the transformer securely in the receptacle. The receptacle must not be under control of a switch.



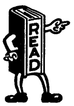
To prevent damage to the data coupler, each data coupler must be powered by an individual transformer.

C. Completion of Installation

4.09 Install cover assembly by hooking bottom end (end with small hinged cover) to base pan, swinging cover up and over the ANS and TST keys, and pressing until cover snaps into place. ***Exercise care when removing or installing coupler cover to prevent damaging the ANS and TST switches.***

4.10 Install telephone set if specified on the service order. If a 503- or 2503-type telephone is used, redesignate the SH terminal on the data coupler as "MI" (mode indicator).

4.11 Instruct the customer to raise only hinged portion of coupler cover to gain access to interface terminals. Also, inform customer that overtightening screws may cause stripping of threads.



Do not connect the customer interface leads to the coupler unless requested by, and under direction of, the customer.

4.12 After the coupler and associated units have been connected to the telephone line, perform the tests outlined in Part 5.

4.13 Inform the customer, at the time the coupler is installed, of the maximum permissible signal power output from the customer data equipment. The output level of the customer-provided equipment is the power measured at the customer interface into a 600-ohm resistive load. It may vary between -1 and -10 dBm depending upon the 1000-Hz loss of the local loop including the nominal insertion loss (approximately 2 dB) of the coupler.

5. MAINTENANCE AND TESTS

5.01 Maintenance and test procedures are provided to assist the employee during installation and troubleshooting visits to a data coupler station. All level measurements and test results made during installation must be recorded on a circuit layout record card (CLRC) to assist in analyzing future trouble and to detect gradual degradation of service. Telephone the test results to the plant service center (PSC), or equivalent test location, prior to leaving the customer location. Some tests will require disconnection of customer equipment from the interface in order to make tests and/or to replace a defective coupler. The following precautions ***must*** be taken:

- ***Obtain permission from the customer to disconnect the interface leads from the coupler.***
- ***Turn the power to both the customer equipment and to the coupler OFF before the customer leads are disconnected. Power to the coupler can be removed by unplugging the KS-20426-L1 low-voltage transformer.***
- ***After all tests are completed and the interface is reconnected, ask the customer to verify that the interface has been reconnected properly.***

A. Maintenance

5.02 All repair employees should be familiar with the tariff provisions which generally provide for a "maintenance service charge" for each customer-requested repair visit to a DAA installation. When the customer requests such a repair visit and it is subsequently determined that the trouble is ***not*** in the Bell System equipment, inform the customer and notify the PSC to fill out Form E-5855 in conformance with Section 660-101-312.

5.03 Maintenance of the coupler on customer premises is limited to local tests, testing by the serving or test office, or replacing a defective unit.

> ***Note:*** Do not attempt individual component repair or replacement on the printed CP.

5.04 Customers using data couplers are instructed, when trouble is experienced, to perform the necessary testing to sectionalize the problem. If the results of the tests indicate that the trouble is in Bell System equipment, the condition should be reported to the designated PSC or equivalent test center. All available information concerning the trouble should be forwarded to the PSC.

5.05 The PSC must analyze the information provided by the customer to determine if a trouble condition does exist and the most probable cause. Available tests (ie, normal dc loop test and remote test of coupler) should be performed to determine if a telco employee must be dispatched to customer premises. The conditions which could warrant a maintenance visit and efforts which lead to each are shown in Fig. 15.

5.06 On a maintenance visit, perform the tests or evaluations to isolate and clear the trouble within the station as directed by the PSC. Begin with the steps shown in Fig. 15 when the test results and analysis received from the PSC lead to that particular activity. If a trouble report is not available or if the report is inconclusive, follow

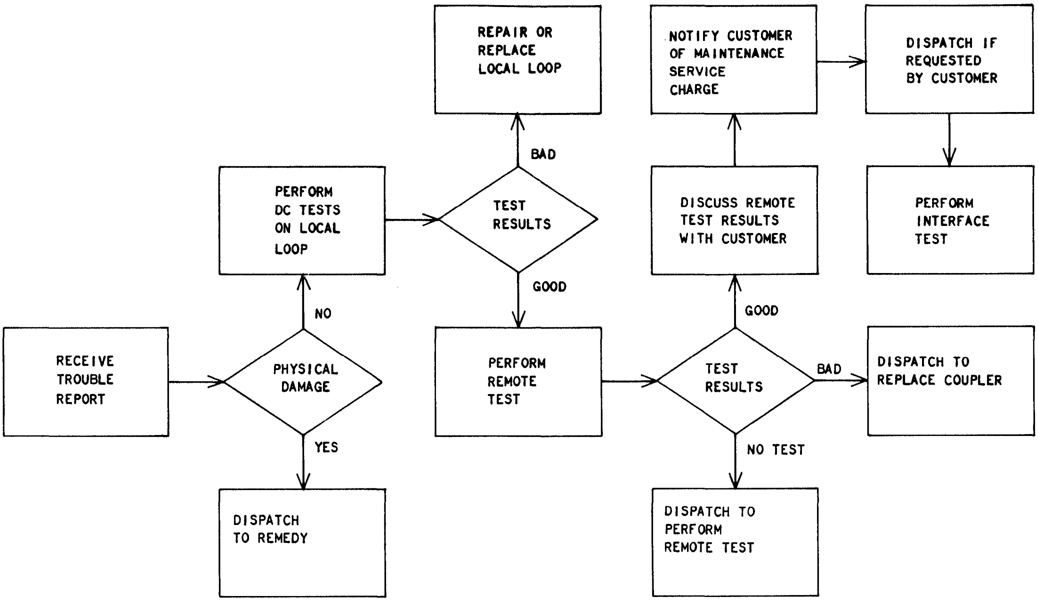


Fig. 15—Basic Activities Prior to Dispatching Employee

the suggested sequence of activities as illustrated in Fig. 16 and described in the following:

(1) The telco employee must be properly equipped with information (BSP documentation, line card details, etc), spare coupler, and test equipment, etc, for locating trouble and effecting repairs at the customer premises.

(2) Upon arrival at the coupler station, question the customer to obtain any information relating to the reported trouble, then perform a visual and mechanical inspection of the installation. Check that TST switch on coupler is not partially operated. Check for disconnected or broken cords, inside wiring, drop wire, broken components or any other possible trouble causes. Repair or replace any defective or marginal components (ie, ringer, dial, handset, etc).

(3) Perform a remote test to the local test desk (LTD) or equivalent test location.

(4) If any components were replaced or repaired ***and*** the results of the remote test are satisfactory, close trouble report.

(5) If all components are satisfactory ***and*** the results of the remote test are satisfactory, perform an interface voltage test.

(6) If the results of the interface voltage test ***or*** remote test are not satisfactory, replace the coupler. Ensure that all level measurements made during the required installation tests are properly recorded on the CLRC.

(7) Perform a remote test on the new coupler.

(8) If the results of the new coupler remote test are ***not*** satisfactory, notify the PSC.

(9) If the results of the new coupler remote test are satisfactory, request the customer to verify that service is restored (ie, try to exchange data with the station that caused the trouble report).

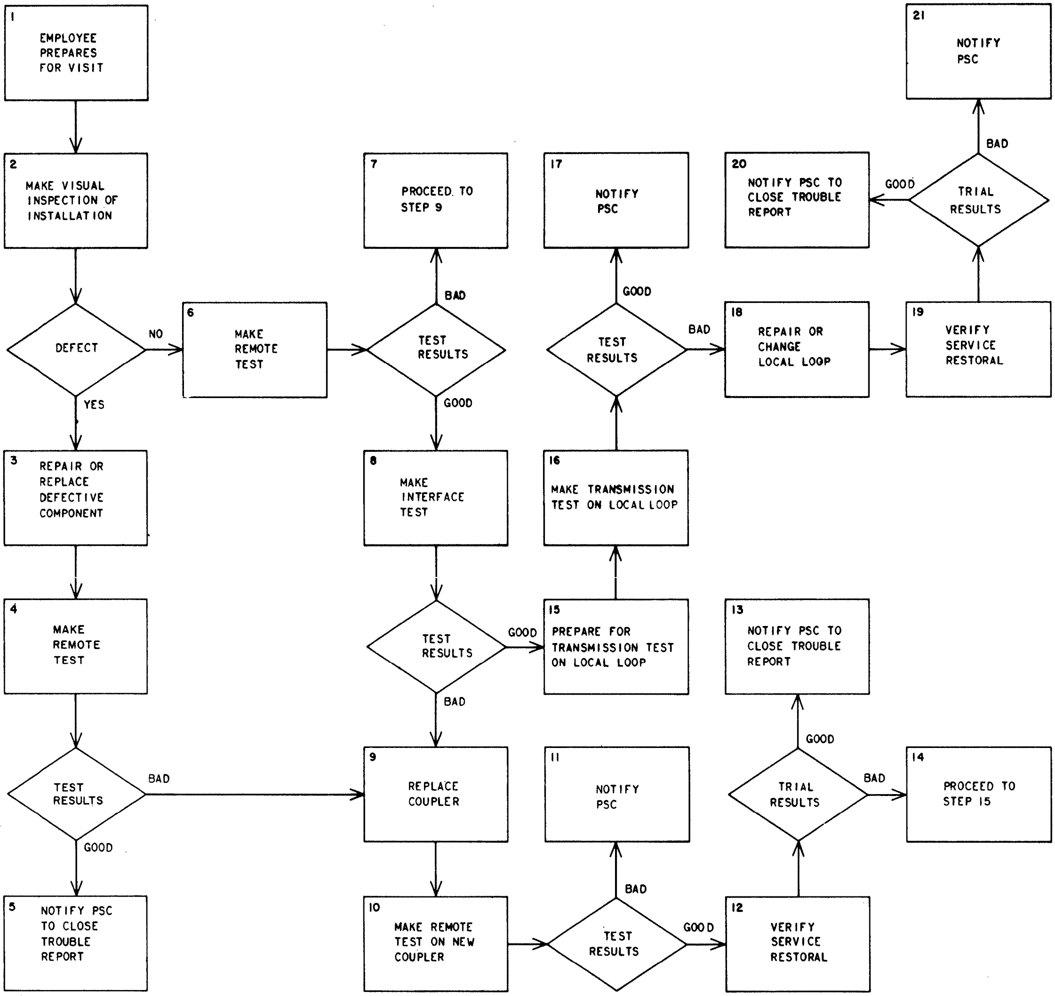


Fig. 16—Activities for Troubleshooting at a Coupler Station

(10) When the customer is satisfied with the service, notify the PSC to close the trouble report.

(11) If the customer cannot exchange data or is ***not*** satisfied with the service, disconnect the coupler and perform a complete transmission test of the local loop as described in Section 314-205-501.

(12) If the results of the loop test are satisfactory, notify the PSC.

Note: The preceding investigation has eliminated the coupler and local loop as possible trouble; therefore, attention must be directed to the data terminal or facilities.

(13) If the results of the loop test are ***not*** satisfactory, arrange with the PSC to have

the loop repaired or changed. The repaired or changed loop must meet requirements outlined in Section 314-205-501.

(14) After changing the defective loop, reconnect the coupler to the telephone line. Perform the insertion loss and impedance matching tests to determine if maximum allowable customer level has been changed. Notify customer of level change and then request customer to verify service restoral (ie, try to exchange data with the station that caused the trouble report).

Note: Prior to leaving customer premises, perform the remote test and record the new level on the CLRC.

(15) When the customer is satisfied with the service, notify the PSC to close the trouble report.

(16) If the customer cannot exchange data or is not satisfied with the service, trouble may still exist in another component of the system or in the data terminal, and further investigation must be pursued. Notify supervision, who can escalate following normal procedures of data technical (DATEC) support. Refer to Sections 010-521-100 and -101. Notify the PSC of the repair work that has been completed and wait for further instructions.

B. Tests

5.07 The following tests are required to ensure proper installation of the data coupler and to determine the operating condition of the unit during a maintenance visit:

- Insertion Loss Test
- Impedance Matching Test
- Remote Test
- Interface Voltage Test
- ACU Test
- LCSI Test
- 503C or 2503C Telephone Set Test.

5.08 The following test equipment is required for the tests:

- 600-ohm ±1 percent resistor
- KS-16979-L1 volt-ohm-milliammeter (VOM), or equivalent with a high-impedance, bridging-type ac voltmeter with a dB scale such that 0.776 Vac corresponds to 0 dB.
- 1013-type hand test set, or equivalent
- KS-19353-L4 oscillator or equivalent with a 600-ohm output impedance and a capability of a -5 dBm reading when connected across 600 ohms.

Note: The insertion loss test ***and*** the impedance matching test are required to determine proper level option strapping, using Table C.

Insertion Loss Test

5.09 The insertion loss test measures the combined loss of the loop and coupler. The results of the test are used to determine the maximum allowable customer signal power level which will result in a signal level no greater than -12 dBm at the SCO. This test requires that the customer interface leads be disconnected from the coupler in accordance with precautions listed in 5.01. The coupler must be connected to the telephone line. Proceed with the test as follows:

(1) Ensure that the KS-20426-L1 transformer is connected to the coupler and plugged into the power receptacle.

(2) Locate and remove any existing straps on level option terminals A through H (Fig. 2).

Note: Cover must be removed to gain access to level option terminals. ***Exercise care when removing coupler cover to prevent damaging the TST and ANS switches on older-type couplers.***

(3) Connect 600-ohm resistor across terminals DT and DR. If a transmission test set is used instead of the VOM, the test set provides the 600-ohm termination.

TABLE C

LEVEL OPTION STRAPPING FOR 1001A DATA COUPLER

MEASURED LEVEL (INSERTION LOSS TEST) DBM	MAXIMUM ALLOWABLE CUSTOMER LEVEL DBM	MEASURED LEVEL (IMPEDANCE MATCHING TEST) DBM				
		−3.6 to 0	−4.6 to −3.7	−5.6 to −4.7	−6.6 to −5.7	−6.7 to −9
		LIMITER OPTION STRAPS				
−2.5 to −3.4	−10	A, B, D, E	A, C, D, E	B, C, D, E	A, B, C, D, E	A, B, C, D, E
−3.5 to −4.4	−9	A, B, C, E	A, B, D, E	A, C, D, E	B, C, D, E	A, B, C, D, E
−4.5 to −5.4	−8	D, E	A, B, C, E	A, B, D, E	A, C, D, E	B, C, D, E
−5.5 to −6.4	−7	C, E	D, E	A, B, C, E	A, B, D, E	A, C, D, E
−6.5 to −7.4	−6	A, E	C, E	D, E	A, B, C, E	A, B, D, E
−7.5 to −8.4	−5	A, B, C, D	A, E	C, E	D, E	A, B, C, E
−8.5 to −9.4	−4	A, C, D	A, B, C, D	A, E	C, E	D, E
−9.5 to −10.4	−3	A, B, C	A, C, D	A, B, C, D	A, E	C, E
−10.5 to −11.4	−2	C	A, B, C	A, C, D	A, B, C, D	A, E

Example: Value obtained in insertion loss test = 6.4 dB.
Value obtained in impedance-matching test = −4.2 dBm.
A strap should be placed between terminals D and E.

(4) Connect strap between terminals DA, OH, and SH.

(5) Connect the hand test set across tip and ring of the telephone line and dial the milliwatt supply (1000 Hz) at the SCO.

Note: If a telephone set is associated with the coupler, remove the handset, ensure that the exclusion key is in talk position, and dial the milliwatt supply.

(6) When the tone is heard, short terminal A to A1 with a clip lead and remove the hand test set from the line (or restore the talk key to data mode on the associated telephone).

(7) Condition the VOM to measure approximately -5 dBm. Measure and record the level (in dBm) of the signal across the coupler DT and DR terminals with the VOM.

(8) Remove the clip lead from A to A1. (The SCO connection will terminate.)

Impedance Matching Test

5.10 This test follows the insertion loss test on either an installation or maintenance visit; therefore, the level option terminals should not be strapped for this test. Proceed with the test as follows:

(1) Set the oscillator for a 1000-Hz frequency and a 600-ohm output impedance.

(2) Select the proper scale on the VOM to measure -5 dBm.

(3) Connect the test equipment and straps as shown in Fig. 17.

(4) Adjust the oscillator output level to obtain a -5 dBm indication on the VOM.

Note: After the indication is obtained, do not change the frequency or level setting on the oscillator.

(5) Connect the hand test set across tip and ring of the telephone line, and dial a quiet battery termination at the SCO.

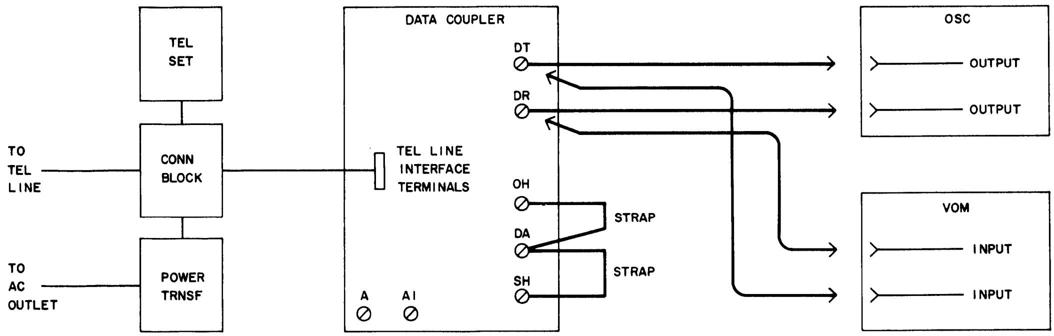


Fig. 17—Test Equipment Connections for Impedance Matching Test

Note: If a telephone set is associated with the coupler, remove the handset, ensure that the exclusion key is in talk position, and dial the quiet termination.

(6) After the connection is completed, short terminal A to A1 with a clip lead and remove the hand test set from the line (or operate the data key to data mode on the associated telephone).

(7) Measure the signal level with the VOM. Use this value to derive the level option strapping from Table C.

(8) Remove the straps, disconnect test equipment, and restore the connection to normal. (The SCO connection will terminate.)

5.11 Using the values obtained in 5.09 and 5.10, apply straps in accordance with Table C. Mark the maximum input limit on the data coupler as determined in 5.09 (Fig. 1).

Note: Cut pieces of insulated 24-gauge solid wire to fit between appropriate terminals. Strip insulation from wire ends and, using long-nose pliers, seat ends of wire straps under terminals.

Remote Test

5.12 The remote test is required in measuring the test signal of the coupler at the SCO at time of installation. The test signal provides a check of the local loop and the limiting function of the coupler. Subsequent readings can then be compared with the initial reading for indications of service degradation.

5.13 The data coupler must be connected to the telephone line for this test and the KS-20426-L1 transformer connected to the coupler and plugged into the ac receptacle. Proceed with the test as follows:

(1) Connect the hand test set across tip and ring of the telephone line and contact the LTD.

Note: If a telephone set is associated with the coupler, remove the handset, ensure that the exclusion (data) key is in talk position, and establish a connection to the LTD.

(2) Request the LTD employee to call the coupler and measure the level of the test tone (2800 Hz) received at the LTD.

(3) Agree upon length of time required to perform the test and restore the connection to idle state (hang up).

(4) Operate TST switch to ON position (depress the red dot half of switch). The TST lamp lights.

(5) Observe that the ANS lamp flashes in response to the incoming call from the test desk. The flashes in response to the ringing cycle are approximately 2 seconds ON and 4 seconds OFF until the ANS switch is operated.

(6) Operate ANS switch to ON position (depress red dot half of switch). The TST and ANS lamps go off. After a 2-second interval, the ANS lamp lights.

(7) After the agreed testing interval, operate TST and ANS switches to OFF position.

(8) Reestablish the connection to the LTD and request the level reading from the employee. This level indicates the loss of the loop and coupler at 2800 Hz. If the test is made at time of installation, the actual value of the loss ***must be recorded*** on the CLRC for comparison against measurements made in subsequent tests. If the level of the 2800-Hz signal on subsequent tests varies by more than 2 dB from the original value, it is an indication of possible trouble in either the loop or coupler.

(9) If the test tone must be measured at a remote test desk or DTC over facilities of unknown or varying loss, a successful receipt of tone indicates that there is ac continuity in the loop and coupler and that the coupler operates satisfactorily. However, the measured level is not important.

(10) Restore the telephone connection to normal.

Interface Voltage Test

5.14 The interface voltage test assures that the interface terminals of the coupler will respond to proper signals from the customer terminal or will indicate to the terminal when the coupler is conditioned for the various operational modes.

5.15 This test requires that the customer interface leads be disconnected from the coupler in accordance with procedures outlined in 5.01. The coupler must be connected to the telephone line and the KS-20426-L1 transformer connected to the coupler and plugged into the ac receptacle. Use the VOM to make the measurements during the test. Proceed as follows:

Note: When making measurements in the following steps, be careful to observe proper polarity with the meter.

(1) Connect a strap between terminals A and A1.

Note: Exercise care when removing the coupler cover to prevent damaging the ANS and TST switches on older-type couplers.

(2) Measure the voltage between terminals (+) SH (or MI) and (-) SG. The meter indicates between +8 and +12 Vdc.

(3) Remove strap from terminals A and A1.

(4) Measure the voltage between terminals (-) SH (or MI) and (+) SG. The meter indicates between -8 and -12 Vdc.

(5) Originate a call to the coupler from another line or arrange to be called from the LTD. Observe that the voltage between terminals RI and SG follows the ringing cycle and swings between +8 to +12 (ON) and -8 to -12 (OFF) Vdc. The ON interval is approximately 2 seconds and the OFF interval approximately 4 seconds.

(6) Connect a strap between terminals OH and SH (or MI), and short terminal A to A1 with a clip lead.

(7) Measure the voltage between (-) RI and (+) SG. The meter indicates between -8 and -12 Vdc after ringing is tripped.

(8) Measure the voltage between terminals (-) CCT and (+) SG. The meter indicates between -8 and -12 Vdc. Leaving the meter on terminals CCT and SG and strap on terminals OH and SH (or MI), connect an additional strap between terminals DA and SH (or MI). After 2 seconds, observe that the voltage swings to between +8 and +12 Vdc.

(9) Connect the meter between terminals KA and KA1. The meter indicates continuity between terminals.

(10) Remove short from between terminals A and A1. An open is indicated on the meter between terminals KA and KA1.

(11) Measure the voltage between (-) CCT and (+) SG. The meter indicates between -8 and -12 Vdc.

(12) Hang up the calling telephone and remove test equipment and straps from the coupler.

ACU Test

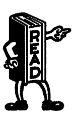
5.16 When an ACU is associated with the coupler, the ACU can be tested as described in the appropriate sections for DAS 801-type ACU (Sections 598-010-ZZZ and 598-012-ZZZ). Options required for the ACU are indicated in Fig. 11. This test requires that the customer interface leads be disconnected from the coupler in accordance with precautions listed in 5.01. The coupler must be connected to the telephone line and the KS-20426-L1 transformer connected to the coupler and plugged into the ac receptacle. Proceed with the test as follows:

(1) While testing the ACU, use the VOM to observe that the SH (or MI) lead turns ***on*** at the appropriate time by measuring the voltage between terminals (+) SH (or MI) and (-) SG. The meter indicates between +8 and +12 Vdc for the ON condition.

(2) Disconnect test equipment and restore the connection to normal.

LCSI Test

5.17 This test should be used to verify proper operation of the LCSI. The option Z test is performed without disconnecting the customer LCSI interface, while the option Y test requires disconnecting the customer LCSI interface.



Take necessary precautions to ensure that the customer does not receive inadvertent signals.

Note: When making measurements in the following steps, be careful to observe proper polarity with the meter.

LCSI With Option Z (EIA Interface)

(1) Measure the voltage between terminals (-) SH (or MI) and (+) SG. The meter indicates between -8 and -12 Vdc (OFF).

(2) Operate TST key.

(3) Initiate a call to the coupler.

(4) When the lamp under the ANS key lights, operate ANS key.

(5) Measure the voltage between terminals (+) SH (or MI) and (-) SG. The meter indicates between +8 and +12 Vdc (ON).

(6) Restore TST and ANS keys to normal.

LCSI With Option Y (Contact Interface)

(1) After disconnecting the customer leads from the separate connecting block, measure the resistance between the two terminals at the customer interface. The meter indicates an open circuit.

(2) Operate TST key.

(3) Initiate a call to the coupler.

(4) When the lamp under the ANS key lights, operate ANS key.

(5) Measure the resistance between the two terminals on the separate connecting block. The meter indicates a short circuit.

(6) Restore TST and ANS keys to normal and reconnect customer leads.

503C or 2503C Telephone Set Test

5.18 This test verifies that the telephone set mode indication and audible monitor features are operating properly. Requirements of this test are based on the logic sense which gives an ON (+) voltage when the telephone set is connected to the line. In all other cases, the mode indication will be OFF (- voltage). This test can be performed without disconnecting the customer interface. Take necessary precautions to ensure that the customer does not receive inadvertent signals.

Note: When making the following measurements, be careful to observe proper polarity with the meter.

5.19 Lift telephone handset. Using the VOM, make voltage measurements between terminals MI (+) and SG (-) on the data coupler, in accordance with the options installed and Table D. Return handset to cradle.

Note: It is only necessary to make the one pair of readings corresponding to the options installed.

TABLE D

MFT SET TEST WITH 1001A DATA COUPLER

INDICATOR	OPTIONS INSTALLED	VOLTMETER READING, DC	
		EXCLUSION KEY	
		UP	DOWN
Voice Mode	A, H, K	+8 to +12	−8 to −12
Data Mode	A, I, J	−8 to −12	+8 to +12
Switchhook	A, G, J	+8 to +12	+8 to +12
Voice Mode	B, I, K	−8 to −12	+8 to +12
Data Mode	B, H, K	+8 to +12	−8 to −12
Switchhook	B, G, J	+8 to +12	+8 to +12

Note: Switchhook operated for all readings.

5.20 Initiate a call to the coupler. Lift handset to answer call. After a 3-second delay, a 2800-Hz tone is heard in handset.

6. REFERENCES

6.01 The following Bell System Practices provide additional information that may be helpful in installing the data coupler:

SECTION	TITLE
010-250-001	Crediting Charges on Test Calls
010-521-100	Data Technical (DATEC) Support
010-521-101	Data Technical (DATEC) Support—Designee Directory
314-205-500	Data Systems—DATA-PHONE® Service and Data Access Arrangements on Direct Distance Dialing Network—Overall Data Transmission Test Requirements
314-205-501	Data Systems—DATA-PHONE® Service and Data Access Arrangements on Direct Distance Dialing Network—Test Requirements for Subscriber, Foreign Exchange, and Remote Exchange Lines
590-010-200	Data Sets and Data Access Arrangements—General Installation and Connection Information
598-010-ZZZ	Data Auxiliary Sets 801A-Type
598-012-ZZZ	Data Auxiliary Sets 801C-Type
660-101-312	Maintenance Service Charge on Services With Customer-Provided Equipment (CPE)

6.02 Detailed information on the 1001A data coupler is contained in the following schematic drawing (SD) and circuit description (CD):

SD-&CD-1D206-01 1001-Type Data Couplers

1001B DATA COUPLER

DESCRIPTION, INSTALLATION, MAINTENANCE, AND TESTS

CONTENTS PAGE

1. GENERAL

1.01 This section provides information required for installing and maintaining the 1001B data coupler (Fig. 1).

1.02 This section is reissued to include:

- Information formerly contained in Addendum 1
- A line current status indicator (LCSI) test
- A 503C or 2503C telephone set test
- A warning about the size of mounting screws used.

Since this reissue constitutes a general revision, arrows ordinarily used to indicate changes have been omitted.

1.03 The data access arrangement (DAA) includes both the data coupler and telephone set as described in appropriate tariffs. The 1001B [rated Manufacture Discontinued (MD)] is an automatic data coupler which provides the means for connecting customer-provided, automatic data equipment to the switched network for data and voice communications. The uniform service order code (USOC) for this coupler is CBT.

NOTICE
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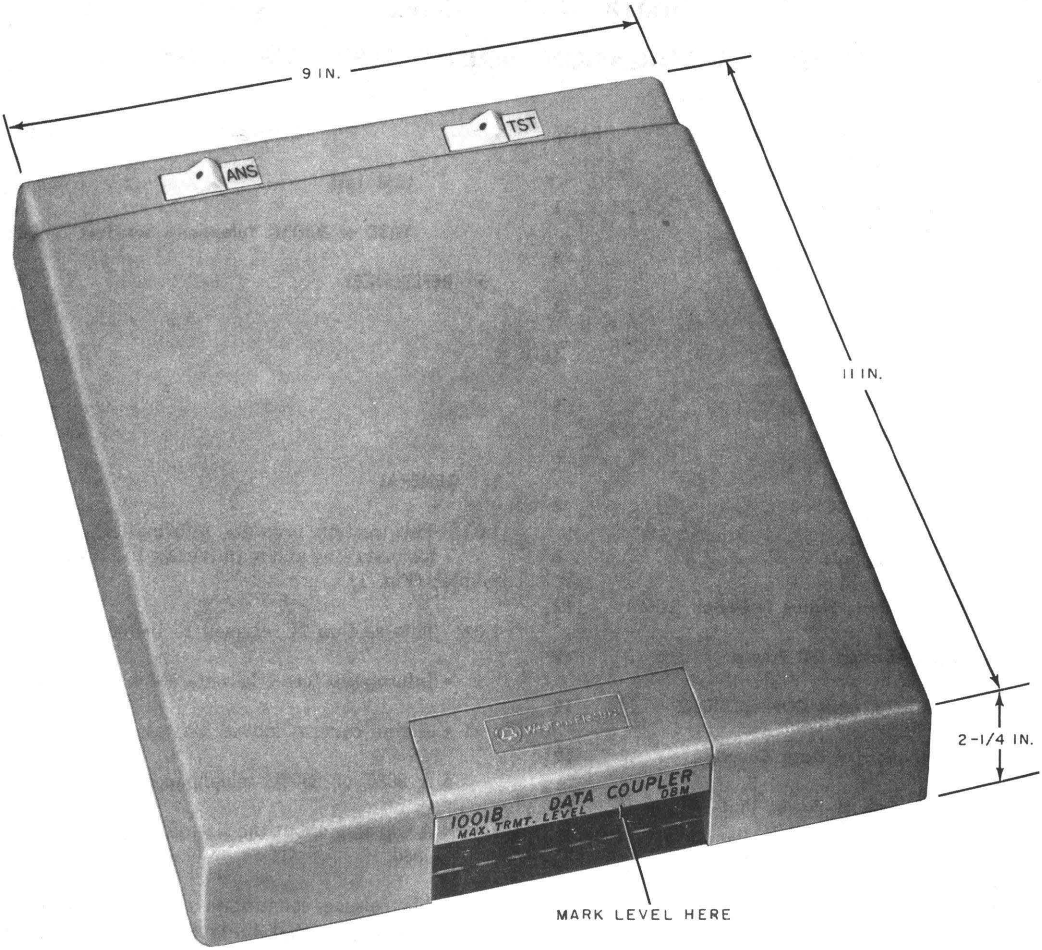


Fig. 1—1001B Data Coupler

1.04 The 1001B data coupler provides the following:

- Isolation of customer equipment for protection of telephone plant and personnel from hazardous voltages. This also provides protection of customer equipment from surges occurring on telephone facilities.
- Automatic linear control of signal level above a specified threshold.
- Contact-type interface.
- Detection of incoming ringing signals to permit customer to operate in unattended answering mode.
- Test circuitry for manually operated remote testing.
- Off-hook control which allows customer equipment to dial-pulse for call origination.

- Timed delay on all calls to permit proper automatic message accounting.

- Indication of switchhook or transfer key status on associated telephone set, if provided.

- 2-way transmission path.

1.05 Additional telephone functions, such as alternate voice service, may be provided with an associated telephone set as a standard option. Audible monitoring of data transmission and mode indication through switch contacts are provided by 503C and 2503C telephone sets.

1.06 Customer equipment may be connected through the data coupler to local loop facilities or to Bell System private branch exchange (PBX) station lines.

1.07 At installations where TOUCH-TONE® calling service has been ordered, the customer may generate tone signals for originating calls through the transmission interface leads of the coupler.

1.08 Service offering in which the data coupler is used provides the customer with end-to-end transmission performance characteristics comparable to DATA-PHONE® service on the switched telecommunications network. Because customer equipment, over which the Bell System has no design control, may contribute significantly to error performance, the Bell System cannot assume responsibility for the accuracy of transmitted data. End-to-end facilities, including the local loop, are to be engineered and maintained to equivalent DATA-PHONE service requirements. These requirements are specified in Section 314-205-501 for local loops and Section 314-205-500 for the switched network.

1.09 A 4.5-second delay on all calls prior to cut-through of the transmission path is provided on series 1 data couplers. A 2-second delay is provided on series 2 or later couplers. For ease of coverage, only the 2-second interval is mentioned throughout this section.

2. DESCRIPTION

A. Physical Description

2.01 The 1001B data coupler is a wall-mounted unit measuring 9 inches wide, 11 inches high, and 2-1/4 inches deep. The coupler weighs approximately 2-1/2 pounds and is enclosed in a gray plastic housing. The housing consists of a dark gray base and a light gray cover that snap together. Two keyhole slots and one screw hole are provided in the base pan for mounting the unit on a wall or other vertical surface. ***The coupler must be vertically mounted to ensure proper operation of the mercury relay.***

> ***Note:*** Three No. 6 by 3/8-inch pan-head metal screws and three No. 6 by 1/2-inch wood screws are shipped with each data coupler repaired and returned to the field for service. The use of larger screws will short circuit printed paths on the circuit pack.

2.02 Circuitry for the coupler is mounted on a single printed CP. Ten screw terminals, located on the lower end under the small hinged cover, provide the interface for connecting customer equipment (Fig. 2). The interface control leads use contact closures for signaling. See Table A for the designation of interface leads. The cord required for connecting customer equipment to the interface must be supplied by the customer.

2.03 Four screw terminals are provided on the printed CP for connecting the telephone line and associated apparatus to the coupler. The housing cover must be removed to make connections within the coupler. To remove, lift cover up from the bottom to relieve tension on mounting lips, then pull cover out at the top. Use D station wire to terminate connections. The following pairs of leads terminate on the four terminals:

- T and R—Telephone line transmission and signaling pair

- A and A1—Extension of associated telephone set switchhook contact or transfer key to the customer equipment.

> ***Note:*** Four additional screw terminals are open-ended (not connected) on the board and are not used on the 1001B.

2.04 Two locking switches (TST and ANS) and associated lamps are located at the top of the coupler to provide control and indication of test mode condition. The two lamps will glow dimly when the unit is not in test mode.

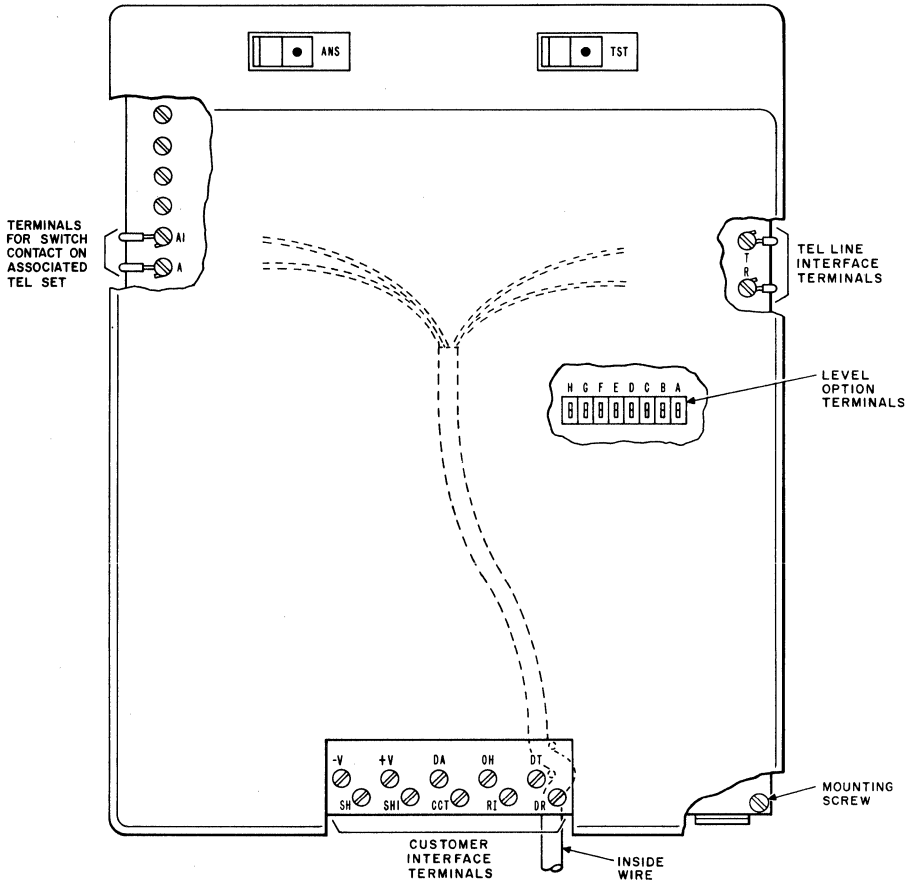


Fig. 2—Route of Station Wiring and Location of Terminals

2.05 Level option terminals located on the CP must be strapped by the installer for adjusting the threshold of the automatic level control (ALC) (limiter) circuit of the coupler.

2.06 The data coupler is designed to operate over an ambient temperature range of 0 to 120°F, with a relative humidity up to 95 percent.

2.07 The coupler ALC circuit is powered from dc telephone line current. An external dc power supply is required for the control circuit of the coupler. The external supply may be provided by the customer, or by the telephone company (telco) at the request of the customer. When the telco is requested to provide the supply, a suitable power source is the 28A1 power unit (Section 167-445-101) or the 19B2 power unit (Section 167-440-201). The customer must provide a standard 2-pole 3-wire grounded 117-Vac power receptacle for either power unit. The receptacle must not be under control of a switch.

B. Functional Description

2.08 ***General:*** The data coupler is a network protective unit designed to interface with a customer-provided automatic data terminal. The

TABLE A

INTERFACE LEAD DESIGNATIONS FOR 1001B DATA COUPLER

TERMINAL DESIGNATION	FUNCTION	
DT	Data Tip	600-Ohm Transmission Leads
DR	Data Ring	
OH	Off-On Hook Control	
DA	Request Data Transmission Path Cut-Through	
RI	Ring Indication	
CCT	Coupler Cut-Through	
SH (or MI)*	Switchhook Status of Associated Tel Set	
SH1	Return for SH Lead	
+V	Positive DC Power	
−V	Return for DC Power and Common for OH, DA, RI, and CCT	

*SH is redesignated MI when used with MFT.

coupler provides contact closures to the data terminal to indicate the detection of ringing signals. In response to the contact closures, the data terminal provides signals which cause the coupler to seize the line, trip ringing, and cut through the transmission path. Prior to the transmission path cut-through, a 2-second delay is provided to allow proper operation of automatic message accounting equipment. A polarity guard, ALC, and a coupling transformer are provided to protect the telecommunications network, coupler, and customer equipment. In addition, the coupler circuitry permits the data terminal to originate and terminate data calls automatically.

2.09 ***Coupler Transmission Path:*** The coupler transmission path primarily consists of a coupling transformer, an ALC circuit, and a polarity guard (Fig. 3). The transformer terminates the telephone loop and provides a 2-way protective function (ie, hazardous voltages, surge protection, and longitudinal isolation). The ALC circuit prevents the customer signal level from exceeding the prescribed maximum limit. The polarity guard maintains the polarity of the line current and voltage required by the ALC circuit.

2.10 The ALC circuit continuously monitors the output of customer data signals. Option strapping on the level adjusting network determines the signal power level (threshold) at which the circuit operates to control the output signal.

2.11 The signal power level is continuously averaged by the detector and integrator. When the averaged signal level exceeds the threshold during any 3-second interval, current is driven through a thermistor. The thermistor heats up, decreases in resistance, and since the thermistor shunts the transmission path, reduces the signal level to the threshold value.

Data Mode

2.12 ***Ring Detection:*** The ring detector (Fig. 3) is activated when the 20-Hz ringing signal is present on the line, indicating an incoming call. The R relay, part of the ring detector, operates and releases in response to each half cycle of

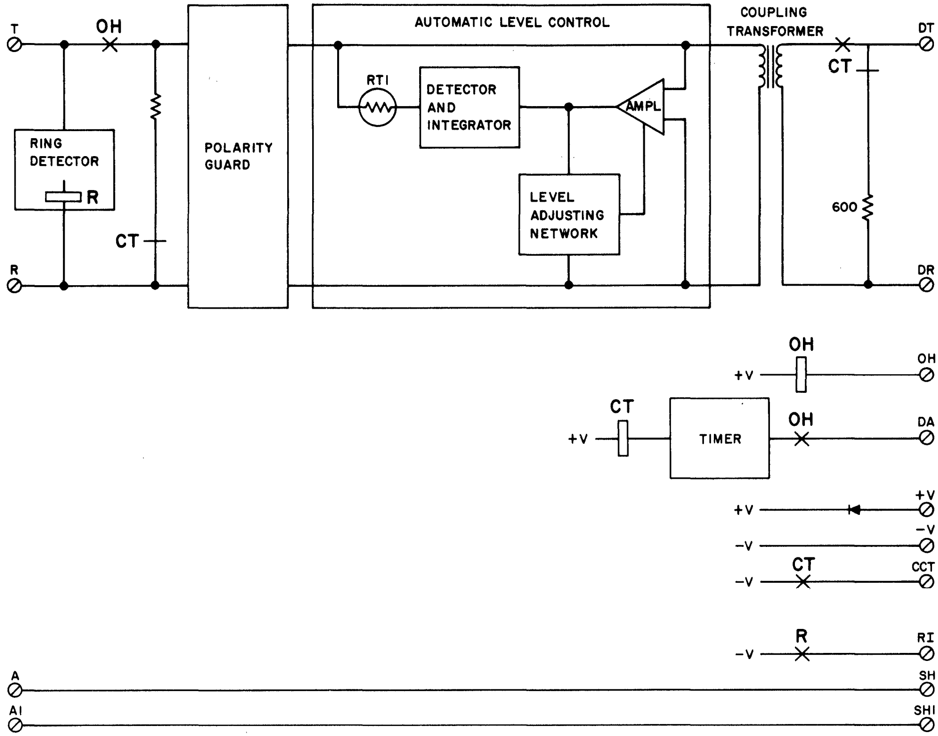


Fig. 3—Functional Schematic of 1001B Data Coupler—Data Mode

ringing current. Contact closures of the R relay are used to close the RI interface lead to -V. ***The contact closures must be integrated by the customer data terminal to protect against false operation due to surges or dial pulses. At least two cycles of the 20-Hz ringing signal should be detected before reacting to the signal.***

> ***Note:*** An interface control lead closed (connected) to -V indicates an ON condition. A control lead opened (not connected) to -V indicates an OFF condition.

2.13 ***Automatic Answer:*** When the data terminal is ready and satisfied that ringing has been received, the OH interface lead is closed to the -V lead. Closure of the OH lead operates the OH relay. In turn, the relay performs the off-hook function by closing the loop to trip ringing. The relay also closes the operation path from the DA interface lead to the delay timer. To complete the data transmission path, the data terminal closes the DA lead to -V. (The DA lead may be closed to -V at all times except when dial pulsing on the OH lead.) The DA lead closure, or the operation of the OH relay when DA is permanently ON except during dialing, starts the timer circuit. After a 2-second interval, the CT relay operates. The CT relay removes the terminating resistor from the loop, removes the terminating resistor from the data terminal, connects the data terminal to the telephone line through the ALC, and closes the CCT interface lead to -V. Closure of the

CCT lead informs the data terminal that the transmission path is now completed through the coupler from the data terminal to the local loop.

Closure of the CCT interface lead does not imply that an end-to-end connection has been established.

2.14 The data coupler contains no circuitry to generate or detect answer-tone signals. The customer must provide or detect the answer tone when required.

2.15 ***Call Origination:*** Closing of the OH interface lead to -V by the customer, either for call origination or for transfer from a manually originated call, causes the OH relay to provide the off-hook function as previously described. Opening the OH lead causes the OH relay to release and open the dc path through the coupler. This sequence of operations permits the data terminal to generate dial pulses for call origination when dial tone is present. The pulsing sequence and timing requirements are as follows (see Fig. 4):

(1) The OH lead is closed.

Note: The DA lead may be closed to -V to detect dial tone, or after an interval, the presence of tone may be assumed and blind dialing initiated. If the DA lead is closed, a 2-second interval occurs before dial tone can be detected. The DA lead must be opened for the remainder of the dialing sequence after dial tone is detected. The dial speed should be a nominal value of 10 pps.

(2) The OH lead is opened for a 61-percent break interval.

(3) The OH lead is closed for a 39-percent make interval.

(4) Steps (2) and (3) are repeated for the number of pulses required, eg, a total of five openings of the OH lead for the digit 5.

(5) After the last pulse of a given digit, a 600- to 1600-ms delay occurs and the first pulse of the next digit is started.

(6) After all digits have been generated, the DA lead is closed.

2.16 Closing the DA lead, either for the detection of dial tone or after the dialing sequence is completed, causes the circuit to function the same as on incoming calls when combined with the closing of the OH lead. After a 2-second interval, the CT relay operates to connect the data terminal to the telephone line and closes the CCT lead to inform terminal equipment that the transmission path has been cut through to the local loop.

2.17 Automatic calling may also use TOUCH-TONE signaling for call origination (Fig. 5). As previously stated, closing the OH and DA leads to -V causes the coupler to go off-hook and provides a transmission path between the data terminal and the telephone line. When dial tone is present, multifrequency signals are generated to access the switched network. The customer may then wait for answer tone or a verbal answer before transmitting data.

2.18 ***Call Termination:*** When data transmission is complete, the data coupler does ***not*** provide an automatic disconnect. ***The data terminal must recognize the end of the call and must open the OH interface lead.*** In turn, the OH and CT relays drop to open the telephone loop and disconnect terminal equipment from the coupler. The coupler returns to idle state.

Test Mode

Operation of the TST switch while transmitting data will interrupt the data signals.

2.19 The data coupler test circuit provides the means for applying a test tone to the line through the ALC circuit (Fig. 6). This permits testing the level control, the local loop, and certain control functions of the coupler. The circuit is designed to be remotely tested from the local test desk (LTD), although a data test center (DTC) or other designated test location may perform the test.

2.20 The test circuit consists of a tone oscillator, test relay, and two switches (TST and ANS) with associated lamps. The TST switch is used to initiate the test mode. The switch operates the relay and causes the TST lamp to light. Operation of the test relay (1) removes the transmission path from customer equipment and connects the path

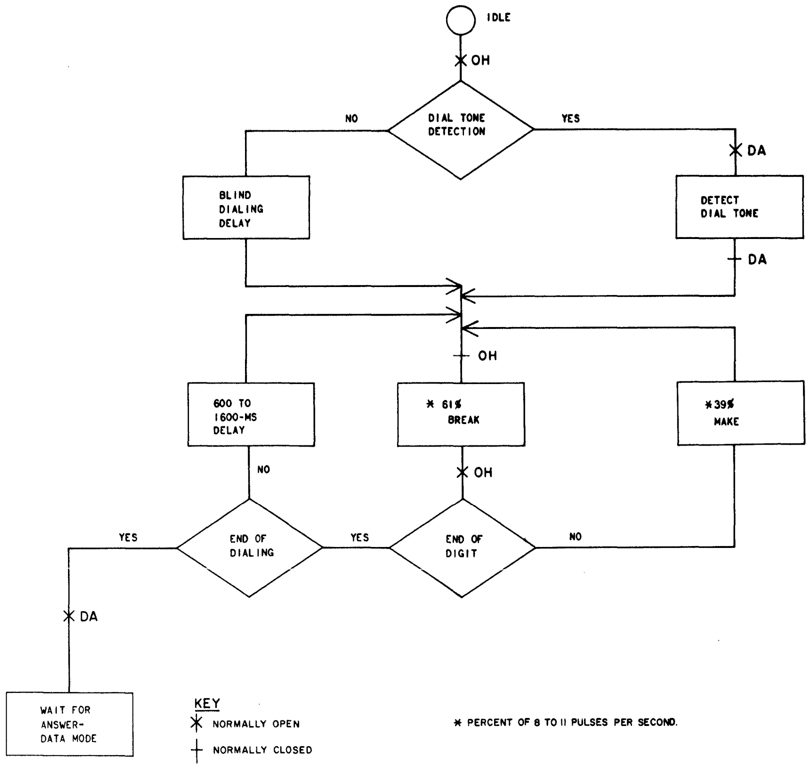


Fig. 4—Customer Automatic Calling Sequence Diagram—DC Dial Pulsing

to the output of the test oscillator, (2) removes the interface control leads from the customer equipment to prevent false operation and connects the leads in the test configuration, (3) enables the ANS lamp to light on incoming ringing, and (4) connects the OH and DA functions to the ANS switch.

2.21 The data coupler detects the incoming ringing signal which causes the ANS lamp to light (ie, 2 seconds ON and 4 seconds OFF). When the ANS switch is operated, the coupler answers the call and the following occurs: (1) the OH relay operates to close the loop and trip ringing, (2) the timer starts, (3) the TST and ANS lamps extinguish, and (4) at the end of the timing interval, the CT relay operates to couple the oscillator output through the ALC circuit to the telephone line and causes the ANS lamp to relight.

2.22 The test circuit generates a 2800-Hz signal at a level which exceeds the maximum power level allowed for any coupler installation. This level causes the ALC circuit to operate and reduce the signal level to the value specified at the time of installation.

2.23 Restoring the TST and ANS switches releases the coupler from test mode. ***The TST and ANS switches must both be restored at the end of the test for proper operation of the coupler.***

3. OPTIONS

A. Telephone Sets

3.01 An associated telephone set is a standard option with the data coupler. The coupler

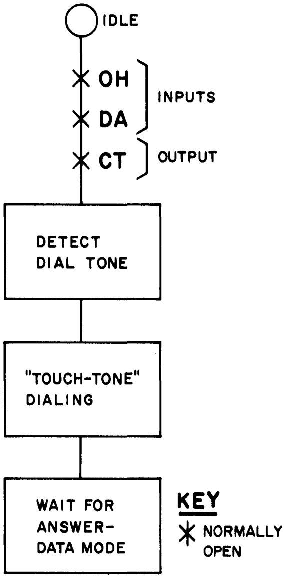


Fig. 5—Customer Automatic Calling Sequence Diagram—TOUCH-TONE Dialing

SH and SH1 interface leads provide the customer with the status of the line switch on an associated telephone set when used with the data coupler. The coupler can be installed without a telephone set to provide fully automatic operation. When a telephone set is provided, the exclusion key and telephone set ringer wiring options must be specified on the service order. The exclusion key options provide for either the coupler or the telephone set to control the line. Telephone set ringer options provide the desired ringing features for each of the two line control options as follows:

(a) ***Option A—Coupler Controls Line (Automatic Operation)***

(b) ***Option B—Telephone Set Controls Line***

(c) ***Option C—With Ringer Connected on Telephone Set Side of Exclusion Key:***

(1) When coupler controls line

When the exclusion key ***is not operated,*** the coupler RI interface lead can be activated but the telephone set cannot ring.

When the exclusion key ***is operated,*** the telephone set cannot ring and the coupler RI interface lead cannot be activated (since handset must be lifted to operate exclusion key and this causes dial tone).

(2) When telephone set controls line

When the exclusion key ***is not operated,*** the telephone set can ring but the coupler RI interface lead cannot be activated.

When the exclusion key ***is operated,*** the coupler RI interface lead can be activated but the telephone set cannot ring.

(d) ***Option D—With Ringer Connected on Telephone Line Side of Exclusion Key:***

(1) When coupler controls line

When the exclusion key ***is not operated,*** the coupler RI interface lead can be activated and the telephone set can ring.

When the exclusion key ***is operated,*** the telephone set cannot ring and the coupler RI interface lead cannot be activated (since handset must be lifted to operate exclusion key and this causes dial tone).

(2) When telephone set controls line

When the exclusion key ***is not operated,*** the telephone set can ring but the coupler RI interface lead cannot be activated.

When the exclusion key ***is operated,*** the telephone set can ring and the coupler RI interface lead can be activated.

3.02 Options specified in 3.01 apply to the standard [502A/B or 2502B (Section 502-501-102 or 502-503-102)] as well as the multifunction telephone (MFT) [503C or 2503C (Section 502-501-120 or 502-503-120)] when used with the 1001B data coupler. Connections for these options using the 502- and 2502-types are shown in Fig. 7. Additional options are available using the MFT, and are discussed in 3.03 and shown in Fig. 8 and 9. Wall-mounted telephones are not recommended and should not be used.

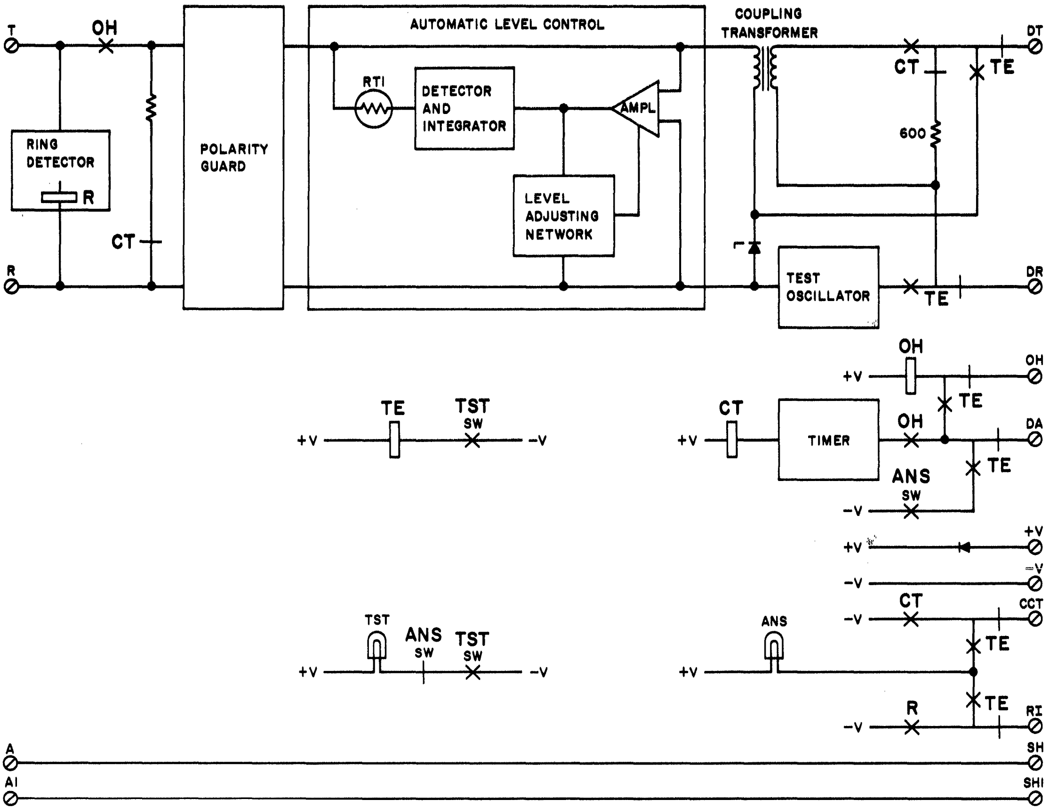


Fig. 6—Functional Schematic of 1001B Data Coupler—Test Mode

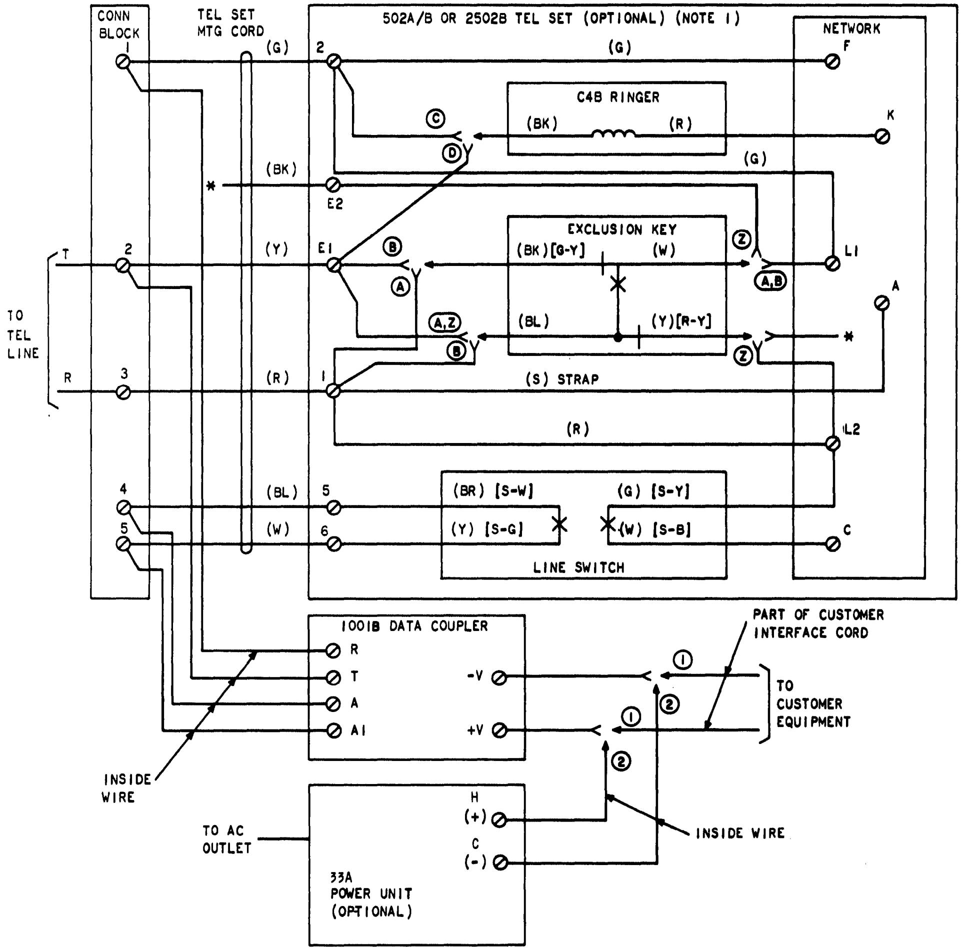
3.03 The 503C (rotary dial) and the 2503C (TOUCH-TONE dial) telephone sets furnish the customer the following in additional options.

- Allows monitoring of data transmission and voice answer-back signals through the telephone handset as used in digital inquiry voice answer-back (DIVA) applications.

- Provides an indication of whether telephone line is connected to telephone set or data coupler, or it may be used to provide an indication of SH (ie, on-hook or off-hook).

These additional features provided by the 503C (or 2503C) telephone set necessitate the use of a triple transfer exclusion key and a high-impedance bridging transformer in the telephone set. One set of the exclusion key contacts switches the line between the telephone and the coupler. The second set switches the monitoring circuit, and the third set provides the mode indication. The high-impedance transformer allows the attendant to monitor data transmission with the telephone handset. Both sets are in a light gray housing; however, they may be enclosed in standard 500- or 2500-type housings of another color if desired.

3.04 In a multiple data coupler installation, it is often desirable to associate several data couplers with one telephone set. Key telephone sets are available in 6-, 10-, 18-, and 30-button



NOTES:

1. EXCLUSION KEY AND RINGER MUST BE REWIRED FOR DESIRED OPTION. SEE TABLE B.
2. IF C4A RINGER IS USED, WIRE AS FOLLOWS:
   (BK) TO 2 OR E1, DEPENDING ON OPTION USED
   (S) TO K OF NETWORK
   (SR) TO A OF NETWORK
   (R) TO 1 OF TERMINAL STRIP

Z ORIGINAL FACTORY WIRING OF TEL SET
1 POWER FURNISHED BY CUSTOMER
2 OPTIONAL TELCO FURNISHED UNIT
* INSULATE AND STORE
( ) CURRENT COLOR CODE
[ ] MD COLOR CODE

EXCLUSION KEY OPTION	WIRING OPTION
COUPLER CONTROLS LINE	A
TEL SET CONTROLS LINE	B

RINGER OPTIONS	WIRING OPTION
RINGER ON TEL SET SIDE OF EXCLUSION KEY	C
RINGER ON TEL LINE SIDE OF EXCLUSION KEY	D

Fig. 7—Typical Connections for 1001B Data Coupler With 502A/B or 2502B Telephone Set

sizes. Key telephone sets can connect to one of several lines. The auxiliary key contact for each line, designated the A lead, is used to operate associated circuitry. The A lead may also be used to operate a relay which transfers a line from the data coupler to the telephone set as shown in Fig. 10. The function of the exclusion key is replaced by the line pickup key on the key telephone set. Note, however, that the coupler is never disconnected from the line when wired as shown in Fig. 10. The switchhook indicator function (SH lead) is not available with key telephone set installations unless auxiliary key telephone units (KTUs) are used. The coupler is assumed to be the primary station. Data calls can be originated and answered without interference from the telephone set. To indicate activity of the data coupler, the OM contact is used to connect the winking lamp supply to the telephone set. The lamp under the key designated for the line assigned to this coupler winks when the data coupler is on-line and off-hook.

3.05 Apparatus necessary for providing telephone service for automatic data couplers consists of a key telephone set with enough capacity for the lines involved, a transfer relay for each line involved, a ringup relay for each line that requires manual answering as a service feature, and a line current detecting relay to supply visual indication of the coupler status. Figure 10 shows the connections for a representative KTU. Other types of KTUs that provide the required features may be used at the discretion of the telco. Additional features such as common pickup of a single group of lines from any of several telephone sets may be supplied by bridging key telephone sets and adding additional KTUs. Any service commonly offered in a local area should be provided according to local practices.

B. Line Current Status Indicator (LCSI)

3.06 An LCSI may be installed with the coupler on an optional basis to aid the customer in recognizing the end of call. The LCSI will not work on facilities served by certain central offices and it performs differently with some of the central offices that it ***will*** work with. Refer to Table B to determine the applicability to a particular installation.

Caution should be exercised in using the LCSI to indicate a far-end disconnect. Momentary line current interrupts occur during call setup. They can be up to 400-ms long and can occur up to 10 seconds after dialing is completed and at the called end, 500 ms after answering a call. In response to far-end disconnect, some switching offices interrupt line current, but it is important to note that some do not. When such interrupts do occur, the LCSI contact will open momentarily. To avoid misinterpretation of momentary opens, it is recommended that an open not be interpreted as an indication of far-end disconnect unless it is greater than 5 ms in duration. Customers should verify disconnect arrangements with the local telephone service organization before relying on the LCSI for that function.

3.07 The line current indication from the LCSI can be presented to the customer in one of two ways. Option Z designates a contact closure between terminals A and A1 on the coupler. If option Y is used, the LCSI contact is wired to a pair of terminals on a separate connecting block.

3.08 The LCSI (Fig. 11) must be made locally and consists of a 317A-type dry reed relay and two varistors in a 74B-49 connecting block measuring 2.75 inches wide, 4 inches long, and 1.6 inches high. The relay is in series with the coupler and gives a contact closure at the customer interface when at least 20 mA of line current is flowing through the relay and coupler. The two varistors are used to provide a low-impedance transmission path to the coupler.

If the customer uses the contact closures directly, current through the terminals should be limited to less than 10 mA. The customer circuit must also be noninductive with an open circuit voltage less than 50 Vdc. The maximum length of the loop over which the coupler can operate is reduced by

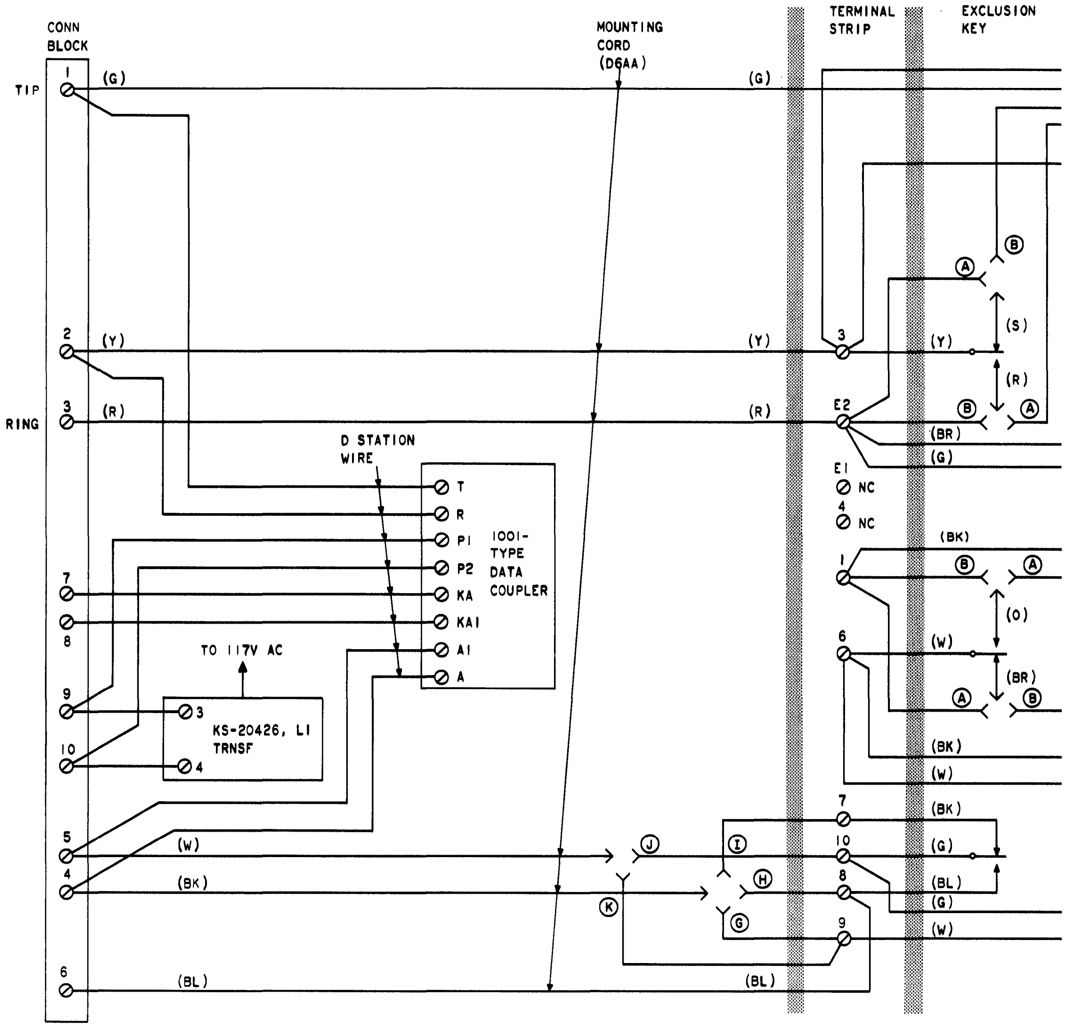
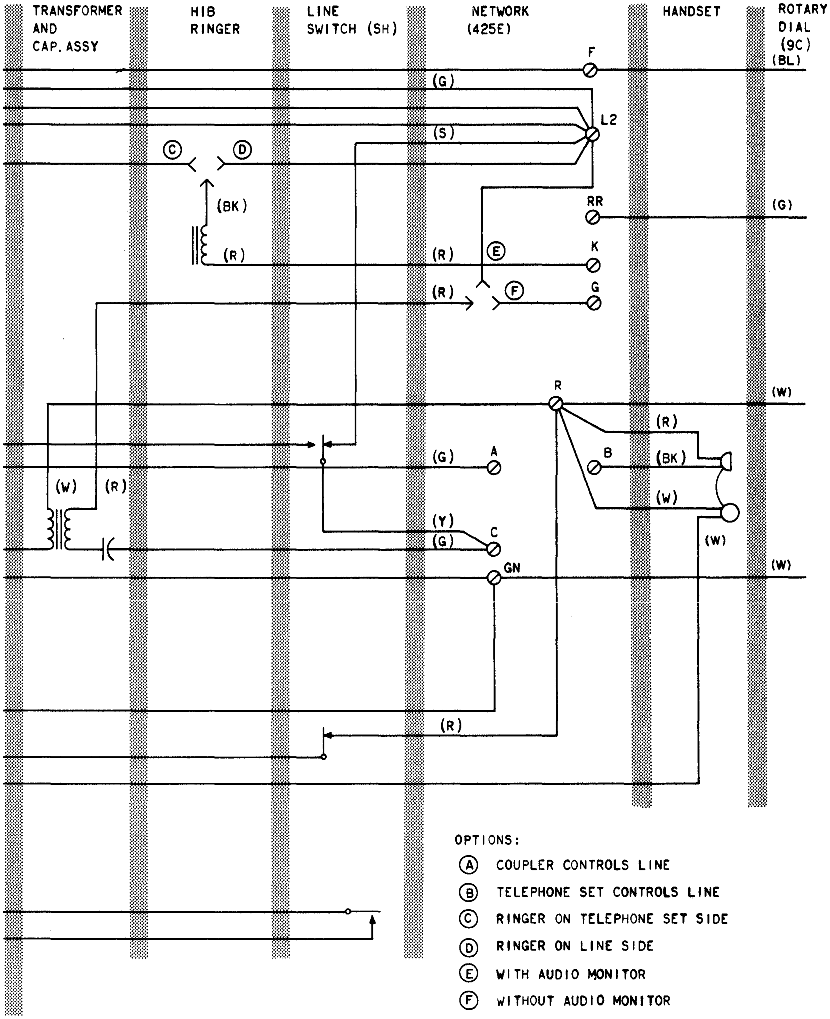


Fig. 8—Typical Connections for 1001B Data Coupler With 503C Telephone Set (Sheet 1 of 2)



OPTIONS:

Ⓐ COUPLER CONTROLS LINE
Ⓑ TELEPHONE SET CONTROLS LINE
Ⓒ RINGER ON TELEPHONE SET SIDE
Ⓓ RINGER ON LINE SIDE
Ⓔ WITH AUDIO MONITOR
Ⓕ WITHOUT AUDIO MONITOR

INDICATOR	ADDITIONAL OPTIONS WITH	
	OPTION A	OPTION B
VOICE MODE	H, K	I, K
DATA MODE	I, J	H, K
SWITCHHOOK	G, J	G, J

Fig. 8—Typical Connections for 1001B Data Coupler With 503C Telephone Set (Sheet 2 of 2)

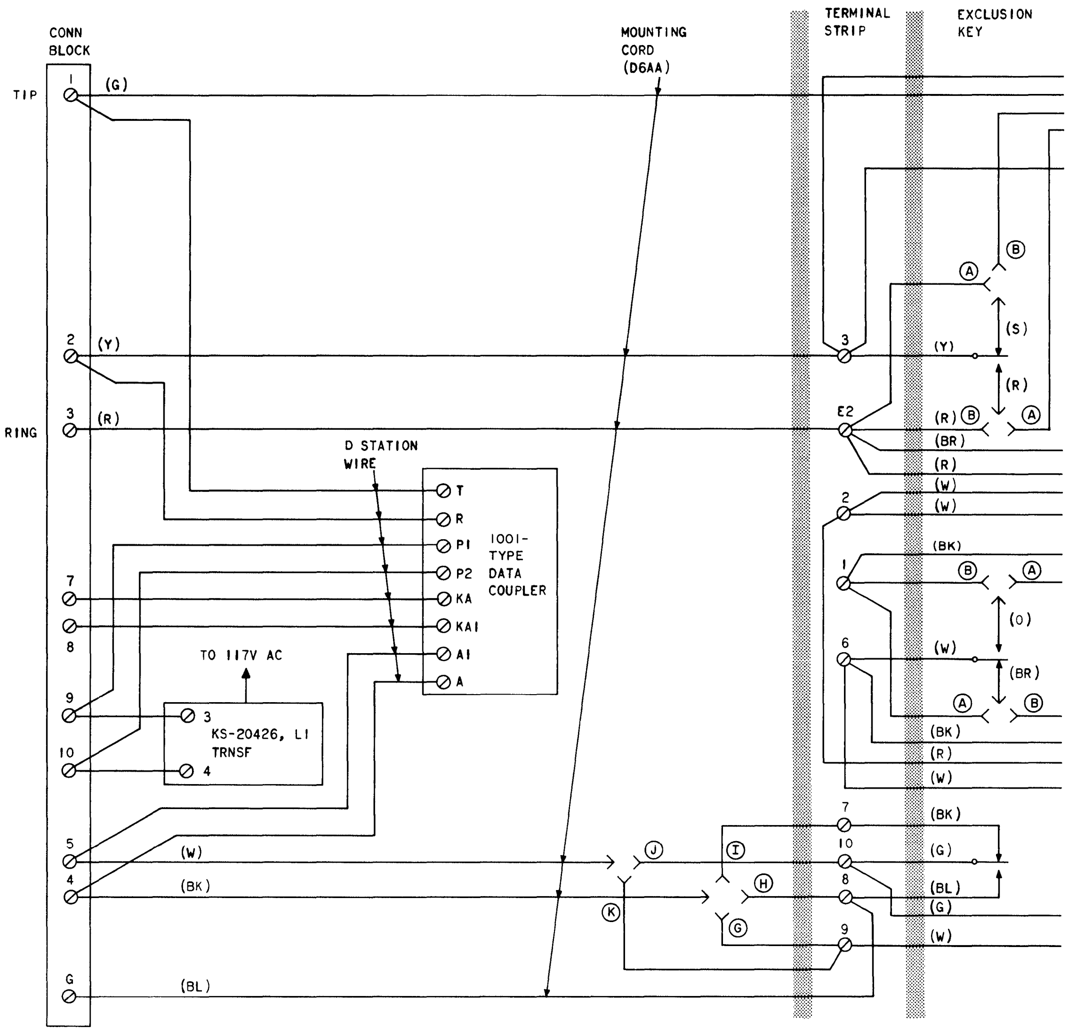
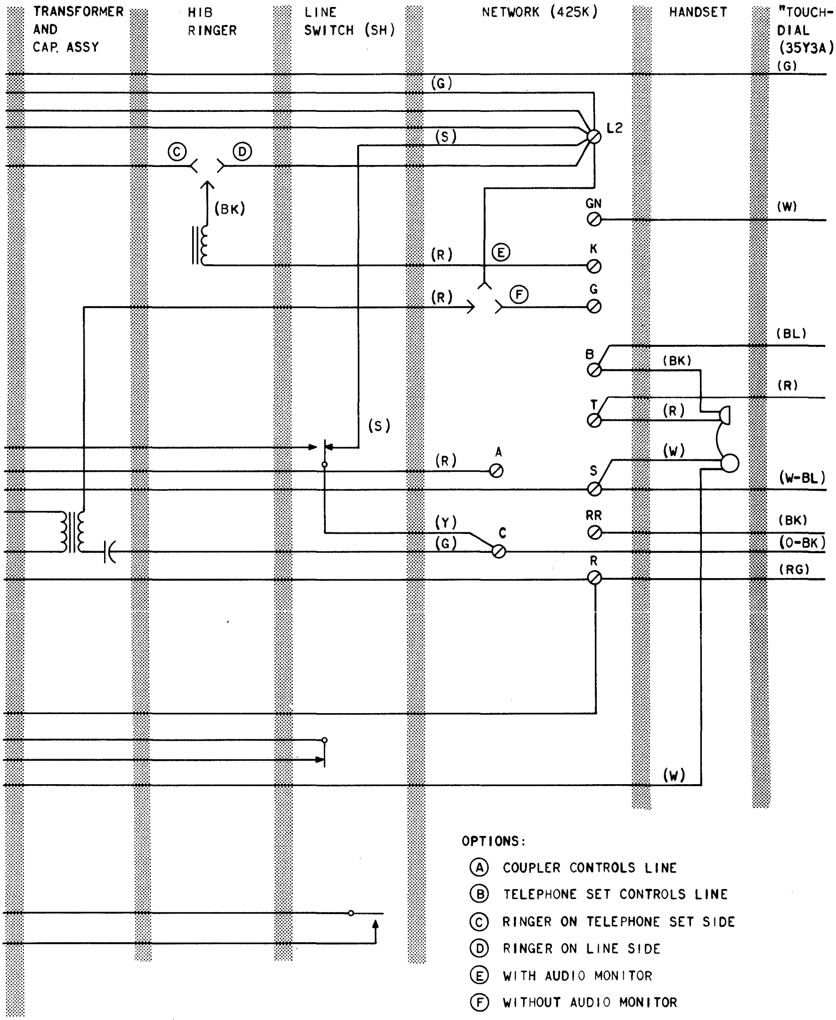


Fig. 9—Typical Connections for 1001B Data Coupler With 2503C TOUCH-TONE Dial Telephone Set (Sheet 1 of 2)



OPTIONS:

- Ⓐ COUPLER CONTROLS LINE
- Ⓑ TELEPHONE SET CONTROLS LINE
- Ⓒ RINGER ON TELEPHONE SET SIDE
- Ⓓ RINGER ON LINE SIDE
- Ⓔ WITH AUDIO MONITOR
- Ⓕ WITHOUT AUDIO MONITOR

INDICATOR	ADDITIONAL OPTIONS WITH	
	OPTION A	OPTION B
VOICE MODE	H, K	I, K
DATA MODE	I, J	H, K
SWITCH HOOK	G, J	G, J

Fig. 9—Typical Connections for 1001B Data Coupler With 2503C TOUCH-TONE Dial Telephone Set (Sheet 2 of 2)

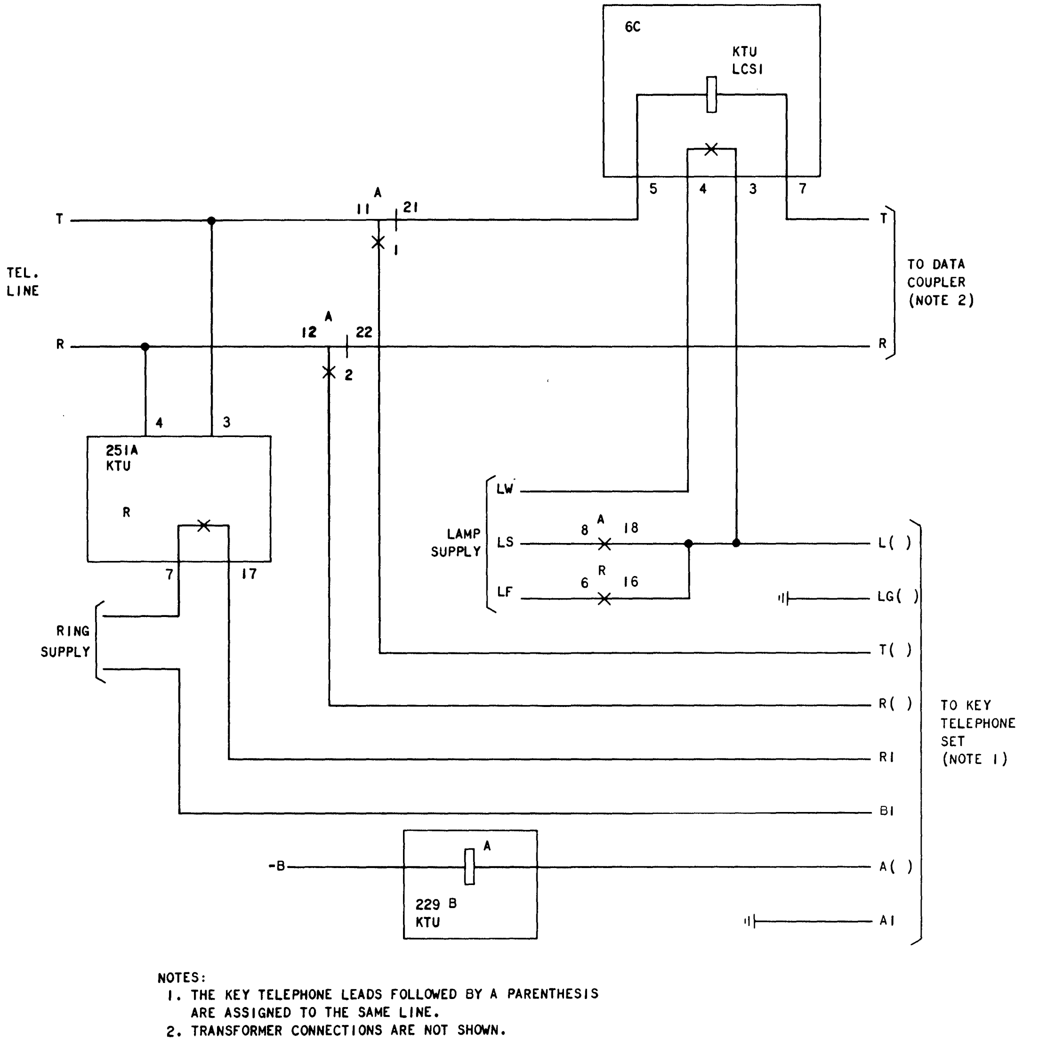


Fig. 10—Key Telephone Unit With a 1001B Data Coupler

approximately 800 feet if an LCSI is used.

3.09 Assemble the unit in accordance with the following procedures.

(1) Remove cover from the 74B-49 connecting block.

(2) Remove the 426A electron tube assembly, including mounting screw, and discard.

Warning: The adhesive used in (3) sets quickly and should not be allowed to come in contact with anything (especially the skin of the installer)

TABLE B

LINE CURRENT STATUS INDICATOR APPLICATION*

OFFICE SERVING OFF-HOOK END	END OFF-HOOK	END ON-HOOK	MIN CURRENT INTERRUPT	RELATED TO DIAL TONE	USE OF LCSI FOR DISCONNECT
ESS	Called	Calling	12 ms	Before	Okay
ESS	Calling	Called	37 ms	Before	Okay
No. 5 X-Bar	Called	Calling	10 ms	Before	Okay
No. 5 X-Bar	Calling	Called	32 ms	After	Discourage
No. 1 X-Bar	Called	Calling	0.4 sec	After	Discourage
No. 1 X-Bar	Calling	Called	0.4 sec	After	Discourage
SXS	Called	Calling			Discourage
SXS	Calling	Called			Discourage

* The use of dial long line circuits and carrier facilities on local loops will isolate station equipment from central office dc interrupts.

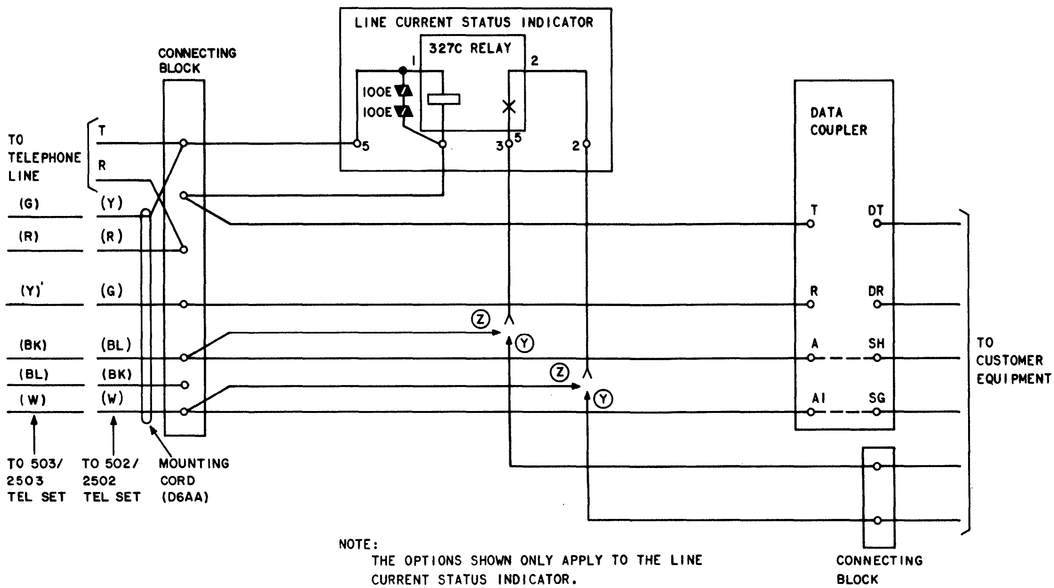


Fig. 11—Line Control Status Indicator Connection Diagram

except the relay, the applicator, and the connecting block base.

(3) Apply adhesive (Eastman 910 or equivalent) in the area to be occupied by the 327C relay.

(4) Place relay on base plate, topside down.

(5) Remove and discard the lower screws from terminal strip eyelets in positions 2, 3, 4, and 5.

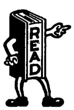
(6) Wire the unit in accordance with Fig. 11.

C. Telco-Provided DC Power

3.10 An external power supply is required to provide a dc supply for the control circuit of the coupler. A 20- to 28-Vdc supply capable of supplying 100 mA will normally be provided by the customer. The telco will optionally furnish power (refer to 2.07 and 4.07).

4. INSTALLATION AND CONNECTIONS

4.01 The 1001B data coupler may be used with various types of central office lines or Bell System PBX station lines that provide access to the switched network.



All installation connections and tests must be performed before the customer makes any connections to the interface.

4.02 Verify that the assigned loop facilities meet transmission requirements for the specific data service before proceeding with the installation. The general requirements for DAA service are covered in Section 314-205-501. The requirements for the 1001B data coupler are as follows:

(a) ***Loop Loss:*** Maximum 1000-Hz insertion loss (including coupler loss of 2 dB) is 11 dB.

(b) ***Set Classification:*** Installation measurements are specified on the service order. When the modem type cannot be determined, Type II requirements should be specified. When the type of modem can be obtained from the customer, the following guidelines should be used.

(1) For all analog modems, Type II requirements should be specified.

(2) For all other modems, requirements based on speed of modem (same as for switched DATA-PHONE service) should be specified.

(3) If the type of modem is known to be similar to a Bell System DATA-PHONE data set, use the requirements for that particular data set.

4.03 Installation of the coupler should comply with general practices to ensure an orderly station arrangement. Information relating to a selection or type of connecting block and electrical code requirements is given in Section 590-010-200. See Fig. 12 for a typical interconnection block diagram.

4.04 When test or demonstration calls are made, refer to Section 010-250-001 for the proper procedure for crediting charges.

4.05 Location of the data coupler shall be determined by the following conditions.

- ***The coupler must be mounted vertically*** on a wall or other smooth vertical surface, to ensure proper operation of OH mercury relay.
- The coupler must be within range of the interface cord supplied by the customer. The maximum recommended length is 50 feet.
- Location of the coupler should provide easy access for viewing and operation of the TST and ANS switches by the customer attendant.

A. Installation of Data Coupler

4.06 Install the coupler on a wall or other vertical surface as follows:

(1) Remove the tape securing the cover to the base pan. Retain the screw envelope under the tape.

(2) Remove the snap-off cover assembly from the coupler and lift up the circuit board from the base pan.

(3) Position the coupler base pan vertically against the wall with the keyhole slots narrow ends up, and not less than 11 inches above the

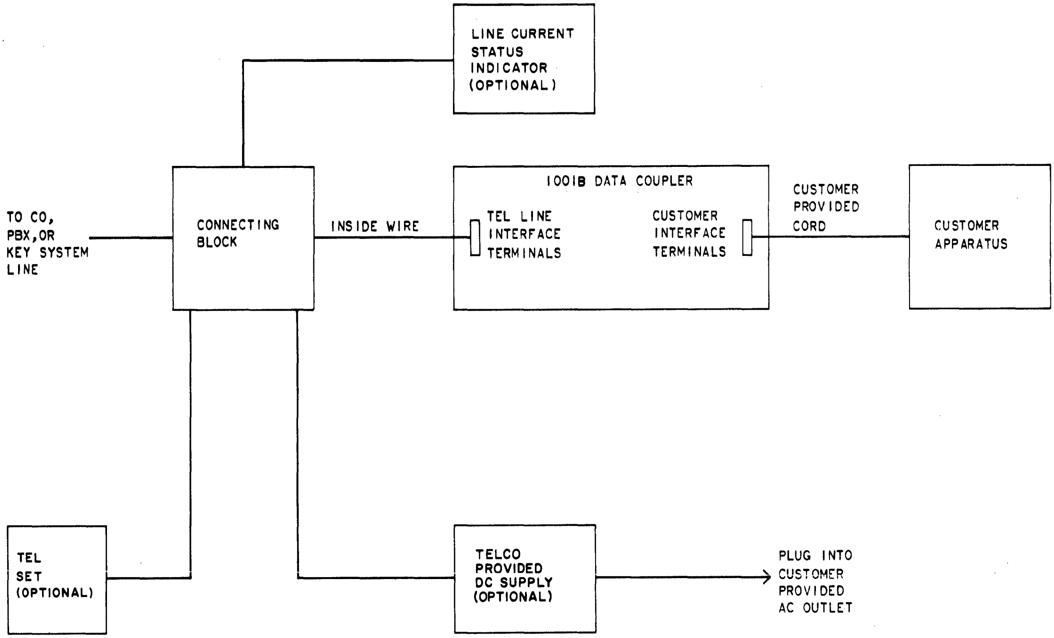


Fig. 12—Block Diagram of Typical 1001B Data Coupler Installation

top of the baseboard or other obstruction which will be below the unit. Secure the base pan with three No. 6 by 1/2-inch wood screws for porous surfaces, or No. 6 by 3/8-inch pan-head type AB self-tapping screws for metal surfaces. The screws are shipped with the coupler.

(4) Route the inside wire through the slots and pins on the base pan as shown in Fig. 2. Attach the CP to the base pan using the six self-tapping screws removed from the envelope. ***Care should be taken not to overtighten screw terminals or stripping will result.*** Connect the leads as required to the terminals on each side of the printed wiring board. Be sure to connect T, R, A, and A1 leads discussed in 2.03.

B. Installation of Power Unit

4.07 When an external dc supply is to be provided by the telco, install a 33A (Section 167-452-101), 19B2 (Section 167-440-101), 28A1 (Section 167-445-101), or equivalent power unit. Connect the power supply as follows:

(1) Connect the power supply ***only*** to data couplers.

(2) Connect the C terminal (33A) or B SIG terminal (negative) (19B2 or 28A1) to -V on the couplers.

(3) Connect the H terminal (33A), or G SIG terminal (positive) (19B2 or 28A1) to +V on the couplers.

(4) If directed by the customer, either the negative or the positive terminal may be connected to LOC GRD or the chassis ground strap as appropriate.

Note: AC lamp and ac ringing supplies are referenced to G SIG terminal (positive).

Do not connect the power unit to local ground when the coupler -V terminal is internally grounded within the customer equipment. The customer must not make any connections to the +V interface terminal.

C. Completion of Installation

4.08 Install cover assembly by hooking bottom end (end with small hinged cover) to base pan, swinging cover up and over the TST and ANS switches, and pressing until cover snaps into place.

4.09 Instruct the customer to raise only the hinged portion of cover to gain access to interface terminals. Also caution customer that overtightening screws may cause stripping.

4.10 Install telephone set if specified on the service order. If a 503- or 2503-type telephone is used, redesignate the SH terminal on the coupler as "MI" (mode indicator).

Do not connect the customer interface leads to the coupler unless requested by, and under direction of, the customer.

4.11 After the coupler and associated units have been mounted and connected to the telephone line, perform the tests outlined in Part 5.

4.12 Inform the customer, at the time the coupler is installed, of the maximum permissible signal power output from the data equipment. The output level of the customer-provided equipment is the power measured at the customer interface into a 600-ohm resistive load. It may vary between -1 and -10 dBm depending upon the 1000-Hz loss of the local loop, including the nominal insertion loss (approximately 2 dB) of the coupler.

5. MAINTENANCE AND TESTS

5.01 Maintenance and test procedures are described in this part to assist the telco employee during installation and troubleshooting visits to a data coupler station. All level measurements and test results made during installation and maintenance must be recorded on a circuit layout record card (CLRC) to assist in analyzing future trouble and to detect gradual degradation of service. Telephone the test results to the plant service center (PSC), or equivalent test location, prior to leaving the customer location. Some tests will require disconnection of customer equipment from the interface in order to make tests and/or to replace a defective coupler. The following precautions ***must*** be taken.

- ***Obtain permission from the customer to disconnect the interface leads from the coupler.***
- ***Turn the power to both the customer equipment and to the coupler OFF before the customer leads are disconnected.***
- ***After all tests are completed and the interface is reconnected, ask the customer to verify that the interface has been reconnected properly.***

A. Maintenance

5.02 All repair forces should be familiar with the tariff provisions which generally provide for a "maintenance service charge" for each customer-requested repair visit to a DAA installation. When the customer requests such a repair visit and it is subsequently determined that the trouble is ***not*** in the telco equipment, inform the customer and notify the PSC to fill out Form E-5855 in conformance with Section 660-101-312.

5.03 Maintenance of a coupler installation at the customer premises is limited to local tests, testing by serving or test office, or replacing a defective unit.

> ***Note:*** Do not attempt individual component repair or replacement on the printed CP.

5.04 Customers using data couplers are instructed, when a trouble condition is experienced, to perform the necessary testing to sectionalize the problem. If the results of the tests indicate the trouble is in Bell System equipment, the condition should be reported to the designated PSC or equivalent test center. All available information concerning the failure mode should be provided to the PSC.

5.05 The PSC must analyze the information provided by the customer to determine if a trouble condition does exist and the most probable cause. Available tests (ie, normal dc loop test and remote test of coupler) should be performed to determine if a telco employee must be dispatched to customer premises. The conditions which could warrant a maintenance visit and the efforts which lead to each are shown in Fig. 13.

5.06 On a maintenance visit, perform the most likely necessary tests or evaluations to isolate and clear the trouble within the station as directed by the PSC. Begin with the steps shown in Fig. 13 when the test results and analysis received from the PSC lead to that particular activity. If a trouble report is not available or if the report is inconclusive, follow the suggested sequence of activities as illustrated in Fig. 14 and described in the following:

(1) The telco employee must be properly equipped with information (BSP documentation, line card details, etc) spare coupler, test equipment, etc, for locating trouble and effecting repairs at the customer premises.

(2) Upon arrival at the coupler station, question the customer to obtain any information relating to the reported trouble, then perform a visual and mechanical inspection of the installation. Check for disconnected or broken cords, inside wiring, drop wire, broken components, or any other possible trouble causes. Repair or replace any defective or marginal components (ie, ringer, dial, handset, etc).

(3) Perform a remote test to the local test desk (LTD) or equivalent test location.

(4) If any components were replaced or repaired ***and*** the results of the remote test are satisfactory, close trouble report.

(5) If all components are satisfactory ***and*** the results of the remote test are satisfactory, perform an interface voltage test.

(6) If the results of the interface voltage test ***or*** remote test are not satisfactory, replace the coupler and perform installation tests. Ensure that all level measurements made during the

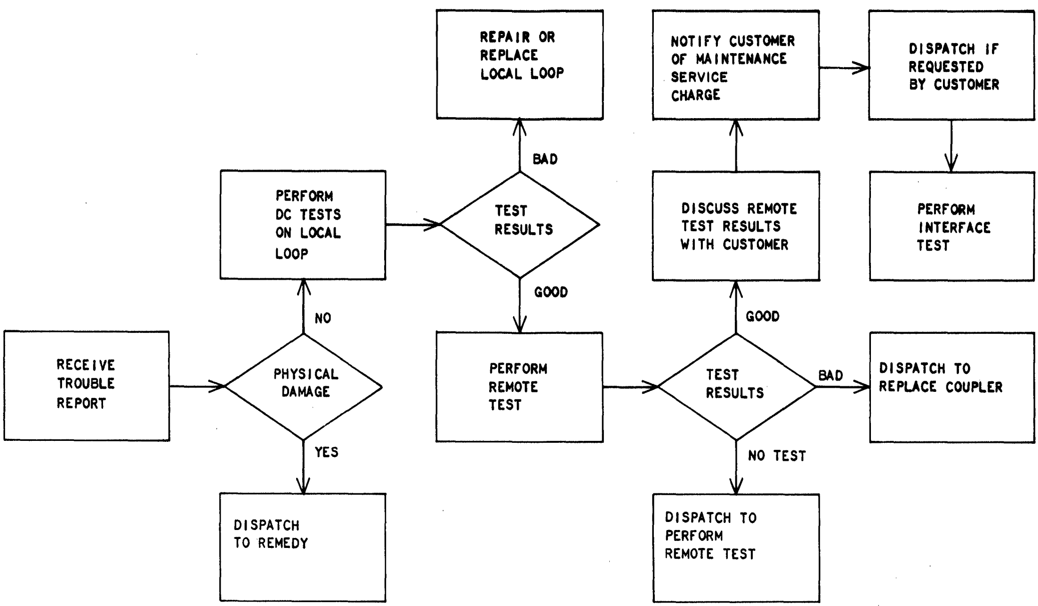


Fig. 13—Basic Activities Prior to Dispatching Employee

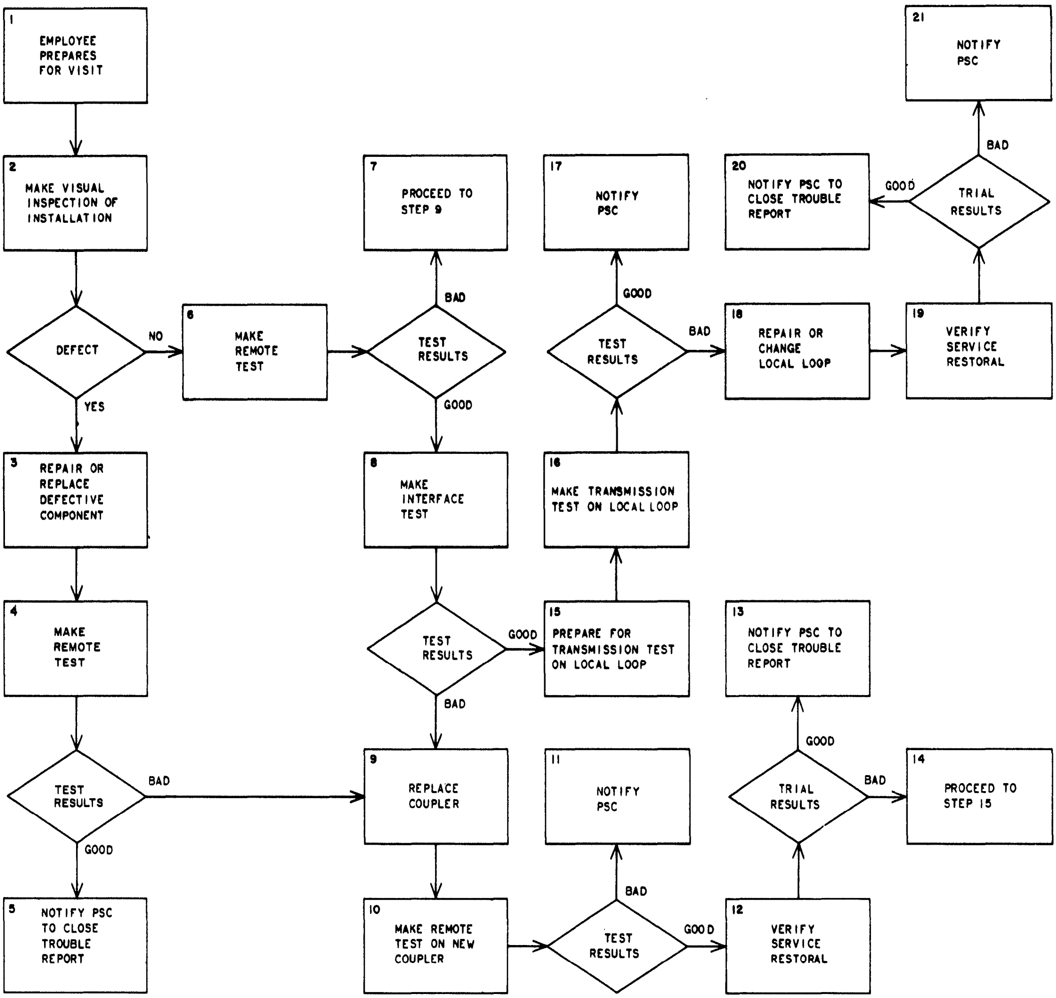


Fig. 14—Activities for Troubleshooting at a Coupler Station

requested installation tests are properly recorded on the CLRC.

(7) Perform a remote test on the new coupler.

(8) If the results of the new coupler remote test are ***not*** satisfactory, notify the PSC.

(9) If the results of the new coupler remote test are satisfactory, request the customer to verify that service is restored (ie, try to exchange data with the station that caused the trouble report).

(10) When the customer is satisfied with the service, notify the PSC to close the trouble report.

(11) If the customer cannot exchange data or is not satisfied with the service, disconnect the coupler and perform a complete transmission test of the local loop as described in Section 314-205-501.

(12) If the results of the loop test are satisfactory, notify the PSC.

Note: The preceding investigation has eliminated the coupler and local loop as possible trouble; therefore, attention must be directed to the data terminal or facilities.

(13) If the results of the loop test are ***not*** satisfactory, arrange with the PSC to have the loop repaired or changed. The repaired or changed loop must meet requirements outlined in Section 314-205-501.

(14) After changing the defective loop, reconnect the coupler to the telephone line. Perform the insertion loss and impedance matching tests to determine if maximum allowable customer level and the required limiter option strapping have changed. Notify customer of level change and then request customer to verify service restoral.

(15) When the customer is satisfied with the service, notify the PSC to close the trouble report.

Note: Prior to leaving customer premises, perform the remote test and record the new level on the CLRC.

(16) If the customer cannot exchange data or is not satisfied with the service, trouble may still exist in another component of the system or in the data terminal, and further investigation must be pursued. Notify supervision, who can escalate according to normal procedures of data technical (DATEC) support. Refer to Sections 010-521-100 and -101. Also notify the PSC of the repair work that has been completed and wait for further instructions.

B. Tests

5.07 The following tests are required to ensure proper installation of the data coupler and to determine the operating condition of the unit during a maintenance visit:

- Insertion Loss Test
- Impedance Matching Test
- Remote Test
- Interface Voltage Test
- LCSI Test
- 503C or 2503C Telephone Set Test.

5.08 The following test equipment is required for the tests:

- KS-16979-L1 volt-ohm-milliammeter (VOM), or equivalent with a high impedance bridging-type ac voltmeter with a dB scale such that 0.776 Vac corresponds to 0 dB.
- 1013-type hand test set, or equivalent
- 600-ohm ±1 percent resistor
- KS-19353-L4 oscillator or equivalent with a 600-ohm output impedance and a capability of a -5 dBm reading when connected across 600 ohms.
- 33A power unit, or equivalent power source providing between 20 and 26 Vdc.

Note: The insertion loss test ***and*** the impedance matching test are required to determine proper level option strapping, using Table C.

Insertion Loss Test

5.09 The insertion loss test measures the combined loss of the loop and coupler. The results of the test are used to determine the maximum allowable customer signal power level which will result in a level no greater than -12 dBm at the serving central office (SCO). This test requires that the customer interface leads be disconnected from the coupler in accordance with procedures outlined in 5.01. The coupler must be connected

TABLE C

LEVEL OPTION STRAPPING FOR 1001B DATA COUPLER

MEASURED LEVEL (INSERTION LOSS TEST) DBM	MAXIMUM ALLOWABLE CUSTOMER LEVEL DBM	MEASURED LEVEL (IMPEDANCE MATCHING TEST) DBM				
		−3.6 to 0	−4.6 to −3.7	−5.6 to −4.7	−6.6 to −5.7	−6.7 to −9
		LIMITER OPTION STRAPS				
−2.5 to −3.4	−10	A, B, D, E	A, C, D, E	B, C, D, E	A, B, C, D, E	A, B, C, D, E
−3.5 to −4.4	−9	A, B, C, E	A, B, D, E	A, C, D, E	B, C, D, E	A, B, C, D, E
−4.5 to −5.4	−8	D, E	A, B, C, E	A, B, D, E	A, C, D, E	B, C, D, E
−5.5 to −6.4	−7	C, E	D, E	A, B, C, E	A, B, D, E	A, C, D, E
−6.5 to −7.4	−6	A, E	C, E	D, E	A, B, C, E	A, B, D, E
−7.5 to −8.4	−5	A, B, C, D	A, E	C, E	D, E	A, B, C, E
−8.5 to −9.4	−4	A, C, D	A, B, C, D	A, E	C, E	D, E
−9.5 to −10.4	−3	A, B, C	A, C, D	A, B, C, D	A, E	C, E
−10.5 to −11.4	−2	C	A, B, C	A, C, D	A, B, C, D	A, E

Example: Value obtained in insertion loss test = 6.4 dB.
Value obtained in impedance-matching test = −4.2 dBm.
A strap should be placed between terminals D and E.

to the telephone line. Proceed with the test as follows:

(1) Locate and remove any existing straps on level option terminals A through H (Fig. 2).

Note: Cover must be removed to gain access to level option terminals.

(2) Connect strap between terminals OH, DA, and -V.

(3) Connect 600-ohm resistor across terminals DT and DR. (If a transmission test set is used instead of a VOM, the test set provides the 600-ohm termination.)

(4) Connect the positive lead (H) of the power unit to the +V terminal, and the negative lead (C) to the -V terminal. ***Do not*** connect the power unit to the ac outlet at this time.

(5) Use the telephone set associated with the coupler, if provided, or connect the hand test set across tip and ring of telephone line, and dial the milliwatt supply (1000-Hz) of the SCO.

Note: If a telephone set is associated with the coupler, remove the handset and ensure that the exclusion (data) key is in the talk position before dialing the milliwatt supply.

(6) When the tone is heard, connect the power unit to a 117-Vac power outlet and remove the hand test set from the line (or operate the exclusion key to data mode on the associated telephone).

(7) Condition the VOM to measure approximately -5 dBm. Measure the level (in dBm) of the signal between the coupler DT and DR terminals with the VOM.

(8) Disconnect power unit from outlet. (The SCO connection will terminate.)

Impedance Matching Test

5.10 This test follows the insertion loss test on either an installation or maintenance visit; therefore, the level option terminals should not be strapped for this test. Proceed with the test as follows:

(1) Set the oscillator for a 1000-Hz frequency and a 600-ohm output impedance.

(2) Select the proper scale on the VOM to measure -5 dBm.

(3) Connect the test equipment and straps as shown in Fig. 15.

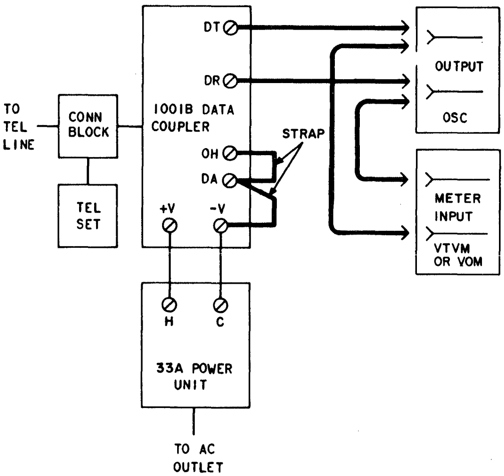


Fig. 15—Test Equipment Connections—Impedance Matching Test

(4) Adjust the oscillator output level to obtain a -5 dBm indication on the VOM.

Note: After the indication is obtained, do not change the frequency or level setting on the oscillator.

(5) Connect the hand test set across tip and ring of the telephone line, and dial a quiet battery termination at the SCO.

Note: If a telephone set is associated with the coupler, remove the handset, ensure that the exclusion key is in talk position, and dial the quiet termination.

(6) After the connection is completed, plug power unit into socket and remove the hand test set from the line (or operate the data key to data mode on the associated apparatus).

(7) Measure the signal level with the VOM. This value is used to derive the level option strapping from Table C.

(8) Remove the straps, disconnect test equipment, and restore the connection to normal. (The CO connection will terminate.)

5.11 Using the values obtained in 5.09(7) and 5.10(7), refer to Table C and apply straps as indicated. Mark the maximum input limit on the data coupler as determined in 5.09(7) (Fig. 1).

Note: Cut pieces of insulated 24-gauge solid wire to fit between appropriate terminals. Strip insulation from wire ends and, using long-nose pliers, seat ends of wire straps under terminals.

Remote Test

5.12 The remote test measures the test signal of the coupler at the SCO at time of installation. The test signal provides a check of the local loop and the limiting function of the coupler. Subsequent readings can then be compared with the initial reading for indications of service degradation.

5.13 The data coupler must be connected to the telephone line for this test. Proceed with the test as follows:

(1) Connect the positive lead (H) of the power unit to the +V terminal, and the negative lead (C) to the -V terminal. Connect the power unit to a 117-Vac power outlet.

(2) Use the telephone set associated with the coupler, if provided, or connect the hand test set across tip and ring of the telephone line, and contact the LTD. If the LTD is not equipped for making ac measurements, call a remote test desk or DTC.

Note: If a telephone set is associated with the coupler, remove the handset and ensure that the exclusion (data) key is in the talk position before initiating the call to the LTD.

(3) Request the LTD employee to call the coupler and measure the level of the test tone (2800 Hz) received at the LTD.

(4) Agree upon length of time required to perform the test and restore the connection to idle state (hang up).

(5) Operate TST switch to ON position (depress the red dot half of switch). The TST lamp lights.

(6) Observe that the ANS lamp flashes in response to incoming call from the LTD. The flashes, in response to the ringing cycle, are approximately 2 seconds ON and 4 seconds OFF until the ANS switch is operated.

(7) Operate the ANS switch to ON position (depress red dot half of switch). The TST and ANS lamps extinguish. After a 2-second interval, the ANS lamp lights.

(8) After the agreed test interval, operate the TST and ANS switches to OFF position.

(9) Call the LTD and request the level reading. This level indicates the loss of the loop and coupler at 2800 Hz. When the test is made at time of installation, the actual value of the loss ***must*** be recorded on the CLRC for comparison against measurements made in subsequent tests. If the level of the 2800-Hz signal on subsequent tests varies by more than 2 dB from the original value, it is an indication of possible trouble in either the loop or coupler. If the test tone must be measured at a remote test desk or DTC over facilities of unknown or varying loss, a successful receipt of the tone indicates there is ac continuity in the loop and coupler and that the coupler operates satisfactorily.

> ***Note:*** On 1001B data couplers prior to series 3, one possible cause of failure of remote test is a 22.6-ohm resistor (R70) in series with the -V lead of the coupler. If customer supplied power is marginal (voltage low) this may cause remote test to fail even though the coupler operates satisfactorily in data mode. If a coupler series 2 or earlier fails remote test, strap out R70 and repeat the test to see if trouble is cleared. Mark the coupler "series 3" after strapping out R70.

(10) Disconnect the power unit and restore telephone connection to normal.

Interface Voltage Test

5.14 The interface test reasonably assures that the interface terminals of the coupler will respond to proper signals from the customer terminal, or will indicate to the terminal when the coupler is conditioned for various operational modes.

5.15 This test requires that the customer interface leads be disconnected from the coupler in accordance with procedures outlined in 5.01. The coupler must be connected to the telephone line. Use the VOM to make the measurements during the test. Proceed as follows:

> ***Note:*** When making measurements in the following steps, be careful to observe proper polarity with the meter.

(1) Connect the positive lead (H) of the power unit to the +V terminal, and the negative lead (C) to the -V terminal. Connect the power unit to a 117-Vac power outlet.

(2) Originate a call to the coupler from another line or arrange to be called from the LTD. Observe that the voltage between terminals (-) RI and +V follows the ringing cycle and swings between -10 to -26 (ON) and 0 (OFF) Vdc; the ON interval being approximately 2 seconds and the OFF interval approximately 4 seconds.

(3) Leaving the meter connected between (-) RI and +V, short terminal OH to -V with a clip lead. Observe that the voltage swings to 0 Vdc after ringing is tripped. This checks the operation of the OH relay.

(4) Leaving short between terminals OH and -V, measure the voltage between terminals (-) CCT and +V. The meter indicates 0 Vdc to show that the interface lead (CCT) is in OFF condition.

(5) Leaving the meter on terminals CCT and +V and the short between terminals OH and -V, connect a strap between terminals OH and DA. After 2 seconds, observe that the voltage swings to between -20 and -26 Vdc. This checks the delay timer and the operation of the CT relay. Remove short between terminals

OH and -V. Observe that voltage between terminals CCT and +V swings back to 0 Vdc.

(6) Remove handset on telephone and connect meter between terminals SH (or MI) and SH1. The meter indicates continuity between the terminals to check the switch contact status circuit.

(7) Replace handset on telephone. An open is indicated on the meter between terminals SH (or MI) and SH1.

(8) Remove the power unit, meter, and straps from the coupler.

(9) Reconnect customer interface leads to the coupler. Request customer to verify connections.

LCSI Test

5.16 This test should be used to verify proper operation of the LCSI. This test is performed by disconnecting the customer LCSI interface only.

LCSI With Option Z

(1) Measure the resistance between terminals SH (or MI) and SH1. The meter indicates an open circuit.

(2) Operate TST key.

(3) Initiate a call to the coupler.

(4) Measure the resistance between terminals SH (or MI) and SH1. The meter indicates a short circuit.

(5) Restore TST key to normal.

LCSI With Option Y

(1) Measure the resistance between the two terminals on the separate connecting block at the customer interface. The meter indicates an open circuit.

(2) Operate TST key.

(3) Initiate a call to the coupler.

(4) Measure the resistance between the two terminals on the separate connecting block. The meter indicates a short circuit.

(5) Restore TST key to normal.

503C or 2503C Telephone Set Test

5.17 This test verifies that the telephone set mode indication and audible monitor features are operating properly. The requirements of this test are based on the logic sense which gives a contact closure when the telephone set is connected to the line. In all other cases, the mode indication will be an open. ***The customer MI interface must be open for this test.***

5.18 Lift telephone handset. Using the VOM, make resistance measurements between terminals MI and SH1 on the data coupler, in accordance with the options installed and Table D. Return handset to cradle.

> *Note:* It is only necessary to make the one pair of readings corresponding to the options installed.

5.19 Initiate a call to the coupler. Lift handset to answer call. After a 2-second delay, a 2800-Hz tone is heard in the handset.

TABLE D

MFT SET TEST WITH 1001B DATA COUPLER

INDICATOR	OPTIONS INSTALLED	OHMMETER READING	
		EXCLUSION KEY	
		UP	DOWN
Voice Mode	A, H, K	0	∞
Data Mode	A, I, J	∞	0
Switchhook	A, G, J	0	0
Voice Mode	B, I, K	∞	0
Data Mode	B, H, K	0	∞
Switchhook	B, G, J	0	0

Note: Switchhook operated for all readings.

6. REFERENCES

6.01 The following documents provide additional information that may be helpful in installing the data coupler:

NUMBER	TITLE
SD-&CD-1D206-01	1001-Type Data Couplers

SECTION	TITLE
010-250-001	Crediting Charges on Test Calls
010-521-100	Data Technical (DATEC) Support
010-521-101	Data Technical (DATEC) Support—Designee Directory
167-440-201	19- and 20-Type Power Units—Identification, Installation, Connections, and Maintenance Arrangements on Direct Distance Dialing Network—Test Requirements for Subscriber, Foreign Exchange, and Remote Exchange Lines
590-010-200	Data Sets and Data Access Arrangements—General Installation and Connection Information
660-101-312	Maintenance Service Charge on Services With Customer-Provided Equipment (CPE)
167-445-101	28A1-Type Power Units—Identification, Installation, and Connections
167-452-101	33A Power Unit—Identification, Installation, and Connections
314-205-500	Data Systems—DATA-PHONE® Service and Data Access Arrangements on Direct Distance Dialing Network—Overall Data Transmission Test Requirements
314-205-501	Data Systems—DATA-PHONE® Service and Data Access

1000B DATA COUPLER

DESCRIPTION, INSTALLATION, MAINTENANCE, AND TESTS

CONTENTS PAGE

1. GENERAL

1.01 This section contains information required for installing, testing, and maintaining the 1000B Data Coupler (Fig 1). Detailed information is contained in SD- and CD-1D205-01.

1.02 The data coupler is a protective unit which connects customer-provided equipment to private line facilities for data and voice communications.

1.03 The 1000B Data Coupler is designed to provide the following:

- Isolation of customer equipment for the protection of telephone plant and personnel
- Protection of customer equipment from metallic and longitudinal surges occurring on the telephone facilities
- Automatic linear control of signal level above a specified threshold
- Test circuitry for manual remote test capabilities
- Two-way transmission path.

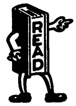
1.04 Alternate voice service may be provided with an associated telephone set and appropriate supplementary equipment. The quality of voice transmission through the coupler may be impaired on consistently strong signals.

1.05 The data coupler is one type of protective interconnecting arrangement, as described in appropriate tariffs, which must be included on all voice-grade private line data channels that terminate in customer-provided equipment.

1.06 When the interface to the customer equipment is 2-wire, the data coupler provides complete protection. However, if the interface to the customer equipment is 4 wire, the coupler is used on the send pair and additional equipment is required on the receive pair to provide proper protection.

1.07 The service offering in which the coupler is used does not provide for a specific data error performance. The telephone company does not assume responsibility for the accuracy of the transmitted data and only ensures that the transmission parameters of the private line circuits are met as ordered. The circuit requirements are specified in Section 314-410-500.

1.08 The customer equipment should limit dc currents through the DT and DR terminals to less than 1 milliampere to prevent distortion of the data signals.



Normally, private line circuits do not present metallic voltages to the T and R terminals of the coupler. If voltages do appear in excess of 5 volts, open circuit, distortion of the data signals, and damage to the coupler could result.

1.09 The term *central office* is used in this section to represent the repair service bureau, serving test center, or any other organization

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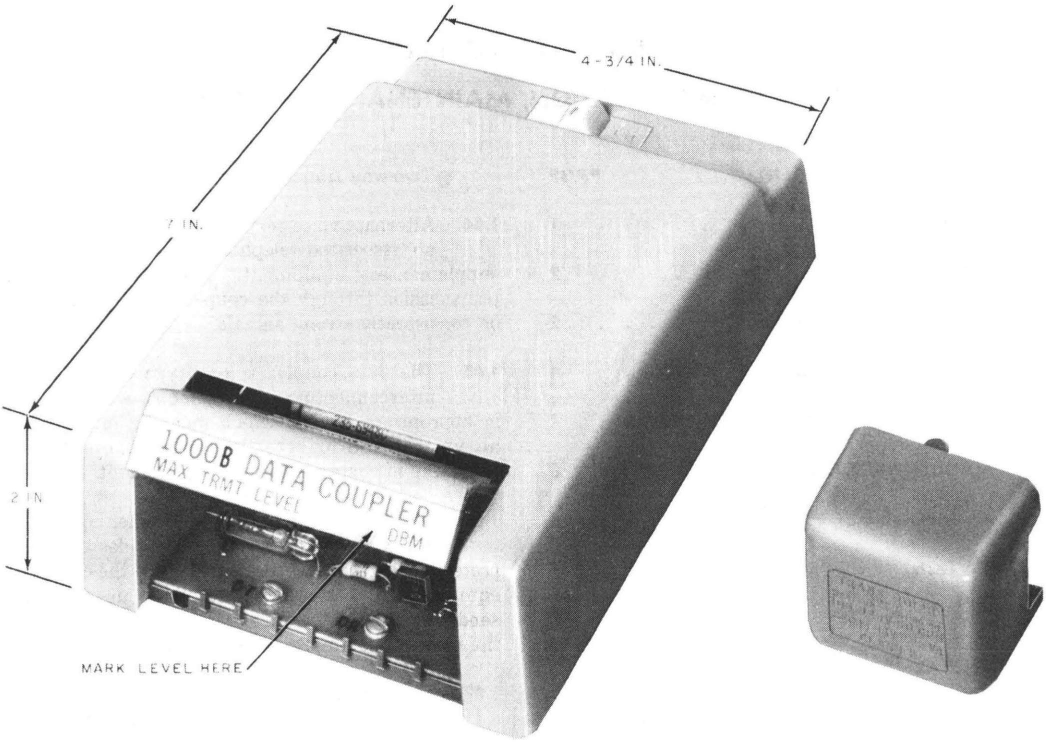


Fig. 1—1000B Data Coupler with 2012B Transformer

designated locally to provide control over private line channels.

2. DESCRIPTION

A. Physical Description

2.01 The data coupler is a wall-mounted unit measuring 4-3/4 inches wide, 7 inches high, and 2 inches deep. The coupler weighs approximately 1-1/2 pounds and is enclosed in a gray plastic housing. The housing consists of a dark gray base and a light gray cover that snap together. One key hole slot and one screw hole are provided in the base so that screws may be used for mounting the unit.

2.02 The circuitry for the coupler is mounted on a single printed circuit pack. Two screw terminals, located under the hinged portion of the cover, provide the interface for connecting the customer equipment (Fig. 2). The cord required for connecting to the interface must be provided by the customer.

2.03 Four screw terminals are provided on the printed circuit pack for connecting the telephone line and 2012B transformer, or equivalent, to the coupler. The housing cover must be removed so that the installer using D station wire may terminate the connections. The following pairs terminate on the four terminals:

- T and R—Telephone transmission line
- P1 and P2—Low-voltage ac leads from external transformer.

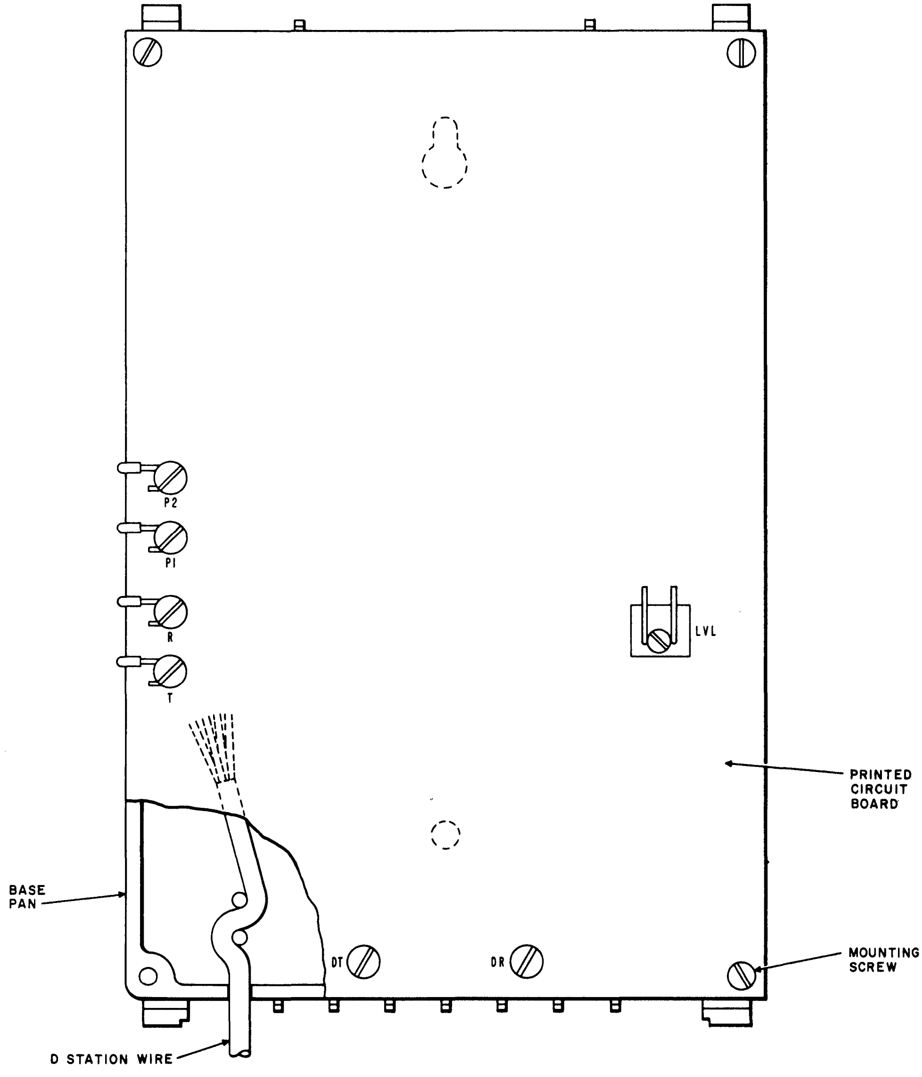


Fig. 2—Route of Station Wiring and Location of Terminals

2.04 A test key (TST) located near the top controls the test mode condition of the coupler.

2.05 A screw switch (LVL) is located on the circuit pack for selecting the threshold of the automatic level control (limiter) circuit of the coupler.

2.06 The data coupler is designed to operate over a range of 20 to 120°F with a relative humidity up to 95 percent.

2.07 A 2012B transformer steps down the 117-volt ac power to the nominal voltage required by the coupler. The rectifier in the coupler provides the dc supply.

B. Functional Description

2.08 The data coupler connects the telephone plant with a data modem that is provided by the customer. The coupler is intended for use with other telephone company equipment on voice-grade private line facilities which will include 2- or 4-wire configurations.

2.09 The coupler circuitry (Fig. 3) provides a transmission path consisting of the following.

- ***Coupling transformer:*** provides a 2-way protective function (ie, hazardous voltages, surge protection, and longitudinal isolation).

- ***Automatic level control (ALC) circuit:*** prevents the customer's signal level from exceeding the prescribed maximum level.

- ***Capacitor coupling and surge protector circuit:*** couples the output signal to the telephone line with minimum delay distortion and guards the circuit against metallic surges.

2.10 The control circuit continuously monitors the customer's data signal level. The detector and integrator continuously average the input power level and when the 3-second average signal exceeds the preset operating level, current is driven through the thermistor. The thermistor heats up, decreases in resistance, provides a shunt path for the data signal, and decreases the level to the preset value. This prevents the signal from exceeding the threshold.

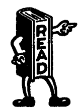
2.11 The level at which the coupler circuit operates to control or limit the data signal is one of two values: ***0 dBm*** and ***−8 dBm.*** The value is selected by means of the LVL screw switch (Fig. 2) on the printed circuit board. With the screw open (normal position), 0 dBm value is selected. With the screw closed (optional value), −8 dBm value is selected.

2.12 The transmit level of the customer modem will determine the limiting level setting of the coupler for a particular installation. The level should be consistent with the design of the private line ordered by the customer. The transmit level of the data modem is the power measured at the customer interface into a 600-ohm resistive load.

> ***Note:*** The maximum limit must be marked on the data coupler at the time of installation (see Fig. 1).

2.13 ***Test Mode:*** The data coupler test circuit provides the means for applying a test tone to the line through the ALC circuit (Fig. 3). This permits testing the coupler level control and the line. The coupler circuit is designed to be remotely tested from the central office or tested locally on the customer premises.

2.14 The test circuit consists of a tone oscillator and a TST key. Operation of the key removes the transmission path from the customer equipment and connects the power supply to the test oscillator. The key also connects the oscillator output to the customer side of the coupling transformer to apply the tone to the line. The tone is a 2800-Hz signal with a level high enough to cause the ALC circuit to operate and reduce the signal to the level (either 0 or −8 dBm) which was specified at the time of installation, thereby testing the limiting action.



Accidental or intentional operation of the TST key while transmitting data will interrupt the data signals.

2.15 Restoring the TST key removes the test oscillator from the circuit and releases the coupler from the test mode.

3. INSTALLATION AND CONNECTIONS

3.01 The 1000B Data Coupler may be used on voiceband private lines associated with customer-provided data equipment. The coupler is just one of the many different components which typically make up a private line data station arrangement. This practice covers only the 1000B Data Coupler, and the specific connections for the unit will depend on the particular station arrangement.

3.02 The installation of the coupler should comply with general practices to ensure an orderly station arrangement. Information relating to a selection of type of connecting block and electrical code requirements is given in Section 590-010-200.

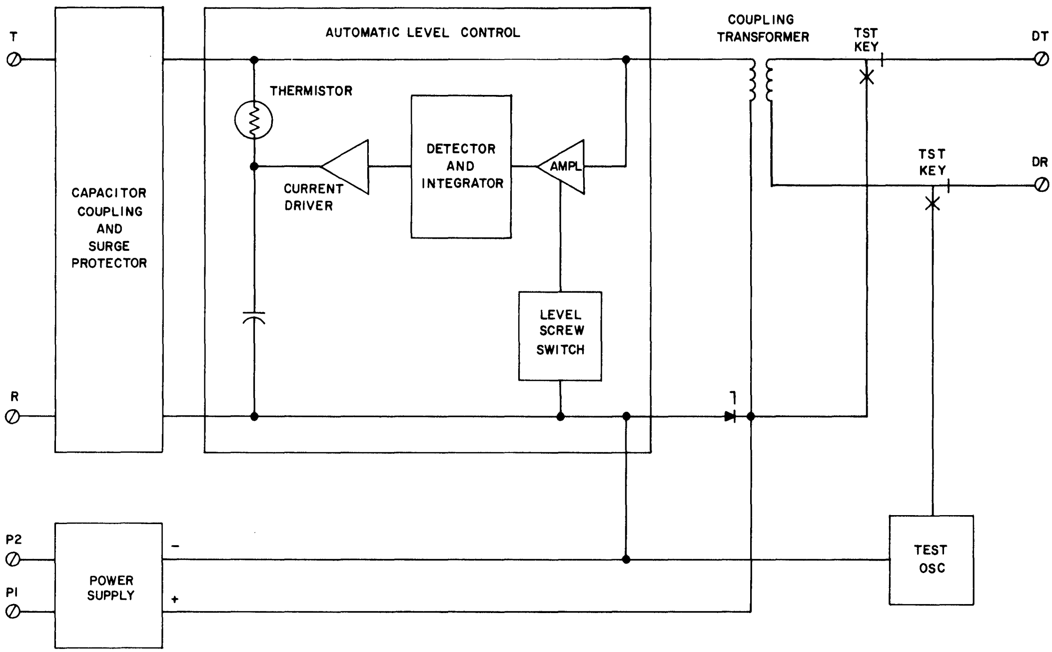


Fig. 3—Functional Schematic of 1000B Data Coupler

3.03 The location of the data coupler shall be determined by the following conditions.

- The coupler should be mounted on a smooth surface.
- The coupler must be within range of the interface cord supplied by the customer.
- The location of the coupler should provide easy access for operation of the test key by the customer attendant.

Note: In general, there is no restriction on the length of the customer interface cord. The telephone company responsibility terminates at the coupler interface.

3.04 Install the coupler as follows.

(1) Remove the snap-off cover assembly.

(2) Remove the four screws securing the printed circuit board to the base pan and remove the board.

(3) To install coupler on wall, position the base pan vertically against the wall with key hole slot up. The base pan should be at least 3 inches above the top of the baseboard or other obstruction which will be below the unit. Secure the base with two screws.

(4) Route the D station wire through the slots and pins on the base as shown in Fig. 2. Attach the circuit board to the base pan by using the four screws. Connect the four leads as required to the terminals on the board.

READ ***Care should be taken not to overtighten screws or stripping will result.***

3.05 A 2012B transformer is provided with each coupler. The transformer primary terminals are two parallel blades which serve as the mounting device in a standard 117-volt, 60-Hz ac power receptacle. Two recessed screw terminals provide the means for connecting to the transformer secondary. The ac receptacle, furnished by the customer, must have continuous power and must not be under control of a switch.

> *Note:* The power must always be on during the transmitting mode or the data signals will be distorted.

3.06 The data coupler and transformer may be connected in accordance with the typical wiring diagram shown in Fig. 4. The coupler may connect directly to a 2-wire private line, to the send pair of a 4-wire private line, or to other telephone equipment. Any associated apparatus which is required to complete the station arrangement should be installed as outlined in appropriate practices.

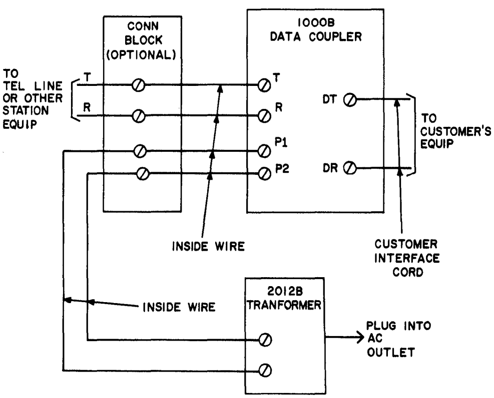


Fig. 4—Typical Data Coupler Connections with Associated Transformer

3.07 When the connections have been completed, the level limiting function of the unit must be checked. Perform the limiter operational test as outlined in Part 4.

3.08 After the installation has been completed, perform the remote test outlined in Part 4. The results of the remote test made during installation must be recorded on a line history record card, or equivalent, by the central office to assist in analyzing future trouble and to detect gradual degradation of the service.

3.09 After the installation, verify that the private line meets the transmission requirements for the specific data channel ordered by the customer. The requirements for various private line offerings are outlined in Section 314-410-500.

4. MAINTENANCE AND TESTS

4.01 The maintenance and testing procedures described in this part are to assist the employee during installation and troubleshooting visits to a data coupler station.

A. Maintenance

4.02 All repair forces should be familiar with the tariff provisions which generally provide for a "Maintenance of a Service Charge" for each repair visit in which it is found that the trouble condition results from or is caused by customer-provided equipment. When such a condition exists, the employee should notify the customer and request the central office to fill out form E-5855 in conformance with Section 660-101-312.

4.03 Maintenance of the coupler on customer premises should be limited to local tests, testing with a central office, or replacing a defective unit. Field repair should not be attempted on a defective coupler. The unit should be returned to the Western Electric Service Center to be salvaged for the best allowance.

B. Tests

4.04 The following tests are required to ensure the proper installation of the coupler and to determine the operating condition of the unit during a maintenance visit:

- Limiter operational test
- Remote test.

4.05 The following test equipment is required for the limiter test:

- 600-ohm resistor

- Hewlett-Packard 400D vacuum tube voltmeter (VTVM), KS-16979-L1 or KS-14510-L1 volt-ohm-milliammeter, 3A noise measuring set, or equivalent meter for measuring signal level

- KS-16979-L1 or KS-14510-L1 volt-ohm-milliammeter, or equivalent meter for measuring resistance.

4.06 ***Limiter Operational Test:*** The limiter operational test makes use of the test oscillator to verify that the coupler will properly limit an input signal that exceeds the preset maximum level. Proceed with the test as follows:

(1) After obtaining permission from customer to interrupt service, disconnect the telephone line and connect the 600-ohm resistor between terminals T and R.

Note: Obtain access to terminals T and R by removing the snap-off cover from the coupler. Access to the terminals may also be obtained at the appearance of tip and ring on the connecting block which terminates the D station wire.

(2) Plug the 2012B transformer into an ac outlet.

(3) Connect available meter across T and R terminals to measure signal level.

(4) Operate the TST key to the ON position (depress the red dot half of switch).

(5) Observe definite increase in meter reading. After a few moments, the reading should decrease to the appropriate following value:

PRESET LEVEL ON COUPLER	METER READING 400D AND KS-16979-L1	KS-14510	*3A
0 dBm	—2 ±0.5 dBm	0.6 ±0.05v	84 ±0.5 dBrn, 3 kHz flat
—8 dBm	—9.6 ±0.7 dBm	Approx 0.25v	77 ±0.7 dBrn, 3 kHz flat

* With FUNCTION switch set at NM BRDG.

(6) To complete operational test, use available ohm meter and measure resistance across terminals DT and DR. With the TST key in the OFF position (blank half of switch depressed), a reading of approximately 85 ohms should be obtained on the meter. Operate TST switch to ON position and observe meter indication of infinite resistance (an open condition).

(7) Remove the resistance and test equipment from the coupler and restore the connection to normal.

4.07 ***Remote Test:*** The remote test is required to measure the test signal of the coupler at the central office at the time of installation. The test should also be performed with customer's assistance prior to a station maintenance visit. The test signal provides a check of the local channel and the limiting function of the coupler.

4.08 The data coupler must be connected to the telephone line for this test. Proceed with the test as follows.

(1) Plug the 2012B transformer into an ac outlet.

(2) Using a telephone set connected to the switched telecommunications network, contact the controlling central office and request the employee to measure the level of the test tone (2800 Hz) received on the private line channel.

(3) Agree upon length of time required to perform the test, and when instructed by test employee operate the TST key (depress red dot half of switch).

(4) After the agreed testing interval, operate the TST key to normal position (depress blank half of switch).

(5) Call the test office and request the level reading. When the test is made at time of installation, the actual value of the received 2800-Hz signal level ***must*** be recorded on the line history card for comparison against measurements made in subsequent tests. If the level of the 2800-Hz signal on subsequent tests varies by more than 2 dB from the original value, it is an indication of ***possible*** trouble in either the local channel or the coupler. A measured level within 2 dB of original value provides a high confidence level that the coupler and associated line are operating satisfactorily.

1001D DATA COUPLER

DESCRIPTION, INSTALLATION, MAINTENANCE, AND TESTS

CONTENTS PAGE

1. GENERAL

1.01 This section provides information required for installing and maintaining the 1001D data coupler (Fig. 1).

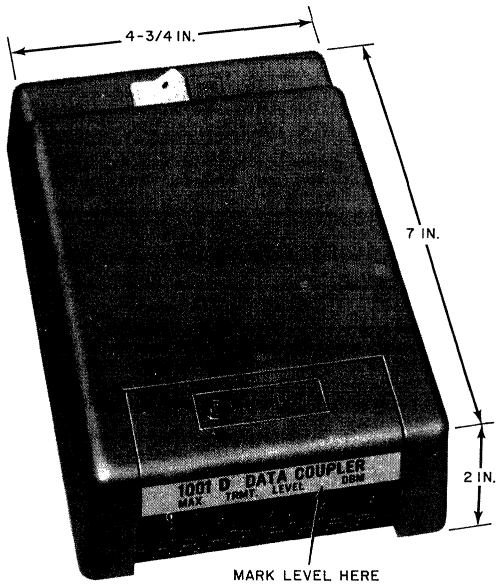


Fig. 1—1001D Data Coupler

NOTICE
Not for use or disclosure outside the
Bell System except under written agreement

1.02 This section is reissued to include:

- Information formerly contained in Addendum 1
- Line current status indicator (LCSI) test
- 503C or 2503C telephone set test
- A warning about the size of mounting screws used.

Since this reissue constitutes a general revision, arrows ordinarily used to indicate changes have been omitted.

1.03 The data access arrangement (DAA) includes both the data coupler and telephone set as described in appropriate tariffs. The 1001D is an automatic data coupler which provides the means for connecting customer-provided automatic data equipment to the switched network for data and voice communications. The uniform service order code (USOC) for this DAA is CBT.

1.04 The 1001D data coupler is smaller than the 1001B coupler [rated Manufacture Discontinued (MD)], which has the same USOC. The 1001B and 1001D are otherwise interchangeable. The 1001D has no ANS switch, automatically answers in the test mode, and requires less current in the test mode.

1.05 The 1001D data coupler provides the following:

- Isolation of customer equipment for the protection of telephone plant and personnel from hazardous voltages. This also provides protection of customer equipment from surges occurring on telephone facilities.
- Automatic linear control of signal level above a specified threshold.
- Contact-type interface.
- Detection of incoming ringing signals to permit customer to operate in unattended answering mode.
- Test circuitry for manually operated remote testing.
- Off-hook control which allows customer equipment to dial-pulse for call origination.
- Timed delay on all calls to permit proper automatic message accounting.
- Indication of switchhook status on associated telephone set, if provided.
- 2-way transmission path.

1.06 Additional telephone functions, such as alternate voice service, may be provided with an associated telephone set as a standard option. Audible monitoring of the data transmission and mode indication through switch contacts are provided by 503C and 2503C telephone sets.

1.07 Customer equipment may be connected through the data coupler to local loop facilities or to Bell System private branch exchange (PBX) station lines.

1.08 At installations where TOUCH-TONE® calling service has been ordered, the customer may generate tone signals for originating calls through the transmission interface leads of the coupler.

1.09 A service offering in which the data coupler is used provides the customer with end-to-end transmission performance characteristics comparable to DATA-PHONE® service on the switched telecommunications network. Because customer equipment, over which the Bell System has no design control, may contribute significantly to error performance, the Bell System cannot assume responsibility for the accuracy of transmitted data. End-to-end facilities, including the local loop, will be engineered and maintained to the equivalent DATA-PHONE service requirements. These requirements are specified in Section 314-205-501 for local loops and in Section 314-205-500 for the switched network.

2. DESCRIPTION

A. Physical Description

2.01 The 1001D data coupler is a wall-mounted unit measuring 4-3/4 inches wide, 7 inches high, and 2 inches deep. The coupler weighs approximately 1-3/4 pounds and is enclosed in a gray plastic housing. The housing consists of a dark gray base and a light gray cover that snap together. One keyhole slot and one screw hole are provided in the base for mounting the unit on a wall or on other vertical surface. ***The coupler must be vertically mounted to ensure proper operation of the mercury relay.***

> ***Note:*** Two No. 6 by 3/8-inch pan-head metal screws and two No. 6 by 1/2-inch wood screws are shipped with the data coupler. The use of larger screws will short circuit printed wiring paths on the circuit pack.

2.02 Circuitry for the coupler is mounted on two printed CPs (Fig. 2). Ten screw terminals at the lower end of the bottom CP provide the interface for connection to customer equipment. Interface control leads use contact closures for signaling. See Table A for lead designations. The cord required for connecting the customer modem to the interface must be supplied by the customer.

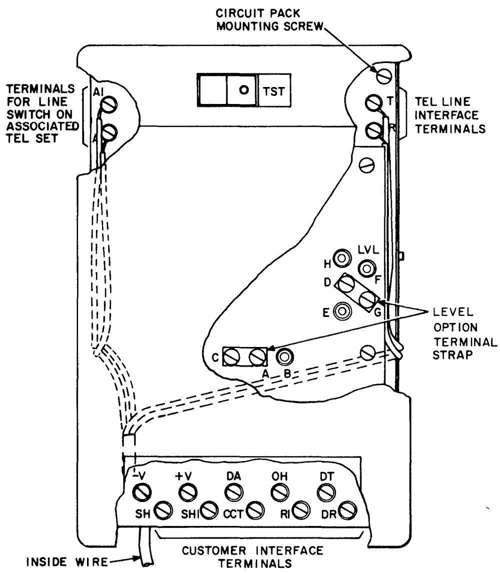


Fig. 2—Route of Station Wiring and Location of Terminals

2.03 Four additional screw terminals are provided on the larger printed CP for connecting the telephone line and associated apparatus to the coupler. The housing cover must be removed to make connections to the coupler. To remove, lift cover up from the bottom to relieve tension on mounting lips, then pull cover out at the top. Use D station wire to terminate connections. The following pairs of leads terminate on the four terminals:

- T and R—Telephone line transmission and signaling pair
- A and A1—Extension of associated telephone set switchhook to the customer equipment.

2.04 A locking switch (TST) is located at the top of the coupler to provide control of the test mode condition.

2.05 Level option terminals located on the smaller CP must be strapped by the installer to adjust the threshold of the automatic level control (ALC) (limiter) circuit of the coupler.

2.06 The data coupler is designed to operate over an ambient temperature range of 0 to 120°F with a maximum relative humidity of 95 percent.

2.07 The coupler ALC circuit is powered from dc telephone line current. An external power supply is required to provide a dc supply for the control circuit of the coupler. The external supply may be provided by the customer, or by the telephone company (telco) at customer request. When the telco is requested to provide the supply, a suitable power source is the 33A power unit (Section 167-452-101), the 28A1 power unit (Section 167-445-101), or the 19B2 power unit (Section 167-440-201). The customer must provide a standard 2-pole 3-wire grounded 117-volt ac power receptacle for either power unit. The receptacle must not be under control of a switch.

B. Functional Description

2.08 ***General:*** The data coupler is a network protective unit designed to interface a customer-provided automatic data terminal. The coupler provides contact closures to the data terminal to indicate the detection of ringing signals. In response to the contact closures, the data terminal provides signals which cause the coupler to seize the line, trip ringing, and cut through the transmission path. Prior to the transmission path cut-through, a 2-second delay is provided to allow proper operation of automatic message accounting

TABLE A

INTERFACE LEAD DESIGNATIONS FOR 1001D DATA COUPLER

TERMINAL DESIGNATION	FUNCTION	
DT	Data Tip	600-Ohm Transmission Leads
DR	Data Ring	
OH	Off-On Hook Control	
DA	Request Data Transmission Path Cut-Through	
RI	Ring Indication	
CCT	Coupler Cut-Through	
SH (or MI)*	Switchhook Status of Associated Tel Set	
SH1	Return for SH Lead	
+V	Positive DC Power	
—V	Return for DC Power	

*SH is redesignated MI when used with MFT.

equipment. A polarity guard, ALC, and a coupling transformer are provided to protect the telecommunications network, coupler, and customer equipment. In addition, the coupler circuitry permits the data terminal to originate and terminate data calls automatically.

2.09 ***Coupler Transmission Path:*** The coupler transmission path consists primarily of a coupling transformer, an ALC circuit, and a polarity guard (Fig. 3). The transformer terminates the telephone loop and provides a 2-way protective function (ie, hazardous voltages, surge protection, and longitudinal isolation). The ALC circuit prevents the customer signal level from exceeding the prescribed maximum limit. The polarity guard maintains the polarity of the line current and voltage required by the ALC circuit.

2.10 The ALC circuit continuously monitors the output of customer data signals. Option strapping on the level-adjusting network determines the customer signal power level (threshold) at which the circuit operates to control the output signal.

2.11 The signal power level is continuously averaged by the detector and integrator. When the averaged signal level exceeds the threshold during any 3-second interval, current is driven through a thermistor. The thermistor heats up, decreases in resistance, and since the thermistor shunts the transmission path, reduces the signal level to the threshold value.

Data Mode

2.12 ***Ring Detection:*** The ring detector (Fig. 3) is activated when the 20-Hz ringing signal is present on the line, indicating an incoming call. The R relay, part of the ring detector, operates and releases in response to each half cycle of ringing current. Contact closures of the R relay are used to close the RI interface lead to -V. ***The contact closures must be integrated by the customer data terminal to protect against false operation due to surges or to dial pulses. At least two cycles of 20-Hz ringing signal should be detected before reacting to the signal.***

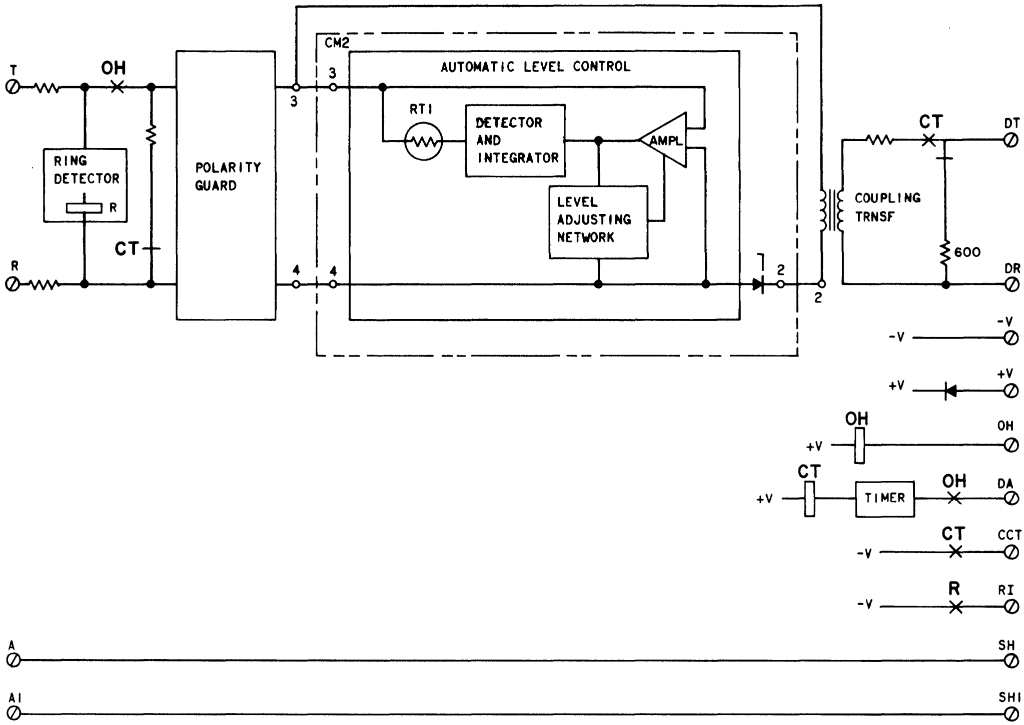
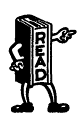


Fig. 3—1001D Data Coupler—Data Mode

Note: An interface control lead closed (connected) to -V indicates an ON condition. A control lead opened (not connected) to -V indicates an OFF condition.

2.13 ***Automatic Answer:*** When the data terminal is ready and satisfied that ringing has been received, the OH interface lead is closed to the -V lead. Closure of the OH lead operates the OH relay. In turn, the relay performs the off-hook function by closing the loop to trip ringing. The relay also closes the operate path from the DA interface lead to the delay timer. To complete the data transmission path, the data terminal closes the DA lead to -V. (The DA lead may be closed to -V at all times except when dial pulsing on the OH lead.) The DA lead closure, or the operation of the OH relay when DA is permanently ON except during dialing, starts the timer circuit. After a 2-second interval, the CT relay operates. The CT relay removes the terminating resistor from the loop, removes the terminating resistor from the data terminal, connects the data terminal to the telephone line through the ALC, and closes the CCT interface lead to -V. Closure of the CCT lead informs the data terminal that the transmission path is now completed through the coupler from the data terminal to the local loop.



Closure of the CCT interface lead does not imply that an end-to-end connection has been established.

2.14 The data coupler contains no circuitry to generate or detect answer-tone signals. The customer must provide or detect the answer tone when required.

2.15 ***Call Origination:*** Closing the OH interface lead to -V by the customer, either for call origination or for transfer from a manually originated call, causes the OH relay to provide the off-hook function as previously described. Opening the OH lead causes the OH relay to release and open the dc path through the coupler. This sequence of operations permits the data terminal to generate dial pulses for call origination when dial tone is present. The pulsing sequence and timing requirements are as follows (Fig. 4):

(1) The OH lead is closed.

Note: The DA lead may be closed to -V to detect dial tone or, after an interval, the presence of tone may be assumed and blind dialing initiated. If the DA lead is closed, a 2-second interval will occur before dial tone can be detected. The DA lead must be opened for the remainder of the dialing sequence after dial tone is detected. The dial speed should be a nominal value of 10 pps.

(2) The OH lead is opened for a 61-percent break interval.

(3) The OH lead is closed for a 39-percent make interval.

(4) Steps (2) and (3) are repeated for the number of pulses required; eg, a total of five openings of the OH lead for the digit 5.

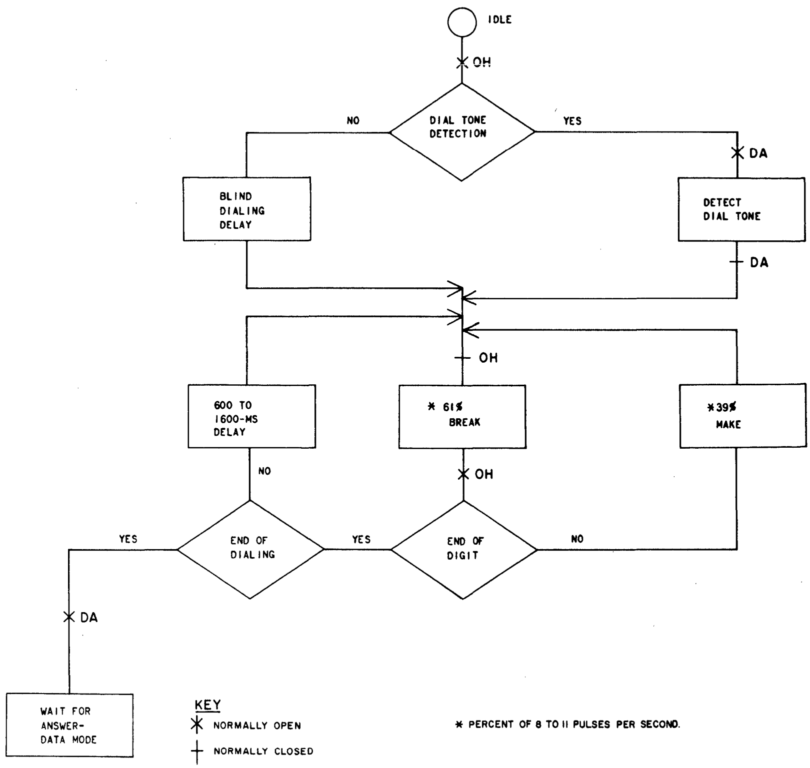


Fig. 4—Customer Automatic Calling Sequence Diagram—DC Dial Pulsing

(5) After the last pulse of a given digit, a 600- to 1600-ms delay occurs and the first pulse of the next digit is started.

(6) After all digits have been generated, the DA lead is closed.

2.16 Closing the DA lead, either for detection of dial tone or after the dialing sequence is completed, causes the circuit to function the same as on incoming calls when combined with the closing of the OH lead. After a 2-second interval, the CT relay operates to connect the data terminal to the telephone line and closes the CCT lead to inform terminal equipment that the transmission path has been cut through to the local loop.

2.17 Automatic calling may also use TOUCH-TONE signaling for call origination (Fig. 5). As previously stated, closing the OH and DA leads to -V causes the coupler to go off-hook and provides a transmission path between the data terminal and the telephone line. When dial tone is present, multifrequency signals are generated to access the switched network. The customer may then wait for answer tone or for a verbal answer before transmitting data.

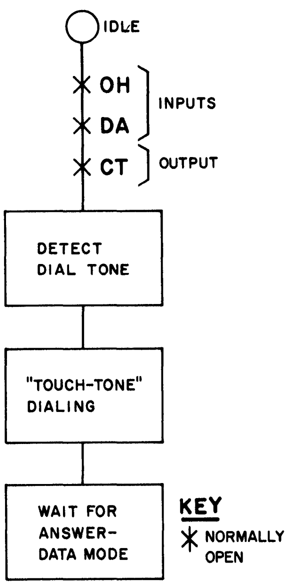
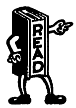


Fig. 5—Customer Automatic Calling Sequence Diagram—TOUCH-TONE Dialing

2.18 *Call Termination:* When data transmission is complete, the data coupler does ***not*** provide an automatic disconnect. ***The data terminal must recognize the end of the call and must open the OH interface lead.*** In turn, the OH and CT relays drop to open the telephone loop and disconnect terminal equipment from the coupler. The coupler returns to idle state.

Test Mode



Operation of the TST switch while transmitting data will interrupt the data signals.

2.19 The data coupler test circuit provides the means for applying a test tone to the line through the ALC circuit (Fig. 6). This permits testing the level control, the local loop, and certain control functions of the coupler. The circuit is designed to be tested remotely from the local test desk (LTD), although a data test center (DTC) or other designated test location may perform the test.

2.20 The test circuit consists of a tone oscillator, test (TE) relay, and a switch (TST). The TST switch is used to condition the test circuit for operation. The switch closes a path to a relay driver for the TE relay and to the winding of the OH relay. The switch also removes two of the interface control leads (OH and RI) from the customer equipment to prevent false operation or indication.

2.21 The data coupler detects the incoming ringing signal of a test call in the same manner as previously described for data mode. The R relay operates and releases in response to ringing current. When the R relay operates, -V is closed to a relay driver which in turn operates the TE relay. A make contact on the TE relay provides a hold path for the TE relay and an operate path for the OH relay. In addition, the TE relay operates to (1) remove the transmission path from the customer equipment and to connect the path to the output of the test oscillator, (2) open the remaining interface control leads (DA, CCT, and RI) to the customer equipment, and (3), close -V to the call timer via a make contact on the OH relay.

2.22 The OH relay operates to close the loop and to trip ringing. The relay also completes

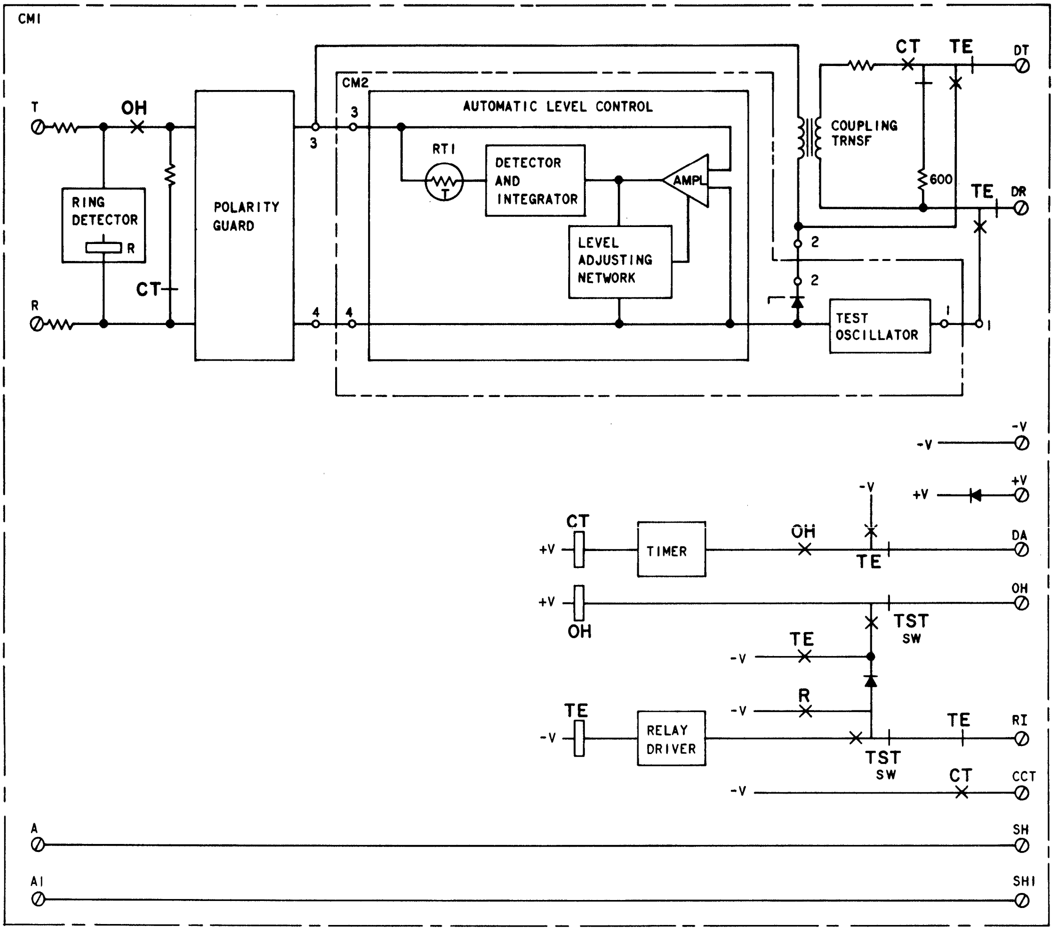


Fig. 6—1001D Data Coupler—Test Mode

the start path for the call timer. After a 2-second delay, the CT relay operates to connect the output of the test oscillator to the telephone line.

2.23 The test circuit generates a 2800-Hz signal at a level which exceeds the maximum power level allowed for any coupler installation. This level causes the ALC circuit to operate and reduce the signal level to the value specified at the time of installation.

2.24 Restoring the TST switch releases the coupler from test mode. The TST switch must be restored at the end of the test for proper operation of the coupler.

3. OPTIONS

A. Telephone Sets

3.01 An associated telephone set is a standard option with the data coupler. The coupler can be installed without a telephone set for fully automatic operation. The coupler SH and SH1 interface leads provide the customer with the status of the line switch on an associated telephone set when used with the data coupler. When a telephone set is provided, the exclusion key and telephone set ringer wiring options must be specified on the service order. The exclusion key options provide for either the coupler to control the line or the telephone set to control the line. Telephone set ringer options provide the desired ringing features for each of the two line control options. A description of these options is included in the following paragraphs.

(a) ***Option A—Coupler Controls Line (Automatic Operation)***

(b) ***Option B—Telephone Set Controls Line***

(c) ***Option C—With Ringer Connected on Telephone Set Side of Exclusion Key:***

(1) When coupler controls line

When the exclusion key ***is not operated,*** the coupler RI interface lead can be activated but the telephone set cannot ring.

When the exclusion key ***is operated,*** the telephone set cannot ring and the coupler RI interface lead cannot be activated (since handset must be lifted to operate exclusion key and this causes dial tone).

(2) When telephone set controls line

When the exclusion key ***is not operated,*** the telephone set can ring but the coupler RI interface lead cannot be activated.

When the exclusion key ***is operated,*** the coupler RI interface lead can be activated but the telephone set cannot ring.

(d) ***Option D—With Ringer Connected on Telephone Line Side of Exclusion Key:***

(1) When the coupler controls line

When the exclusion key ***is not operated,*** the coupler RI interface lead can be activated and the telephone set can ring.

When the exclusion key ***is operated,*** the telephone set cannot ring and the coupler RI interface lead cannot be activated (since handset must be lifted to operate exclusion key and this causes dial tone).

(2) When telephone set controls line

When the exclusion key ***is not operated,*** the telephone set can ring but the coupler RI interface lead cannot be activated.

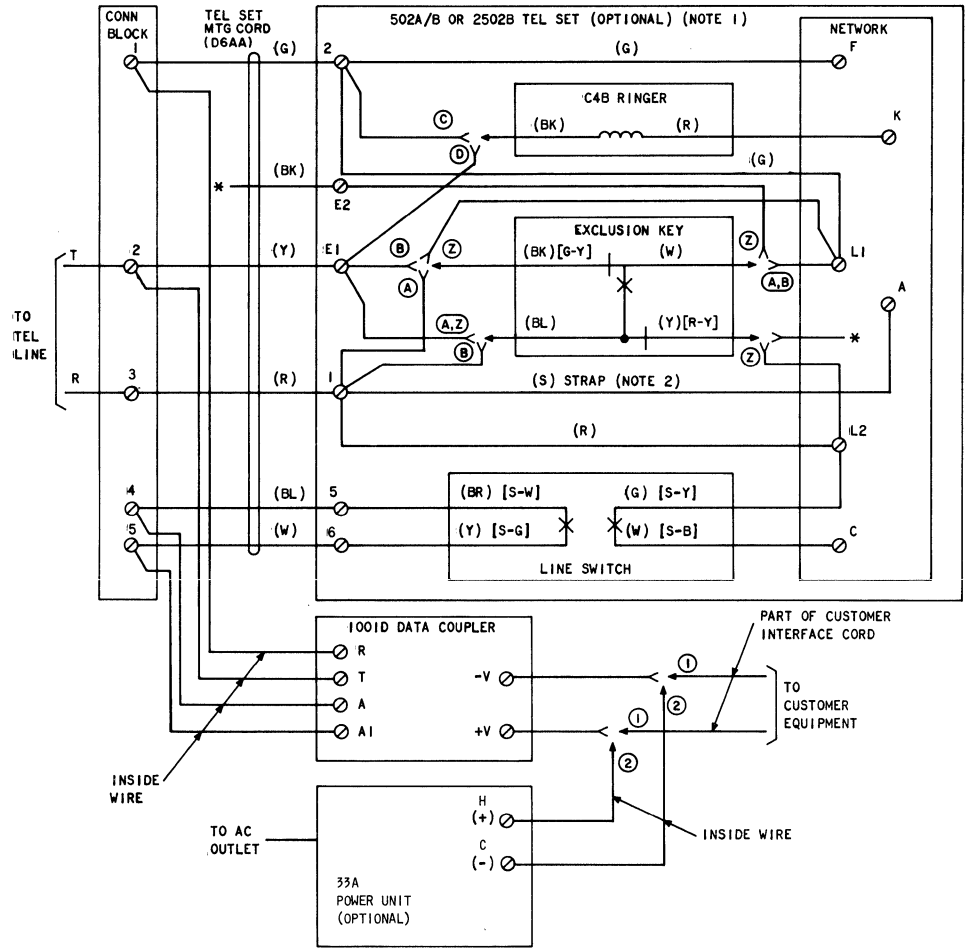
When the exclusion key ***is operated,*** the telephone set can ring and the coupler RI interface lead can be activated.

3.02 Options specified in 3.01 apply to the standard [502A/B or 2502B (Section 502-501-102 or 502-503-102)] as well as the multifunction telephone (MFT) [503C or 2503C (Section 502-501-120 or 502-503-120)] when used with the 1001D data coupler. Connections for these options using the 502- and 2502-types are shown in Fig. 7. Additional options are available using the MFT, and are discussed in 3.03, and shown in Fig. 8 and 9. Wall-mounted telephones are not recommended and should not be used.

3.03 The 503C (rotary dial) and the 2503C (TOUCH-TONE dial) telephone sets furnish the customer the following additional options.

- Allows monitoring of data transmission and voice answer-back signals through the telephone handset as used in digital inquiry voice answer-back (DIVA) applications.
- Provides an indication of whether telephone line is connected to telephone set or data coupler, or it may be used to provide an indication of SH (ie, on-hook or off-hook).

These additional features provided by the 503C (or 2503C) telephone set necessitate the use of a triple transfer exclusion key and a high-impedance bridging transformer in the telephone set. One set of the exclusion key contacts switches the line between the telephone and the coupler. The second set switches the monitoring circuit, and the third set provides the mode indication. The high-impedance transformer allows the attendant to monitor data transmission with the telephone handset. Both sets are in a light gray housing; however, they



NOTES:
1. EXCLUSION KEY AND RINGER MUST BE REWIRED FOR DESIRED OPTION.
2. IF C4A RINGER IS USED, WIRE AS FOLLOWS:
   (BK) TO 2 OR E1, DEPENDING ON OPTION USED
   (S) TO K OF NETWORK
   (S-R) TO A OF NETWORK
   (R) TO 1 OF TERMINAL STRIP

Z ORIGINAL FACTORY WIRING OF TEL SET
1 POWER FURNISHED BY CUSTOMER
2 OPTIONAL TELCO FURNISHED UNIT
* INSULATE AND STORE
( ) CURRENT COLOR CODE
[ ] MD COLOR CODE

EXCLUSION KEY OPTION	WIRING OPTION
COUPLER CONTROLS LINE	A
TEL SET CONTROLS LINE	B

RINGER OPTIONS	WIRING OPTION
RINGER ON TEL SET SIDE OF EXCLUSION KEY	C
RINGER ON TEL LINE SIDE OF EXCLUSION KEY	D

Fig. 7—Typical Connections for 1001D Data Coupler With 502A/B or 2502B Telephone Set

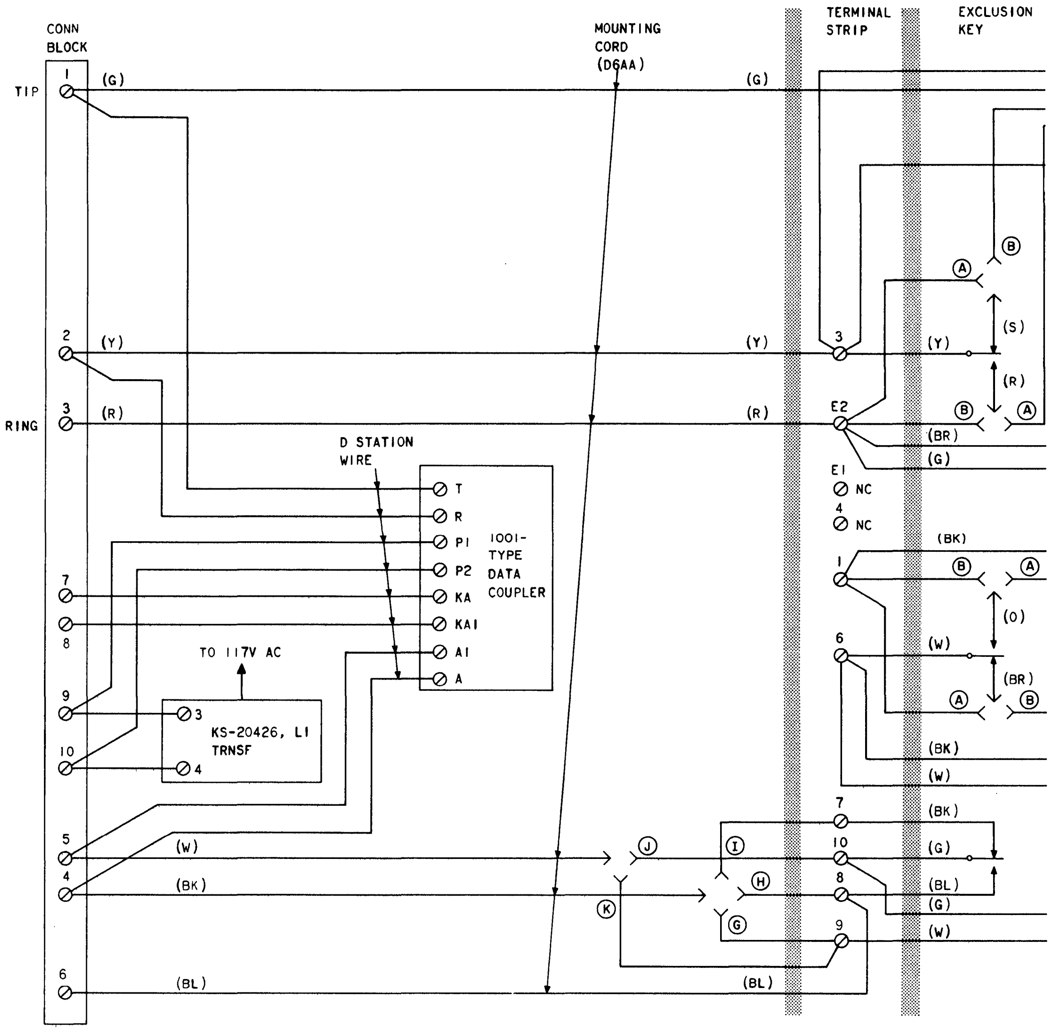
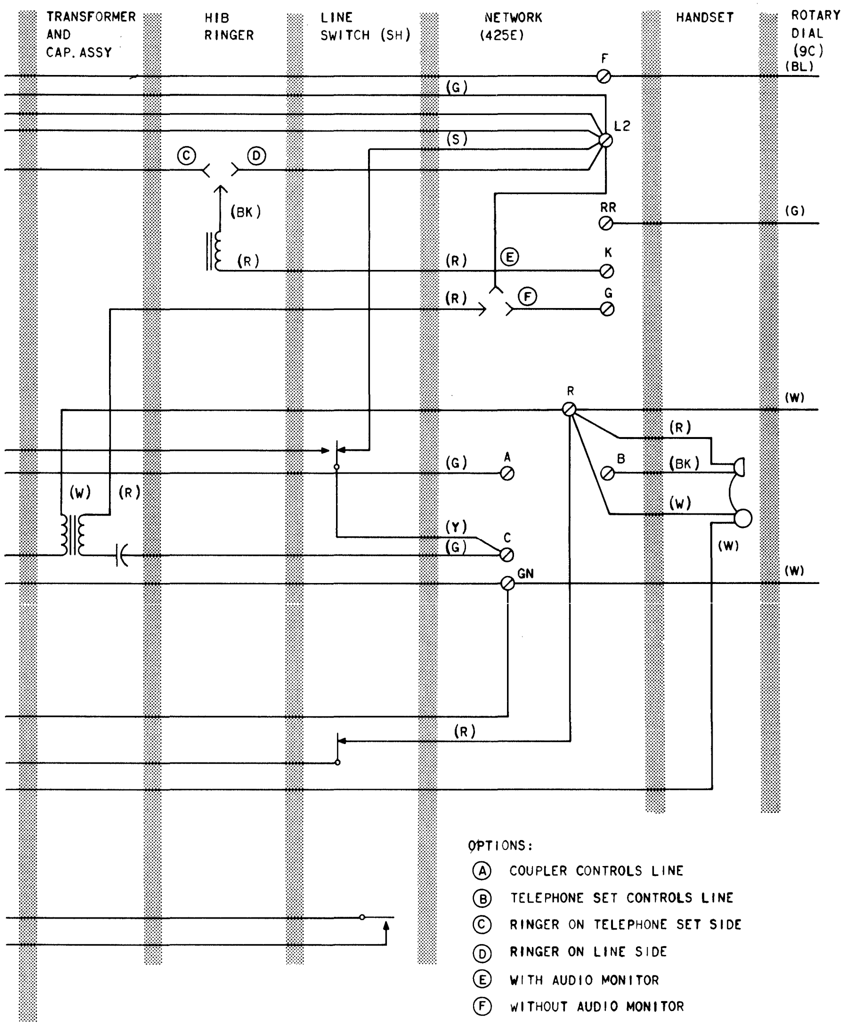


Fig. 8—Typical Connections for 1001D Data Coupler With 503C Telephone Set (Sheet 1 of 2)



INDICATOR	ADDITIONAL OPTIONS WITH	
	OPTION A	OPTION B
VOICE MODE	H, K	I, K
DATA MODE	I, J	H, K
SWITCHHOOK	G, J	G, J

Fig. 8—Typical Connections for 1001D Data Coupler With 503C Telephone Set (Sheet 2 of 2)

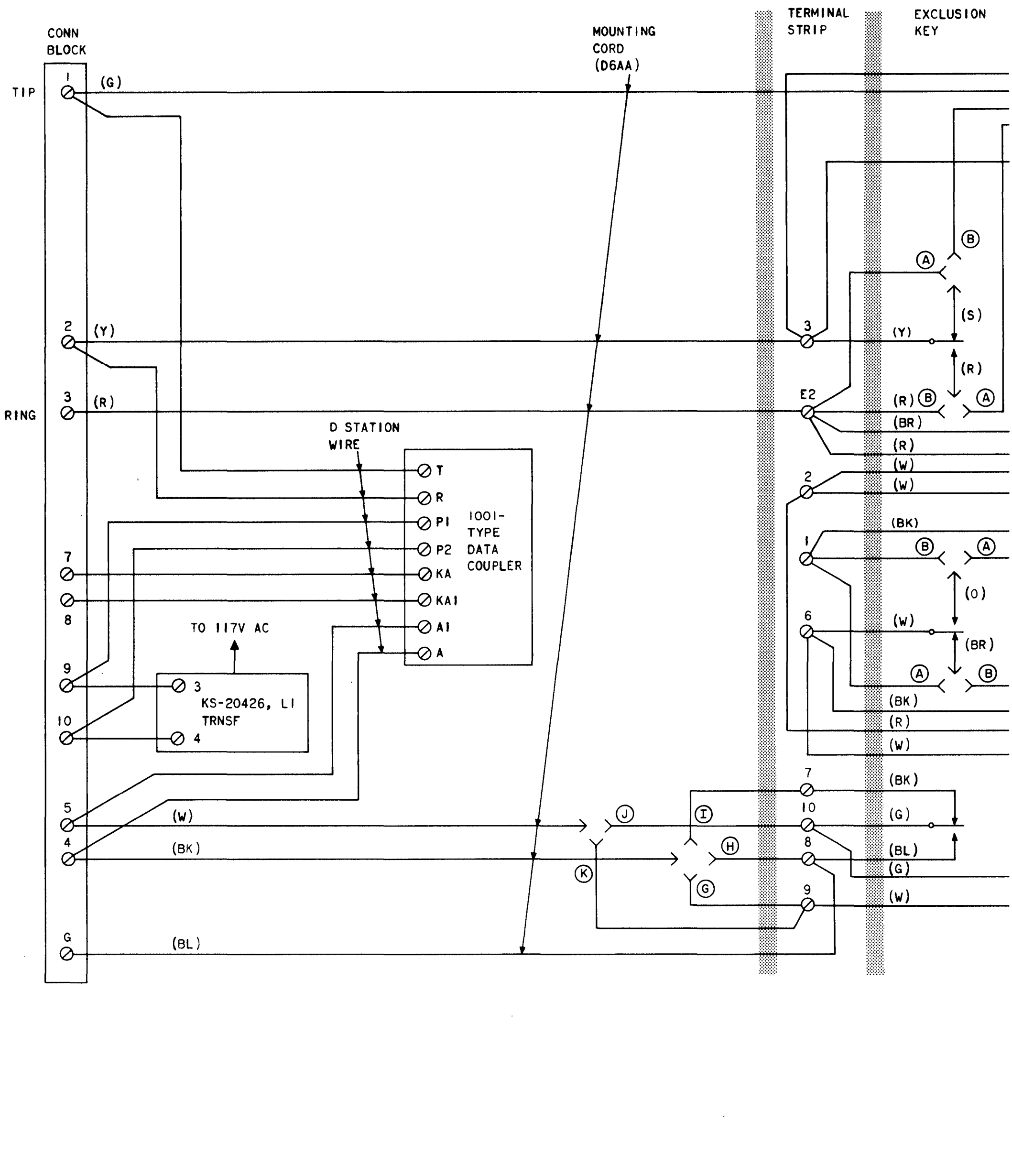
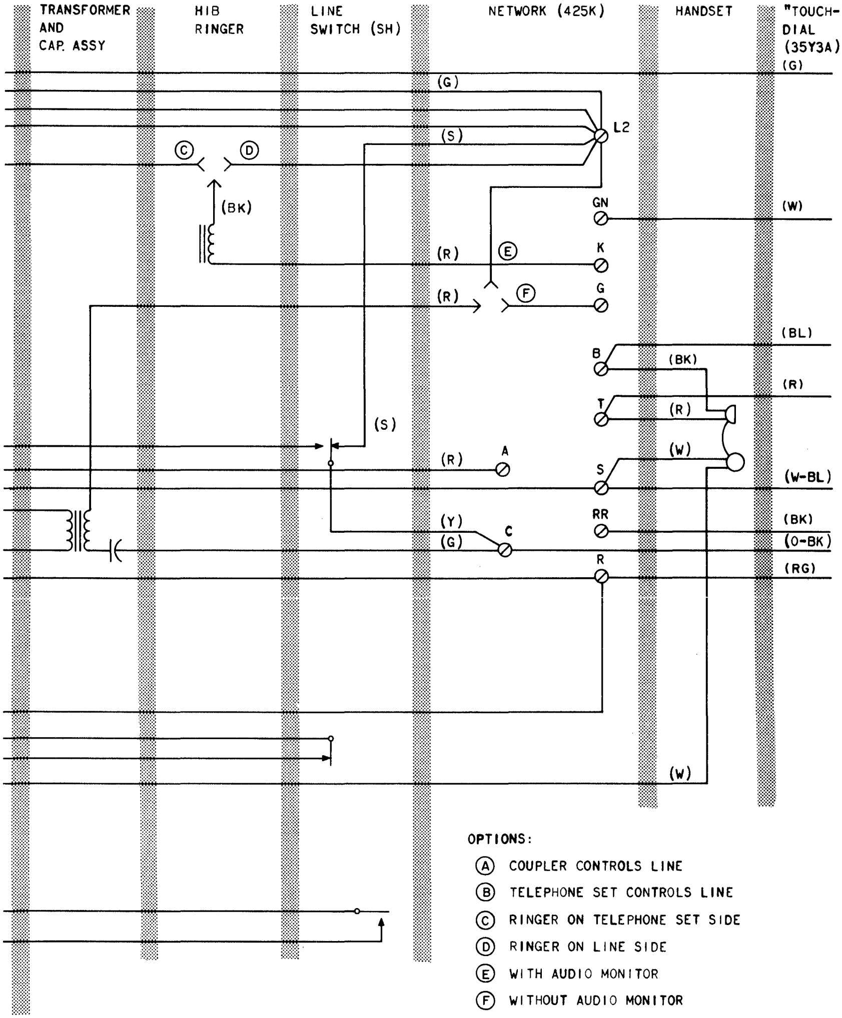


Fig. 9—Typical Connections for 1001D Data Coupler With 2503C Telephone Set (Sheet 1 of 2)



OPTIONS:

Ⓐ COUPLER CONTROLS LINE

Ⓑ TELEPHONE SET CONTROLS LINE

Ⓒ RINGER ON TELEPHONE SET SIDE

Ⓓ RINGER ON LINE SIDE

Ⓔ WITH AUDIO MONITOR

Ⓕ WITHOUT AUDIO MONITOR

INDICATOR	ADDITIONAL OPTIONS WITH	
	OPTION A	OPTION B
VOICE MODE	H, K	I, K
DATA MODE	I, J	H, K
SWITCH HOOK	G, J	G, J

Fig. 9—Typical Connections for 1001D Data Coupler With 2503C Telephone Set (Sheet 2 of 2)

may be enclosed in standard 500- or 2500-type housings of another color if desired.

3.04 In a multiple data coupler installation, it is often desirable to associate several data couplers with one telephone set. Key telephone sets are available in 6-, 10-, 18-, and 30-button sizes. Key telephone sets can connect to one of several lines. The auxiliary key contact for each line, designated the A lead, is used to operate associated circuitry. The A lead may also be used to operate a relay which transfers a line from the data coupler to the telephone set as shown in Fig. 10. The function of the exclusion key is replaced by the line pickup key on the key telephone set. Note, however, that the coupler is never disconnected from the line when wired as shown in Fig. 10. The switchhook indicator function (SH lead) is not available with key telephone set installations unless auxiliary key telephone units (KTUs) are used. The coupler is assumed to be the primary station. Data calls can be originated and answered without interference from the telephone set. To indicate activity of the data coupler, the OH contact is used to connect the winking lamp supply to the telephone set. The lamp under the key designated for the line assigned to this coupler winks when the data coupler is on-line and off-hook.

3.05 Apparatus necessary for providing telephone service for automatic data couplers consists of a key telephone set with enough capacity for the lines involved, a transfer relay for each line involved, a ringup relay for each line that requires manual answering as a service feature, and a line current detecting relay to supply visual indication of the coupler status. Figure 10 shows the connections for a representative KTU. Other types of KTUs that provide the required features may be used at the discretion of the telco. Additional features such as common pickup of a single group of lines from any of several telephone sets may be supplied by bridging key telephone sets and adding additional KTUs. Any service commonly offered in a local area should be provided according to local practices.

B. Line Current Status Indicator (LCSI)

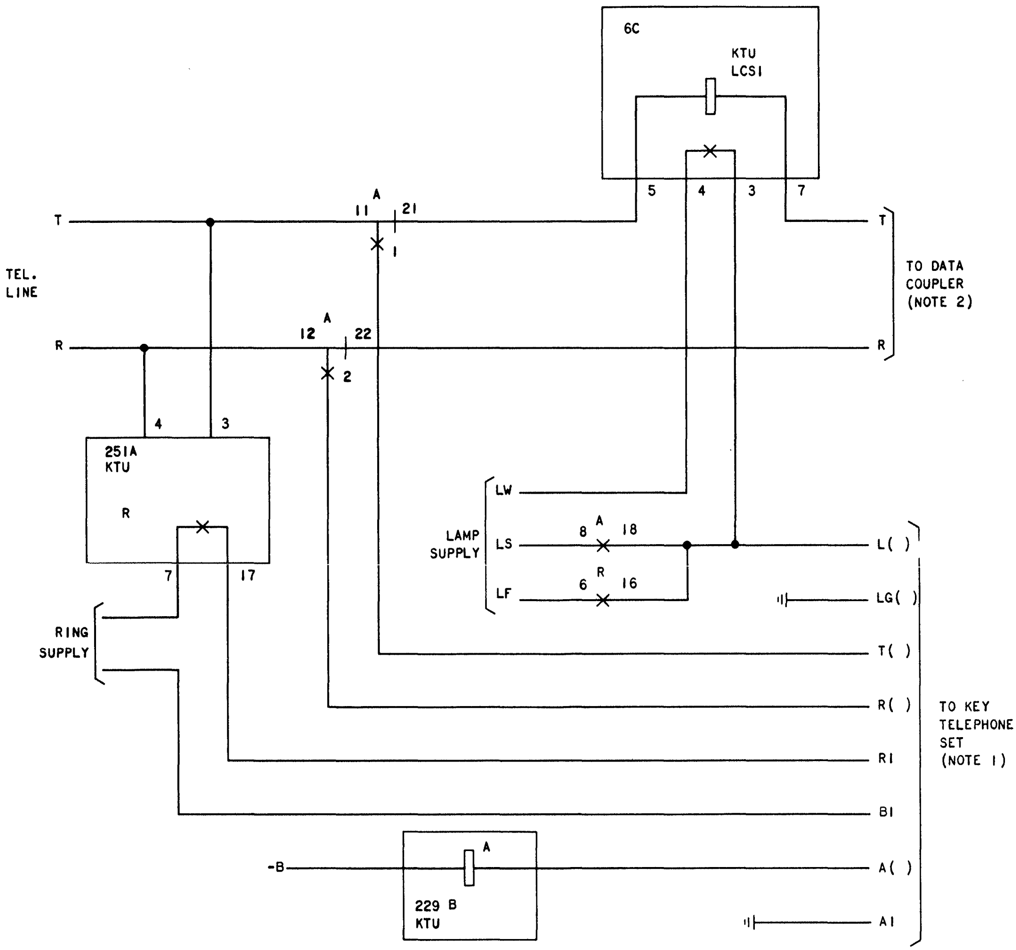
3.06 An LCSI may be installed with the coupler on an optional basis to aid the customer in recognizing the end of call. The LCSI will not work on facilities served by certain central offices and it performs differently with some of the central offices that it ***will*** work with. Refer to Table B to determine the applicability to a particular installation.

Caution should be exercised in using the LCSI to indicate a far-end disconnect. Momentary line current interrupts occur during call setup. They can be up to 400 ms long and can occur up to 10 seconds after dialing is completed and at the called end, 500 ms after answering a call. In response to far-end disconnect, some switching offices interrupt line current, but it is important to note that some do not. When such interrupts do occur, the LCSI contact will open momentarily. To avoid misinterpretation of momentary opens, it is recommended that an open should not be interpreted as an indication of far-end disconnect unless it is greater than 5 ms in duration. Customers should verify disconnect arrangements with the local telephone service organization before relying on the LCSI for that function.

3.07 The line current indication from the LCSI can be presented to the customer in one of two ways. Option Z designates a contact closure between terminals A and A1 on the coupler. If option Y is used, the LCSI contact is wired to a pair of terminals on a separate connecting block.

3.08 The LCSI (Fig. 11) must be made locally and consists of a 317A-type dry reed relay and two varistors in a 74B-49 connecting block measuring 2.75 inches wide, 4 inches long, and 1.6 inches high. The relay is in series with the coupler and gives a contact closure at the customer interface when at least 20 mA of line current is flowing through the relay and coupler. The two varistors are used to provide a low-impedance transmission path to the coupler.

If the customer uses the contact closures directly, current through the terminals should be limited to less than 10 mA. The customer circuit must also be noninductive with an open circuit voltage less than



NOTES:
1. THE KEY TELEPHONE LEADS FOLLOWED BY A PARENTHESIS ARE ASSIGNED TO THE SAME LINE.
2. TRANSFORMER CONNECTIONS ARE NOT SHOWN.

Fig. 10—1001D Data Coupler Connections With KTU

50 Vdc. The maximum length of the loop over which the coupler can operate is reduced by approximately 800 feet if an LCSI is used.

3.09 Assemble the unit in accordance with the following procedures.

(1) Remove cover from the 74B-49 connecting block.

(2) Remove the 426A electron tube assembly, including mounting screw, and discard.

Warning: The adhesive used in (3) sets quickly and should not be allowed

TABLE B

LINE CURRENT STATUS INDICATOR APPLICATION*

OFFICE SERVING OFF-HOOK END	END OFF-HOOK	END ON-HOOK	MIN CURRENT INTERRUPT	RELATED TO DIAL TONE	USE OF LCSI FOR DISCONNECT
ESS	Called	Calling	12 ms	Before	Okay
ESS	Calling	Called	37 ms	Before	Okay
No. 5 X-Bar	Called	Calling	10 ms	Before	Okay
No. 5 X-Bar	Calling	Called	32 ms	After	Discourage
No. 1 X-Bar	Called	Calling	0.4 sec	After	Discourage
No. 1 X-Bar	Calling	Called	0.4 sec	After	Discourage
SXS	Called	Calling			Discourage
SXS	Calling	Called			Discourage

* The use of dial long line circuits and carrier facilities on local loops will isolate station equipment from central office dc interrupts.

to come in contact with anything (especially the skin of the installer) except the relay, the applicator, and the connecting block base.

(3) Apply adhesive (Eastman 910 or equivalent) in the area to be occupied by the 327C relay.

(4) Place relay on base plate, topside down.

(5) Remove and discard the lower screws from terminal strip eyelets in positions 2, 3, 4, and 5.

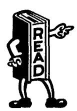
(6) Wire the unit in accordance with Fig. 11.

C. Telephone Company-Provided DC Power

3.10 An external power supply is required to provide a dc supply for the control circuit of the coupler. A 20- to 28-Vdc supply capable of supplying 100 mA will normally be provided by the customer. The telephone company will optionally furnish power (refer to 2.07 and 4.07).

4. INSTALLATION AND CONNECTIONS

4.01 The 1001D data coupler may be used with various types of central office lines or Bell System PBX station lines that provide access to the switched network.



All installation connections and tests must be performed prior to the customer making any connections to the interface.

4.02 Verify that the assigned loop facilities meet transmission requirements for the specific data service before proceeding with the installation. The requirements for the 1001D data coupler are as follows:

(a) ***Loop Loss:*** Maximum 1000-Hz insertion loss (including coupler loss of 2 dB) is 11 dB.

(b) ***Set Classification:*** Installation measurements are specified on the service order. When the modem type cannot be determined, Type II requirements should be specified. When the

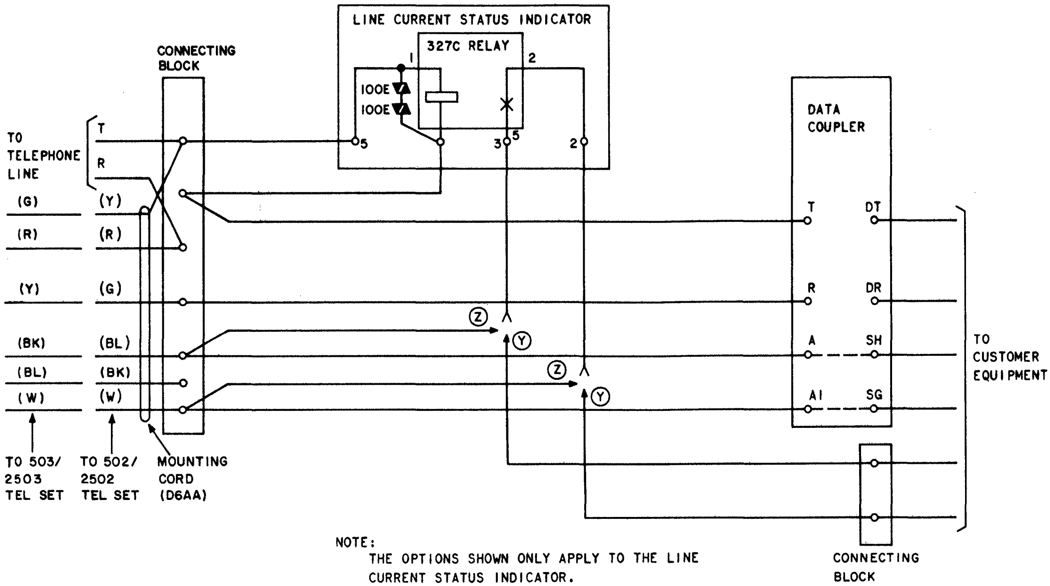


Fig. 11—Line Current Status Indicator Connection Diagram

type of modem can be obtained from the customer, the following guidelines should be used.

(1) For all analog modems, Type II requirements should be specified.

(2) For all other modems, requirements based on speed of modem (same as for switched DATA-PHONE service) should be specified.

(3) If the type of modem is known to be similar to a Bell System DATA-PHONE data set, use the requirements for that particular data set.

4.03 Installation of the coupler should comply with general practices to ensure an orderly station arrangement. Information relating to a selection of type of connecting block and electrical code requirements is given in Section 590-010-200. See Fig. 12 for a typical interconnection block diagram.

4.04 When test or demonstration calls are made, refer to Section 010-250-001 for the proper procedure for crediting charges.

4.05 Location of the data coupler shall be determined by the following conditions.

- ***The coupler must be mounted vertically*** on a wall or other smooth vertical surface to ensure proper operation of the OH mercury relay.

- The coupler must be within range of the interface cord supplied by the customer. The maximum recommended length is 50 feet.

- Location of the coupler should provide easy access for operation of the TST switch by the customer attendant.

A. Installation of Data Coupler

4.06 Install the coupler on a wall or other vertical surface as follows:

(1) Remove the tape securing the cover to the base pan. Retain the screw envelope which is between the tape and cover. The envelope

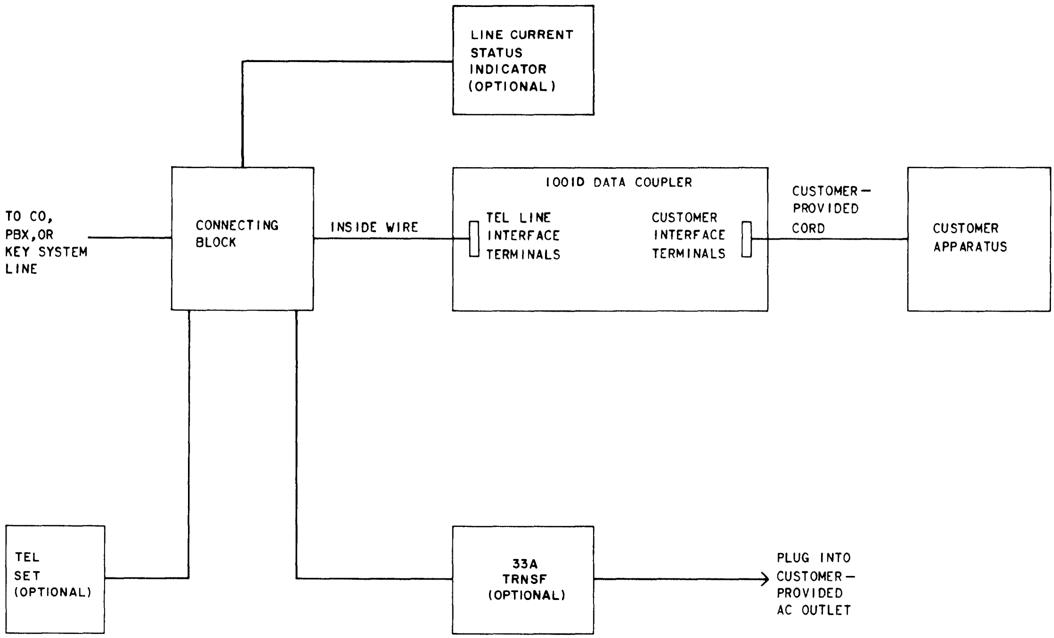


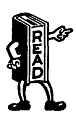
Fig. 12—Block Diagram of Typical 1001D Data Coupler Installation

contains two wood screws and two pan-head metal screws used to mount the coupler base pan to either a wood or metal surface. It also contains the four screws used to attach the CP to the base pan.

(2) Remove the snap-off cover assembly from the coupler.

(3) Position the coupler base pan vertically against the wall with the keyhole slot narrow end up and not less than 7 inches above the top of the baseboard or other obstruction which will be below the unit. Secure the base pan with two No. 6 by 1/2-inch wood screws for porous surfaces, or No. 6 by 3/8-inch pan-head type AB self-tapping screws for metal surfaces. The screws are supplied with the coupler.

(4) Route the D station wire through the slots on the base pan as shown in Fig. 2. Attach the CP to the base pan using the four self-tapping screws in the envelope. ***Care should be taken not to overtighten screw terminals or stripping will result.*** Connect the leads as required to the screw terminals on each side of the printed wiring board. Be sure to connect T, R, A, and A1 leads discussed in 2.03.



Trouble has been experienced in certain 1001D couplers with cable stress studs in the base pans pressing against the printed circuit paths. The employee should examine the coupler during an installation or maintenance visit and remove these studs with diagonal cutters as applicable.

B. Installation of Power Unit

4.07 When an external dc supply is to be provided by the telco, install a 33A (Section 167-452-101), 19B2 (Section 167-440-201), 28A1 (Section 167-445-101), or equivalent power unit. Connect the power supply as follows:

(1) Connect the power supply ***only*** to the data couplers

(2) Connect the C terminal (33A) or B SIG terminal (19B2 or 28A1) (negative) to -V on the couplers.

(3) Connect the H terminal (33A) or G SIG terminal (19B2 or 28A1) positive to +V on the couplers.

(4) If directed by the customer, either the negative or positive terminal may be connected to LOC GRD or the chassis ground strap as appropriate.

Note: AC lamp and AC ringing supplies are referenced to G SIG terminal (positive).

Do not connect the power unit to local ground when the coupler -V terminal is internally grounded within the customer equipment. The customer must not make any connections to the +V interface terminal.

C. Completion of Installation

4.08 Install the cover assembly by hooking the bottom end (end with small hinged cover) to the base pan, swinging the cover up and over the TST switch, and pressing until the cover snaps into place.

4.09 Instruct the customer to raise only the hinged portion of the cover to gain access to the interface terminals. Also caution the customer that overtightening the interface screws may cause stripping.

4.10 Install telephone set if specified on the service order. If a 503- or 2503-type telephone is used, redesignate the SH terminal as "MI" (mode indicator) on the coupler.

Do not connect the customer interface leads to the coupler unless requested by, and under the direction of, the customer.

4.11 After the coupler and associated units have been mounted and connected to the telephone line, perform the tests outlined in Part 5.

4.12 Inform the customer, at the time the coupler is installed, of the maximum permissible signal power output from the data equipment. The output level of the customer-provided equipment is the power measured at the customer interface into a 600-ohm resistive load. It may vary between -1 and -10 dBm depending upon the 1000-Hz loss of the local loop including the nominal insertion loss of the coupler (approximately 2 dB).

5. MAINTENANCE AND TESTS

5.01 Maintenance and test procedures are provided to assist the telco employee during installation and troubleshooting visits to a data coupler station. All level measurements and test results made during installation and maintenance must be recorded on a circuit layout record card (CLRC) to assist in analyzing future trouble and to detect gradual degradation of service. Telephone the test results to the plant service center (PSC), or equivalent test location, prior to leaving the customer location. Some tests will require disconnection of customer equipment from the interface in order to make tests and/or to replace a defective coupler. The following precautions ***must*** be taken.

- ***Obtain permission from the customer to disconnect and reconnect the interface leads from the coupler.***

- ***Turn the power to both the customer equipment and to the coupler OFF before the customer leads are disconnected.***

- ***After all tests are completed and the interface is reconnected, ask the customer to verify that the interface has been reconnected properly.***

A. Maintenance

5.02 All repair forces should be familiar with the tariff provisions which generally provide for a "maintenance service charge" for each customer-requested repair visit to a DAA installation. When the customer requests such a repair visit and it is subsequently determined that the trouble is ***not*** in the telco equipment, the employee must inform the customer and notify the PSC to fill out Form E-5855 in conformance with Section 660-101-312.

5.03 Maintenance of a coupler installation on customer premises is limited to local tests, testing by serving or test office, or replacing a defective unit.

> ***Note:*** Do not attempt individual component repair or replacement on the printed CPs.

5.04 Customers using data couplers are instructed, when a trouble condition is experienced, to perform the necessary testing to sectionalize the problem. If the results of the tests indicate that the trouble is in Bell System equipment, the condition should be reported to the designated PSC or equivalent test center. All available information concerning the failure mode should be provided to the PSC.

5.05 The PSC must analyze the information provided by the customer to determine if a trouble condition does exist and the most probable cause. Available tests (ie, normal dc loop test and remote test of coupler) should be performed to determine if a telco employee must be dispatched to customer premises. The conditions which could warrant a maintenance visit and efforts which lead to each are shown in Fig. 13.

5.06 On a maintenance visit, perform the most likely necessary tests or evaluations to isolate and clear the trouble within the station as directed by the PSC. Begin with the steps shown in Fig. 12 when test results and analysis received from the PSC lead to that particular activity. If a trouble report is not available or if the report is inconclusive, follow the suggested sequence of activities as illustrated in Fig. 14 and described in the following:

(1) The telco employee must be properly equipped with information (BSP documentation, line card details, etc), spare coupler, and test equipment, etc, for locating trouble and effecting repairs at the customer premises.

(2) Upon arrival at the coupler station, question the customer to obtain any information relating to the reported trouble, then perform a visual and mechanical inspection of the installation. Check that the TST switch on the coupler is not partially operated. Check for disconnected or broken cords, inside wiring, drop wire, broken components, or any other possible trouble causes. Repair or replace any defective or marginal components (ie, ringer, dial, handset, etc).

(3) Perform a remote test to the LTD or equivalent test location.

(4) If any components were replaced or repaired ***and*** the results of the remote test are satisfactory, close trouble report.

(5) If all components are satisfactory ***and*** the results of the remote test are satisfactory, perform an interface voltage test.

(6) If the results of the interface voltage test ***or*** remote test are not satisfactory, replace the coupler and perform installation tests. Ensure that all level measurements made during the required installation tests are properly recorded on the CLRC.

(7) Perform a remote test on the new coupler.

(8) If the results of the new coupler remote test are ***not*** satisfactory, notify the PSC.

(9) If the results of the new coupler remote test are satisfactory, request the customer to verify that service is restored (ie, try to exchange data with the station that caused the trouble report).

(10) When the customer is satisfied with the service, notify the PSC to close the trouble report.

(11) If the customer cannot exchange data or is ***not*** satisfied with the service, disconnect the coupler and perform a complete transmission test of the local loop as described in Section 314-205-501.

(12) If the results of the loop test are satisfactory, notify the PSC.

> ***Note:*** The preceding investigation has eliminated the coupler and local loop as possible trouble; therefore, attention must be directed to the data terminal or facilities.

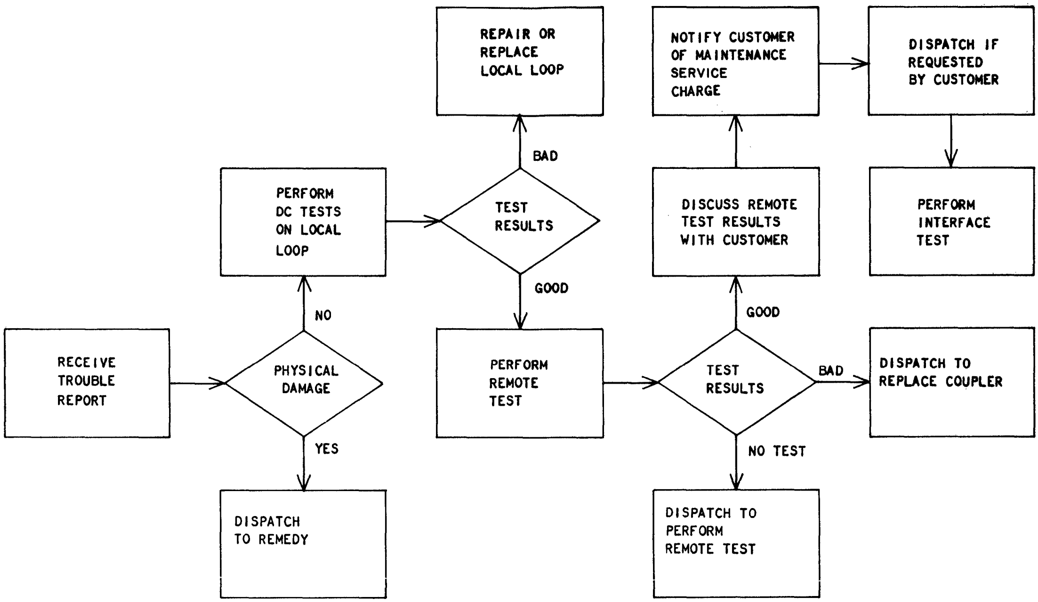


Fig. 13—Basic Activities Prior to Dispatching Employee

(13) If the results of the loop test are ***not*** satisfactory, arrange with the PSC to have the loop repaired or changed. The repaired or changed loop must meet requirements outlined in Section 314-205-501.

(14) After changing the defective loop, reconnect the coupler to the telephone line. Perform the insertion loss and impedance matching tests to determine if the maximum allowable customer level and the required limiter option strapping have changed. Notify the customer of the level change and then request the customer to verify service restoral.

(15) When the customer is satisfied with the service, notify the PSC to close the trouble report.

Note: Prior to leaving customer premises, perform the remote test and record the new level on the CLRC.

(16) If the customer cannot exchange data or is not satisfied with the service, trouble may still exist in another component of the system or in the data terminal, and further investigation must be pursued. Notify supervision, who can escalate according to normal procedures of data technical (DATEC) support. Refer to Sections 010-521-100 and -101. Notify the PSC of the repair work that has been completed and wait for further instructions.

B. Tests

5.07 The following tests are required to ensure proper installation of the data coupler and to determine the operating condition of the unit during a maintenance visit:

- Insertion Loss Test
- Impedance Matching Test
- Remote Test
- Interface Voltage Test
- LCSI Test

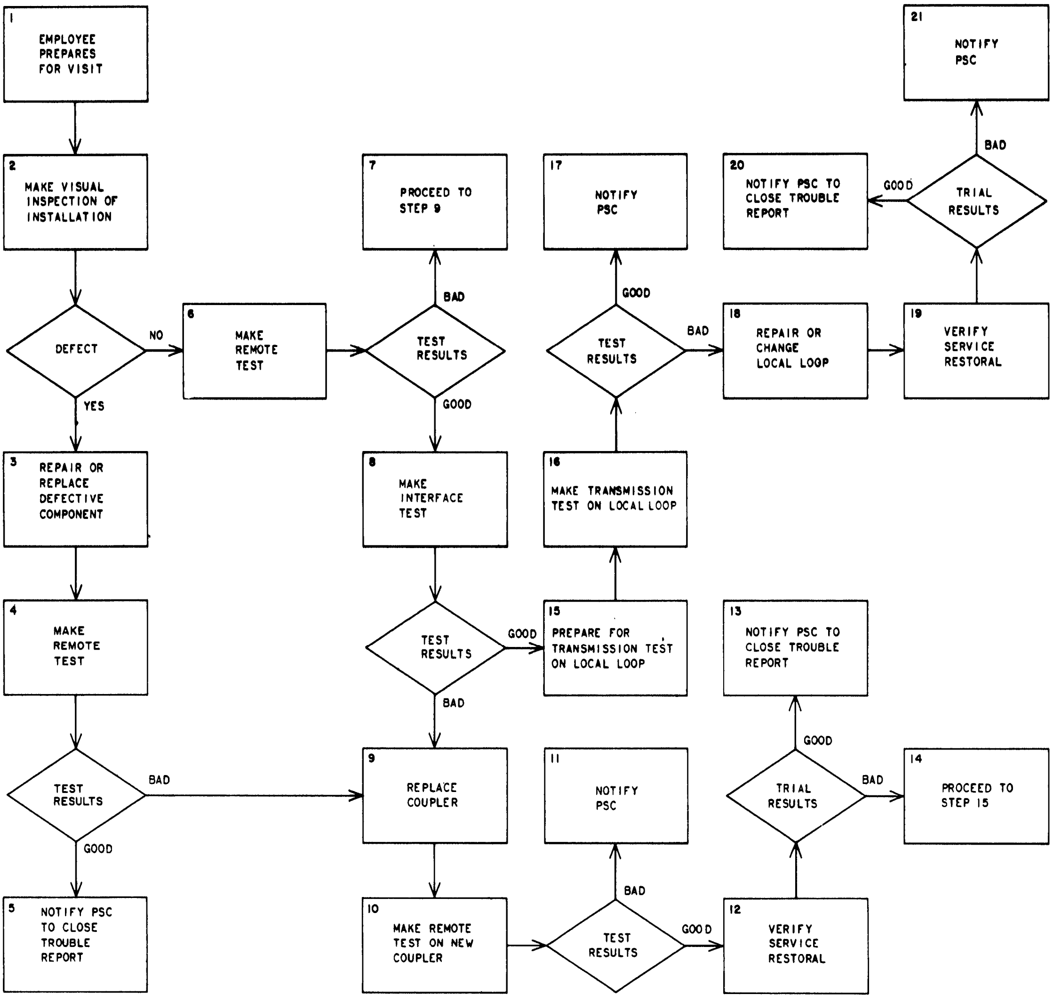


Fig. 14—Activities for Troubleshooting at a Coupler Station

- 503C or 2503C Telephone Set Test.

5.08 The following test equipment is required for the tests:

- 600-ohm ±1% resistor
- KS-16979-L1 volt-ohm-milliammeter (VOM), or equivalent with a high-impedance, bridging-type ac voltmeter with a dB scale such that 0.776 Vac corresponds to 0 dB.
- 1013-type hand test set, or equivalent
- KS-19353-L4 oscillator or equivalent with a 600-ohm output impedance and a capability of a -5 dBm reading when connected across 600 ohms.

- 33A power unit or equivalent power source providing between 20 and 26 Vdc.

Note: The insertion loss test ***and*** the impedance matching test are required to determine proper level option strapping, using Table C.

Insertion Loss Test

5.09 The insertion loss test measures the combined loss of the loop and coupler. The results of the test are used to determine the maximum allowable customer signal power level which will result in a level no greater than -12 dBm at the serving central office (SCO). This test requires that the customer interface leads be disconnected from the coupler in accordance with precautions outlined in 5.01. The coupler must be connected to the telephone line. Proceed with the test as follows:

(1) Locate and remove any existing straps on level option terminals A through H (Fig. 2).

Note: Cover must be removed to gain access to level option terminals.

(2) Connect strap between terminals OH, DA, and -V.

(3) Connect 600-ohm resistor across terminals DT and DR. If a transmission measuring test set is used instead of the VOM, the test set provides the 600-ohm termination.

(4) Connect the positive lead (H) of the power unit to the +V terminal, and the negative lead (C) to the -V terminal. ***Do not*** connect the power unit to the ac outlet at this time.

(5) Use the telephone set associated with the coupler, if provided, or connect the hand test set across tip and ring of telephone line, and dial the milliwatt supply (1000 Hz) of the SCO.

Note: If a telephone set is associated with the coupler, remove the handset and ensure

TABLE C

LEVEL OPTION TERMINALS FOR 1001D DATA COUPLER

INSERTION LOSS (INSERTION LOSS TEST) dB			MAXIMUM ALLOWABLE CUSTOMER LEVEL dBm	LIMITER OPTION TERMINALS — LEVEL MEASURED IN IMPEDANCE MATCHING TEST (dBm)			
LOOP LOSS	COUPLER LOSS	TOTAL OR MEASURED LOSS		0 TO −3.6	−3.7 TO −4.6	−4.7 TO −5.6	−5.7 OR BELOW
0 − 0.9	2	2 − 2.9	−10	AB, DE	AC, DE	AC, DE	AC, DE
1 − 1.9	2	3 − 3.9	−9	AC, DF	AB, DE	AC, DE	AC, DE
2 − 2.9	2	4 − 4.9	−8	AB, DF	AC, DF	AB, DE	AC, DE
3 − 3.9	2	5 − 5.9	−7	AC, DG	AB, DF	AC, DF	AB, DE
4 − 4.9	2	6 − 6.9	−6	AB, DG	AC, DG	AB, DF	AC, DF
5 − 5.9	2	7 − 7.9	−5	AC, DH	AB, DG	AC, DG	AB, DF
6 − 6.9	2	8 − 8.9	−4	AB, DH	AC, DH	AB, DG	AC, DG
7 − 7.9	2	9 − 9.9	−3	AC	AB, DH	AC, DH	AB, DG
8 − 8.9	2	10 − 10.9	−2	AB	AC	AB, DH	AC, DH

Example: Value obtained in insertion loss test = 6.4 dB.
Value obtained in impedance matching test = —4.2 dBm.
Place straps between A and C, and D and H.

that the exclusion (data) key is in the talk position before dialing the milliwatt supply.

(6) When the tone is heard, connect the power unit to a 117-Vac power outlet and remove the hand test set from the line (or operate the exclusion key to data mode on the associated telephone).

(7) Condition the VOM to measure approximately -5 dBm. Measure the level (in dBm) of the signal between the coupler DT and DR terminals with the VOM.

(8) Remove power unit from outlet. (The CO connection will terminate.)

Impedance Matching Test

5.10 This test follows the insertion loss test on either an installation or maintenance visit; therefore, the level option terminals should not be strapped for this test. Proceed with the test as follows:

(1) Set the oscillator for a 1000-Hz frequency and a 600-ohm output impedance.

(2) Select the proper scale on the VOM to measure -5 dBm.

(3) Connect the test equipment and straps as shown in Fig. 15.

(4) Adjust the oscillator output level to obtain a -5 dBm indication on the VOM.

Note: After the indication is obtained, do not change the frequency or level setting on the oscillator.

(5) Connect the hand test set across tip and ring of the telephone line, and dial a quiet battery termination at the SCO.

Note: If a telephone set is associated with the coupler, remove the handset, ensure that the exclusion key is in talk position, and dial the quiet termination.

(6) After the connection is completed, plug power unit into socket and remove the hand test set from the line (or operate the data key to data mode on the associated apparatus).

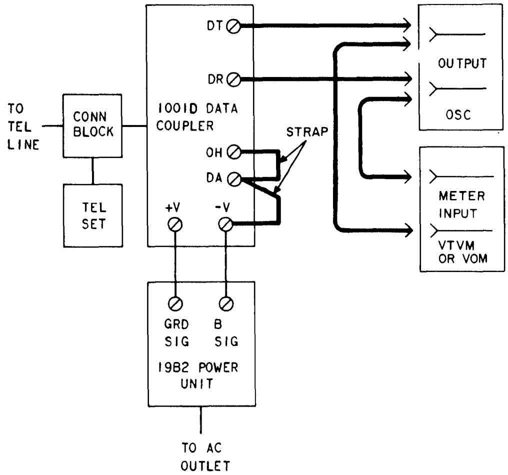


Fig. 15—Test Equipment Connections for Impedance Matching Test

(7) Measure the signal level with the VOM. This value is used to derive the level option strapping from Table C.

(8) Remove the straps, disconnect test equipment, and restore the connection to normal. (The CO connection will terminate.)

5.11 Using the values obtained in 5.09 (7) and 5.10 (7), refer to Table C and apply straps as indicated. Mark the maximum input limit on the data coupler as determined in 5.09 (7) (Fig. 1).

Remote Test

5.12 The remote test measures the test signal of the coupler at the SCO at time of installation. The test signal provides a check of the local loop and the limiting function of the coupler. Subsequent readings can then be compared with the original reading for indications of service degradation.

5.13 The data coupler must be connected to the telephone line for this test. Proceed with the test as follows:

(1) Connect the positive lead (H) of the power unit to the +V terminal, and the negative

lead (C) to the -V terminal. Connect the power unit to a 117-Vac power outlet.

(2) Use the telephone set associated with the coupler, if provided, or connect the hand test set across tip and ring of the telephone line, and contact the LTD. If the LTD is not equipped for ac testing, contact a remote test location that is equipped, or a DTC.

Note: If a telephone set is associated with the coupler, remove the handset and ensure that the exclusion (data) key is in talk position before initiating the call to the test desk.

(3) Request the LTD employee to call the coupler and to measure the level of the test tone (2800 Hz) received at the LTD.

(4) Agree upon length of time required to perform the test, and restore the connection to idle state (hang up).

(5) Operate TST switch to ON position (depress the red dot half of switch).

(6) After the agreed test interval (Step 4 above), operate TST switch to OFF position.

(7) Call the LTD and request the level reading from the employee. This level indicates the loss of the loop and coupler at 2800 Hz. When the test is made at time of installation, the actual value of the loss ***must*** be recorded on the CLRC for comparison against measurements made in subsequent tests. If the level of the 2800-Hz signal on subsequent tests varies by more than 2 dB from the original value, it is an indication of possible trouble in either the loop or coupler.

(8) If the test tone must be measured at a remote test desk or DTC over facilities of unknown or varying loss, a successful receipt of the tone indicates that there is ac continuity in the loop and coupler and that the coupler operates satisfactorily.

(9) Disconnect the power unit and restore telephone connection to normal.

Interface Voltage Test

5.14 The interface test reasonably assures that the interface terminals of the coupler will respond to proper signals from the customer terminal, or will indicate to the terminal when the coupler is conditioned for various operational modes.

5.15 This test requires that the customer interface leads be disconnected from the coupler in accordance with precautions outlined in 5.01. The coupler must be connected to the telephone line. Use the VOM to make the measurements during the test. Proceed as follows:

Note: When making measurements in the following steps, be careful to observe proper polarity with the meter.

(1) Connect the positive lead (H) of the power unit to the +V terminal, and the negative lead (C) to the -V terminal. Connect the power unit to a 117-Vac power outlet.

(2) Originate a call to the coupler from another line or arrange to be called from the LTD. Observe that the voltage between terminals (-) RI and +V follows the ringing cycle and swings between -10 to -26 (ON) and 0 (OFF) Vdc; the ON interval being approximately 2 seconds and the OFF interval approximately 4 seconds.

(3) Leaving the meter connected between (-) RI and +V, short terminal OH to -V with a clip lead. Observe that the voltage swings to 0 Vdc after ringing is tripped. This checks the operation of the OH relay.

(4) Leaving short between terminals OH and -V, measure the voltage between terminals (-) CCT and +V. The meter indicates 0 Vdc to show that the interface lead (CCT) is in OFF condition.

(5) Leaving the meter on terminals CCT and +V and the short between terminals OH and -V, connect a strap between terminals OH and DA. After 2 seconds, observe that the voltage swings to between -20 and -26 Vdc. This checks the delay timer and the operation of the CT relay. Remove short between terminals OH and -V. Observe that voltage between terminals CCT and +V swings back to 0 Vdc.

(6) Remove handset on telephone and connect meter between terminals SH (or MI) and SH1. The meter indicates continuity between the terminals to check the switch contact status circuit.

(7) Replace handset on telephone. An open is indicated on the meter between terminals SH (or MI) and SH1.

(8) Remove the power unit, meter, and straps from the coupler.

(9) Reconnect customer interface leads to the coupler. Request customer to verify connections.

LCSI Test

5.16 This test should be used to verify proper operation of the LCSI. This test is performed by disconnecting the customer LCSI interface only.

LCSI With Option Z

(1) Measure the resistance between terminals SH (or MI) and SH1. The meter should indicate an open circuit.

(2) Operate TST key.

(3) Initiate a call to the coupler.

(4) Measure the resistance between terminals SH (or MI) and SH1. The meter indicates a short circuit.

(5) Restore TST key to normal.

LCSI With Option Y

(1) Measure the resistance between the two terminals on the separate connecting block at the customer interface. The meter indicates an open circuit.

(2) Operate TST key.

(3) Initiate a call to the coupler.

(4) Measure the resistance between the two terminals on the separate connecting block. The meter indicates a short circuit.

(5) Restore TST key to normal.

503C or 2503C Telephone Set Test

5.17 This test verifies that the telephone set mode indication and audible monitor features are operating properly. The requirements of this test are based on the logic sense which gives a contact closure when the telephone set is connected to the line. In all other cases, the mode indication will be an open. The customer MI interface must be open for this test.

5.18 Lift telephone handset. Using the VOM, make resistance measurements between terminals MI and SH1 on the data coupler, in accordance with the options installed and Table D. Return handset to cradle.

> ***Note:*** It is only necessary to make the one pair of readings corresponding to the options installed.

5.19 Initiate a call to the coupler. Lift handset to answer call. After a 3-second delay, a 2800-Hz tone is heard in handset.

TABLE D

MFT SET TEST WITH 1001D DATA COUPLER

INDICATOR	OPTIONS INSTALLED	OHMMETER READING — EXCLUSION KEY UP	OHMMETER READING — EXCLUSION KEY DOWN
Voice Mode	A, H, K	0	∞
Data Mode	A, I, J	∞	0
Switchhook	A, G, J	0	0
Voice Mode	B, I, K	∞	0
Data Mode	B, H, K	0	∞
Switchhook	B, G, J	0	0

Note: Switchhook operated for all readings.

6. REFERENCES

6.01 The following BSPs provide additional information that may be helpful in installing the data coupler:

SECTION	TITLE
010-250-001	Crediting Charges on Test Calls
010-521-100	Data Technical (DATEC) Support
010-521-101	Data Technical (DATEC) Support—Designee Directory
167-440-201	19- and 20-Type Power Units—Identification, Installation, Connections, and Maintenance
167-445-101	28A1-Type Power Units—Identification, Installation, and Connections
167-452-101	33A Power Unit—Identification, Installation, and Connections
314-205-500	Data Systems—DATA-PHONE® Service and Data Access Arrangements on Direct Distance Dialing Network—Overall Data Transmission Test Requirements
314-205-501	Data Systems—DATA-PHONE® Service and Data Access Arrangements on Direct Distance Dialing Network—Test Requirements for Subscriber, Foreign Exchange, and Remote Exchange Lines
590-010-200	Data Sets and Data Access Arrangements—General Installation and Connection Information
660-101-312	Maintenance Service Charge on Services With Customer-Provided Equipment (CPE)
SD-&CD-1D206-01	1001-Type Data Couplers

1001F DATA COUPLER

DESCRIPTION, INSTALLATION, MAINTENANCE, AND TESTS

CONTENTS PAGE

1. GENERAL

1.01 This section contains information required for installing and maintaining 1001F data couplers (Fig. 1).

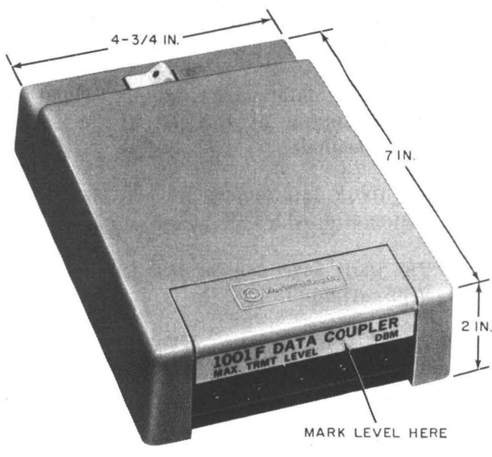


Fig. 1—1001F Data Coupler

NOTICE
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Bell System except under written agreement

1.02 This section is reissued to reflect the options covered in CBS and CBT Technical Reference—PUB 41802 dated May 1974 or subsequent, and to incorporate comments from the field. Since this reissue constitutes a general revision, arrows generally used to indicate changes have been omitted.

1.03 The data access arrangement (DAA) includes both the data coupler and telephone set as described in appropriate tariffs. The 1001F is an automatic data coupler which provides the means for connecting customer-provided, automatic data equipment to the switched network for data and voice communications. The uniform service order code (USOC) for the unit is CBS.

1.04 The 1001F data coupler is smaller than the 1001A data coupler [rated Manufacture Discontinued (MD)], which has the same USOC. The 1001F can replace the 1001A; however, due to different Electronic Industries Association (EIA) standards, the 1001A cannot always replace the 1001F. Other significant differences are as follows:

(a) The 1001F data coupler has no ANS switch.

(b) The 1001F data coupler remote test is performed differently due to the absence of lamps and the ANS switch.

(c) The 1001F data coupler option designations for strapping of the output levels are between terminals.

(d) The 1001F data coupler provides for optional customer-provided dc power.

(e) The 1001F level control does not require dc loop current.

1.05 The 1001F data coupler provides the following:

- Interface control lead voltages as specified in EIA Standard RS-232-C
- Automatic linear control of signal level above a specified threshold
- Isolation of customer equipment for protection of telephone plant and personnel from hazardous voltages. This also provides protection of customer equipment from surges occurring on telephone facilities.
- Detection of incoming ringing signals to permit customer to operate in unattended answering mode
- Test circuitry for manual remote test capabilities
- Off-hook control which allows customer equipment to dial-pulse for call origination
- A 2 ±1 second delay in giving access to telephone line on incoming calls to permit proper operation of automatic message accounting equipment
- Switchhook indicator to provide customer status of switchhook (line switch) on associated telephone set when provided
- 2-way transmission path
- Internal dc power supply
- KA and KA1 lead controls for operation with key telephone equipment
- Capability of operation with data auxiliary set (DAS) 801-type automatic calling unit (ACU).

1.06 Additional telephone functions, such as alternate voice service, may be provided with an associated telephone set as a standard option. Audible monitoring of data transmission and mode indication through switch contacts are provided by 503C and 2503C telephone sets.

1.07 The data coupler may interface customer equipment directly to local loop facilities, key telephone system station lines, or to private branch exchange (PBX) station lines.

1.08 At installations where TOUCH-TONE calling service has been ordered, the customer may generate tone signals for originating calls through the transmission interface leads of the coupler.

1.09 The service offering in which the data coupler is used provides the customer with end-to-end transmission performance characteristics comparable to DATA-PHONE® service on the switched telecommunications network. Because customer equipment, over which the Bell System has no design control, may contribute significantly to error performance, the Bell System cannot assume responsibility for the accuracy of transmitted data. End-to-end facilities, including the local loop, will be engineered and maintained to the equivalent DATA-PHONE service requirements. These requirements are specified in Section 314-205-501 for local loops, and Section 314-205-500 for the direct distance dialing (DDD) network.

2. DESCRIPTION

A. Physical Description

2.01 The 1001F data coupler (Fig. 1) is a wall-mounted unit measuring 4-3/4 inches wide, 7 inches high, and 2 inches deep. The coupler weighs approximately 1-3/4 pounds and is enclosed in a gray plastic housing. The housing consists of a dark gray base and a light gray cover which snap together. One keyhole slot and one screw hole are provided on the base for mounting the unit on a wall or other vertical surface. ***The coupler must be vertically mounted to allow proper operation of the mercury relay.***

> ***Note:*** Two No. 6 by 3/8-inch pan-head metal screws and two No. 6 by 1/2-inch wood screws are shipped with the data coupler. The use of larger screws will short-circuit printed wiring paths on the circuit pack.

2.02 Circuitry for the coupler is mounted on two printed CPs (Fig. 2). Ten screw terminals at the lower end of the bottom CP provide the interface for connection to customer equipment. Interface control leads use EIA RS-232-C voltage levels. See Table A for lead designations. The cord required for connecting the customer modem to the interface must be supplied by the customer.

2.03 Eight screw terminals on the printed CP provide the interface for connecting the telephone line and associated apparatus to the coupler. The housing cover must be removed to make connections within the coupler. To remove, lift cover up from the bottom to relieve tension on mounting lips, then pull cover out at the top. Use D station wire to terminate the connections. The following pairs of leads terminate on this interface:

- T and R—Telephone line transmission pair

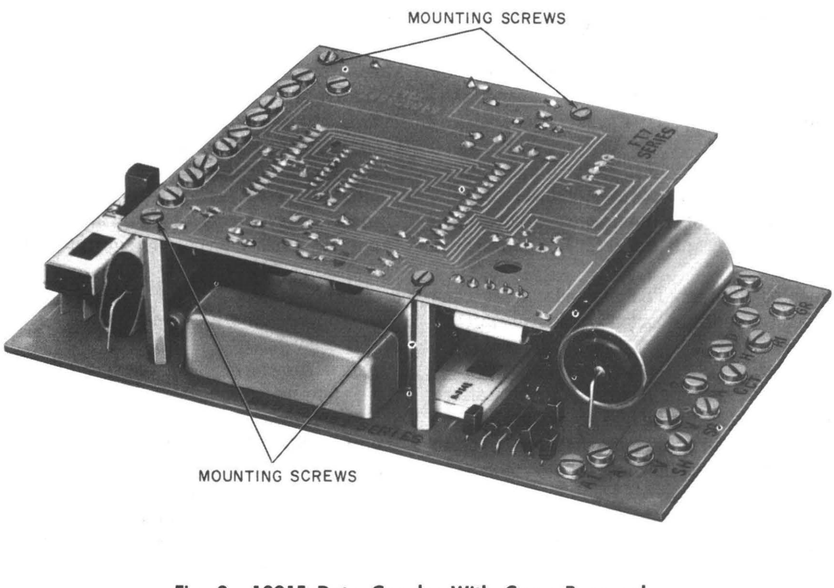


Fig. 2—1001F Data Coupler With Cover Removed

TABLE A

INTERFACE LEAD DESIGNATIONS FOR 1001F DATA COUPLER

TERMINAL DESIGNATION	FUNCTION	
DT	Data Tip	600-Ohm Transmission Leads
DR	Data Ring	
OH	Off-On Hook Control	
DA	Request Data Transmission Path Cut-Through	
RI	Ring Indication	
CCT	Coupler Cut-Through	
SH	Switchhook Status of Associated Tel Set	
−V	Negative DC Power	
+V	Positive DC Power	
SG	Return for DC Power and Common for OH, DA, RI, and CCT, and is Signal Ground.	

- KA and KA1—Key system *A* lead control contacts to indicate the off-hook condition to associated key telephone equipment
- A and A1—Extension of associated telephone set switchhook (line switch) to terminal equipment
- P1 and P2—Low-voltage ac leads from external transformer to internal power supply. Terminals 3 and 4 of transformer KS-20426-L1 are wired to P1 and P2 screw terminals.

2.04 One locking switch (TST) is located at the top of the coupler to provide control of the test mode condition.

2.05 Level option terminals located on the smaller CP must be strapped by the installer to adjust the threshold of the automatic level control (ALC) (limiter) circuit of the coupler.

2.06 The data coupler is designed to operate over a range of 0 to 120°F with a relative humidity of up to 95 percent.

2.07 An external transformer (KS-20426-L1) is required with each coupler to step down the standard 117-Vac power to 23.6 Vac. When telco furnishes the power, the internal rectifier provides the dc supply to all the coupler circuitry. This uses the two factory-provided straps which are left connected (option X not applied). The coupler may also be powered by the customer through the +V, -V, and SG customer interface leads. In this case the two factory-provided straps must be removed (Fig. 3 and 4) (option X is applied). Customer power requirements are indicated in 3.15.

B. Functional Description

2.08 ***General:*** The data coupler is a network protective unit designed to interface with a customer-provided automatic data terminal. The coupler provides signals to the data terminal to indicate the detection of ringing signals. In response to the signals, the data terminal provides signals which cause the coupler to seize the line, trip ringing, and cut through the transmission path. Prior to the transmission path cut-through, a 2-second delay is provided to allow proper operation

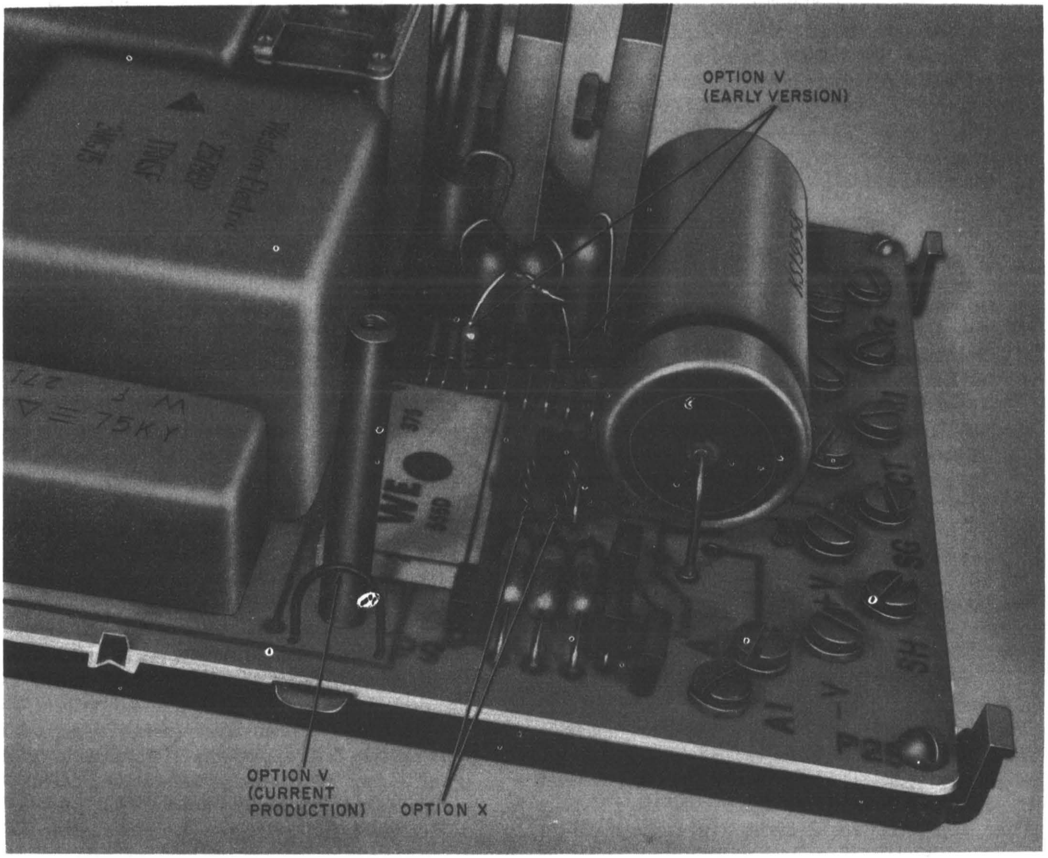


Fig. 3—1001F Data Coupler Showing Option Straps

of automatic message accounting equipment. An ALC and a coupling transformer are provided to protect the telecommunications network, coupler, and customer equipment. In addition, the coupler circuitry permits the data terminal to originate and terminate data calls automatically.

2.09 ***Coupler Transmission Path:*** The coupler transmission path primarily consists of a coupling transformer, and an ALC circuit. (Fig. 4). The transformer terminates the telephone loop and provides a 2-way protective function (ie, hazardous voltages, surge protection, and longitudinal isolation). The ALC circuit prevents the customer signal level from exceeding the prescribed maximum limit.

2.10 The ALC circuitry continuously monitors the output of the data signals. Option strapping on the level-adjusting network determines the proper power level (threshold) at which the circuit operates to control the output signal.

2.11 The signal power level is continuously averaged by the detector and integrator. When the averaged signal level exceeds the threshold during any 3-second interval, current is driven through a lamp (part of KS-20949 optical coupler).

The lamp causes the resistance of the photo-conductive cell to decrease, which allows signal current to flow through the control winding. The signal current in the control winding causes a transformer core flux, which is 180 degrees out of phase with the flux due to signal current in the customer winding, and thus reduces signal power level to the threshold value.

> ***Note:*** When certain 1001F couplers are subjected to high frequency longitudinal voltages, customer data set tones are attenuated to unusable levels. This is caused by the coupler limiter responding to these unwanted voltages. This condition can be corrected by adding a KS-19774-L1, 2, 7, or 8, 1000-pF capacitor between the E terminal printed path and the signal ground printed path. This capacitor may be installed by the employee in the field as required. All 1001F couplers returned to the repair facility will be updated to include this capacitor, and will be marked series 3 or higher.

Data Mode

2.12 ***Ring Detection:*** The ring detector (Fig. 4) is activated when the 20-Hz ringing signal is present on the line, indicating an incoming call. The R relay, part of the ring detector, operates and releases in response to each half cycle of ringing current. Closures of the R relay contact are used to drive the ring signal integrator circuit. After approximately 2 cycles (100 ms) of 20-Hz ringing signal, the ring detector (part of IC1) output (R) goes high. In a similar manner, R goes low approximately 100 ms after the last contact closure. The ring detector output R is connected to the set leads of the call timer flip-flop (CTFF) and the automatic answer flip-flop (AAFF), and is ANDed with the test mode signal (T). Since the T signal is 1 when the TST switch is ***not*** operated, a received ring signal causes the ring indicator EIA output RI to switch from a normal output of -5 volts to +5 volts when not in test mode. RI then switches back to -5 volts during the period between rings. RI delay is equal to the ring relay driver delay plus the ring integrator delay. In test mode, the T signal is 0, which allows the AAFF to be set and inhibits the RI output from responding to ring.

> ***Note:*** When dial pulsing through certain 1001F couplers into a No. 5 crossbar or a step-by-step central office, sharp pulses are generated which cause capacitor C1 to discharge into the R relay. This causes the R relay to operate momentarily and may result in the RI circuit being activated during dialing. This condition can be corrected by the addition of a 458A, 458C, KS-21222, or equivalent diode (50-volt 1-amp silicon junction, such as a 1N4001) in series with a KS-20616-L1 220-ohm (or equivalent) resistor. Connect the anode of the diode to the junction of R10, R9, and C4. Connect the resistor between the cathode of the diode and pin 8 of IC1. If the diode is installed incorrectly (reversed), the RI circuit will be activated permanently and the OH relay will operate erratically. This diode may be installed by the employee during a maintenance visit. When a coupler is returned to the repair facility, the diode is installed by the repair facility. Series 2 couplers have this diode (CR8) added. This reduces the RI positive-to-negative transition to less than 10 μs. Before the diode was added, the transition time was approximately 100 ms. If the RI positive time is too short for customer equipment, a series 1 coupler should be used, or the diode should be cut out of the circuit. Wiring which must be cut to remove the diode is designated option V in series 4 and higher couplers. In some installations, a long ring trip interval results in saturation of the ALC to maximum attenuation. This is evidenced by the customer being unable to transmit for 5 seconds or more after CCT turns ***on.*** To prevent this, wire the CT (1) make contact between terminal 4 to the upper board and the 8 (U) or 9 (T) terminal of the 2578BP (U) or 2578CB (D) transformer. Series 5A couplers have this wiring installed.

2.13 ***Answering Incoming Calls:*** Ringing causes CTFF to be set and its Q output to go low. When the exclusion key of an associated telephone is wired so that the data coupler is in control of the line, a call is answered by a positive OH EIA input. The OH relay in the coupler operates to close the loop and stop ringing.

> ***Note:*** If an ACU is used with the DAA, the ACU is informed that the data line is occupied.

Data access is generally requested at the same time (by a positive DA EIA input). Both inputs

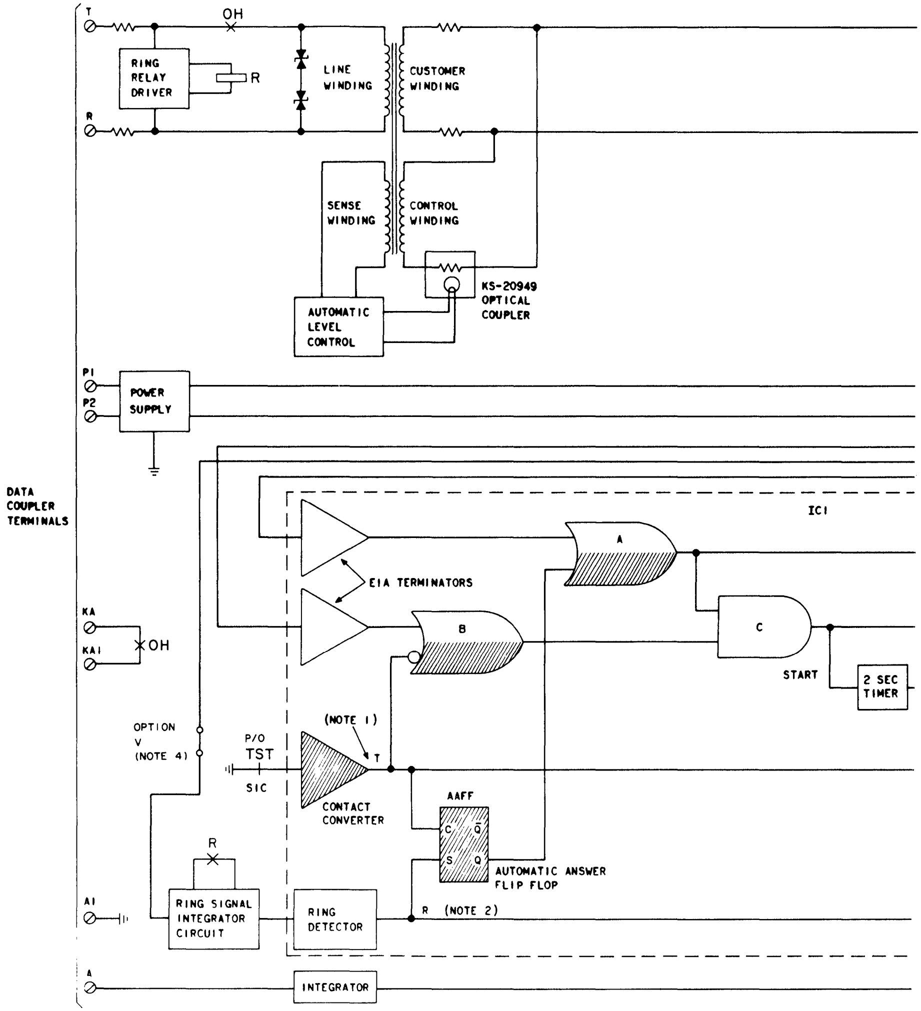
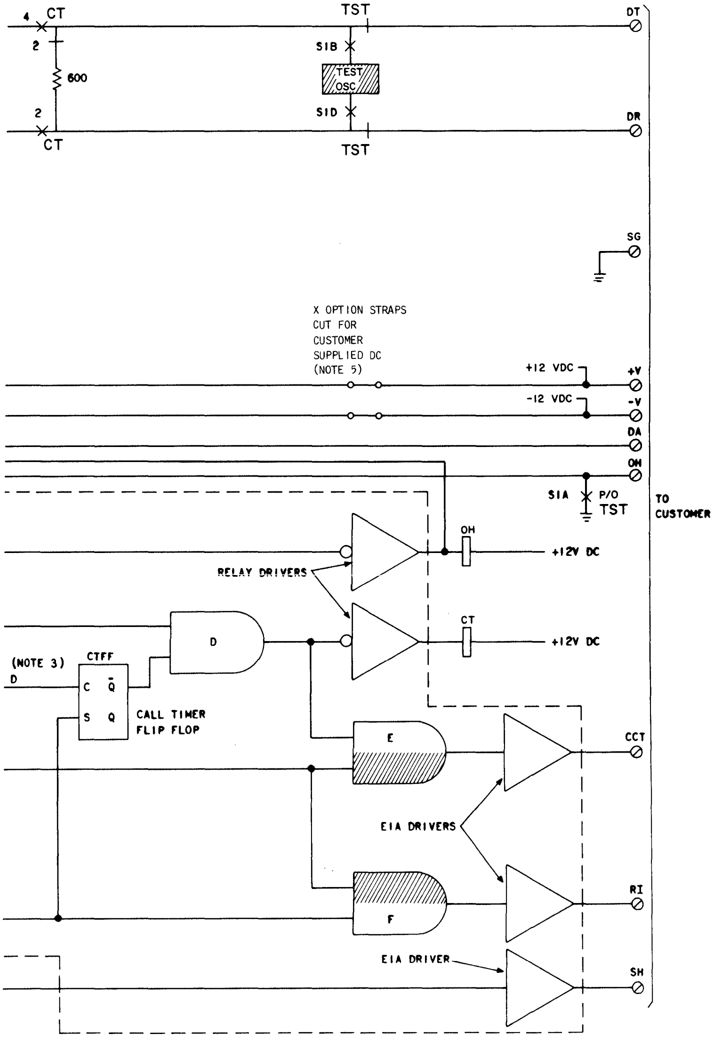


Fig. 4—Functional Schematic of 1001F Data Coupler (Sheet 1 of 2)



NOTES:
1. T= 1 WHEN TEST SWITCH IS NOT OPERATED.
   T= 0 WHEN TEST SWITCH IS OPERATED.
2. R= 1 WHEN RINGING IS RECEIVED.
   R= 0 OTHERWISE.
3. D= 0 WHEN START = 0.
   D= 1 TWO SECONDS AFTER START SIGNAL CHANGES FROM 0 TO 1.
4. SERIES 5 AND LATER, CUT FOR EXTENDED RI (+) ON TIME.
5. WITH OPTION X IN, THE STRAPS ARE REMOVED (CUSTOMER PROVIDED DC POWER); WITH OPTION X OUT, STRAPS ARE PROVIDED (TELCO PROVIDED DC POWER).

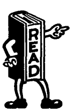
Fig. 4—Functional Schematic of 1001F Data Coupler (Sheet 2 of 2)

are ANDed which cause the C gate output to go high and start the call timer. Two seconds after the C gate output goes high, the call timer delay circuit output clears CTFF, making Q go high. This then causes the D gate output to go high, allowing the CT relay to operate and the CCT output voltage to become positive. After the initial 2-second delay, CTFF remains in the reset state and the customer has full control over the CT relay via the DA input.

> ***Note:*** The 2-second delay in granting the customer access to the telephone line is required by serving central office (SCO) billing equipment.

2.14 When the CT relay is ***not*** operated, the customer DT and DR leads are terminated in 600 ohms. After the CT relay is operated and the CCT output voltage has become positive, CT contacts connect the customer data signal inputs (DT and DR) to the telephone line via the transmission circuit.

> ***Note:*** The presence of the ***on*** voltage on the CCT lead does not imply that an end-to-end connection has been established.



An EIA ON voltage is a voltage more positive than +5 volts. An EIA OFF voltage is a voltage more negative than -5 volts.

2.15 The data coupler contains no circuitry to generate or detect answer-tone signals. The customer must provide or detect the answer-tone when required.

2.16 ***Automatic Answer:*** The customer can provide answer of incoming calls by automatically providing a positive ***on*** voltage to the OH interface lead in response to a positive RI interface lead output. The customer must hold OH input positive to remain in data mode. Also, the exclusion key option must provide for the coupler to control the line (option A).

2.17 ***Call Origination (Dial-Pulsing):*** The customer can originate a call by dial pulsing (rotary dial) or tone-address signaling (eg, TOUCH-TONE). A positive ***(on)*** voltage applied to the OH interface lead, either as a call origination or as a transfer from a manually originated call, will cause the OH relay to provide the off-hook function. A negative ***(off)*** voltage applied to the lead causes the OH relay to drop and open the telephone loop. Also, the circuit between the KA lead and the KA1 lead is opened. This sequence of operation permits the data terminal to generate dial pulses for call origination when dial tone is present. The pulsing sequence and timing requirements are as follows (Fig. 5):

(1) The ON lead is closed.

> ***Note:*** The DA lead can be closed ***(on)*** to detect dial tone or, after an interval, the presence of tone may be assumed and blind dialing initiated. The DA lead must be released for the remainder of the dialing sequence after tone is detected. The dialing rate is 8 to 11 pulses per second.

(2) The OH lead is opened for 61-percent break interval.

(3) The OH lead is closed for 39-percent make interval.

(4) Steps (2) and (3) above are repeated for the number of pulses required, eg, a total of five releases of the OH lead for the digit 5.

(5) After the last pulse of a given digit, a delay of 600 to 1600 ms occurs and the first pulse of the next digit is started.

(6) After all digits have been generated, the DA lead is closed.

2.18 Operation of the DA lead, either for the detection of dial tone or after the dialing sequence is completed, causes the circuit to function the same as on incoming calls when combined with the operation of the OH lead. The CT relay operates to connect the data terminal to the telephone line, and CCT EIA driver turns ***on*** the CCT lead to inform the terminal equipment that the coupler has closed the transmission path to the local loop.

> ***Note:*** Since there is no ringing signal present on an outgoing call, the 2-second timer is not reset and CCT turns ***on*** immediately after OH and DA are turned ***on.***

2.19 ***Call Origination (Tone-Address Signaling):*** Figure 6 shows the call

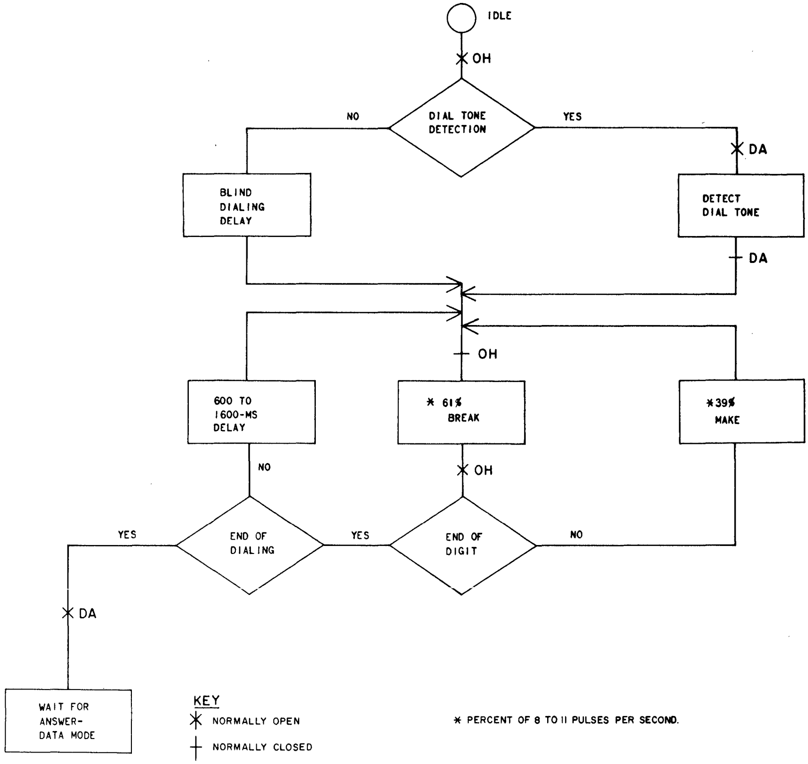


Fig. 5—Call Origination Sequence Diagram—DC Dial Pulsing

origination sequence for tone-address signaling. As previously stated, turning ***on*** the OH and DA leads causes the coupler to go off-hook and provide a transmission path between the data terminal and the telephone line. When dial tone is present, multifrequency signals are generated to access the switched network. The terminal must then wait for answer tone before transmitting data.

2.20 *Call Termination:* When data transmission is complete, the data coupler does ***not*** provide automatic disconnect. ***The data terminal must recognize the end of the call and must turn OFF the OH interface lead.*** In turn, the OH and CT relays drop to open the telephone loop and to disconnect terminal equipment from the coupler. The coupler returns to idle state. A line current status indicator (LCSI) may be installed with the coupler on an optional basis to aid the customer in recognizing end of call. The LCSI is further described in 3.11 through 3.14.

Test Mode

Operation of the TST switch while transmitting data will interrupt the data signals.

2.21 A test circuit provides the means for applying a test tone to the line through the ALC circuit (Fig. 4). This permits testing the level control, the local loop, and certain logic control functions of the coupler. The circuit is designed to be remotely tested from the local test desk

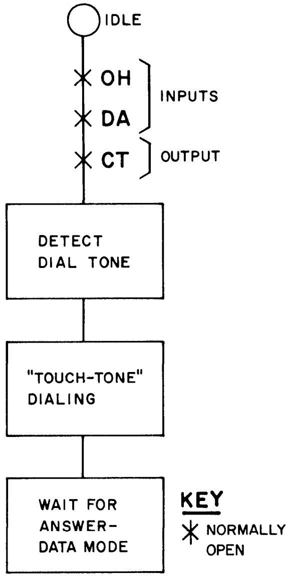


Fig. 6—Call Origination Sequence Diagram—Tone-Address Signaling

(LTD), although a data test center (DTC), or other designated test location may perform the test.

2.22 The test circuit consists of a test oscillator, the test switch (TST), and the AAFF. When the TST switch is operated, the following occurs.

(a) TST switch contacts S1B and S1D disconnect DT and DR interface signals and connect the test oscillator signal of 2800 Hz to the transmission circuit via make contacts CT4 and CT2.

(b) Contact S1A grounds the OH input lead, removing customer control of the OH and CT relays.

(c) Contact S1C disconnects ground from the IC1 contact converter, causing the output T to switch from high to low.

2.23 The low state of T in test mode:

- Causes the output of gates E and F to go low, which results in CCT and RI interface leads remaining negative in test mode
- Removes the clear signal from AAFF so that it may respond to ringing
- After being inverted, provides a cut-through signal from gate B to gate C.

2.24 To test the coupler, the customer operates the TST switch, after which the serving test center (STC) calls the data coupler. Detected ringing causes AAFF and CTFF to be set. The Q output of AAFF then goes high which:

(a) Causes the OH relay (via gate A and the OH relay driver) to operate and trip ringing, thus automatically answering the call

(b) Provides a start signal (via gates A and C) to the call timer delay circuit and a high input to gate D.

The Q output of CTFF is low and prevents the CT relay from operating. Two seconds after ringing is detected, the 2-second delay circuit clears CTFF, causing its Q output to go high. This in turn allows the high output of gate C to operate the CT relay. CT contacts CT2 and CT4 then connect the test oscillator, whose output is approximately +6 dBm, to the telephone line via the transmission circuit. The variolosser operates and reduces the transmitted level to the value chosen at the time of installation. Should the level received by the test center disagree with previous records of the installation, the trouble should be analyzed and cleared.

2.25 Resetting the TST switch terminates the call by resetting the OH relay and conditions the coupler control circuit for normal customer control. The TST switch must be restored at the end of the test for proper operation of the coupler.

3. OPTIONS

A. Telephone Sets

3.01 An associated telephone set is a standard option with the data coupler. The coupler SH and SG interface leads provide the customer with the status of the line switch on an associated telephone set when used with the data coupler. The coupler can be installed without a telephone set for fully automatic operation. When a telephone set is provided, the exclusion key and telephone set ringer wiring options must be specified on the service order. The exclusion key options provide for either the coupler or the telephone set to control the line. Telephone set ringer options provide the desired ringing features for each of the two line control options. A description of these options is included in the following paragraphs.

(a) ***Option A—Coupler Controls Line (Automatic Operation):***

(b) ***Option B—Telephone Set Controls Line:***

(c) ***Option C—With Ringer Connected on Telephone Set Side of Exclusion Key:***

(1) When coupler controls line

When the exclusion key ***is not operated,*** the coupler RI interface lead can be activated but the telephone set cannot ring.

When the exclusion key ***is operated,*** the telephone set cannot ring and the coupler RI interface lead cannot be activated (since handset must be lifted to operate exclusion key and this causes dial tone).

(2) When telephone set controls line

When the exclusion key ***is not operated,*** the telephone set can ring but the coupler RI interface lead cannot be activated.

When the exclusion key ***is operated,*** the coupler RI interface lead can be activated but the telephone set cannot ring.

(d) ***Option D—With Ringer Connected on Telephone Line Side of Exclusion Key:***

(1) When coupler controls line

When the exclusion key ***is not operated,*** the coupler RI interface lead can be activated and the telephone set can ring.

When the exclusion key ***is operated,*** the telephone set cannot ring and the coupler RI interface lead cannot be activated (since handset must be lifted to operate exclusion key and this causes dial tone).

(2) When telephone set controls line

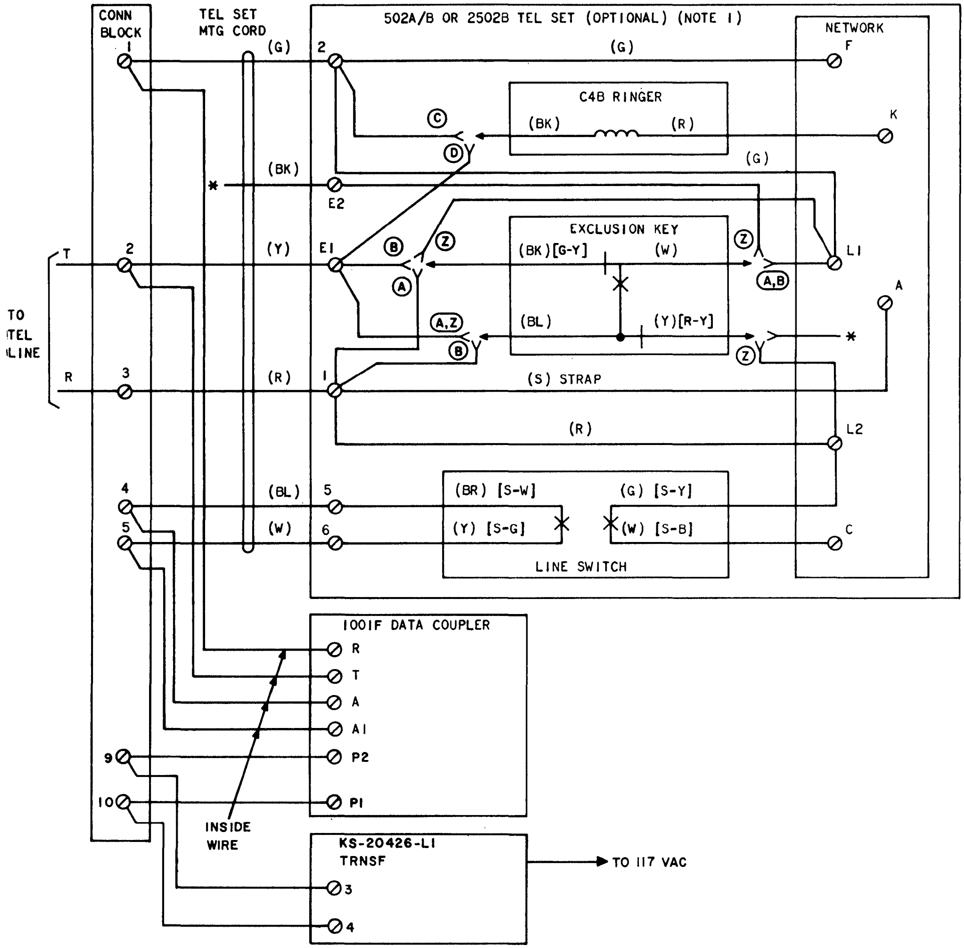
When the exclusion key ***is not operated,*** the telephone set can ring but the coupler RI interface lead cannot be activated.

When the exclusion key ***is operated,*** the telephone set can ring and the coupler RI interface lead can be activated.

3.02 Options specified in 3.01 apply to the standard [502A/B or 2502B (Section 502-501-102 or 502-503-102)] as well as the multifunction telephone (MFT) [503C or 2503C (Section 502-501-120 or 502-503-120)] when used with the 1001F data coupler. Connections for these options using the 502- and 2502-types are shown in Fig. 7. Additional options are available using the MFT, and are discussed in 3.03 and shown in Fig. 8 and 9. Wall-mounted telephones are not recommended and should not be used.

3.03 The 503C (rotary dial) and the 2503C (TOUCH-TONE dial) telephone sets furnish the customer the following additional options:

- Allows monitoring of data transmission and voice answer-back signals through the telephone handset as used in digital inquiry voice answer-back (DIVA) applications.



NOTES:

1. EXCLUSION KEY AND RINGER MUST BE REWIRED FOR DESIRED OPTION.
2. IF C4A RINGER IS USED, WIRE AS FOLLOWS:
   (BK) TO 2 OR E1, DEPENDING ON OPTION USED
   (S) TO K OF NETWORK
   (S-R) TO A OF NETWORK
   (R) TO 1 OF TERMINAL STRIP

Ⓩ ORIGINAL FACTORY WIRING OF TEL SET
② FURNISHED UNIT
* INSULATE AND STORE
( ) CURRENT COLOR CODE
[ ] MD COLOR CODE

EXCLUSION KEY OPTION	WIRING OPTION
COUPLER CONTROLS LINE	A
TEL SET CONTROLS LINE	B

RINGER OPTIONS	WIRING OPTION
RINGER ON TEL SET SIDE OF EXCLUSION KEY	C
RINGER ON TEL LINE SIDE OF EXCLUSION KEY	D

Fig. 7—502A/B or 2502B Tel Set Connection With 1001F Data Coupler

- Provides an indication of whether telephone line is connected to telephone set or data coupler, or it may be used to provide an indication of SH (ie, on-hook or off-hook).

These additional features provided by the 503C (or 2503C) telephone set necessitate the use of a triple transfer exclusion key and a high-impedance, bridging transformer in the telephone set. One set of the exclusion key contacts switches the line between the telephone and the coupler. The second set switches the monitoring circuit, and the third set provides the mode indication. The high-impedance transformer allows the attendant to monitor data transmission with the telephone handset. Both sets are in a light gray housing; however, they may be enclosed in standard 500- or 2500-type housings of another color if desired.

3.04 In a multiple data coupler installation, it is often desirable to associate several data couplers with one telephone set. Key telephone sets are available in 6-, 10-, 18-, and 30-button sizes. Key telephone sets can connect to one of several different lines. The auxiliary key contact for each line, designated the A lead, is used to operate associated circuitry. The A lead may also be used to operate a relay which transfers a line from the data coupler to the telephone set as shown in Fig. 10. The function of the exclusion key is replaced by the line pickup key on the key telephone set. Note, however, that the coupler is never disconnected from the line when wired as shown in Fig. 10. The switchhook indicator function (SH lead) is not available with key telephone set installations unless auxiliary key telephone units (KTUs) are used. The coupler is assumed to be the primary station. Data calls can be originated and answered without interference from the telephone set. To indicate activity of the data coupler, the OH contact is used to connect the winking lamp supply to the telephone set. The lamp under the key designated for the line assigned to this coupler winks when the data coupler is on-line and off-hook.

3.05 Apparatus necessary for providing telephone service for automatic data couplers consists of a key telephone set with enough capacity for the lines involved, a transfer relay for each line involved, and a ringup relay for each line that requires manual answering as a service feature. Figure 10 shows the connections for a representative type of KTU. Other types of KTUs that provide the required features may be used at the discretion of the telco. Additional features, such as common pickup of a single group of lines from any of several telephone sets, may be supplied by bridging key telephone sets and adding additional KTUs. Any service commonly offered in a local area should be provided according to local practices.

B. ACU Application

3.06 The data coupler is designed to operate with automatic data terminals which can generate dial pulses for automatic calling. The coupler will also operate with a DAS 801-type ACU to provide the automatic calling function on either TOUCH-TONE or dc dial pulse lines. A partial schematic of a coupler/ACU connection is shown in Fig. 11 and a description of operational sequences is provided in the following text. A diagram for connecting the ACU to the coupler is shown in Fig. 12.

> ***Note:*** When an optional 801-type ACU is provided for automatic call origination, install the unit in accordance with the section covering that unit.

3.07 ***Call Origination:*** Call origination with an ACU can be based on end-of-number (EON) operation or on answer-tone detection by the ACU.

3.08 To originate a call by using ***EON operation,*** the control leads to the coupler interface are in the ***off*** condition (the DA lead may be turned ***on*** permanently when all call originations are via the ACU). The ACU transfers the line from the coupler to the ACU in response to the call request (CRQ) signal from the data terminal. The normal dial sequence is presented to the ACU followed by the EON code. When the EON code is received, the ACU operates the ANS relay, causing the SH lead on the coupler to turn ***on.*** The previously operated LT relay drops in the ACU to return line control to the coupler. The data terminal responds to the ***on*** condition of the SH lead by turning ***on*** the OH lead on the coupler. Operation of the OH relay drops the ANS relay, turning the SH lead ***off.*** The OH relay operates to close and hold the loop and to supply the required supervisory contact closure to the ACU. The ACU turns ***on*** lead DSS and the customer terminal should respond by turning ***off*** circuit CRQ. The data terminal turns ***on*** the DA lead (if not permanently ***on***) and looks for the CCT lead to indicate that the terminal has been cut through to the local telephone line. The data terminal should wait for answer tone or other

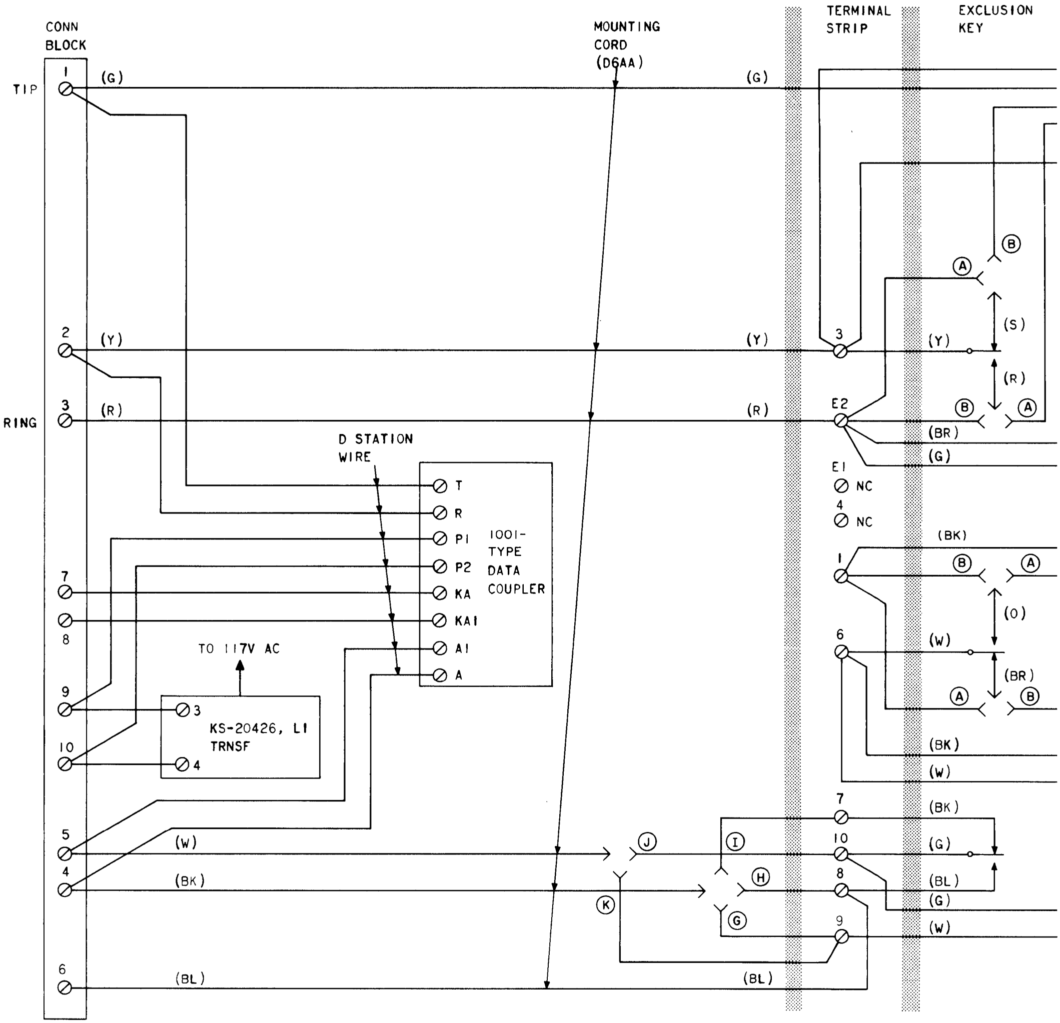
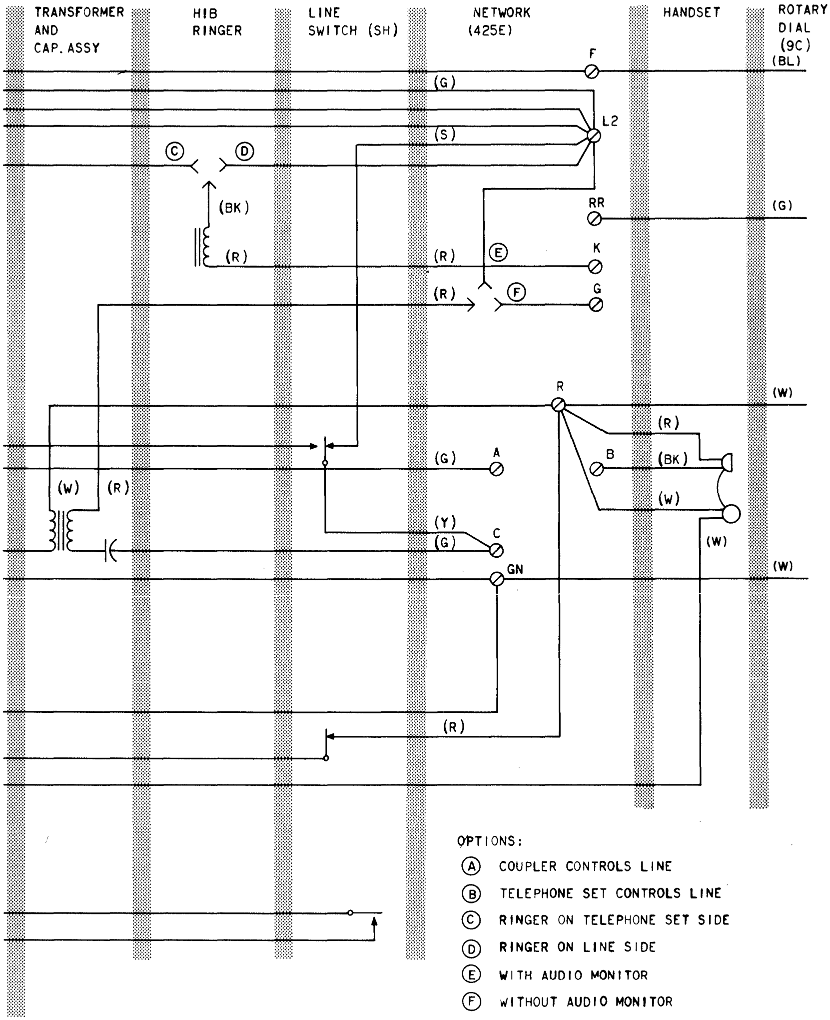


Fig. 8—503C Rotary Dial Telephone Set Connections With 1001F Data Coupler (Sheet 1 of 2)



OPTIONS:

- Ⓐ COUPLER CONTROLS LINE
- Ⓑ TELEPHONE SET CONTROLS LINE
- Ⓒ RINGER ON TELEPHONE SET SIDE
- Ⓓ RINGER ON LINE SIDE
- Ⓔ WITH AUDIO MONITOR
- Ⓕ WITHOUT AUDIO MONITOR

INDICATOR	ADDITIONAL OPTIONS WITH	
	OPTION A	OPTION B
VOICE MODE	H, K	I, K
DATA MODE	I, J	H, K
SWITCHHOOK	G, J	G, J

Fig. 8—503C Rotary Dial Telephone Set Connections With 1001F Data Coupler (Sheet 2 of 2)

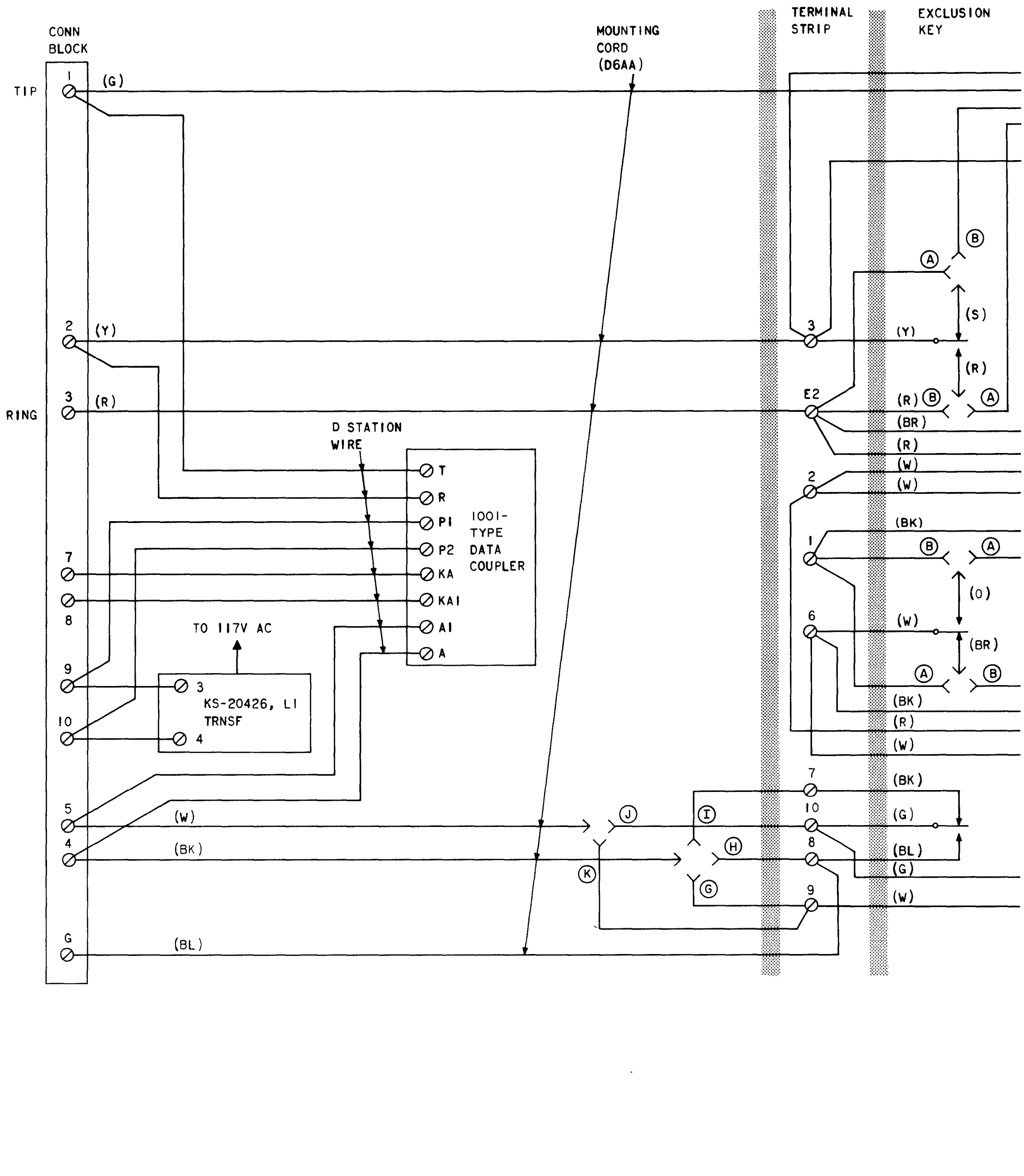
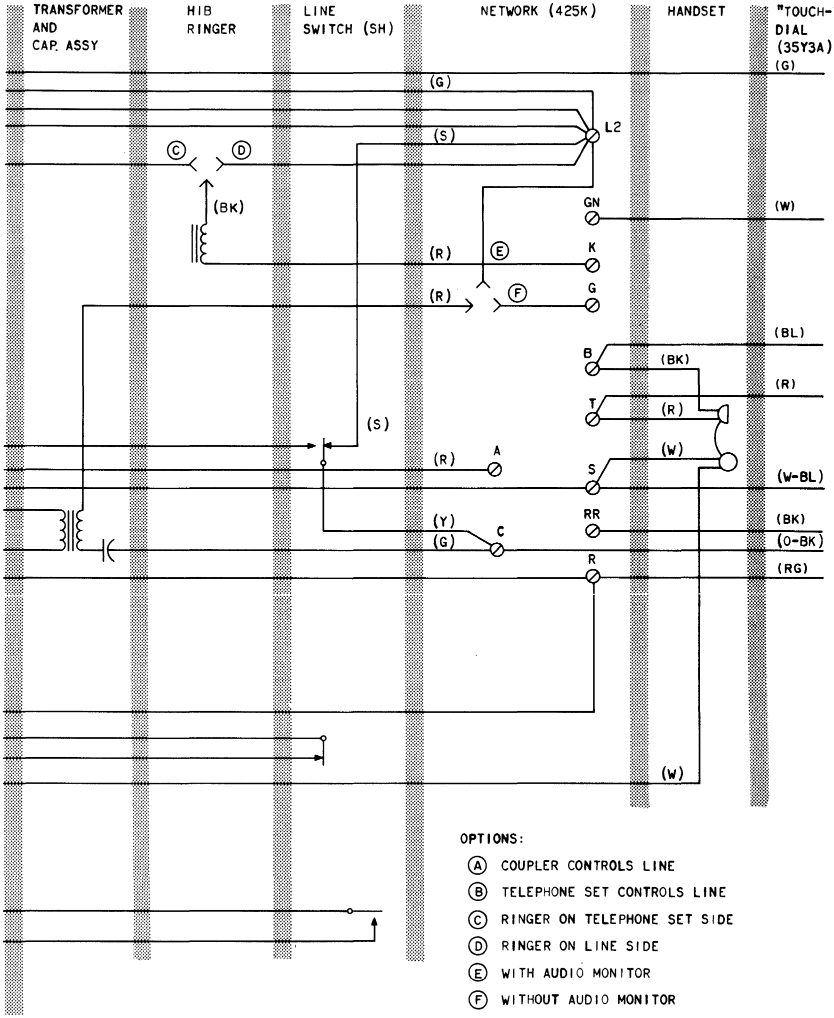


Fig. 9—2503C TOUCH-TONE Dial Telephone Set Connections With 1001F Data Coupler (Sheet 1 of 2)



INDICATOR	ADDITIONAL OPTIONS WITH	
	OPTION A	OPTION B
VOICE MODE	H, K	I, K
DATA MODE	I, J	H, K
SWITCH HOOK	G, J	G, J

Fig. 9—2503C TOUCH-TONE Dial Telephone Set Connections With 1001F Data Coupler (Sheet 2 of 2)

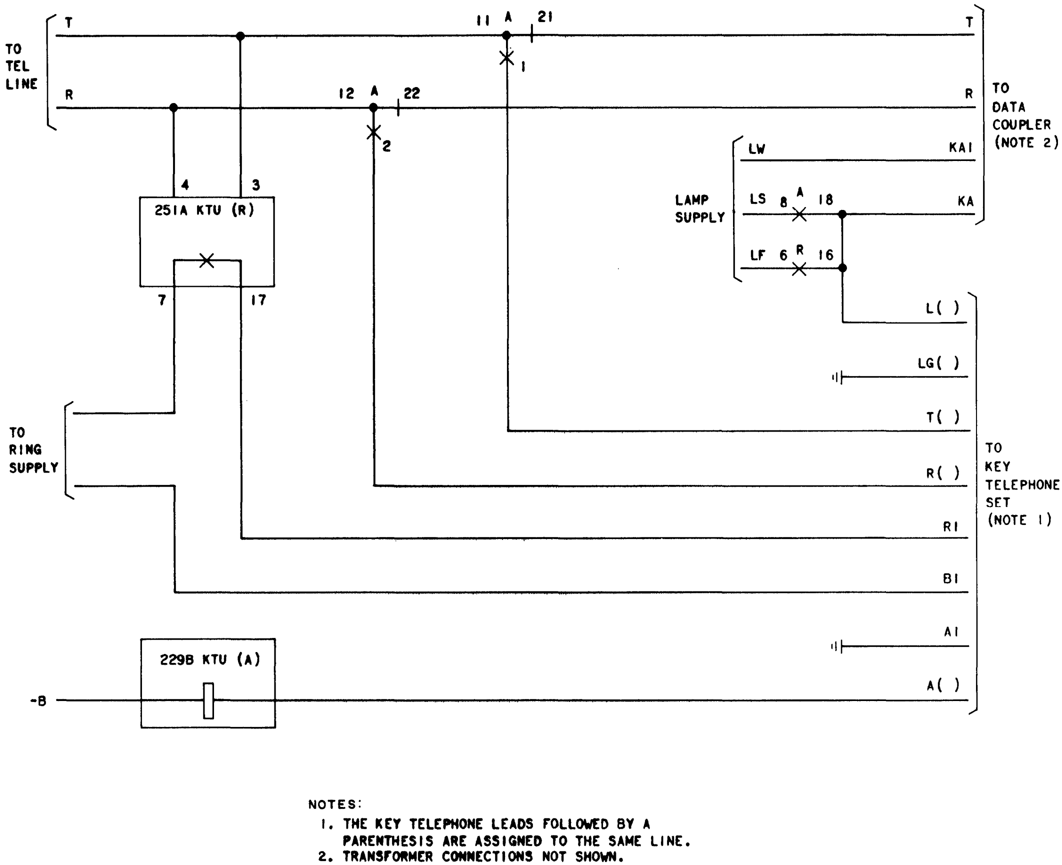


Fig. 10—Key Telephone Unit Connection With 1001F Data Coupler

signal from the called station before attempting to send data.

3.09 To originate a call by using the ***answer-tone detection operation,*** the control leads to the coupler interface are in the ***off*** condition (the DA lead may be turned ***on*** permanently when all call originations are via the ACU). The ACU transfers the line from the coupler to the ACU in response to the CRQ signal from the data terminal and accepts the normal dial sequence as presented. After dialing is completed, the ACU waits for detection of answer tone (2025 or 2225 Hz) from the called station. When answer tone is detected, the ACU operates the ANS relays, causing the SH lead on the coupler to turn ***on.*** The previously operated LT relay drops in the ACU to transfer line control back to the coupler. The sequence of operation now follows the same as for EON operation.

3.10 ***Call Termination:*** The data terminal terminates a call by turning ***off*** the OH lead to the coupler. The OH relay drops to open the loop-holding path and to inform the ACU that the data line is idle. The data terminal must monitor the DLO interface lead from the ACU to determine when the next call may be originated.

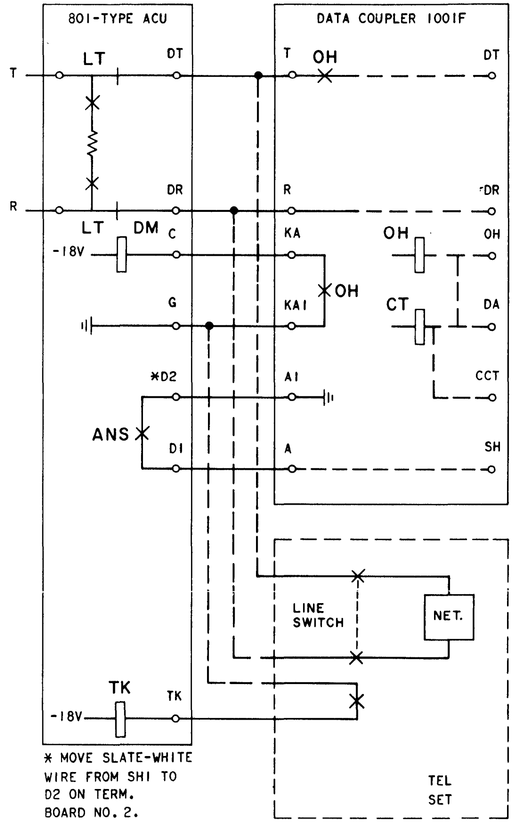


Fig. 11—801-Type ACU Partial Functional Schematic With 1001F Data Coupler

C. Line Current Status Indicator

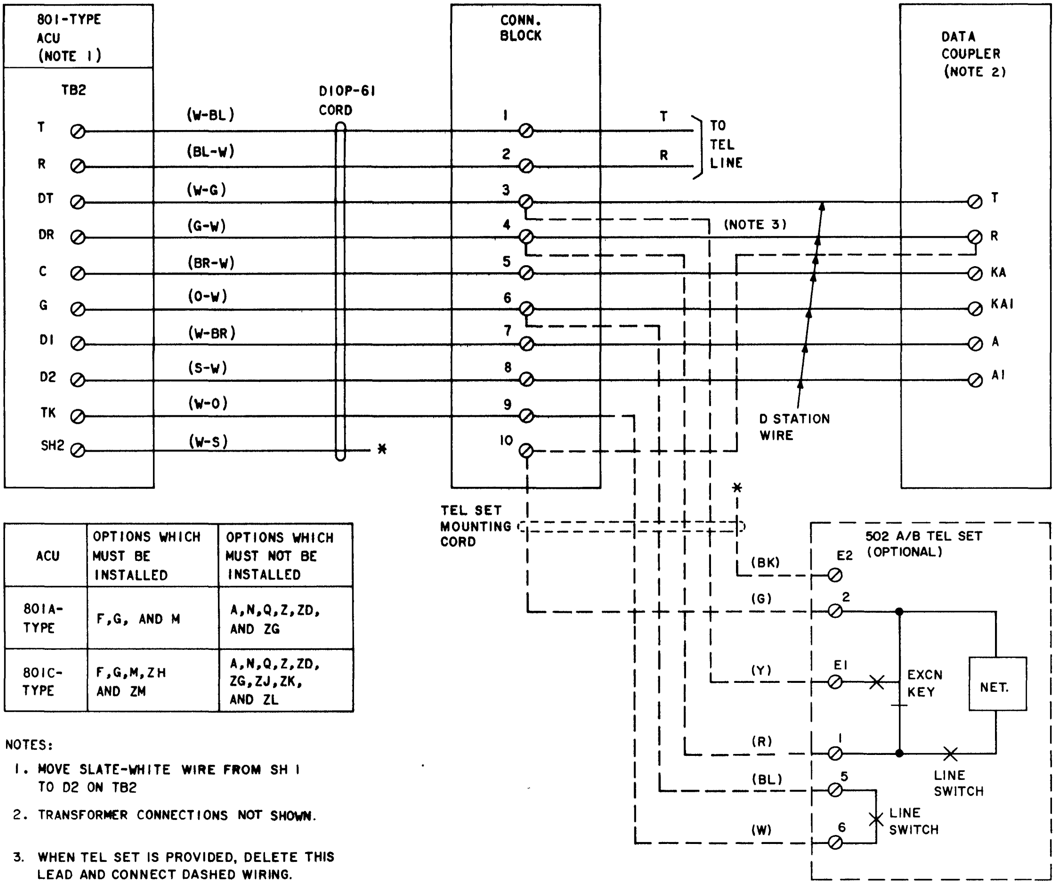
3.11 A line current status indicator (LCSI) may be installed with the coupler on an optional basis to aid the customer in recognizing end of call. The LCSI will not work on facilities served by certain central offices and it performs differently with some of the central offices that it ***will*** work with. Refer to Table B to determine the applicability to a particular installation.

Caution should be exercised in using the LCSI to indicate a far-end disconnect. Momentary line current interrupts occur during call setup. They can be up to 400 ms long and can occur up to 10 seconds after dialing is completed and, at the called end, up to 500 ms after answering a call. In response to far-end disconnect, some switching offices interrupt line current, but it is important to note that some do not. When such interrupts do occur, the LCSI contact will open momentarily. To avoid misinterpretation of momentary opens, it is recommended that an open not be interpreted as an indication of far-end disconnect unless it is greater than 5 ms in duration. Customers should verify disconnect arrangements with the local telephone service organization before relying on the LCSI for that function.

3.12 The LCSI can be arranged to present an EIA voltage with a parallel indication to SH contact closure spare leads (option Z) ***or*** a contact closure (option Y) to the customer as an indication of line current. The EIA voltage is derived from the SH driver circuit in the data coupler under control of the switchhook or the LCSI. If no associated telephone set is used, the indication is LCSI only. The LCSI indication will be a voltage on the SH lead at the customer interface. The contact closure option is a set of the LCSI relay contacts connected to two terminals on a separate connector block.

3.13 The LCSI (Fig. 13) must be made locally. It consists of a dry reed relay and two varistors on a 74B-49 connecting block measuring 2.75 inches wide, 4 inches long, and 1.6 inches high. The relay is in series with the coupler and gives a contact closure at the customer interface or the input to the coupler SH driver circuit when at least 20 mA of line current is flowing through the relay and coupler. The two varistors are used to provide a low-impedance transmission path to the coupler.

If the customer uses the contact closures directly, current through the terminals should be limited to less than 10 mA. The customer circuit must also be noninductive with an open circuit voltage less than



ACU	OPTIONS WHICH MUST BE INSTALLED	OPTIONS WHICH MUST NOT BE INSTALLED
801A-TYPE	F,G, AND M	A,N,Q,Z,ZD, AND ZG
801C-TYPE	F,G,M,ZH AND ZM	A,N,Q,Z,ZD, ZG,ZJ,ZK, AND ZL

NOTES:

1. MOVE SLATE-WHITE WIRE FROM SH 1 TO D2 ON TB2
2. TRANSFORMER CONNECTIONS NOT SHOWN.
3. WHEN TEL SET IS PROVIDED, DELETE THIS LEAD AND CONNECT DASHED WIRING.

* TAPE AND STORE.

Fig. 12—801-Type ACU Connection With 1001F Data Coupler

50 Vdc. The maximum length of the loop over which the coupler can operate is reduced by approximately 800 feet if an LCSI is used.

3.14 Assemble the unit in accordance with the following procedures.

(1) Remove cover from the 74B-49 connecting block.

(2) Remove the 426A electron tube assembly, including mounting screw, and discard.

Warning: The adhesive used in Step (3) sets quickly and should not be allowed to come in contact with anything (especially the skin of the installer) except the relay, the applicator, and the connecting block base.

(3) Apply adhesive (Eastman 910 or equivalent) in the area to be occupied by the 327C relay.

TABLE B

LINE CURRENT STATUS INDICATOR APPLICATION*

OFFICE SERVING OFF-HOOK END	END OFF-HOOK	END ON-HOOK	MIN CURRENT INTERRUPT	RELATED TO DIAL TONE	USE OF LCSI FOR DISCONNECT
ESS	Called	Calling	12 ms	Before	Okay
ESS	Calling	Called	37 ms	Before	Okay
No. 5 X-Bar	Called	Calling	10 ms	Before	Okay
No. 5 X-Bar	Calling	Called	32 ms	After	Discourage
No. 1 X-Bar	Called	Calling	0.4 sec	After	Discourage
No. 1 X-Bar	Calling	Called	0.4 sec	After	Discourage
SXS	Called	Calling			Discourage
SXS	Calling	Called			Discourage

* The use of dial long line circuits and carrier facilities on local loops will isolate station equipment from central office dc interrupts.

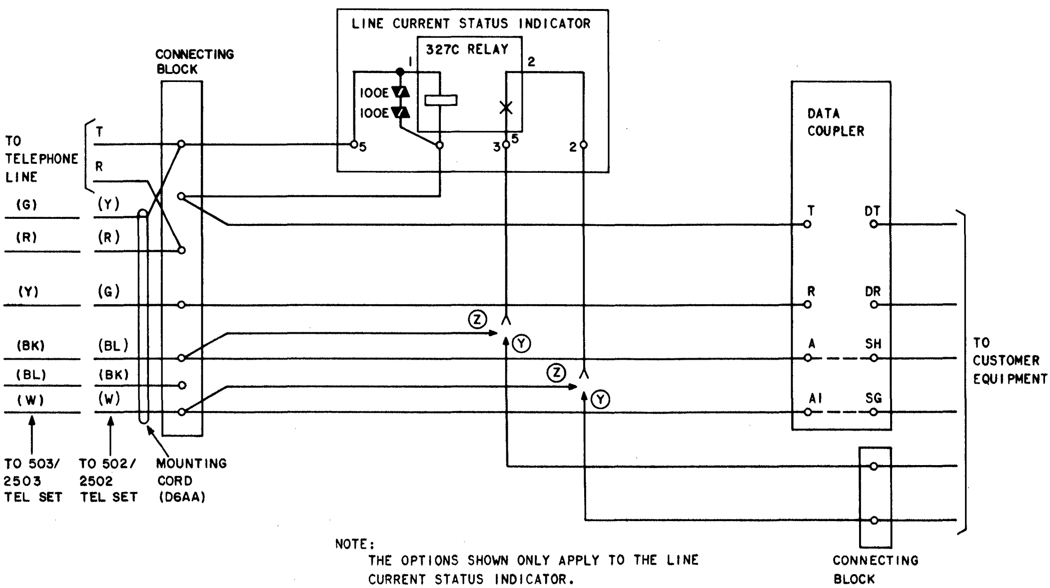


Fig. 13—Line Current Status Indicator Connection Diagram

(4) Place relay on baseplate, topside down.

(5) Remove and discard the lower screws from terminal strip eyelets in positions 2, 3, 4, and 5.

(6) Wire the unit in accordance with Fig. 13.

D. Customer-Provided Power

3.15 Customer-provided direct current may be used to power the 1001F data coupler. The factory-provided straps must be removed (Fig. 3 and 4). (Option X is applied.) These straps are accessed by removing the 1001F cover from the base and then removing the four screws that hold the top printed circuit board to the bottom printed circuit board (Fig. 2). To locate the two wire strap options, see Fig. 3. Each of these two wires should be cut at both ends near the printed circuit board and discarded. It is important that the remaining wire ***not*** touch any printed wiring paths or any components. Care should be exercised in replacing the top printed circuit board. The customer-provided dc power is connected to the +V, -V, and SG customer interface terminals and must conform to requirements shown in Table C. The ±0.3 volt range stated in Table C allows for power supply tolerances, line regulation, and temperature variations. Supply voltage in excess of +12.7 volts (and less than -12.7 volts) could cause damage to the 1001F integrated circuits. A common dc supply may be used to power several couplers as long as the voltage requirements stated above are met. There should be no connections made to the P1 and P2 data coupler power terminals when the data coupler is customer powered.

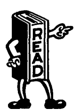
E. Ring Indicator Lead Voltage Changes

3.16 The 1001F data couplers, series 2 and later, are equipped with diode CR8 and resistor R28. These were added to prevent false operation of the R relay when dial pulsing outward through the coupler. CR8 and R28 reduce the positive-to-negative transition time of the ring indicator (RI) lead to less than 10 μs. Without CR8 and R28 the transition time of the RI lead is approximately 100 ms.

3.17 Option V (Fig. 3 and 4) connects CR8 and R28 into the circuitry. The coupler is shipped with option V connected. Option V should be removed (cut out) if the off-on control lead (OH) is not used for out dial pulsing.

4. INSTALLATION AND CONNECTIONS

4.01 The 1001F data coupler may be used with various types of SCO lines, key telephone systems, or PBX lines that provide access to the switched network facilities.



All installation connections and tests must be performed prior to the customer making any connections to the interface.

4.02 Verify that the assigned loop facilities meet the transmission requirements for the specific data service before proceeding with the installation. General requirements for DAA are covered in

TABLE C

POWER SUPPLY PARAMETERS

PARAMETER	SUPPLY	
	+V	–V
Voltage	+12 ±0.3V	–12 ±0.3V
Load Current	0 to 50 mA	0 to 100 mA
Load Regulation	±2%	±2%
Output Ripple (peak-to-peak)	50 mV	50 mV
Operating Temperature Range	0 to 120° F	0 to 120° F

Sections 314-205-500 and -501. Requirements for the 1001F data coupler are as follows:

(a) ***Loop Loss:*** Maximum 1000-Hz insertion loss (including coupler loss of 2 dB) is 11 dB.

(b) ***Set Classification:*** Installation measurements to be made should have been determined from the type of data modem information provided by the customer and specified on the service order. When the modem type cannot be determined, Type II requirements should be specified. When the type of modem can be obtained from the customer, the following guidelines should be used.

(1) For all analog modems, Type II requirements should be specified.

(2) For all other modems, requirements based on speed of modem (same as for switched DATA-PHONE service) should be specified.

(3) If the type of modem is known to be similar to a Bell System DATA-PHONE data set, use the requirements for that particular data set.

4.03 Installation of the coupler should comply with general practices to ensure an orderly station arrangement. Information relating to selection of type of connecting block and electrical code requirements is given in Section 590-010-200. See Fig. 14 for typical interconnection block diagram.

4.04 When test or demonstration calls are made, refer to Section 010-250-001 for proper procedure for crediting charges.

4.05 Location of the coupler shall be determined by the following conditions:

- ***The coupler must be mounted vertically*** on a wall, or other vertical surface with the TST switch at the top, to ensure proper operation of OH mercury relay.

- The coupler must be within range of the interface cord supplied by the customer. This cord should not exceed 50 feet to meet EIA RS-232-C voltage specifications.

- Location of the coupler should provide easy access for viewing and operating the TST switch by the customer attendant.

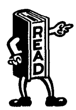
A. Installation of Data Coupler

4.06 Install the coupler on a wall or vertical surface as follows:

(1) Remove the tape securing the cover to the base pan. Retain the screw envelope which is between the tape and cover.

(2) Remove the snap-off cover assembly from the coupler.

(3) Position the coupler base pan vertically against the wall with the keyhole slot narrow end up and the slot not less than 7 inches above the top of the baseboard or other obstruction which will be below the unit. Secure the base with two No. 6 by 1/2-inch wood screws for porous surfaces, or No. 6 by 3/8-inch pan-head type AB self-tapping screws for metal surfaces supplied with the coupler.



Trouble has been experienced in certain 1001F couplers with cable stress studs shorting the printed circuit paths. The employee should examine the coupler during an installation or maintenance visit and remove these studs with diagonal cutters as applicable.

(4) Route the D station wire through the slots and pins on the base as shown in Fig. 15. Attach the CP to the base pan by using the four self-tapping screws in the envelope. ***Connect the A and A1 leads and, if necessary, the KA and KA1 leads to the terminals on each side of the printed wiring board. Care should be taken not to overtighten screws or stripping of the base pan screw holes will result.***

4.07 When the coupler installation does not include an associated telephone set, tip and ring of the telephone line may be connected directly to terminals T and R, respectively, on the coupler instead of to terminals on an associated connecting block shown in Fig. 7, 8, and 9. See 3.01 through 3.05 for information on installing an optional telephone set.

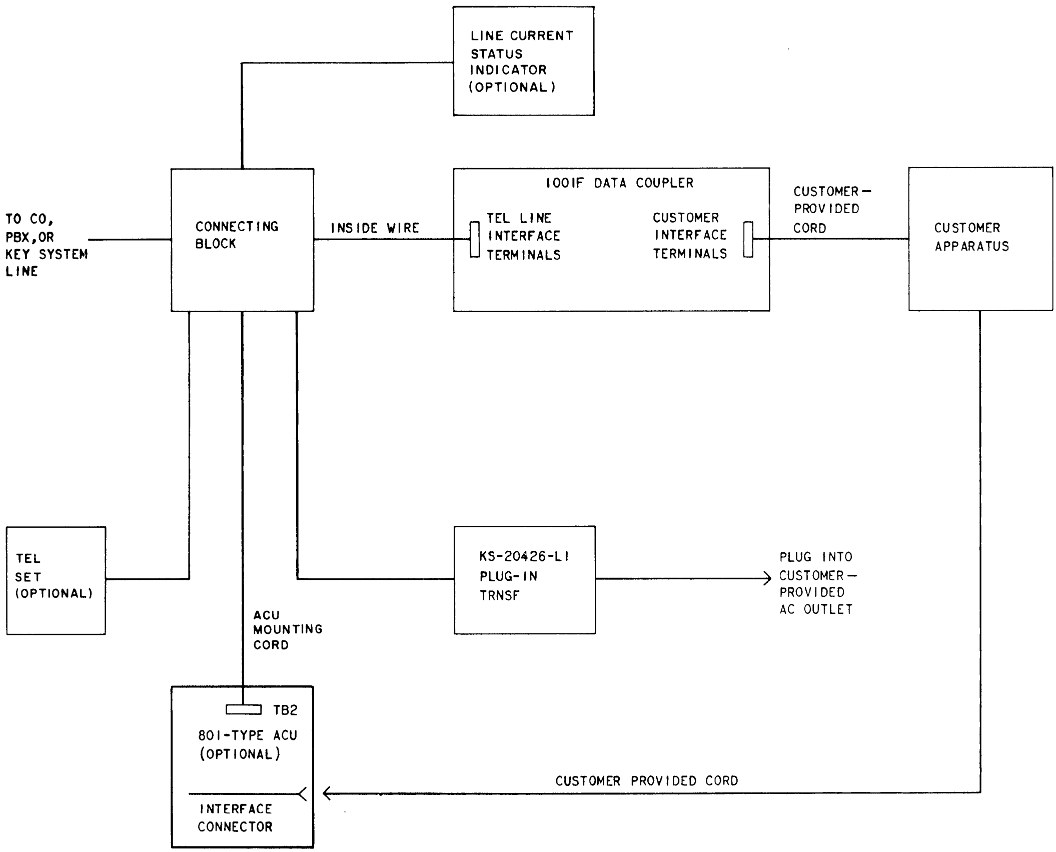


Fig. 14—Block Diagram of Typical 1001F Data Coupler Installation

B. Installation of Power Transformer

Installation of the power transformer will not be necessary if the option for customer-provided power has been chosen. However, if the customer-provided power option has been chosen but the terminal (and the customer power) has not been installed, the power transformer must be installed in order to adjust and test the coupler. After completion of tests (when customer-provided power was chosen but not available), the power transformer is disconnected. The customer-provided power option must then be installed as described in 3.15.

4.08 The 1001F data coupler can be powered by the wall-mounted KS-20426-L1 low-voltage transformer supplied with each coupler. The KS-20426-L1 transformer provides two primary terminals in the form of parallel blades for use in a standard 2-pole, 3-wire grounded receptacle which serves as the mounting device. Two recessed screw terminals provide the means for connecting to the transformer secondary. Connections from the transformer are made ***directly to the coupler***

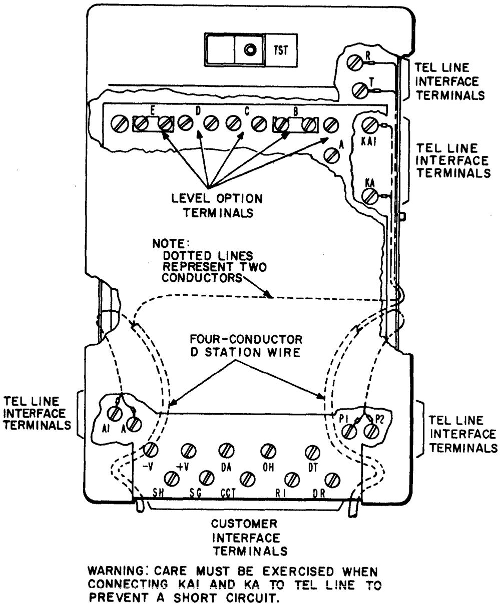


Fig. 15—Route of Station Wiring and Location of Terminals

or to an associated connecting block. Terminals 3 and 4 of transformer KS-20426-L1 are wired to P1 and P2 screw terminals of the coupler. The furnished clamp must be used to hold the transformer securely in the receptacle. The receptacle provided by the customer must ***not*** be under control of a switch.

To prevent damage to the data coupler when using ac power, each data coupler must be powered by an individual transformer.

C. Completion of Installation

4.09 Install cover assembly by hooking bottom end (end with small hinged cover) to base pan, swinging cover up and over the TST key, and pressing until cover snaps into place.

4.10 Install telephone set if specified on the service order. If a 503-, or 2503-type telephone is used, redesignate the SH terminal on the coupler as "MI" (mode indicator).

4.11 Instruct the customer to raise only the hinged portion of cover to gain access to interface terminals. Also, inform customer that overtightening screws may cause stripping.

Do not connect the customer interface leads to the coupler unless requested by, and under direction of, the customer.

4.12 After the coupler and associated units have been connected to the telephone line, perform the tests outlined in Part 5.

4.13 Inform the customer, at the time the coupler is installed, of the maximum permissible signal power output from the customer data equipment. The output level of the customer-provided equipment is the power measured at the customer interface into a 600-ohm resistive load. It may vary between -1 and -10 dBm depending upon the 1000-Hz loss of the local loop including the nominal insertion loss (approximately 2 dB) of the coupler.

5. MAINTENANCE AND TESTS

5.01 Maintenance and test procedures described in this part are provided to assist the employee during installation and troubleshooting visits to a data coupler station. All level measurements and test results made during installation must be recorded on a circuit layout record card (CLRC) to assist in analyzing future trouble and to detect gradual degradation of service. Telephone the test results to the plant service center (PSC), or equivalent test location, prior to leaving the customer location. Some tests will require disconnection of customer equipment from the interface in order to make tests and/or to replace a defective coupler. The following precautions ***must*** be taken.

- ***Obtain permission from the customer to disconnect the interface leads from the coupler.***

- ***Turn the power to both the customer equipment and to the coupler OFF before the customer leads are disconnected. Power to the coupler can be removed by unplugging the KS-20426-L1 transformer.***

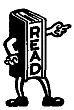
- ***After all tests are completed and the interface is reconnected, ask the customer to verify that the interface has been reconnected properly.***

A. Maintenance

5.02 All repair forces should be familiar with the tariff provisions which generally provide for a "maintenance service charge" for each customer-requested repair visit to a DAA installation. When the customer requests such a repair visit and it is subsequently determined that the trouble is ***not*** in the Bell System equipment, inform the customer and notify the PSC to fill out Form E-5855 in conformance with Section 660-101-312.

5.03 Maintenance of the coupler on customer premises is limited to local tests, testing by the serving or test office, or replacing a defective unit.

Note: Do not attempt individual component repair or replacement on the printed CP.



The 1001F data coupler can only be replaced by a 1001A if the customer terminal can work with EIA RS-232-B. Otherwise, a defective 1001F must be replaced by another 1001F.

5.04 Customers using data couplers are instructed, when a trouble condition is experienced, to perform the necessary testing to sectionalize the problem. If the results of the tests indicate that the trouble is in Bell System equipment, the condition should be reported to the designated PSC or equivalent test center. All available information concerning the failure mode should be forwarded to the PSC.

5.05 The PSC must analyze the information provided by the customer to determine if a trouble condition does exist and the most probable cause. Available tests (ie, normal dc loop test and remote test of coupler) should be performed to determine if a telco employee must be dispatched to customer premises. The conditions which could warrant a maintenance visit and efforts which lead to each are indicated in Fig. 16.

5.06 On a maintenance visit, tests or evaluations to isolate and clear trouble within the station should be performed as directed by the PSC. Begin with the steps shown in Fig. 16 when test results and analysis received from the PSC lead to that particular activity. If a trouble report is not available or if the report is inconclusive, follow the suggested sequence of activities as illustrated in Fig. 17 and described in the following:

(1) The telco employee must be properly equipped with information (BSP documentation, line card details, etc), spare coupler, and test equipment, etc, for locating trouble and effecting repairs at the customer premises.

(2) Upon arrival at the coupler station, question the customer to obtain any information relating to the reported trouble, then perform a visual and mechanical inspection of the installation. Check that TST switch on coupler is not partially operated. Check for disconnected or broken cords, inside wiring, drop wire, broken components, or any other possible trouble causes. Repair or replace any defective or marginal components (ie, ringer, dial, handset, etc).

(3) Perform a remote test to the local test desk (LTD) or equivalent test location.

(4) If any components were replaced or repaired ***and*** the results of the remote test are satisfactory, close trouble report.

(5) If all components are satisfactory ***and*** the results of the remote test are satisfactory, perform an interface voltage test.

(6) If the results of the interface voltage test ***or*** remote test are not satisfactory, replace the coupler. Ensure that all level measurements made during the required installation tests are properly recorded on the CLRC.

(7) Perform a remote test on the new coupler.

(8) If the results of the new coupler remote test are ***not*** satisfactory, notify the PSC.

(9) If the results of the new coupler remote tests are satisfactory, request the customer to verify that service is restored (ie, try to exchange data with the station that caused the trouble report).

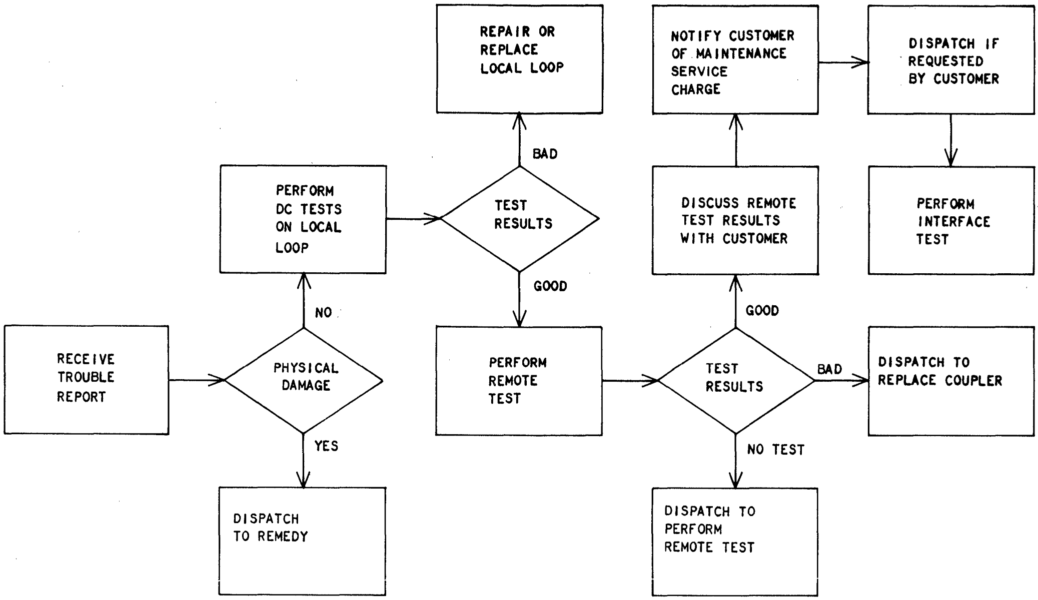


Fig. 16—Basic Activities Prior to Dispatching Employee

(10) When the customer is satisfied with the service, notify the PSC to close the trouble report.

(11) If the customer cannot exchange data or is ***not*** satisfied with the service, disconnect the coupler and perform a complete transmission test of the local loop as described in Section 314-205-501.

(12) If the results of the loop test are satisfactory, notify the PSC.

> ***Note:*** The preceding investigation has eliminated the coupler and local loop as possible trouble; therefore, attention must be directed to the data terminal or facilities.

(13) If the results of the loop test are ***not*** satisfactory, arrange with the PSC to have the loop repaired or changed. The repaired or changed loop must meet requirements outlined in Section 314-205-501.

(14) After changing the defective loop, reconnect the coupler to the telephone line. Perform the insertion loss test and impedance matching test to determine if maximum allowable customer level has been changed. Notify customer of level change and then request customer to verify service restoral (ie, try to exchange data with the station that caused the trouble report).

> ***Note:*** Prior to leaving customer premises, perform the remote test and record the new level on the CLRC.

(15) When the customer is satisfied with the service, notify the PSC to close the trouble report.

(16) If the customer cannot exchange data or is ***not*** satisfied with the service, trouble may still exist in another component of the system or in the data terminal, and further investigation must be pursued. Notify supervision, who can escalate following normal procedures of data technical (DATEC) support. Refer to Sections 010-521-100 and -101. Notify the PSC

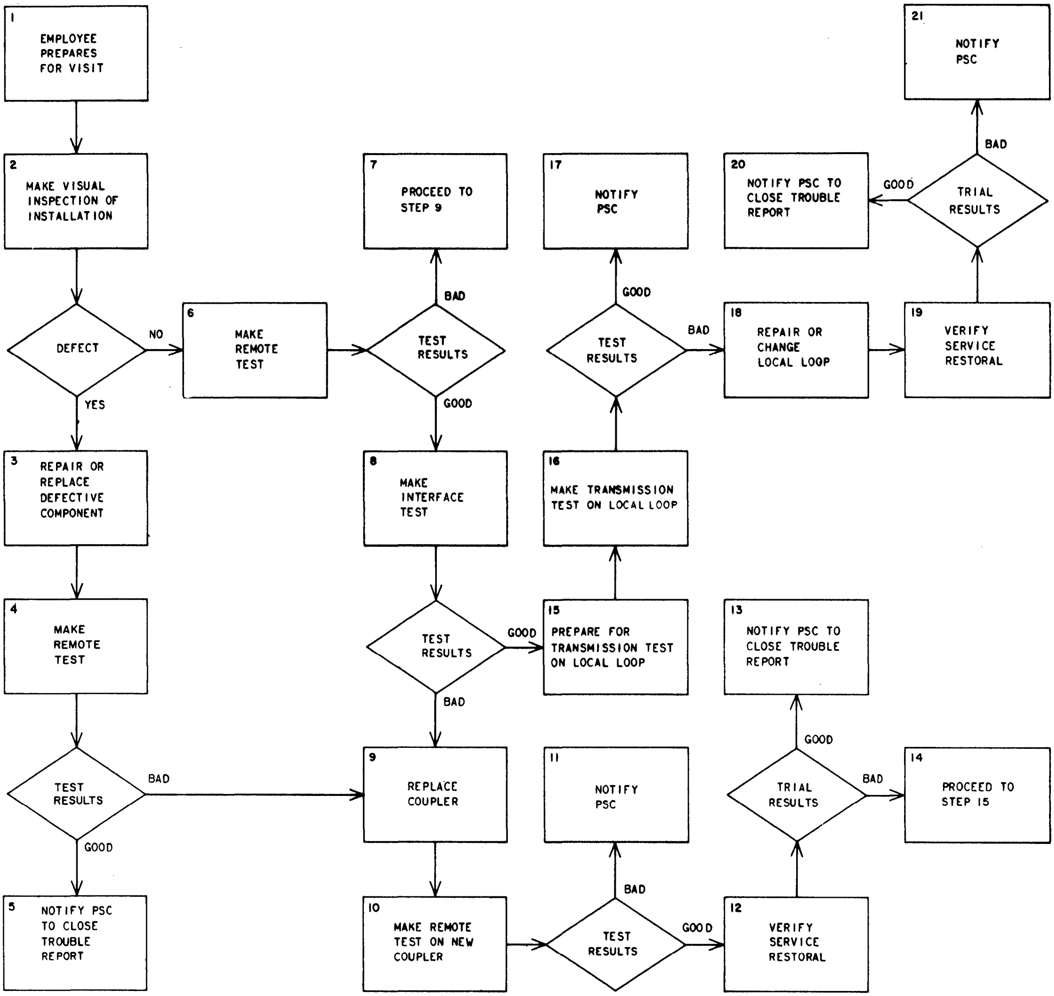


Fig. 17—Activities for Troubleshooting at a Coupler Station

of the repair work that has been completed and wait for further instructions.

B. Tests

5.07 The following tests are required to ensure proper installation of the data coupler and to determine the operating condition of the unit during a maintenance visit:

- Insertion Loss Test
- Impedance Matching Test
- Remote Test

- Interface Voltage Test
- ACU Test
- LCSI Test
- 503C or 2503C Telephone Set Test.

5.08 The following test equipment is required for the tests:

- 600-ohm ±1 percent resistor
- KS-16979-L1 volt-ohm-milliammeter (VOM), or equivalent with a high-impedance, bridging-type ac voltmeter with a dB scale such that 0.776 Vac corresponds to 0 dB.
- 1013-type hand test set, or equivalent
- KS-19353-L4 oscillator or equivalent with a 600-ohm output impedance and a capability of a -5 dBm reading when connected across 600 ohms.

Note: The insertion loss test ***and*** the impedance matching test are required to determine proper level option strapping, using Table D.

Insertion Loss Test

5.09 The insertion loss test measures the combined loss of the loop and coupler. The results of the test are used to determine the maximum allowable customer signal power level which will result in a signal level no greater than -12 dBm at the SCO. This test requires that the customer interface leads be disconnected from the coupler in accordance with procedures outlined in 5.01. The coupler must be connected to the telephone line. Proceed with the test as follows:

(1) Ensure that KS-20426-L1 transformer is connected to the coupler and plugged into power receptacle, or that customer-furnished power has been properly installed.

(2) Locate and remove any existing straps on level option straps A through E (Fig. 15).

Note: Cover must be removed to gain access to level option terminals.

(3) Connect 600-ohm resistor across terminals DT and DR. (If a transmission test set is used instead of the VOM, the test set provides the 600-ohm termination.)

(4) Connect strap between terminals DA, OH, and SH.

(5) Connect the hand test set across tip and ring of the telephone line and dial the milliwatt supply (1000 Hz) at the SCO.

Note: If a telephone set is associated with the coupler, remove the handset, ensure that the exclusion key is in talk position, and dial the milliwatt supply.

(6) When the tone is heard, short terminal A to A1 with a clip lead and remove the hand test set from the line (or restore the talk key to data mode on the associated telephone).

(7) Condition the VOM to measure approximately -5 dBm. Measure and record the level (in dBm) of the signal between the coupler DT and DR terminals with the VOM.

(8) Remove the clip lead from A to A1. (The SCO connection will terminate.)

Impedance Matching Test

5.10 This test follows the insertion loss test on either an installation or maintenance visit; therefore, the level option terminals should not be strapped for this test. Proceed with the test as follows:

(1) Set the oscillator for a 1000-Hz frequency and a 600-ohm output impedance.

(2) Select the proper scale on the VOM to measure -5 dBm.

(3) Connect the test equipment and straps as shown in Fig. 18.

(4) Adjust the oscillator output level to obtain a -5 dBm indication on the VOM.

Note: After the indication is obtained, do not change the frequency or level setting on the oscillator.

TABLE D

LEVEL OPTION TERMINALS FOR 1001F DATA COUPLER

INSERTION LOSS (INSERTION LOSS TEST) dB			MAXIMUM ALLOWABLE CUSTOMER LEVEL dBm	LIMITER OPTION TERMINALS — LEVEL MEASURED IN IMPEDANCE MATCHING TEST (dBm)			
LOOP LOSS	COUPLER LOSS	TOTAL OR MEASURED LOSS		0 TO −3.6	−3.7 TO −4.6	−4.7 TO −5.6	−5.7 OR BELOW
0 — 0.9	2	2 — 2.9	−10	AB, DE	AC, DE	AC, DE	AC, DE
1 — 1.9	2	3 — 3.9	−9	AC, DF	AB, DE	AC, DE	AC, DE
2 — 2.9	2	4 — 4.9	−8	AB, DF	AC, DF	AB, DE	AC, DE
3 — 3.9	2	5 — 5.9	−7	AC, DG	AB, DF	AC, DF	AB, DE
4 — 4.9	2	6 — 6.9	−6	AB, DG	AC, DG	AB, DF	AC, DF
5 — 5.9	2	7 — 7.9	−5	AC, DH	AB, DG	AC, DG	AB, DF
6 — 6.9	2	8 — 8.9	−4	AB, DH	AC, DH	AB, DG	AC, DG
7 — 7.9	2	9 — 9.9	−3	AC	AB, DH	AC, DH	AB, DG
8 — 8.9	2	10 — 10.9	−2	AB	AC	AB, DH	AC, DH

Example: Value obtained in insertion loss test = 6.4 dB.
Value obtained in impedance matching test = —4.2 dBm.
Place straps between A and C, and D and H.

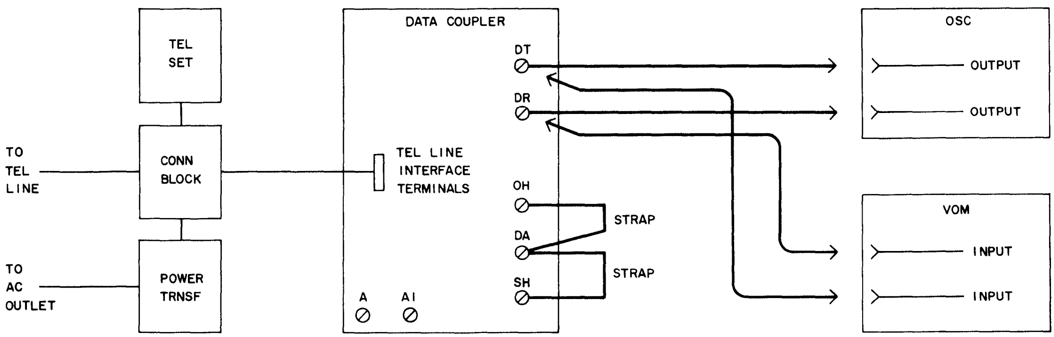


Fig. 18—Test Equipment Connections—Impedance Matching Test

(5) Connect the hand test set across tip and ring of the telephone line, and dial a quiet battery termination at the SCO.

Note: If a telephone set is associated with the coupler, remove the handset, ensure that the exclusion key is in talk position, and dial the quiet termination.

(6) After the connection is completed, short terminal A to A1 with a clip lead and remove the hand test set from the line (or operate the

data key to data mode on the associated telephone).

(7) Measure the signal level with the VOM. Use this value to derive the level option strapping from Table D.

(8) Remove the straps, disconnect test equipment, and restore the connection to normal. (The SCO connection will terminate.)

5.11 Using the values obtained in 5.09 and 5.10, apply straps in accordance with Table D. Mark the maximum input limit on the data coupler as determined in 5.09 (Fig. 1).

Remote Test

5.12 The remote test is required in measuring the test signal of the coupler at the SCO at time of installation. The test signal provides a check of the local loop and the limiting function of the coupler. Subsequent readings can then be compared with the original reading for indications of service degradation.

5.13 The data coupler must be connected to the telephone line for this test and the KS-20426-L1 transformer connected to the coupler and plugged into the ac receptacle. Proceed with the test as follows:

(1) Connect the hand test set across tip and ring of the telephone line and contact the LTD.

Note: If a telephone set is associated with the coupler, remove the handset, ensure that the exclusion (data) key is in the talk position, and establish a connection to the LTD.

(2) Request the LTD employee to call the coupler and measure the level of the test tone (2800 Hz) received at the LTD.

(3) Agree upon length of time required to perform the test and restore the connection to idle state (hang up).

(4) Operate TST switch to ON position (depress the red dot half of switch).

(5) After the agreed testing interval, operate TST switch to OFF position.

(6) Reestablish the connection to the LTD and request the level reading from the employee. This level indicates the loss of the loop and coupler at 2800 Hz. If the test is made at time of installation, the actual value of the loss ***must*** be recorded on the CLRC for comparison against measurements made in subsequent tests. If the level of the 2800-Hz signal on subsequent tests varies by more than 2 dB from the original value, it is an indication of possible trouble in either the loop or coupler.

(7) If the test tone must be measured at a remote test desk or DTC over facilities of unknown or varying loss, a successful receipt of the tone indicates there is ac continuity in the loop and coupler and that the coupler operates satisfactorily.

(8) Restore the telephone connection to normal.

Interface Voltage Test

5.14 The interface voltage test assures that the interface terminals of the coupler will respond to proper signals from the customer terminal or will indicate to the terminal when the coupler is conditioned for the various operational modes.

5.15 This test requires that the customer interface leads be disconnected from the coupler in accordance with procedures outlined in 5.01. The coupler must be connected to the telephone line and the KS-20426-L1 transformer connected to the coupler and plugged into the ac receptacle. Use the VOM meter to make the measurements during the test. Proceed as follows:

Note: When making measurements in the following steps, be careful to observe proper polarity with the meter.

(1) Connect a strap between terminals A and A1.

(2) Measure the voltage between terminals (+) SH (or MI) and (-) SG. The meter indicates between +5 and +12 Vdc.

(3) Remove strap from terminals A and A1.

(4) Measure the voltage between terminals (-) SH (or MI) and (+) SG. The meter should indicate between -5 and -12 Vdc.

(5) Originate a call to the coupler from another line or arrange to be called from the LTD. Observe that the voltage between terminals RI and SG follows the ringing cycle and swings between +8 and +12 (ON) and -8 and -12 (OFF) Vdc. The ON interval is approximately 2 seconds and the OFF interval approximately 4 seconds.

(6) Connect a strap between terminals OH and SH (or MI), and short terminal A to A1 with a strap.

(7) Measure the voltage between (-) RI and (+) SG. The meter indicates between -8 and -12 Vdc after ringing is tripped.

(8) Measure the voltage between terminals (-) CCT and (+) SG. The meter indicates between -8 and -12 Vdc. Leaving the meter on terminals CCT and SG and strap on terminals OH and SH (or MI), connect an additional strap between terminals DA and SH (or MI). After 2 seconds, observe that the voltage swings to between +8 and +12 Vdc.

(9) Connect the meter between terminals KA and KA1. The meter indicates continuity between terminals.

(10) Remove strap from between terminals A and A1. The meter indicates no continuity between terminals KA and KA1.

(11) Measure the voltage between (-) CCT and (+) SG. The meter indicates between -8 and -12 Vdc.

(12) Hang up the calling telephone and remove test equipment and test accessories from the coupler.

ACU Test

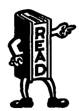
5.16 When an ACU is associated with the coupler, the ACU can be tested as described in the appropriate sections for the 801-type ACU (Sections 598-010-ZZZ and 598-012-ZZZ). Options required for the ACU are indicated in Fig. 12. This test requires that the customer interface leads be disconnected from the coupler in accordance with procedures outlined in 5.01. The coupler must be connected to the telephone line and KS-20426-L1 transformer connected to the coupler and plugged into the ac receptacle. Proceed with the test as follows:

(1) While testing the ACU, use the VOM to observe that the SH (or MI) lead turns ***on*** at the appropriate time by measuring the voltage between terminals (+) SH (or MI) and (-) SG. The meter indicates between +8 and +12 Vdc for the ***on*** condition.

(2) Disconnect test equipment and restore the connection to normal.

LCSI Test

5.17 This test should be used to verify proper operation of the LCSI. The test with option Z is performed without disconnecting the customer LCSI interface, while the test with option Y requires disconnecting the customer LCSI interface.



Take necessary precautions to ensure that the customer does not receive inadvertent signals.

Note: When making measurements in the following steps, be careful to observe proper polarity with the meter.

LCSI With Option Z (EIA Interface)

(1) Measure the voltage between terminals (-) SH (or MI) and (+) SG. The meter indicates between -8 and -12 Vdc (OFF).

(2) Operate TST key.

(3) Initiate a call to the coupler.

(4) Measure the voltage between terminals (+) SH (or MI) and (-) SG. The meter should indicate between +8 and +12 Vdc (ON).

(5) Restore TST key to normal.

LCSI With Option Y (Contact Closure)

(1) After disconnecting the customer leads from the separate connecting block, measure the resistance between the two terminals at the customer interface. The meter indicates an open circuit.

(2) Operate TST key.

(3) Initiate a call to the coupler.

(4) Measure the resistance between the two terminals on the separate connecting block. The meter indicates a short circuit.

(5) Restore TST key to normal and reconnect customer leads.

503C or 2503C Telephone Set Test

5.18 This test verifies that the telephone set mode indication and audible monitor features are operating properly. Requirements of this test are based on the logic sense which gives an ON (+) voltage when the telephone set is connected to the line. In all other cases, the mode indication will be OFF (-) voltage. This test can be performed without disconnecting the customer interface in which case necessary precautions should be taken to ensure that the customer does not receive inadvertent signals.

Note: When making the following measurements, be careful to observe proper polarity with the meter.

5.19 Lift telephone handset. Using the VOM, make voltage measurements between terminals MI (+) and SG (-) on the data coupler, in accordance with the options installed and Table E. Return handset to cradle.

Note: It is only necessary to make the one pair of readings corresponding to the options installed.

5.20 Initiate a call to the coupler. Lift handset to answer call. After a 3-second delay, a 2800-Hz tone is heard in handset.

TABLE E

MFT SET TEST WITH 1001F DATA COUPLER

INDICATOR	OPTIONS INSTALLED	VOLTMETER READING, DC — EXCLUSION KEY	
		UP	DOWN
Voice Mode	A, H, K	+8 to +12	−8 to −12
Data Mode	A, I, J	−8 to −12	+8 to +12
Switchhook	A, G, J	+8 to +12	+8 to +12
Voice Mode	B, I, K	−8 to −12	+8 to +12
Data Mode	B, H, K	+8 to +12	−8 to −12
Switchhook	B, G, J	+8 to +12	+8 to +12

Note: Switchhook operated for all readings.

6. REFERENCES

6.01 The following BSPs provide additional information that may be helpful in installing the data coupler:

SECTION	TITLE
010-250-001	Crediting Charges on Test Calls
010-521-100	Data Technical (DATEC) Support
010-521-101	Data Technical (DATEC) Support—Designee Directory
167-440-201	19- and 20-Type Power Units—Identification, Installation, Connections, and Maintenance
167-445-101	28A1-Type Power Unit—Identification, Installation, and Connections
167-452-101	33A Power Unit—Identification, Installation, and Connections
314-205-500	Data Systems—DATA-PHONE® Service and Data Access Arrangements on Direct Distance Dialing Network—Overall Data Transmission Test Requirements
314-205-501	Data Systems—DATA-PHONE® Service and Data Access Arrangements on Direct Distance Dialing Network—Test Requirements for Subscriber, Foreign Exchange, and Remote Exchange Lines
590-010-200	Data Sets and Data Access Arrangements—General Installation and Connection Information
660-101-312	Maintenance Service Charge on Services With Customer-Provided Equipment (CPE)

6.02 Detailed information on the 1001F data coupler is contained in the following schematic drawing (SD) and circuit description (CD):

SD-&CD-1D206-01 1001-Type Data Couplers.

Bell System