

COMPUTER SYSTEM

Pocket Reference

NOTE: Placement of New Device Sections or Revisions on Older Sections.

- New Device Sections should be placed in the Pocket Reference Book in their entirety.
- Revisions on Older Sections will replace the existing page in the Pocket Reference Book. Only the sides which have changes show a revision date.
- For additional copies and/or suggestions for improvement, contact the Training and Documentation Department.

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ACTIVITY CODE

ITEM

01 Basic Maintenance
 02 Preventive Maintenance
 03 Installation
 04 Removal
 05 Customer Relations
 06 Equipment Modifications
 07 Customer Training
 08 Carry Parts
 09 Other
 10 Customer Call Back
 11 Parts Call Back
 12 Scheduled Call Back
 13 Bench Maintenance
 14 Continued Repair

ACTION

00 None
 01 Replaced
 02 Repaired
 03 Re seated
 04 Mech. Adj. - Tighten
 05 Cleaned - lube
 06 Elec. Alignment
 07 Moved
 08 Order Parts
 09 Update
 10 Completed
 11 Assist
 12 Operator Error
 13 Trained
 14 No Trouble Found
 15 Vendor Service
 16 Tested
 17 Pre-site Inspection
 18 Incomplete
 19 Removed
 20 Configuration
 21 Inspection
 22 Wait
 23 Observe

00 None
 01 Power Supply
 02 Cable, I/O - DEV.
 03 Connector
 04 Controller, IOG
 05 P.C. Board
 06 Processor
 07 Memory
 08 Head, R/W
 09 Hammer, Print
 10 Motor, A-C Spin
 11 Solenoid
 12 Ribbon Mechanisms
 13 Belt
 14 Video Monitor
 15 Backplane
 16 Transducer/Magnetic Sensors
 17 Clutches
 18 System
 19 Device
 20 Electro-Mechanical
 21 Indicators/Lights
 22 Software
 23 Unknown
 24 Misc.
 25 Keyboards
 26 Data Media
 27 Wiring/Harness
 28 Head, Print
 29 Print Drum
 30 Motor, D.C.
 31 Motor, Stepper
 32 Motor(linear), Positioner
 33 Ribbon
 34 Light Sensors
 35 Jumper Board
 36 Fans
 37 Environment
 38 Spindle
 39 Switches
 40 Filters
 41 Platen
 42 Communication lines
 43 Strapping
 44 VFU
 45 Sheet Metal
 46 A.C. Power
 47 Tractor Assembly
 48 Punch Assembly
 49 Paper Stock
 50 Gears
 51 Latches
 52 Hubs, Rollers, Wheels
 53 Resistor
 54 Capacitor
 55 Diode

6841	ASYNC MODEM ELIMINAT	5280	IOU-04 A/B, A/C
6852	ASYNC-TO-SYNC CONVTR	5018	IOU-05, 5R
5311	BADGE READER	5308	IOU-06
2000	BPU-A/B/C	5708	IOU-09
5010	BULL PRINTER	4209	IOU-10
5006	CENT. 702 VIDEO PTR.	6300	IOU-11A
5003	CENT. PTR. W/IOU-39	6200	IOU-11A/B
5002	CENTRONIC 702 PTR.	6100	IOU-11A/C
5001	CENTRONICS 101 PTR	3080	IOU-13 A/B
5004	CENTRONICS PTR (210)	6001	IOU-15A/B SYNC.
5005	CENTRONICS PTR (QSP)	6101	IOU-15A/B ASYNC.
3201	CENTURY DISC 30M	6201	IOU-15A/C RCU MUX
3000	CENTURY DISC 7.6M	6301	IOU-15A/E AUDIO
2001	CPU A/B CPU AR/BR	5009	IOU-17
2002	CPU-AS/BS	5709	IOU-18
2004	CPU-Q29BR	5281	IOU-20A/B 25IPS
5300	D.P. CARD READER	5285	IOU-20A/B 45IPS
5213	DIGI 1600 (1400)	5282	IOU-21A/B 25IPS
5215	DIGI 1600 (2-3XX)	5286	IOU-21A/B 45IPS
5216	DIGI 1600 (2-3XX)S/A	6202	IOU-22
5214	DIGI 1600-CE (1400)	5029	IOU-23
5205	DIGI 800 (2-3XX)	3081	IOU-24 A/B, AR/C
5206	DIGI 800 (2-3XX) S/A	2901	IOU-25
5203	DIGI 800 BPI (1400)	5309	IOU-26
5204	DIGI 800-CE (1400)	5019	IOU-27
5011	DIGITRONIC PRINTER	4802	IOU-28 24/4800 BAUD
5041	DP 2230 PTR 64ch	4801	IOU-28 A/B, A/C
5042	DP 2230 PTR 96ch	5049	IOU-30
5046	DP 2230 VIDEO PTR-64	4381	IOU-31
5047	DP 2230 VIDEO PTR-96	3481	IOU-32A/B (DMA)
5051	DP 2260 PTR 64ch	3485	IOU-32A/B (NON-DMA)
5052	DP 2260 PTR 96ch	5069	IOU-37
5021	DP 2420 PTR 64ch	3381	IOU-38
5022	DP 2420 PTR 96ch	5180	IOU-39P
5031	DP 2440 PTR 64ch	4804	IOU-39Q
5032	DP 2440 PTR 96ch	4803	IOU-39T
6111	DTC COM ASYNC	6251	IOU-40
6011	DTC COM SYNC	3487	IOU-42 FOR MARKSMAN
2003	DTC CPU	3486	IOU-42 FOR MEMOREX
4081	DTC CRT CONTR.	3488	IOU-43
3382	DTC FLOPPY CONTR.	5212	KENNEDY TAPE 1600
4091	DTC KEYBOARD	5202	KENNEDY TAPE 800 BPI
2202	DTC MEM 48K	4832	LINE DRIVER
2204	DTC MEM, 64K	3021	MARKSMAN 10MB
4101	HAZELTINE CRT	3033	MARKSMAN 20M 1450S/A
4831	HUB UNIT	3031	MARKSMAN 20MB
4202	IBM SELECTRIC/IOU-1	3032	MARKSMAN 20MB S/A
4201	IBM SELECTRIC/IOU-10	3041	MARKSMAN 40MB
3001	IOMEC DISC 3+3	3042	MARKSMAN 40MB S/A
3101	IOMEC DISC 6+6	2100	MEM-2 OR CORE MEM
3102	IOMEC S/A 6+6	2101	MEM-3B 4K MODULE
4208	IOU-01A/B	2111	MEM-5AP MEMORY M/B
5409	IOU-02	2102	MEM-5B 8K MODULE
6000	IOU-03	2107	MEM6A MEMORY M/B

2108	MEM6B 32K MEMORY	1450	Q29 SYSTEM
3426	MEMOREX S/A 140M 3XX	1960	Q5 SYSTEM 4K
3401	MEMOREX S/A 25M	1961	Q5 SYSTEM 8K
3402	MEMOREX S/A 25M (42)	1972	Q6 SYSTEM 12K
3411	MEMOREX S/A 50M	1973	Q6 SYSTEM 16K
3425	MEMOREX S/A 70M 3XX	1976	Q6 SYSTEM 20K
3421	MEMOREX S/A 75M	1974	Q6 SYSTEM 24K
3422	MEMOREX S/A 75M (42)	1977	Q6 SYSTEM 28K
4441	NEC AUX PTR	1975	Q6 SYSTEM 32K
4431	NEC AUX PTR (QSP)	1970	Q6 SYSTEM 4K
4451	NEC AUX PTR(120/210)	1971	Q6 SYSTEM 8K
4446	NEC AUX PTR-BTMFEED	800	Q6.5 SYSTEM
4456	NEC PTR BTM-FED(210)	900	Q6.5 SYSTEM
4447	NEC PTR FRONT-FEED	950	Q6.5 SYSTEM
4436	NEC PTR-BTMFED (QSP)	960	Q6.5 SYSTEM
4421	NEC VIDEO PTR	965	Q6.5 SYSTEM
4426	NEC VIDEO PTR-BTMFED	1100	Q7 SYSTEM
5301	P.D.I. CARD READER	1200	Q7 SYSTEM
5211	PEC TAPE 1600-7.0"	1300	Q7.5 SYSTEM
5209	PEC TAPE 800-10.5"	1400	Q7.5 SYSTEM
5200	PEC TAPE 800-12.5IPS	4001	QCRT1
5201	PEC TAPE 800-7"25IPS	4011	QCRT2 (27 LINE)
3301	PERSCI 1.3 M/BYTE	4012	QCRT2 W/LINE DRIVERS
3311	PERSCI 2.6 M/BYTE	4013	QCTR2 2400/4800 BAUD
3303	PERSCI S/A 1.3M 1400	5131	QPTR 150CPS-13" W/39
3302	PERSCI S/A 1.3M 210	5133	QPTR 150CPS-13"(210)
3312	PERSCI S/A 2.6M 120	5132	QPTR 150CPS-13"(QSP)
3313	PERSCI S/A 2.6M 1400	5136	QPTR 150CPS-13"VIDEO
1954	POWER SUPPLY (6.5)	4835	QSP CABLE TERMINATOR
1950	POWER SUPPLY (PS-1)	4341	QUME AUX PTR
1951	POWER SUPPLY (PS-2)	4342	QUME AUX PTR(900SYS)
1952	POWER SUPPLY (PS-3)	4346	QUME AUX PTR-BTMFEED
1953	POWER SUPPLY (PS-4)	4921	QUME FORMS TRACTOR
1955	POWER SUPPLY 120/210	4922	QUME PINFEED PLAIN
2905	PROG. CONSOLE Q29A/B	4321	QUME VIDEO PTR
231	Q29 SYS/MARKS 10/20M	4326	QUME VIDEO PTR-BTMFD
331	Q29 SYS/MARKS 20M	4301	QUME W/KEYBD
232	Q29 SYS/MARKS 40M	4302	QUME W/KEYBD (800)
332	Q29 SYS/MARKS 40M	4306	QUME W/KEYBD-BTMFEED
246	Q29 SYS/MEMX 140M	4805	REMOTE DEV. INTERFACE
346	Q29 SYS/MEMX 140M	5400	ROYTRON PAPER TAPE
245	Q29 SYS/MEMX 70M	120	SINGLE USER / 2.6MB
345	Q29 SYS/MEMX 70M	210	SINGLE USER SYS. 48K
253	Q29 SYS/STC 200MB	9998	SOFTWARE
353	Q29 SYS/STC 200MB	3452	STC 200MB-2ND DISC
251	Q29 SYS/STC 40MB	3432	STC 40MB-2ND DISC
351	Q29 SYS/STC 40MB	3442	STC 90MB-2ND DISC
252	Q29 SYS/STC 90MB	3451	STC S/A 200MB
352	Q29 SYS/STC 90MB	3453	STC S/A 200MB(1400)
218	Q29 SYS/W-D 3+3M	3431	STC S/A 40MB
220	Q29 SYS/W-D 6+6M	3441	STC S/A 90MB
320	Q29 SYS/W-D 6+6M	3443	STC S/A 90MB (1400)
970	Q29 SYSTEM	9999	SYSTEM
975	Q29 SYSTEM	2902	TCU CONSOLE (Q-5)

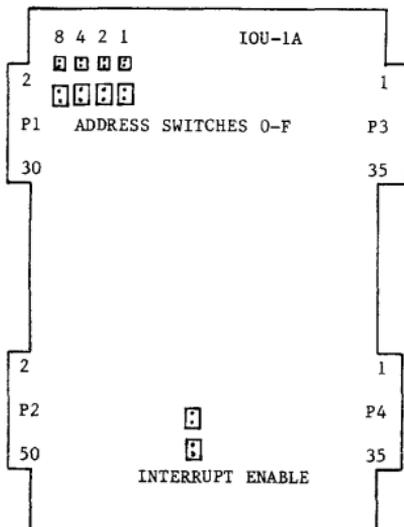
6804 TEK-COM MODEM (202T)
5065 TELETYPE PTR (1450)
5066 TELETYPE PTR (2-3XX)
5061 TELETYPE PTR 64ch-37
5062 TELETYPE PTR 96ch-37
5063 TELETYPE PTR-64(210)
5064 TELETYPE PTR-96(210)
5701 TEN KEY DEVICE-BUFF
5700 TEN KEY DEVICE-UNBUF
2904 TPA
2903 TPU CONSOLE
5067 TTY PTR (QSP/1400)
5068 TTY PTR (QSP/2-3XX)
6801 VADIC 1205G W/REV.
6802 VADIC 1230K WO/REV
6803 VADIC 34XX DIAL-UP
4026 VT2
4082 VT2 ON 120/210 SYS
4031 VT3 Terminal
3011 W-D DISC 3+3
3111 W-D DISC 6+6
3010 W-D DISC 3+3 2XX/3XX
3110 W-D DISC 6+6 2XX/3XX
3114 W-D S/A 6+6 2XX/3XX
3113 W-D S/A 6+6 (1400)
3112 W-D S/A 6+6 (900)
3112 W-D S/A 6+6 (900)

120	SINGLE USER / 2.6MB	2102	MEM-5B 8K MODULE
210	SINGLE USER SYS. 48K	2107	MEM6A MEMORY M/B
218	Q29 SYS/W-D 3+3M	2108	MEM6B 32K MEMORY
220	Q29 SYS/W-D 6+6M	2111	MEM-5AP MEMORY M/B
231	Q29 SYS/MARKS 10/20M	2202	DTC MEM 48K
232	Q29 SYS/MARKS 40M	2204	DTC MEM, 64K
245	Q29 SYS/MEMX 70M	2901	IOU-25
246	Q29 SYS/MEMX 140M	2902	TCU CONSOLE (Q-5)
251	Q29 SYS/STC 40MB	2903	TPU CONSOLE
252	Q29 SYS/STC 90MB	2904	TPA
253	Q29 SYS/STC 200MB	2905	PROG. CONSOLE Q29A/B
320	Q29 SYS/W-D 6+6M	3000	CENTURY DISC 7.6M
331	Q29 SYS/MARKS 20M	3001	IOMEC DISC 3+3
332	Q29 SYS/MARKS 40M	3010	W-D DISC 3+3 2XX/3XX
345	Q29 SYS/MEMX 70M	3011	W-D DISC 3+3
346	Q29 SYS/MEMX 140M	3021	MARKSMAN 10MB
351	Q29 SYS/STC 40MB	3031	MARKSMAN 20MB
352	Q29 SYS/STC 90MB	3032	MARKSMAN 20MB S/A
353	Q29 SYS/STC 200MB	3033	MARKSMAN 20M 1450S/A
800	Q6.5 SYSTEM	3041	MARKSMAN 40MB
900	Q6.5 SYSTEM	3042	MARKSMAN 40MB S/A
950	Q6.5 SYSTEM	3080	IOU-13 A/B
960	Q6.5 SYSTEM	3081	IOU-24 A/B, AR/C
965	Q6.5 SYSTEM	3101	IOMEC DISC 6+6
970	Q29 SYSTEM	3102	IOMEC S/A 6+6
975	Q29 SYSTEM	3110	W-D DISC 6+6 2XX/3XX
1100	Q7 SYSTEM	3111	W-D DISC 6+6
1200	Q7 SYSTEM	3112	W-D S/A 6+6 (900)
1300	Q7.5 SYSTEM	3113	W-D S/A 6+6 (1400)
1400	Q7.5 SYSTEM	3114	W-D S/A 6+6 2XX/3XX
1450	Q29 SYSTEM	3201	CENTURY DISC 30M
1950	POWER SUPPLY (PS-1)	3301	PERSCI 1.3 M/BYTE
1951	POWER SUPPLY (PS-2)	3302	PERSCI S/A 1.3M 210
1952	POWER SUPPLY (PS-3)	3303	PERSCI S/A 1.3M 1400
1953	POWER SUPPLY (PS-4)	3311	PERSCI 2.6 M/BYTE
1954	POWER SUPPLY (6.5)	3312	PERSCI S/A 2.6M 120
1955	POWER SUPPLY 120/210	3313	PERSCI S/A 2.6M 1400
1960	Q5 SYSTEM 4K	3381	IOU-38
1961	Q5 SYSTEM 8K	3382	DTC FLOPPY CONTR.
1970	Q6 SYSTEM 4K	3401	MEMOREX S/A 25M
1971	Q6 SYSTEM 8K	3402	MEMOREX S/A 25M (42)
1972	Q6 SYSTEM 12K	3411	MEMOREX S/A 50M
1973	Q6 SYSTEM 16K	3421	MEMOREX S/A 75M
1974	Q6 SYSTEM 24K	3422	MEMOREX S/A 75M (42)
1975	Q6 SYSTEM 32K	3425	MEMOREX S/A 70M 3XX
1976	Q6 SYSTEM 20K	3426	MEMOREX S/A 140M 3XX
1977	Q6 SYSTEM 28K	3431	STC S/A 40MB
2000	BPU-A/B/C	3432	STC 40MB-2ND DISC
2001	CPU A/B CPU AR/BR	3441	STC S/A 90MB
2002	CPU-AS/BS	3442	STC 90MB-2ND DISC
2003	DTC CPU	3443	STC S/A 90MB (1400)
2004	CPU-Q29BR	3451	STC S/A 200MB
2100	MEM-2 OR CORE MEM	3452	STC 200MB-2ND DISC
2101	MEM-3B 4K MODULE	3453	STC S/A 200MB(1400)

3481	IOU-32A/B (DMA)	5010	BULL PRINTER
3485	IOU-32A/B (NON-DMA)	5011	DIGITRONIC PRINTER
3486	IOU-42 FOR MEMOREX	5018	IOU-05, 5R
3487	IOU-42 FOR MARKSMAN	5019	IOU-27
3488	IOU-43	5021	DP 2420 PTR 64ch
4001	QCRT1	5022	DP 2420 PTR 96ch
4011	QCRT2 (27 LINE)	5029	IOU-23
4012	QCRT2 W/LINE DRIVERS	5031	DP 2440 PTR 64ch
4013	QCTR2 2400/4800 BAUD	5032	DP 2440 PTR 96ch
4026	VT2	5041	DP 2230 PTR 64ch
4031	VT3 Terminal	5042	DP 2230 PTR 96ch
4081	DTC CRT CONTR.	5046	DP 2230 VIDEO PTR-64
4082	VT2 ON 120/210 SYS	5047	DP 2230 VIDEO PTR-96
4091	DTC KEYBOARD	5049	IOU-30
4101	HAZELTINE CRT	5051	DP 2260 PTR 64ch
4201	IBM SELECTRIC/IOU-10	5052	DP 2260 PTR 96ch
4202	IBM SELECTRIC/IOU-1	5061	TELETYPE PTR 64ch-37
4208	IOU-01A/B	5062	TELETYPE PTR 96ch-37
4209	IOU-10	5063	TELETYPE PTR-64(210)
4301	QUME W/KEYBD	5064	TELETYPE PTR-96(210)
4302	QUME W/KEYBD (800)	5065	TELETYPE PTR (1450)
4306	QUME W/KEYBD-BTMFEED	5066	TELETYPE PTR (2-3XX)
4321	QUME VIDEO PTR	5067	TTY PTR (QSP/1400)
4326	QUME VIDEO PTR-BTMFD	5068	TTY PTR (QSP/2-3XX)
4341	QUME AUX PTR	5069	IOU-37
4342	QUME AUX PTR(900SYS)	5131	QPTR 150CPS-13" W/39
4346	QUME AUX PTR-BTMFEED	5132	QPTR 150CPS-13"(QSP)
4381	IOU-31	5133	QPTR 150CPS-13"(210)
4421	NEC VIDEO PTR	5136	QPTR 150CPS-13"VIDEO
4426	NEC VIDEO PTR-BTMFD	5180	IOU-39F
4431	NEC AUX PTR (QSP)	5200	PEC TAPE 800-12.5IPS
4436	NEC PTR-BTMFD (QSP)	5201	PEC TAPE 800-7"25IPS
4441	NEC AUX PTR	5202	KENNEDY TAPE 800 BPI
4446	NEC AUX PTR-BTMFEED	5203	DIGI 800 BPI (1400)
4447	NEC PTR FRONT-FEED	5204	DIGI 800-CE (1400)
4451	NEC AUX PTR(120/210)	5205	DIGI 800 (2-3XX)
4456	NEC PTR BTM-FED(210)	5206	DIGI 800 (2-3XX) S/A
4801	IOU-28 A/B, A/C	5209	PEC TAPE 800-10.5"
4802	IOU-28 24/4800 BAUD	5211	PEC TAPE 1600-7.0"
4803	IOU-39T	5212	KENNEDY TAPE 1600
4804	IOU-39Q	5213	DIGI 1600 (1400)
4805	REMOTE DEV. INTERFACE	5214	DIGI 1600-CE (1400)
4831	HUB UNIT	5215	DIGI 1600 (2-3XX)
4832	LINE DRIVER	5216	DIGI 1600 (2-3XX)S/A
4835	QSP CABLE TERMINATOR	5280	IOU-04 A/B, A/C
4921	QUME FORMS TRACTOR	5281	IOU-20A/B 25IPS
4922	QUME PINFEED PLAIN	5282	IOU-21A/B 25IPS
5001	CENTRONICS 101 PTR	5285	IOU-20A/B 45IPS
5002	CENTRONIC 702 PTR.	5286	IOU-21A/B 45IPS
5003	CENT. PTR. W/IOU-39	5300	D.P. CARD READER
5004	CENTRONICS PTR (210)	5301	P.D.I. CARD READER
5005	CENTRONICS PTR (QSP)	5308	IOU-06
5006	CENT. 702 VIDEO PTR.	5309	IOU-26
5009	IOU-17	5311	BADGE READER

5400 ROYTRON PAPER TAPE
5409 IOU-02
5700 TEN KEY DEVICE-UNBUF
5701 TEN KEY DEVICE-BUFF
5708 IOU-09
5709 IOU-18
6000 IOU-03
6001 IOU-15A/B SYNC.
6011 DTC COM SYNC
6100 IOU-11A/C
6101 IOU-15A/B ASYNC.
6111 DTC COM ASYNC
6200 IOU-11A/B
6201 IOU-15A/C RCU MIX
6202 IOU-22
6251 IOU-40
6300 IOU-11A
6301 IOU-15A/E AUDIO
6801 VADIC 1205G W/REV.
6802 VADIC 1230K WO/REV
6803 VADIC 34XX DIAL-UP
6804 TEK-COM MODEM (202T)
6841 ASYNC MODEM ELIMINAT
6852 ASYNC-TO-SYNC CONVTR
9998 SOFTWARE
9999 SYSTEM

IOU-1A/B
IBM SELECTRIC
QANTEL MODEL 4208



MAX. PWR. REQUIREMENTS

+5V 1.61A
+12V .34A
-12V .54A
+26V .92A

ELECTRIC POWER

115 VAC 60 HZ.
1.5A FOR .05 SEC.
0.7A NORMAL

PRINTER HEAT GEN.

300 BTU/HR.

WRITE CONTROL INSTRUCTIONS

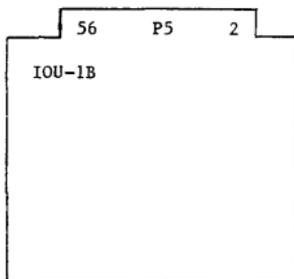
1XYY9D X = DEVICE ADDRESS
YY = CONTROL BYTE

CONTROL BYTE	FUNCTION
00	NULL
01	SIG 1 OFF
02	SIG 2 OFF
03	SIGS 1 & 2 OFF
05	SIG 1 ON
06	SIG 2 ON
07	SIGS 1 & 2 ON
09	SET TEST

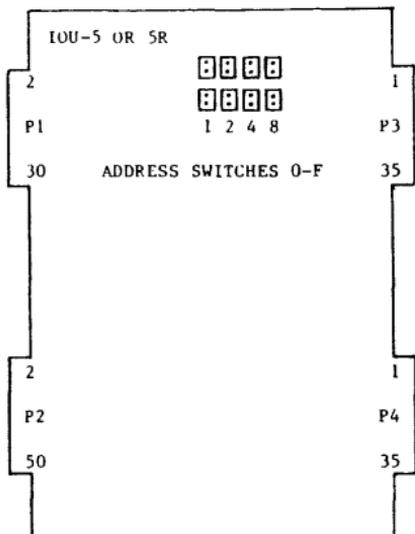
STATUS IN INSTRUCTIONS

4XYY9D X = DEVICE ADDRESS
YY = STATUS BYTE

STATUS BYTE	MEANING
01	READ BUSY
02	WRITE BUSY
04	END
08	SERVICE REQUEST
10	FLAG 1/INTERRUPT
20	FLAG 2
40	FLAG 3
80	ERROR



IOU-5 OR 5R
 BULL
 QANTEL MODEL 5018



MAX. PWR. REQUIREMENTS

-12V = .13A
 +12V = .13A
 +5V = .30A
 +26V = .03A

PRINTER POWER

115 VAC 60 HZ.
 12.5A FOR 1.2 SEC.
 4.0A NORMAL

PRINTER HEAT GEN.

550 BTU/HR.

WRITE CONTROL INSTRUCTIONS

1XY9D X = DEVICE ADDRESS YY = CONTROL BYTE

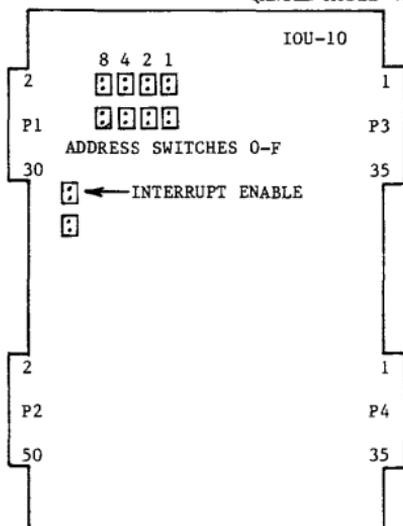
CONTROL BYTE	FUNCTION
30	GO TO CHANNEL 0
31	GO TO CHANNEL 1
32	GO TO CHANNEL 2
33	GO TO CHANNEL 3
34	GO TO CHANNEL 4
35	GO TO END OF FORM
36	GO TO TOP OF FORM
37	ADVANCE ONE LINE

STATUS IN INSTRUCTIONS

4XY9D X = DEVICE ADDRESS YY = STATUS BYTE

STATUS BYTE	MEANING
01	N/A
02	WRITE BUSY
04	END
08	SERVICE REQUEST
10	N/A
20	N/A
40	END OF FORM
80	INOPERABLE

IOU-10
SELECTRIC
QANTEL MODEL 4209



MAX. PWR. REQUIREMENTS

-12V = .19A
+12V = .18A
+5V = 1.35A
+26V = .92A

SELECTRIC POWER

115 VAC 60 HZ.
1.5A FOR .05 SEC.
0.7A NORMAL

SELECTRIC HEAT GEN.

300 BTU/HR.

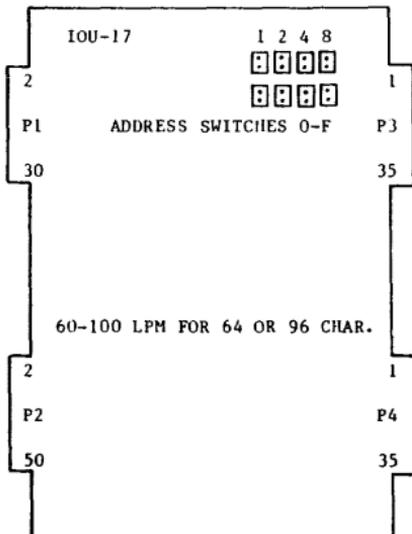
WRITE CONTROL INSTRUCTIONS

1XYY9D CONTROL BYTE	X = DEVICE ADDRESS FUNCTION	YY = CONTROL BYTE
01	RESET SIGNAL 1	
02	RESET SIGNAL 2	
03	RESET SIGNAL 1 AND 2	
05	SET SIGNAL 1	
06	SET SIGNAL 2	
07	SET SIGNAL 1 AND 2	
08	FILL BUFFER ONLY/READ CORR.	
0D	READ ASCII/PRINT CONT.	
0E	PRINT AND COLLECT ECHO	
10	RESET ALLOW TERMINATION INTERRUPT	
14	SET ALLOW TERMINATION INTERRUPT	

STATUS IN INSTRUCTIONS

4XYY9D STATUS BYTE	X = DEVICE ADDRESS MEANING	YY = STATUS BYTE
01	READ BUSY	
02	WRITE BUSY	
04	END	
08	SERVICE REQUEST	
10	FLAG 1/INTERRUPT	
20	FLAG 2	
40	FLAG 3	
80	INOPERABLE	

IOU-17
CENTRONICS PRINTERS
QANTEL MODEL 5009



MAX. PWR. REQUIREMENTS

+5V .32A
-12V .44A

PRINTER POWER

115 VAC 60 HZ.
2.8A MAX. FOR .1 SEC.
1.5A NORMAL

I/O CABLE LENGTH

15 FT. ONLY

PRINTER HEAT GEN.

650 BTU/HR.

WRITE CONTROL INSTRUCTIONS

IXYY9D X - DEVICE ADDRESS YY - CONTROL BYTE

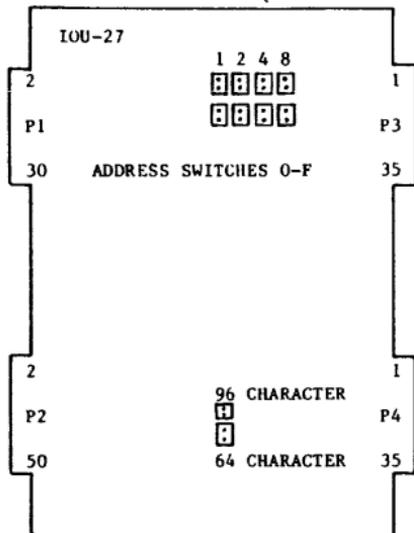
CONTROL BYTE	FUNCTION
01	VERTICAL TAB
06	FORM FEED
07	LINE FEED
0E	EXPAND PRINT - USE 50E IN DATA STREAM INSTEAD
20	RESET ALLOW TERMINATION INTERRUPT
60	SET ALLOW TERMINATION INTERRUPT

STATUS IN INSTRUCTIONS

4XYY9D X - DEVICE ADDRESS YY - STATUS BYTE

STATUS BYTE	MEANING
00	N/A
02	WRITE BUSY
04	END
08	SERVICE REQUEST
10	N/A
20	N/A
40	N/A
80	INOPERABLE

IOU-27
DIGITRONICS
QANTEL MODEL 5019



MAX. FWR. REQUIREMENTS

+5V = .53A

PRINTER POWER

115 VAC 60 HZ.
4.5A FOR .6 SEC.
2.3A NORMAL

PRINTER HEAT GEN.

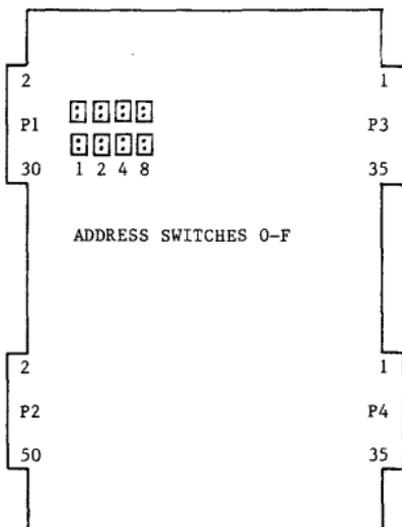
1000 BTU/HR.

WRITE CONTROL INSTRUCTIONS

IXYY9D	X - DEVICE ADDRESS	YY - CONTROL BYTE
CONTROL	FUNCTION	
BYTE		
00	SKIP TO CHANNEL 8 - INTERFACE TOF	
01	SKIP TO CHANNEL 1 - PRINTER TOF	
02	SKIP TO CHANNEL 2	
03	SKIP TO CHANNEL 3	
04	SKIP TO CHANNEL 4	
05	SKIP TO CHANNEL 5	
06	SKIP TO CHANNEL 6	
07	SKIP TO CHANNEL 7	
11	LINE FEED	
12	LINE FEED 2 LINES	
20	RESET ALLOW TERMINATION INTERRUPT	
60	SET ALLOW TERMINATION INTERRUPT	

STATUS IN INSTRUCTIONS

4XYY9D	X - DEVICE ADDRESS	YY - STATUS BYTE
STATUS	MEANING	
BYTE		
01	ALWAYS ZERO	
02	BUSY - WRITE, PRINTER, PAPER ADVANCE	
04	END	
08	SERVICE REQUEST	
10	INTERRUPT	
20	ALWAYS ZERO	
40	ALWAYS ONE	
80	INOPERABLE	



MAX. PWR. REQUIREMENTS

+5V = .59A

WRITE CONTROL INSTRUCTIONS

1XYY9D X = DEVICE ADDRESS YY = CONTROL BYTE

CONTROL BYTE	FUNCTION
0N	SLEW TO CHANNEL N (N = 0-3)
1N	SLEW N LINES (N = 0-3)
20	RESET ALLOW TERMINATION INTERRUPT
30	SUPPRESS LINE FEED
60	SET ALLOW TERMINATION INTERRUPT

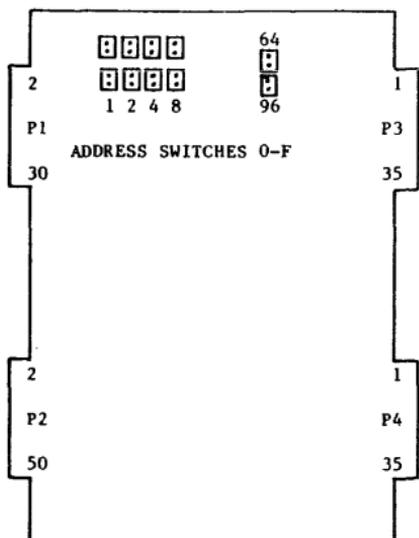
STATUS IN INSTRUCTIONS

4XYY9D X = DEVICE ADDRESS YY = STATUS BYTE

STATUS BYTE	MEANING
01	N/A
02	WRITE BUSY
04	END
08	SERVICE REQUEST
10	INTERRUPT
20	N/A
40	N/A
80	INOOPERABLE

Rev L for Q264

IOU-30
DATA PRODUCTS 2230/2260
QANTEL MODEL 5049



MAX. PWR. REQUIREMENTS

+5V = .71A

PRINTER POWER

115 VAC 60 HZ.
9.0A FOR 2.0 SEC.
4.6A NORMAL.

PRINTER HEAT GEN.

1840 BTU/HR.

STATUS IN INSTRUCTIONS

4XYY9D X=DEV. ADDRESS
YY=STATUS BYTE

STATUS MEANING

BYTE	MEANING
01	ALWAYS ZERO
02	WRITE BUSY
04	END
08	SERVICE REQUEST
10	INTERRUPT
20	VFU LD. REQUEST
40	ALWAYS ONE
80	INOPERABLE

WRITE CONTROL INSTRUCTIONS

IXYY9D X= DEVICE ADDRESS YY= CONTROL BYTE

CONTROL BYTE	FUNCTION
00	SLEW TO CHANNEL 0 (TOP OF FORM)
01	SLEW TO CHANNEL 1
02	SLEW TO CHANNEL 2
03	SLEW TO CHANNEL 3
04	SLEW TO CHANNEL 4
05	SLEW TO CHANNEL 5
06	SLEW TO CHANNEL 6
07	SLEW TO CHANNEL 7
08	SLEW TO CHANNEL 8
09	SLEW TO CHANNEL 9
0A	SLEW TO CHANNEL 10
0B	SLEW TO CHANNEL 11 (BOTTOM OF FORM)
0X	SLEW TO LINE X
1X	SLEW X LINES
20	RESET ALLOW TERMINATION INTERRUPT
60	SET ALLOW TERMINATION INTERRUPT
EE	START DAVFU MEMORY LOAD
EF	STOP DAVFU MEMORY LOAD

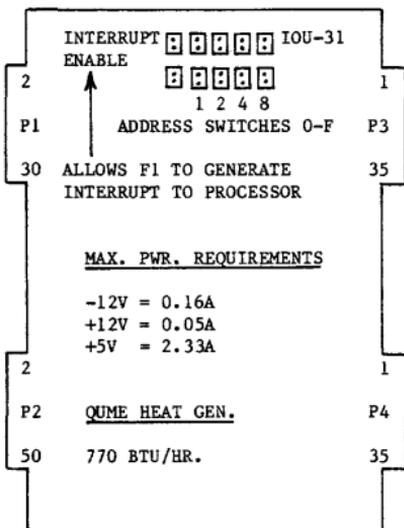
E4 - VFU not loaded

1-8

Revised 11/77

1dEE9D 008FF3 0100Bd 1dEF9D } To Fake out the VFU

IOU-31
QUME
QANTEL MODEL 4381



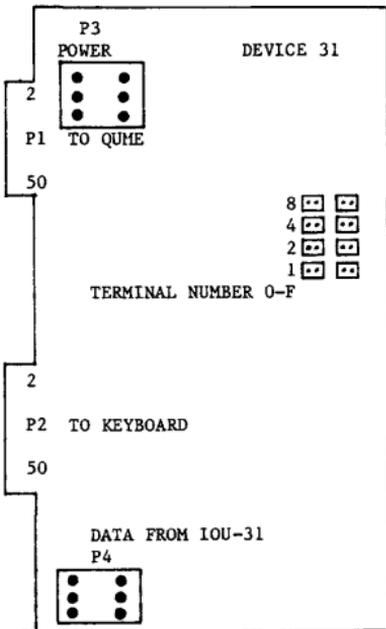
STATUS IN INSTRUCTIONS

4XYY9D X=DEV. ADDRESS
YY=STATUS BYTE

STATUS BYTE	MEANING
01	READ BUSY
02	WRITE BUSY
04	END
08	SERV. REQUEST
10	FLAG 1 (INT.)
20	FLAG 2
40	FLAG 3
80	INOPERABLE

PRINTER POWER

115 VAC 60 HZ.
4.0A FOR .1 SEC.
1.93A NORMAL



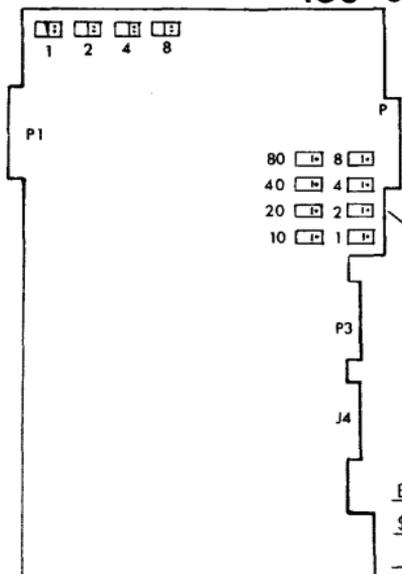
WRITE CONTROL INSTRUCTIONS

1XYY9D X = DEVICE ADDRESS
YY = CONTROL BYTE

CONTROL BYTE	FUNCTION
01	RESET SIG. 1
02	RESET SIG. 2
03	RESET SIG. 1 & 2
04	SET BLIND ENTRY
05	SET SIG. 1
06	SET SIG. 2
07	SET SIG. 1 & 2
09	SET BLACK RIBBON
0A	RESET ATI (WRITE)
0B	SET 8 LINES/INCH
0C	SET KANA MODE
0D	SET RED RIBBON
0E	SET ATI (WRITE)
0F	SET 6 LINES/INCH
10	RESET ATI (READ)
12	SET 10CH./INCH
13	LOAD TAB REGISTER
14	SET ATI (READ)
15	SET DUAL FRAME
B2	SET 12CH./INCH
D2	SET 8 CH./INCH

Revised 11/77

IOU-39 P



TYPICAL POWER REQUIREMENTS

-12V = .100A
 +12V = .150A
 +5V = 1.5A

CONFIGURATION SWITCHES:

Set for Printer Type and Baud Rate per the following Bit Values.

BAUD RATE

BIT VALUES		RATE
\$ 10	\$ 08	
0	0	300 BPS
0	1	1200 BPS
1	0	2400 BPS
1	1	9600 BPS

BIT VALUES

PRINTER TYPE

\$ 80	\$ 40	\$ 20	
0	0	0	NONE
0	0	1	CENTRONICS (Reverse Channel Mode)
0	1	0	CENTRONICS (REV-3; using ETX / ACK)
0	1	1	TELETYPE 40
1	0	0	NEC SPINWRITER
1	0	1	NONE
1	1	0	QANTEL 51XX
1	1	1	NONE

MODEM REMOTE/LOCAL

BIT VALUES

\$04

0	Direct to printer or line driver
1	Connected to Modem

BIT VALUES \$02, \$01 equal DON'T CARE Values. SET TO 0

IOU39-P

WRITE CONTROL INSTRUCTIONS

1ddy9D d=Device Address yy=Control Byte

Write Control Byte	IOU39P	CENTRONICS	TELETYPE	NEC	51xx	FUNCTION
\$00	X					Reset Interrupt
10	X					Reset Allow Termination Interrupt
14	X					Set Allow Termination Interrupt
18	X					Soft IPL
60	X					Diagnostic Write
73	X					Dump Trace Buffer
30		X	X	X	X	Line Suppress
06		X	X	X	X	Top of Form
07		X	X	X	X	Line Feed
0F				X		Set 6 LPI
0B				X		Set 8 LPI
52				X		Set 8 CPI
12				X		Set 10 CPI
32				X		Set 12 CPI
0D				X		Select Red Ribbon
09				X		Select Black Ribbon

IOU 39P

STATUS IN INSTRUCTIONS

4dyy9D d=Device Address yy=Test Bit Value

<u>STATUS BYTE</u>	<u>FUNCTION</u>
--------------------	-----------------

\$ 80	———— Inoperable
40	———— Always 0
20	———— Always 0
10	———— Termination
08	———— Service Request
04	———— End
02	———— Write Busy
01	———— Read Busy

READ STATUS 2

xdyy86 d = DEVICE ADDRESS x = DON'T CARE yy = TEST BIT VALUE

\$A1 - Indicates IOU-39 is in Printer Mode of operation.

SPECIAL CONTROLLED WRITE

NOTE: Teletype 40 will interface with IOU-39P only through a Device 39. (Dev 39 receives its power through the Teletype 40.)

RDI/NPC
REMOTE DEVICE INTERFACE/NETWORK PRINTER CONTROLLER

The Remote Device Interface (R.D.I.) is a single card Z-86 controlled asynchronous communication protocol converter. It's primary function is to allow a Standard RS-232 printer to be linked to the IOU 39Q daisy chain along with Video Terminals.

Note: Use of this device requires the following considerations:

- 1) Configuration switches of the IOU-39Q network master (See VT-3 Section pg. 4-25.)
- 2) Operating System configuration as determined by CFG
- 3) Cables must conform to proper installation procedures (See VT-3 Section pg. 4-27.)

Service LED 5 conditions:

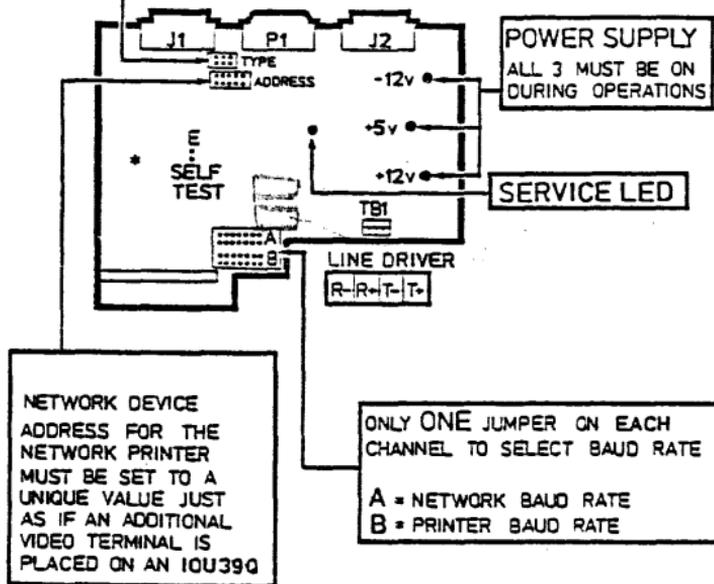
	PRINTER	QSP NETWORK
1) Dark	OK	NOT POLLING
2) Bright	Inoperative	NOT POLLING
3) Mostly Dark	OK	OK
4) Mostly Bright	Inoperative	OK

- 5) Flashing at Approximately 1 sec: RDI/NPC FAILURE:
 - a) BAD FIRMWARE
 - b) FIRMWARE/HARDWARE INCOMPATIBLE
 - c) ILLEGAL NETWORK ADDRESS
 - d) UNDEFINED PRINTER TYPE

device RDI / NPC

REMOTE DEVICE INTERFACE used as
NETWORK PRINTER CONTROLLER

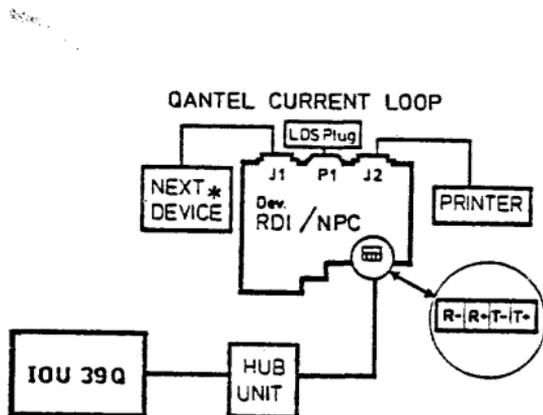
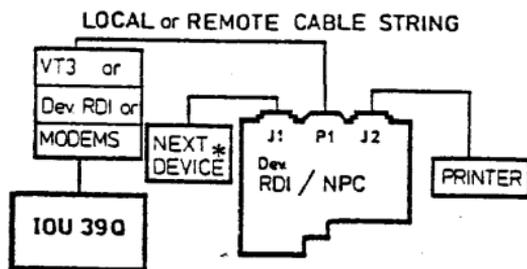
IDENTIFICATION of TYPE of ATTACHED PRINTER			
BIT VALUES	PRINTER TYPE		
\$80	\$40	\$20	
0	0	0	NONE
0	0	1	CENTRONICS (REVERSE CHANNEL MODE)
0	1	0	CENTRONICS (REV-3, USING ETX ACK)
0	1	1	TELETYPE 48
1	0	0	NEC SPINWRITER <i>HP, Dablo</i>
1	0	1	NONE
1	1	0	SIXX
1	1	1	NONE



FOR ALL JUMPERS (1=ON = JUMPER INSTALLED
0=OFF = NO JUMPER PRESENT

* Self Test: Installed - Normal operation
Removed - Printer will print short test pattern at the time of R.D.I. power on. Do not leave in this position!

RDI/NPC



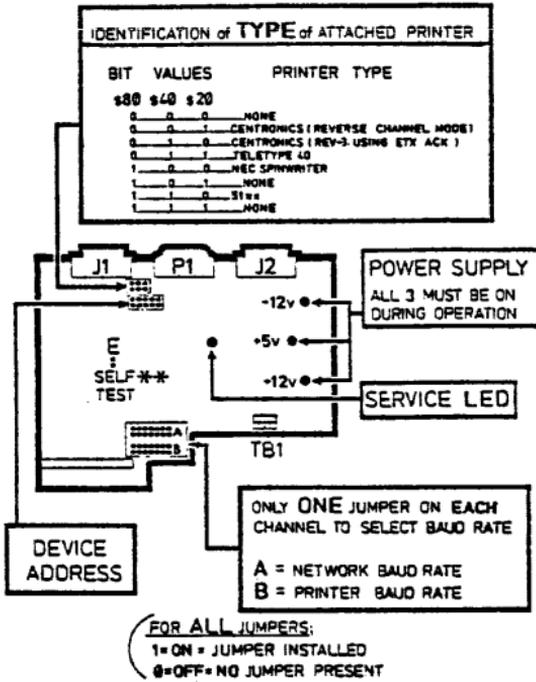
*NEXT DEVICE MAY BE: VT3 or / Device RDI or / QSP Terminator

NOTE: LDS Plug is REQUIRED in CURRENT LOOP CONFIGURATIONS

LINE DRIVER SELECT (LDS) PLUG
PART NUMBER M43021-001

QSP TERMINATOR
PART NUMBER M42540-001

RDI/NPC



****SELF TEST:** PLEASE REFER TO page 1-9E

TO DUMP TRACE BUFFER:

```
(IPL) 0020A7 Q0020 (CR)
      1d309D 0013f20040Bd 1d119D 0020A8
Q0040 (CR)
      02nn00000000000000000000000000 01E9F3
      (28 "0"s)
```

QUME

ELECTRICAL ALIGNMENT

Electrical alignment must be performed when the Qume is installed, or when either board 2 or board 3 are changed. The first portion of the electrical alignment given below is for introducing new boards. If the machine has been running, and the purpose is verification or fine adjustment, the steps that are flagged by an asterisk (*) can be skipped. It is good procedure to check all of the electrical adjustments even if only one board is replaced. All adjustments require an oscilloscope, and the printer must be on line to the computer.

NOTE

Disable switches were replaced by test points on some boards. Where a function is to be disabled, short the test points together.

WARNING

The procedure listed below requires the carrier to move rapidly under full power, and with the cover removed. Keep hands and tools away from the carrier movement area except where specifically directed otherwise.

- Remove the printer top cover if it is not already removed.
- Bypass the interlock switch connection, so the printer will run with the covers off.

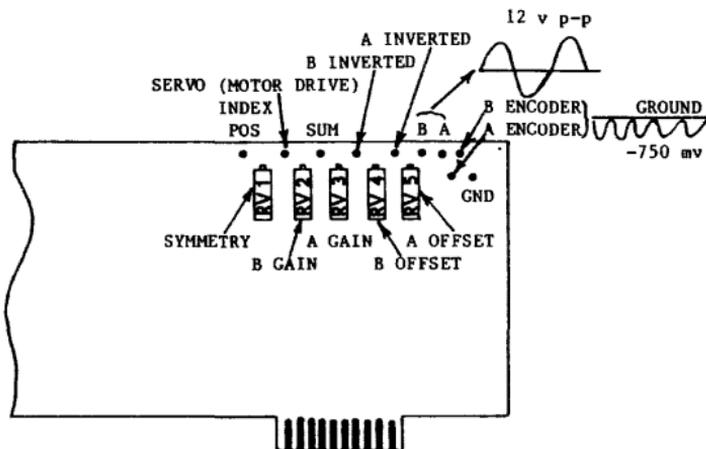


INTERLOCK
BYPASS
(SIDE PLUG)

- Place the carrier disable switch on BD.#1 in the OFF position.
- Place the printwheel disable switch on BD.#1 in the OFF position.
- Place the hammer disable switch on BD.#3 in the OFF position.
- Apply power to the printer.
- Set the oscilloscope as follows:
 - VERT: 2v/cm (calibrated)
 - HORIZ: 10ms/cm (may be changed for best display)
 - TRIGGER: Automatic, Internal, Positive
- Vertically center the oscilloscope trace so that zero volts, or ground, is on the center gradicule line.
- Connect an oscilloscope probe to TP 3 on Board 2.
- Manually move the carrier, and observe the oscilloscope pattern. A sine wave should be displayed that is +6v to -6v (12 volts peak-to-peak and centered about ground - Gain and Offset)

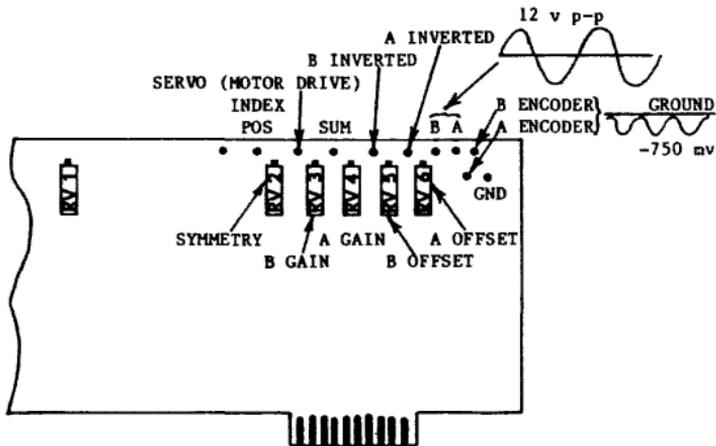
QUME

- Adjust RV5 to center any offset, and RV3 for overall signal amplitude. See the illustration below for adjustment locations.



CARRIAGE SERVO (PCB #2)

- Move the oscilloscope probe to TP 4 on Board 2.
- Adjust RV 4 and RV 2 for offset and gain as in the steps above.



PRINTWHEEL SERVO (PCB #3)

QUME

- Move the oscilloscope probe to TP 3 on Board 3.
- Adjust RV 6 and RV 4 (Board 3 shown below) to 12v peak-to-peak (gain), and centered about ground (offset) while manually moving the printwheel.
- Move the oscilloscope probe to TP 4 on Board 3.
- Adjust RV 5 and RV 3 for offset and gain as explained above.

NOTE

The preceding (manual) steps of this procedure can be skipped if the boards are not newly introduced into the system, and need only to be re-adjusted.

- Verify: The IOU-31 must be at or above REV L.
- Place the printwheel disable switch, and the carrier disable switch in the ON position.

WARNING

From this point on, keep hands and tools away from the carriage movement area.

- From the keyboard, type in the following (where x is the Qume address or the CRT address in the slave printer configuration).

Regular Printer:

(IPL) 000cf30100000008f30200000100a7 (XMIT)
1x159d0008f20200bx0100a7 (XMIT)
40a0769140b05091 (XMIT)

Slave Printer (to CRT):

(IPL) 0000f10100000100a7 (XMIT)
0007f20109b00100a7040e76091c5001 (XMIT)

The carrier should be oscillating approximately one inch. The printwheel is also moving, but is difficult to see when the carrier is moving.

- Place the oscilloscope channel #1 probe on TP 9 on Board 2.
- Place the oscilloscope channel #2 probe on TP 3 on Board 2.

Set the oscilloscope as follows:

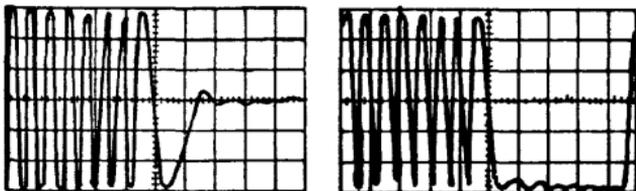
Vert:	Channel #1 5v/cm (calibrated)
	Channel #2 2v/cm (calibrated)
Horiz:	10 ms/cm
Trigger:	Normal, Internal, Positive.
Source:	Channel 1

Display channel #2.

QUME

The waveform should be similar to the left hand illustration below. The pattern should be centered on the screen (offset) and 12 volts peak-to-peak at the minimum point (gain).

- Adjust RV 5 and RV 3 on Bd.#2 if necessary for offset and gain.
- Move the CH 2 probe to TP 4 on Board #2. The pattern should change to one similar to the right hand illustration below.

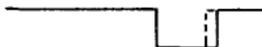


- Adjust RV 4 and RV 2 on Bd.#2 for offset and gain (similar to the steps above).

NOTE

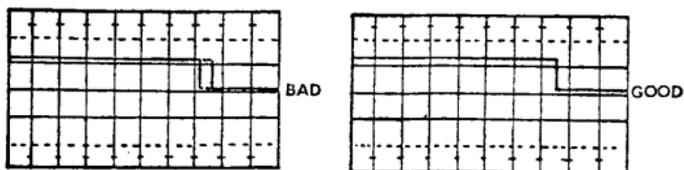
Slave printers using the single buffer ROM board can not be adjusted for symmetry. They must be removed to a non-slave system configuration to be adjusted. Slave printers with the ROM R board can be adjusted in the system; The platen will advance with each back and forth movement of the carriage.

- Move the CH 2 probe to TP 8 on Board #2.
- Set the CH 2 vertical to 5v/cm.
- Rotate (uncalibrate) the HORIZONTAL control until the waveform triggers and displays alternate positive and negative signals.
- Display CH 1. It should look similar to the waveform below.



- Depress the 10X magnification button on the oscilloscope and verify that the negative going edge is still displayed.
- Adjust the horizontal position of the trace if necessary for the correct display.
- Adjust RV 1 on Board #2 (carriage symmetry) until the negative going edge is stable (see the illustration below). The adjustment is "TOUCHY" and must be done with care.
- Return the HORIZONTAL control to CALIBRATE, and release the 10X button by depressing it again.

QUME



SYMMETRY ADJUSTMENT

- Place the oscilloscope channel #1 probe on TP 9 on Board 3.
- Place the channel #2 probe on TP 3 on Board 3.
- Set the CH #2 gain to 2v/cm.
- Set the horizontal time base to 5ms/cm.
- Display channel #2, and adjust RV 6 and RV 4 on Board3 for offset and 12v peak-to-peak. The pattern that is displayed should be similar to that for board 2.
- Move the oscilloscope channel #2 probe to TP 4 on Board 3.
- Adjust RV 5 and RV 3 on Board 3 for offset and gain as in the previous step above.
- Set the CH #2 gain to 5v/cm.
- Move the CH #2 probe to TP 8 on Board #3.
- Set the trigger level to display alternate positive and negative signals (this is similar to the procedure that was performed for Board #2).
- Set the oscilloscope to display channel #1.
- Depress the 10X magnification button and adjust the horizontal position to display the negative going edge.
- Adjust RV 2 (printwheel symmetry) until the dropoff of the pattern remains stable (the same pattern as shown for Board 2).
- Release the 10X magnification button.

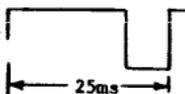
PRINT SPEED

- Return the channel #1 oscilloscope probe to TP 9 on Board 2.
- Enter the following program from device zero.

```
(IPL) 0084f20100000084f20100bx0006a7 (XMIT)
      pppppppp...entire line (132 char.) (XMIT)
```

QUME

- Carefully measure the time interval between the positive going trigger, and the return to positive (see the illustration). The time should be 25ms if the printer is to operate at an average of 45 characters per second. If the time that is measured is less than 25ms, the printer will run faster than 45cps and may cause other problems. The carriage servo encoder amplifiers (TP 3 and TP 4 on board 2) can be adjusted to greater than 12 volts to increase the time (above) to 25 ms.



HAMMER INTENSITY

This adjustment is factory set, and should only be changed if the overall print quality for a particular set of forms is too heavy. First check all of the mechanical adjustments for the hammer and associated parts. Check that the proper ribbon is used for the particular job. Verify that the hammer plunger moves freely. If the print is still too light or heavy, adjust as follows.

- Install the forms or paper that will be used.
- Set the forms thickness lever for the forms that are being used (see the Operator Manual).
- Type in ten to twenty upper case M's or W's.
- Type the same number of lower case n's, a's, or o's.
- Type in a number of commas, periods, and lower case i's.
- Adjust RV 1 on Board #3 if necessary to lighten or darken the print.
- Repeat the letters typed above, adjusting again if necessary until the overall print quality is the best possible. The factory setting is 3.2ms for an upper case M, and 1.7ms for a lower case g, measured at TP-11.

POWER SUPPLY

The +5 volt power supply to the printer must be maintained at full value. In a worst case, 4.7 volts can cause a power failure detection, and consequently a restore. In the table configuration the +5 volts should be adjusted to 5.00 volts (under load) at the printer end (+5v.T.P.) of the supply cable with a DVM. However, the 6.5 processors use the same supply for the processor and the printer. The 6.5 processors are model numbers 800, 900, 900, and 950. In these, the voltage should be adjusted to 5.1 volts (under load) at pin 2 of the terminal strip at the back of the power supply.

QUME

MECHANICAL ADJUSTMENTS

Mechanical adjustments for the printer require strict attention to detail, and must be performed in the order that is given. Do not make adjustments indiscriminately, or attempt any procedure that is not completely understood.

Mechanical misalignment is usually observed in the overall print quality, or the alignment of one character to the next. Once the printer has been properly adjusted, it should not need re-adjustment unless it has received violent physical abuse. However, re-adjustment is necessary when one or more of the following parts is replaced:

- Printwheel Carriage
- Printwheel Servomotor
- Printhammer Solenoid
- Ribbon Lift Solenoid
- Carriage Servomotor
- Paper Feed Stepper Motor
- Platen
- Paper Feed Rollers
- Platen Drive Gears
- Plastic Card Guide

All adjustments are not required for each of the parts that are listed; the necessary adjustments are listed with the part removal instructions.

REMOVE COVERS

The printer cover is in three sections, an upper snap-on cover, and middle and lower sections that are fastened by screws. Removing the top and middle sections exposes all of the electronics and mechanics. It will be seldom, if ever, that the bottom cover must be removed.

Top Cover

Removing the top cover is an operator function, and must be done to replace the ribbon cartridge or exchange printwheels for various type styles. The top cover snaps out with firm pressure, and is replaced in the same way. When replacing the top cover, be sure that the interlock switch is activated. The interlock switch is at the left-rear corner of the top cover, and disables the carriage and printwheel while the top is open.

Middle Section

- Remove the three 8/32 screws at the rear of the unit.
- Remove the seven 10/32 screws inside the periphery of the cover.
- Remove the platen by grasping at each end, and depressing both latch mechanisms.

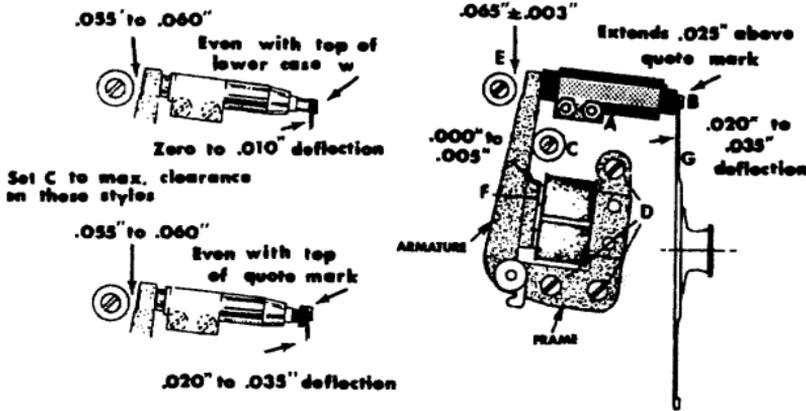
QUME

- Lift the center cover section free of the printer chassis. Be careful to disconnect the associated wiring.
- If the printer is to be run with the covers off, a jumper must be placed on J4, where the interlock switch cable was removed.

PRINTHAMMER ALIGNMENT

Printhammer misadjustment usually produces characters that are too light, too dark, or uneven. Occasionally, however, a faulty adjustment will cause noisy operation or printwheel breakage. Printhead adjustments should be made as a group, and in the given order. Check all adjustments first. Do not change hammer adjustments unless there is a known problem, or a check shows one or more dimensions out of specification.

- Remove all power from the unit.
- Remove the top cover and ribbon cartridge.
- Determine which of the three hammer types you are adjusting by referring to the drawings below. Use the designated character and dimensions for the style hammer that is being adjusted.



- Manually position the character petal at the top position.
- Displace the printhead out until it touches or deflects the spoke as indicated in the drawing. Observe the vertical position of the hammer on the character petal.
- Adjust the height if necessary by loosening the two screws, "A" in the drawing.
- Re-tighten the two screws (A). When adjusting the hammer height, the angle must remain 7 degrees from horizontal.

QUME

- Using a 3/16" wrench, loosen the retaining nut at the opposite end of screw C.
- Rotate the bumper beneath screw C to the maximum clearance possible between the bumper and the armature. Do not re-tighten, this adjustment will be completed later.
- Loosen the three screws, (D).
- While pinching the armature lever against the core piece, position the entire assembly so that the tip of the printhead deflects the printwheel spoke by about the amount specified in the drawing.
- Hold assembly in the proper position, and tighten screws (D).
- Hold the armature to the core piece.
- With a screwdriver, rotate the eccentric bumper (C) to within .003" + or - .002" between the armature and the coil piece.
- While holding the adjustment with a screwdriver, tighten the nut at the opposite end of C.
- Loosen the retaining nut at the opposite end of screw (E)
- Place the proper thickness gauge between the bumper and the armature.
- With the thickness gauge in place, rotate the bumper (E) until the armature is against the polepiece (F).
- Hold the adjustment with a screwdriver, and tighten the nut at the opposite end of screw (E).

PRINTWHEEL INDEX ADJUSTMENT (HUB)

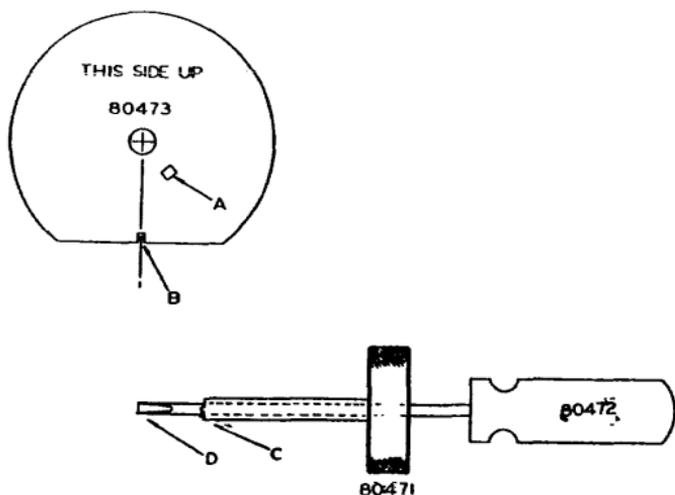
Although the printwheel index adjustment is not technically a printhead adjustment, it should be checked when the printhead adjustments are made. Printhead maladjustment can produce symptoms ranging from poor print quality to physically breaking the printwheel spokes. The printwheel should not be adjusted until after all other adjustments are perfect, and then only if the misalignment is greater than 10% of the character width.

The printwheel index adjustment requires two special tools, and a 1/8" screwdriver. These tools are illustrated below. DO NOT ATTEMPT ADJUSTMENT WITHOUT THESE TOOLS.

WARNING

This adjustment is made with the printer energized. Keep hands and tools clear of the carriage and printwheel, except as specifically instructed in the text.

QUME



- Remove the top cover, if it is not already off.
- Bypass the interlock switch by placing a small bit of folded paper into the opening to hold the switch lever. The interlock switch is located at the left rear of the top cover opening (as seen from the operator position).
- Disconnect the data cable from the Qume device and apply power.
- Extend the printhead and verify that the lower case "w" is squarely in front of the printhead. If it is aligned properly, skip the remaining procedure, otherwise continue.
- Release the carriage locking lever by depressing the "0" button on the carriage.
- Remove the printwheel by grasping firmly at the hub, and pull away from the shaft.
- Briefly activate the ribbon feed switch inside the lower right portion of the carrier travel area. The ribbon will raise and advance, then return to the lowered position. When the ribbon returns to the lowered position, the printwheel will index to a "home position", where the lower case 'w' is in the printing position.
- Using the collet adjusting tool and the concentric screwdriver, hold the shaft with the screwdriver and loosen the hub collet. The collet loosens by twisting the knurled knob of the tool counterclockwise.

QUME

- Mount the alignment disc on the printwheel hub with the "UP" side away from the motor. The "UP" marking references the flat surface, not the rotation.
- Place a folded piece of paper between the printhead slug and the armature, causing the printhead to extend.
- While holding the motor shaft with the screwdriver portion of the adjustment tool, rotate the disc (but not the motor shaft) until the extended tip of the printhead engages (or aligns with) the cut in the flat edge of the disc.
- Carefully tighten the collet hub by turning the knurled knob clockwise. DO NOT tighten with brut force. A very snug fit is sufficient.
- Remove the alignment tools, the disc, and the paper wedge in the printhead.
- Re-mount the printwheel onto the motorshaft.
- Briefly activate the ribbon feed switch again.
- Verify that the lower case "w" is squarely in front of the printhead. If it is not, remove the printwheel and repeat the adjustment.
- When the adjustment is complete, return the carriage to the operating position, and press the "C" button to lock it into place.

PLATEN ADJUSTMENTS

Platen misalignment usually causes variation in print quality over the width of the page, ragged lines, lines that taper, or lines that gradually fade from side to side. Difficulty in accurate overprinting may also indicate platen maladjustment. The platen should be aligned routinely when any of the following items are replaced:

- Paper Feed Stepper Motor.
- Paper Feed Idler Gear
- Carriage
- Printwheel Servo Motor.

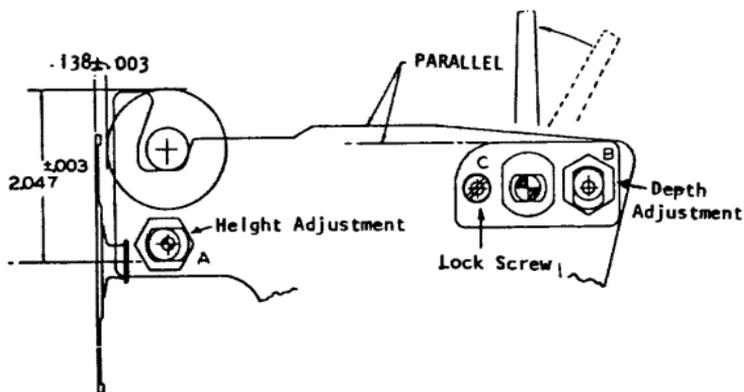
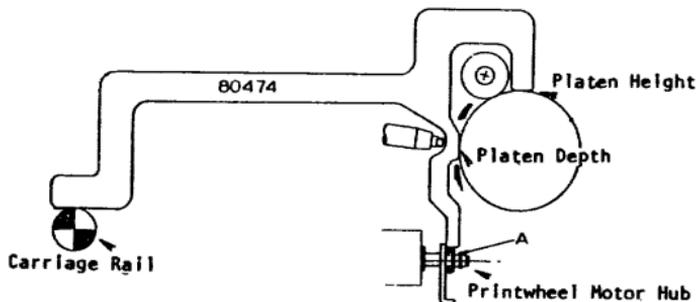
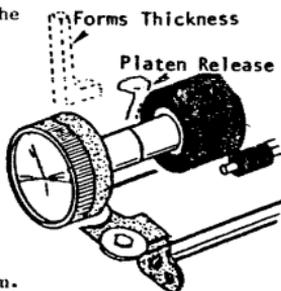
Adjustments within this group are highly interdependent, and should be performed as a group, in the order that is given.

Platen Depth

- Remove the top and middle cover sections. Cover removal instructions are given in the first portion of this section of the manual.

QUME

- Place the forms thickness lever in the extreme forward position. The forms thickness lever is behind the platen on the top left side. Be sure that the platen is properly seated and latched into position (the two platen releases have returned to the latch position).
- Tilt the carriage forward, and remove the printwheel.
- Return the carriage to the operating position, and lock into place by depressing the "C" button.
- Manually position the carriage to the end of travel on the side that is to be adjusted.
- Place the alignment jig (80474) on the platen, printwheel hub, and front carriage rail as shown in the following illustration.



QUME

- The figure below shows the adjustment on the carrier side plate. The adjustment locations are the same for each end, and are "mirror images" of each other. Each adjustment has a slotted locking screw, and 5/8" hex adjustment eccentric. With a screwdriver, loosen, but do not remove, the two lock screws.
- Using the hex eccentric, adjust the plate until the forward edge of the platen barely touches the flattened vertical edge of the alignment gauge.
- When the adjustment is correct, tighten the lock screws, and repeat the procedure for the opposite end of the platen.

Platen Height

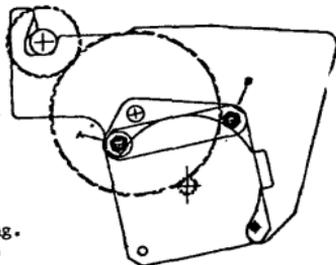
- Place the alignment gauge (80474) as shown on the previous page. This is the same tool, in the same place as for the depth adjustment.
- Loosen the locking screw for the eccentric (See the illustration above).
- Adjust until the top of the platen barely touches the gauge.
- Re-tighten the locking screw, being careful not to change the adjustment.

PLATEN DRIVE GEAR ADJUSTMENT

Adjust the platen drive gear for minimum backlash in the paper feed gear train. A drive mechanism that is too tight will bind, causing poor vertical positioning. A mechanism that is too loose causes poor registration and overprinting, or uneven lines.

The gear train is adjusted at the factory, but must be checked when any of the platen adjustments are made, or when a paper feed motor is replaced. The illustration below shows the location of the adjustment screws. Access to the screw labeled A is through a hole in the large gear.

- Loosen the two retaining screws, A and B. These should be loose enough to allow adjustment, but retain the position without being held.
- Move the large gear into both of the other gears. This should gently bottom without binding.
- Re-tighten the securing screws, and check for backlash or binding. The large gear should be able to slide in and out on the shaft (without the limits of the endplay)

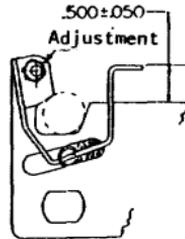


QUME

- but it should not have any rotational motion.
- Rotate the platen knob to verify that there is no binding or backlash at some other point in the rotation. The paper feed motor will exert some resistance, even without power.
- If the gear cannot be adjusted to eliminate backlash, the condition must be corrected by replacing worn parts. However, the quality of the printout should determine if that is necessary.

PLATEN LATCH ADJUSTMENT

- Remove the platen by pressing both releases, and lifting the platen.
- Loosen the locking screw (slot head). See the illustration for the screw location.
- Adjust the eccentric until the dimension is as shown.
- Re-tighten the locking screw, and replace the platen.



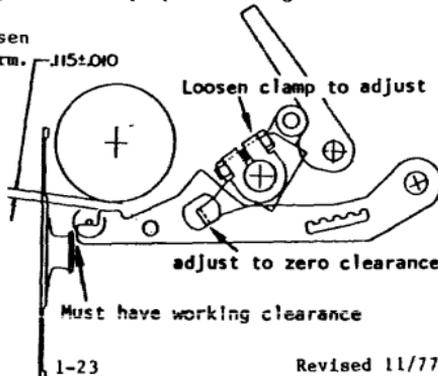
PAPER FEED ROLLER ADJUSTMENTS

Feed rollers that are not properly adjusted may cause the paper to "creep" sideways or become misaligned as the paper passes through. All of the paper feed roller adjustments are interdependent, and should be performed as a group.

Remove all power from the unit when making these adjustments.

Feed Roller Depth

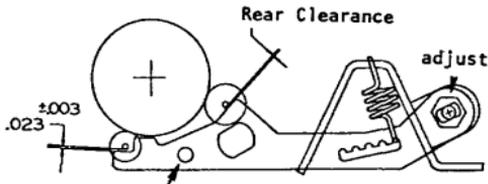
- The figure below shows the mechanical details of one of the four feed roller arms. The arm is spring loaded from an adjustable pivot point. By moving the arm toward the front or rear, the roller alignment is adjusted. All four arms must be adjusted, one at a time, to assure proper tracking.
- Using two wrenches, loosen the adjustment on one arm. $.115 \pm 0.010$
Loosen only enough to allow movement with finger pressure.
- Adjust the front clearance to the value shown. The front and rear clearance should be approximately equal.
- Re-tighten the adjust-



QUME

ment screws, being careful that the adjustment does not change when the screw is tightened.

- Adjust the other three arms in the same manner. Before operating the unit, manually slide the carriage over the entire travel to verify that there is no interference between the front portion of the arm and the printwheel hub.
- Remove the platen from the unit.
- Carefully lift the paper guide pan (under the platen) and allow it to lay back, out of the way. Do not stretch the springs that are attached to the pan.



Front Clearance Forward movement increases front clearance.

Pivot Point Rear movement reduces front clearance and increases rear clearance.

- Move the paper release all the way forward; replace the platen. Place a .115" gauge between the platen and one lever arm (see the illustration).
- Adjust the arm for zero clearance by loosening the clamp, and changing the position of the lever.
- Re-tighten the clamp, making sure that the adjustment does not change when doing so.
- Adjust the other three arms in the same manner.
- Re-install the paper guide pan and the platen.

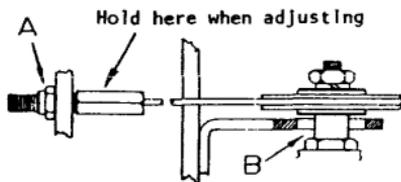
CARRIAGE CABLE TENSION ADJUSTMENT

Cable tension should be checked routinely during preventive maintenance inspections or whenever the carriage is removed and replaced. Cable tension is maintained by spring tension on one idler pulley at the right side of the printer. Adjust the cable tension as follows:

- Using a 3/16" wrench, turn the adjustment nut (item A in the illustration) until the shaft, B, is centered in the hole of the pulley mounting bracket, or 1" from the frame if the bracket does not have a hole. Either, or both ends may be

QUME

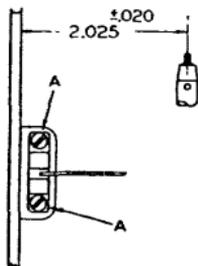
adjusted whichever is convenient, but DO NOT TWIST THE CABLE.



LEFT MARGIN PHOTO SENSOR

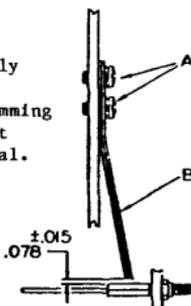
The optical sensor sets the beginning point for carriage travel. It is used only during the RESTORE sequence, which is issued in initialization and reset sequences.

- Initialize the printer by removing power, then returning the power. The carriage should move to the left side of the travel.
- Using a graduated rule or other suitable measuring instrument, measure the distance from the printhead axis to the frame (see the illustration).
- If the distance must be adjusted, loosen the two mounting screws on the photo sensor, and move the assembly.
- When the adjustment has been moved, re-initialize the printer by power OFF/ON. The carriage will move to the adjusted location.



DECELERATION STOPS

- The deceleration stops are located at each end of the carrier travel. Normally these stops are not touched. However, when the stops are used (by mis-programming or malfunction) the stopping force must be as close to the cable as is practical. Adjust by loosening the screws (A) and moving the stop (B).



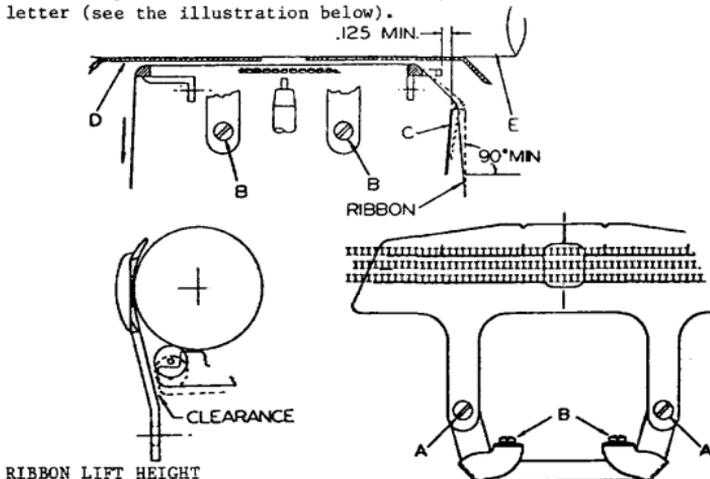
CARD GUIDE ADJUSTMENT

The card guide must operate with both proper clearance and alignment. The clearance is adjusted (with power off) by loosening the two mounting screws (B) that are shown in the illustration below. The card guide should lightly touch the platen along the entire working surface of the guide. Be sure

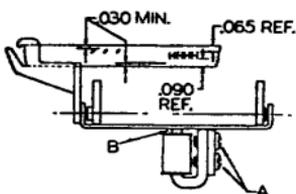
QUME

that when the adjustment is made, there is clearance between the guide and the front platen rollers (see the lower illustration).

To set the card guide height, type several lines of capital I's at 6 lines per inch spacing. Adjust the guide by loosening the two screws (A) shown in the illustration. At 6 lines/inch, two lines should "rest" on the guide lines, while the center line is between the guide lines. The vertical mark, indicating the print position, should point directly at the center of the letter (see the illustration below).



Print a few characters, alternating between the apostrophe (') and the underscore (_). Examine the ribbon to be sure that the characters are striking the ribbon properly as shown in the illustration. If adjustment is required, loosen the mounting screws (A) for the ribbon lift solenoid and re-position the solenoid until the ribbon is struck correctly.



MOTHERBOARD ALIGNMENT

If difficulty is encountered when inserting or removing the power and data connectors at the rear of the chassis, re-aligning the motherboard may help.

QUME

- Remove all power from the unit.
- Remove the top and middle cover sections.
- Remove all four printed circuit boards from the inside of the printer.
- Loosen, but do not remove, the eight pan-head screws that hold the motherboard.
- Insert the power and data connectors. Be sure that both connectors are well seated onto the motherboard connector flange.
- Tighten the jackscrews on the connectors.
- Tighten the eight motherboard mounting screws.
- Replace the printed circuit cards and the covers. Be sure that all printed circuit cards are securely seated, and the board switches are in the proper positions.

ASCII EXCEPTIONS

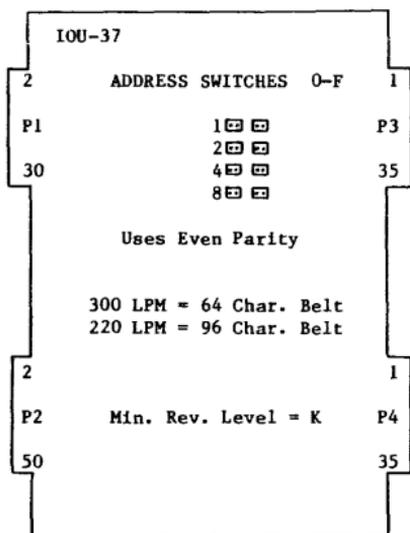


b ₄	b ₃	b ₂	b ₁	Column	Row
0	0	0	0	0	0
0	0	0	1	1	
0	0	1	0	2	
0	0	1	1	3	
0	1	0	0	4	
0	1	0	1	5	
0	1	1	0	6	
0	1	1	1	7	
1	0	0	0	8	BS
1	0	0	1	9	TAB
1	0	1	0	A	↓IDX
1	0	1	1	B	↓IDX
1	1	0	0	C	↓RID
1	1	0	1	D	CR
1	1	1	0	E	RID
1	1	1	1	F	

SELECTRIC

5B = +
 5C = ¢
 5E = ½
 08 = BS
 09 = TAB
 0A = INDEX
 0D = CR

IOU-37
TELETYPE
Qantel Model 5061, 5062



MAX. PWR. REQUIREMENTS

+5V 1.70A
-12V .04A

PRINTER POWER

115 VAC 60 HZ.
10A MAX. FOR .4 SEC.
1.3A NORMAL

I/O CABLE LENGTH

Can Be Up To 2000 FT.

PRINTER HEAT GEN.

513 BTU/HR.

WRITE CONTROL INSTRUCTIONS

1XYY9D X = DEVICE ADDRESS YY = CONTROL BYTE

CONTROL
BYTE

FUNCTION

06	FORM FEED
07	LINE FEED
20	RESET ALLOW TERMINATION INTERRUPT
60	SET ALLOW TERMINATION INTERRUPT

STATUS IN INSTRUCTIONS

4XYY9D X = DEVICE ADDRESS YY = STATUS BYTE

STATUS
BYTE

MEANING

01	ALWAYS ZERO
02	WRITE BUSY
04	END
08	SERVICE REQUEST
10	INTERRUPT FLAG
20	ALWAYS ZERO
40	ALWAYS ZERO
80	INOPERABLE

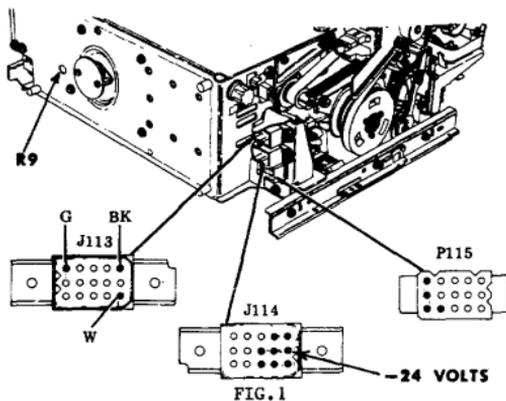
TELETYPE

POWER SUPPLY ADJUSTMENTS (Fig.1)

The regulator card is located in the power module assembly. Access to the -24 volt DC voltage adjustment and fuse is at the rear of the printer. The regulator card is adjustable from approximately -21 volts to -26 volts. This card has an over-voltage protection (crowbar) at approximately a -27 volt level. When an overvoltage occurs (malfunction), the output is shorted to ground and should cause fuse F1 to blow. Fuse F1 should not exceed the 2.5 amp fast blow rating.

- The LED provides a visible indication that the DC voltage is present. The LED is located next to the adjustment pot (R9).
- The DC voltage on fuse F1 is approximately -35 volts.
- Place a DVM between GND and the pin on J114 as shown in Fig. 1.
- Adjust potentiometer R9 to equal $-24 \pm .25$ volts on the DVM.
- The 410151 Regulator Board has two option screws (A & B). Screw "A" should be on the component side, which connects the -24v common to chassis. Screw "B" should also be on the component side, which connects the -24v common to the +11.3v common.

NOTE: You must remove the power module assembly and the regulator board from the power module to reach screws "A" and "B".



BACKUP BAR ADJUSTMENT (Fig. 2, 3 & 4)

The backup bar determines the distance between the hammers and the type carrier. This distance is initially set up with 4 thicknesses of paper (or 3-part paper with carbons) which should satisfy most customers for print quality on one to six part paper. The Backup Bar adjustment should only be necessary under special circumstances with customer forms.

TELETYPE

- Remove the type carrier.
- Use a new or almost new ribbon for this adjustment.
- Insert the customer's forms in question for print quality.
- Insert 402868 gauge (Fig.3) into carrier track and hold firmly against the backup bar at one side of the print station.
- With printer power turned on, place the printer test switch in "on" position and pass a steel object (screwdriver) over the flag sensor to initiate hammer firing. While hammers are firing, areas 2, 4, and 6 should not be visible, areas 3 and 5 should be just visible, and areas 1 and 7 should be the darkest and approximately equal (Fig.3). This requirement must be met with the 402868 gauge at both sides of the print station.

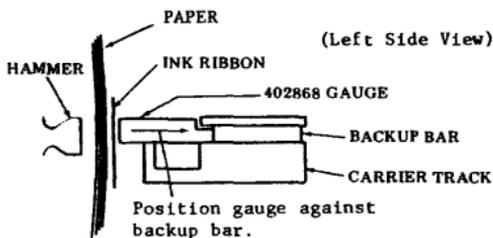


FIG.2

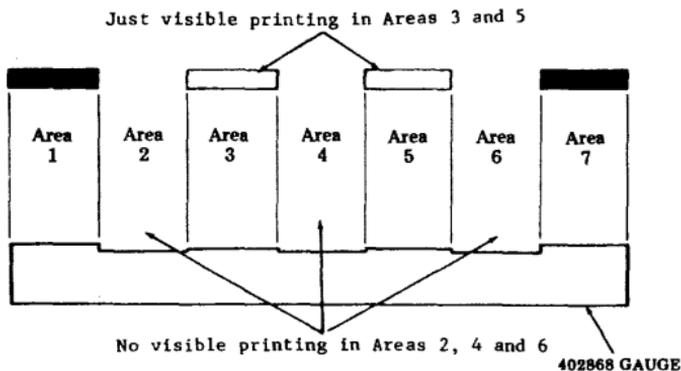


FIG.3

- If adjustment is necessary, loosen the five track assembly mounting screws friction tight.
- Turn the adjustment screw clockwise to move backup bar closer to hammers and counterclockwise to move backup bar away from hammers. Fig.4 shows mounting and adjustment screw locations.

TELETYPE

- When the proper printout is achieved (Fig.3) on the left and right side, place the "test" switch in the off position.
- Tighten the five track assembly mounting screws.
- Remove the 402868 gauge.

NOTE: For maximum ribbon life, the BACKUP BAR adjustment should be made to give the lightest acceptable printed copy.

NOTE: Each time the BACKUP BAR adjustment is made, the left and right CARRIER SPROCKETS, left and right RIBBON GUIDES, and the PAPER POSITIONER ROLLER adjustments must be made.

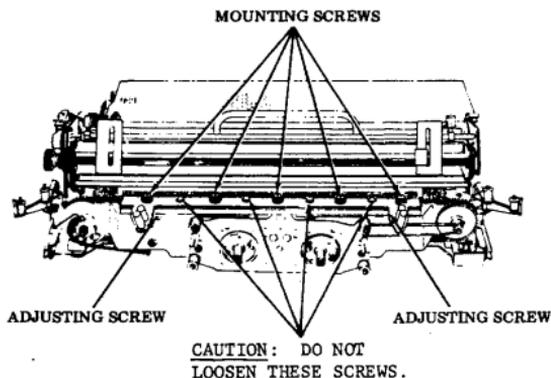


FIG. 4

To perform the CARRIER SPROCKET, RIBBON GUIDE, and PAPER POSITIONER ROLLER adjustments, turn the printer A-C power off, and remove the paper and ribbon. Insert gauges 402716 and 402717 in the left and right carrier track positions respectively as shown in Figures 5 and 6.

LEFT CARRIER SPROCKET ADJUSTMENT (Fig.5)

- Position the 402716 gauge against the backup bar.
- Position the finger lever of the sprocket hub parallel to the track assembly (Fig.5).
- Turn the adjusting nut clockwise or counterclockwise until the rear surface of sprocket flange clears the 402716 gauge by .006" (Max.) to some (Min.) at its closest point.

RIGHT CARRIER SPROCKET ADJUSTMENT (Fig.5)

- Position the 402717 gauge against the backup bar.
- Loosen the two hub clamp screws.

TELETYPE

- Turn the split adjusting nut clockwise or counterclockwise until the sprocket flange clears the 402717 gauge by .005" (Max.) to some (Min.) at its closest point.
- Tighten the two hub clamp screws.

LEFT AND RIGHT RIBBON GUIDE ADJUSTMENTS (Fig.5)

- Loosen the two left and right ribbon guide mounting screws.
- Position the 402716 and 402717 gauges against the backup bar.
- As a preliminary adjustment, position the left and right ribbon guides to clear the gages.
- Tighten the two left and right ribbon guide mounting screws.

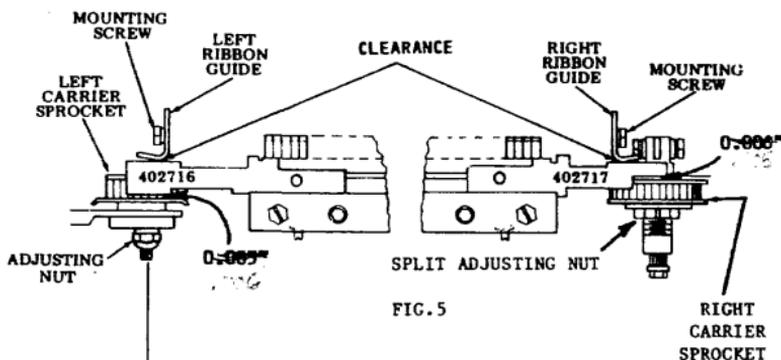


FIG. 5

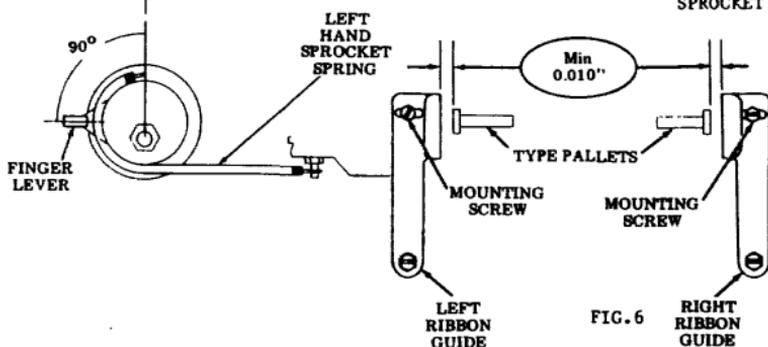


FIG. 6

NOTE: The remaining ribbon guide adjustment is performed with the type carrier installed. The adjustment is a final operational check to assure proper clearance between the type pallets and ribbon guides.

- Seat all pallets of the type carrier against the rear surface of the large diameter flange of the left carrier sprocket.

TELETYPE

- Position a .010" flat gauge against each ribbon guide and rotate the impeller shaft through one complete rotation of the carrier to check for a minimum .010" clearance between the closest pallet and ribbon guide (Refer to Fig.6).

PAPER POSITIONER ROLLER ADJUSTMENT (preliminary) (Fig.7)

- Position the 402716 and 402717 gauges against the backup bar.
- Loosen the two eccentric clamp screws friction tight.
- Rotate the eccentrics on both sides until the paper positioner roller just touches the gauge posts.
- Tighten the eccentric clamp screws.
- Remove the 402716 and 402717 gauges and install the type carrier, ribbon, and paper.

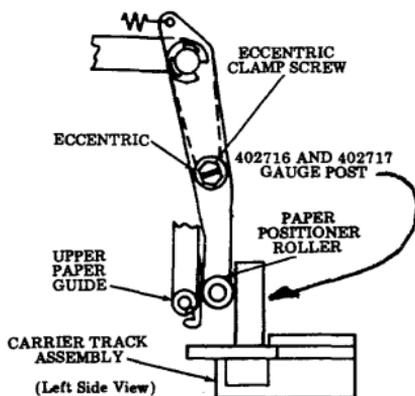


FIG. 7

PAPER POSITIONER ROLLER ADJUSTMENT (final)

Further adjustment will be necessary if the two requirements below are not met. These requirements do not apply when printing within two lines of a fold on fan-fold paper.

- a) The printed copy should not be illegible due to ribbon smudging after a one minute printer idle period.
 - b) There shall be no smudge when printing a text character (not font or identification symbol).
- If adjustment is needed, loosen the left and right eccentric clamp screws friction tight.
 - Rotate eccentrics to meet the requirements above.

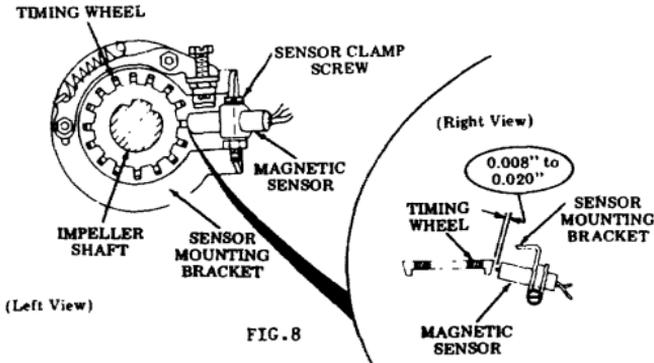
TELETYPE

IMPELLER SHAFT SENSOR ADJUSTMENT (Fig. 8 & 9)

NOTE: It is preferable to use nonmagnetic gauges to check the gaps on both magnetic sensors.

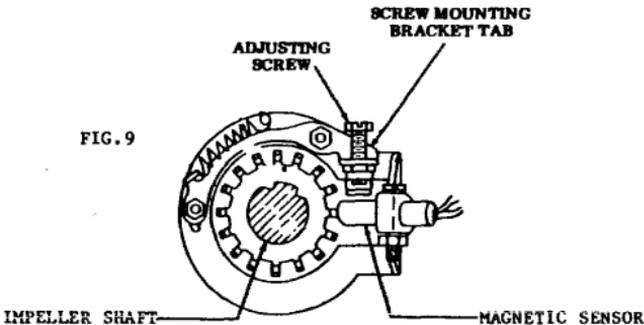
Air Gap (Fig.8)

- Loosen sensor clamp screw.
- Insert a .015" flat gauge between the magnetic sensor pole piece and a tooth on the timing wheel and adjust the gap for a snug fit. The tolerance is minimum .008" -- maximum .020". Tighten the sensor clamp screw and remove gauge.



Under Power (Fig.9)

- With the unit in the "test" position and printing the test character, turn the impeller sensor adjusting screw COUNTERCLOCKWISE until a column/s does not print. The impeller sensor adjusting screw can be reached through a hole in the top cover just above the screw (FIG.9).
- Slowly turn the adjusting screw CLOCKWISE until all columns print correctly for at least ten lines.
- Turn the adjusting screw CLOCKWISE an additional 2.5 turns.

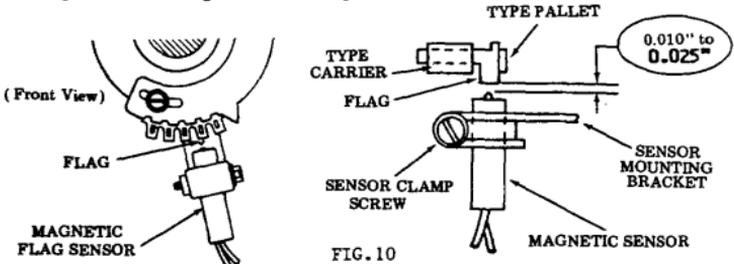


TELETYPE

FLAG SENSOR ADJUSTMENT (Fig. 10 & 11)

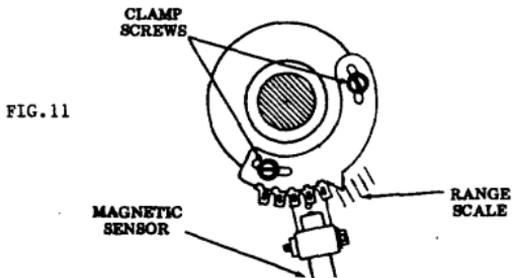
Air Gap (Fig.10)

- Loosen the Flag Sensor clamp screw.
- Insert a .020" flat gauge between the magnetic sensor pole piece and a Flag on the font belt and adjust for a snug fit. This should meet the requirement for a minimum .010" clearance between the closest Flag and magnetic sensor pole piece and a maximum .030" clearance between any Flag and sensor pole piece.
- Tighten the Flag Sensor clamp screw.



Under Power (Fig.11)

- Loosen the Flag Sensor bracket clamp screws friction tight.
- Turn printer "test" switch on.
- Move the sensor bracket CLOCKWISE until a different or no character prints in one or more columns. Note the position of the indicator on the range scale.
- Move the sensor bracket COUNTERCLOCKWISE until again a different or no character prints in one or more columns. Note the position of the indicator on the range scale.
- Position the Flag Sensor indicator midway between the two previously noted failure points.
- Turn the "test" switch off.
- Tighten the clamp screws.

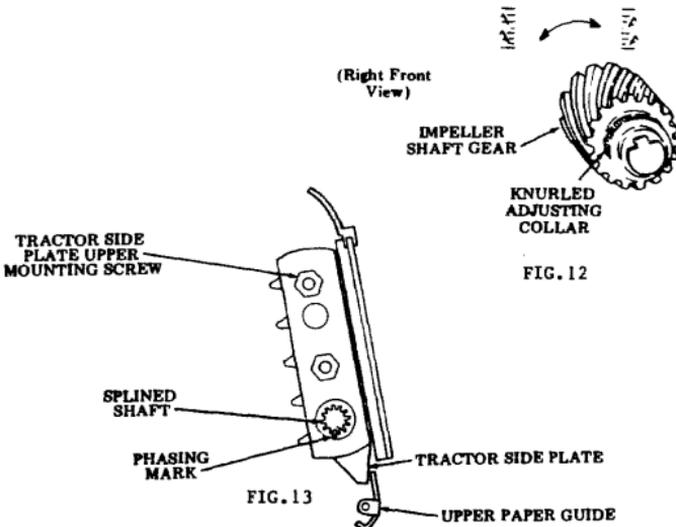


TELETYPE

IMPELLER SHAFT TO CARRIER PHASING (Fig.12)

- Enter a program to print a full line of capital M's.
- Print several lines, place printer off-line, and wait for motor to stop.
- Inspect the characters to see if the right or left portion of the characters are being clipped.
- To make adjustment, push the impeller shaft gear (which has a strong spring tension) away from the knurled adjusting collar and turn the collar:
 - a) CLOCKWISE if right portion of character is clipped.
 - b) COUNTERCLOCKWISE if left portion of character is clipped.
- Place the printer back on-line and repeat above steps until proper printing of complete character is achieved.

NOTE: When multicopies are used, phasing should be adjusted to minimize clipping on the last copy with no clipping on the original copy.



TRACTOR PHASING (Fig.13)

- This adjustment is done by the factory and should not be needed unless tractors are removed or replaced.
- The phasing marks (white dot) on the left and right tractors shall be on the same spline shaft groove.
- To adjust, remove the left tractor from the splined shaft, turn the tractor, and reassemble on the correct spline shaft groove.

TELETYPE

RIBBON MECHANISM DRAG (Fig.14)

- Place a spring scale over the ribbon disc drive pin.
- A force of 8 to 10 ounces should start the free wheeling ribbon drive disc moving when pulling tangentially on its drive pin.
- To adjust, rotate the adjusting nut CLOCKWISE to increase drag and COUNTERCLOCKWISE to decrease drag to meet the requirement above.
- Reverse the ribbon mechanism by pulling up on the reversing lever adjacent to the free wheeling drive disc.
- Manually rotate the impeller shaft clockwise as viewed from the right side of the printer until ribbon reversal occurs.
- The other ribbon drive disc is now the free wheeling disc and may be checked and adjusted as above.

NOTE: Before checking the drag, rotate the free wheeling drive disc at least one-half revolution in the direction to be pulled in order to take up all play.

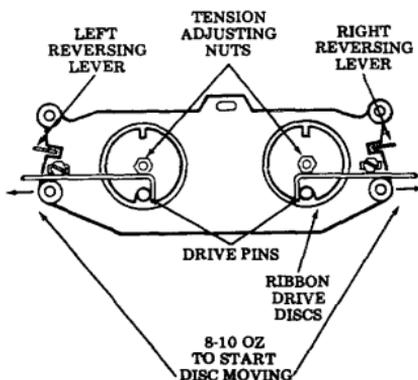


FIG.14

RIBBON MECHANISM DRIVE BELT TENSION (Fig.15)

- Loosen the two ribbon mechanism mounting screws.
- Place a spring scale gauge around the bottom of the belt.
- Position the ribbon mechanism left or right to obtain a minimum $11/32$ " -- maximum $1/2$ " between the outside surfaces of the drive belt when a force of 8 ounces is applied adjacent to the ribbon mechanism frame.

TELETYPE

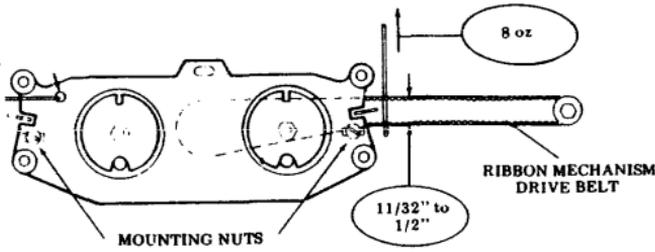


FIG.15

IMPELLER SHAFT DRIVE BELT TENSION (Fig.16)

- Loosen the four motor assembly mounting screws friction tight.
- Place a spring scale gauge perpendicular to the drive belt approximately midway along its free length.
- Using one of the pry points, adjust the belt to deflect $1/8''$ to $3/16''$ with a force of 5 ounces applied from the spring scale gauge.
- Tighten the four motor assembly mounting screws.

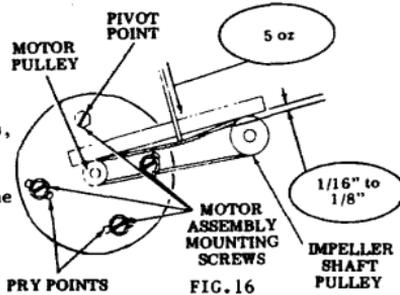


FIG.16

LINE FEED CLUTCH DRIVE BELT TENSION (FIG.17)

- Loosen the three line feed assembly mounting screws.
- Place a spring scale gauge perpendicular to the drive belt approximately midway along its free length.
- Position the line feed assembly so the belt deflects $1/16''$ to $5/32''$ with a force of 5 ounces applied from the spring gauge.
- Tighten the three line feed assembly mounting screws with the tension applied.

FEED BAR DRIVE BELT TENSION (Fig.18)

- Loosen nut mounting the feed bar shaft to the mounting plate.
- Place a spring scale gauge perpendicular to the feed bar drive belt approximately midway along its free length.
- Move feed bar shaft left or right so belt deflects $1/16''$ to $1/8''$ with a force of 5 ounces applied by spring scale gauge.
- Tighten the feed bar shaft nut.

TELETYPE

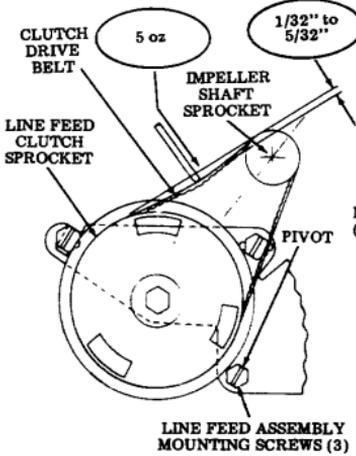


FIG. 17

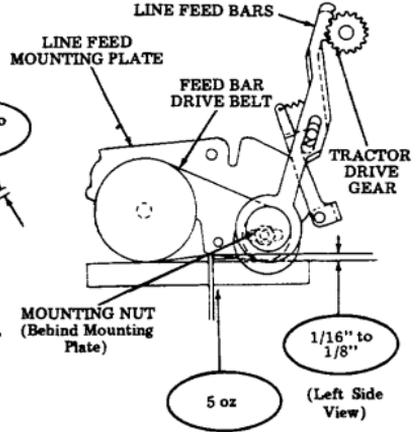


FIG. 18

PAPER-OUT SWITCH ADJUSTMENT (Fig. 19)

- Loosen the two switch clamp screws friction tight.
- Place a .075" gauge between end of paper-out switch arm and rear paper guide. The switch should trip before arm contacts .075" gauge.
- Place a .095" gauge between end of paper-out switch arm and rear paper guide. The switch should not trip when lightly held against the .095" gauge.
- Tighten the clamp screws while meeting the requirements.

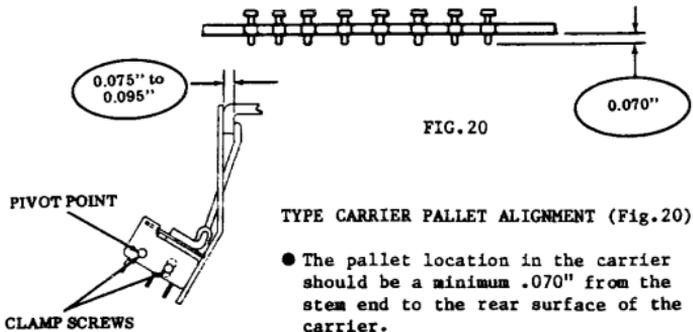


FIG. 19

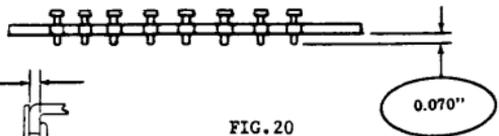


FIG. 20

TYPE CARRIER PALLET ALIGNMENT (Fig. 20)

- The pallet location in the carrier should be a minimum .070" from the stem end to the rear surface of the carrier.

TELETYPE

CLUTCH STOP LEVER (Fig.21)

- Loosen the two Magnet Assembly Mounting nuts and the Armature Stop Mounting screw (back of Magnet Mounting nut) friction tight.
- Position Armature Stop so that Clutch Stop lever is a minimum flush -- maximum .005" overflush with the top surface of the Shoe Release Arm.
- Tighten the Armature Stop screw and Magnet Mounting nuts.

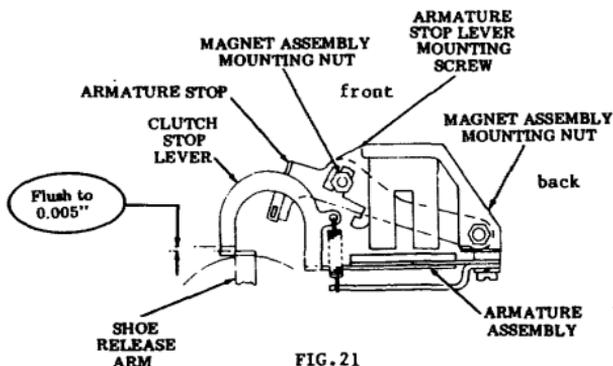


FIG. 21

LINE FEED ARMATURE GAP (Fig.22)

- Loosen the two Magnet Assembly Mounting nuts and the Magnet Assembly Mounting Post (in front of right Magnet Assembly Mounting nut) friction tight.
- Rotate the Magnet Assembly about mounting post so that a .025" gauge will enter between the armature and magnet pole piece but will not pass beyond the midpoint of the pole piece.
- Tighten the Magnet Mounting nuts and the Magnet Mounting Post.

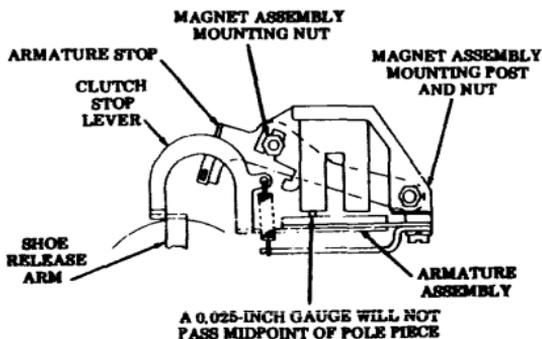


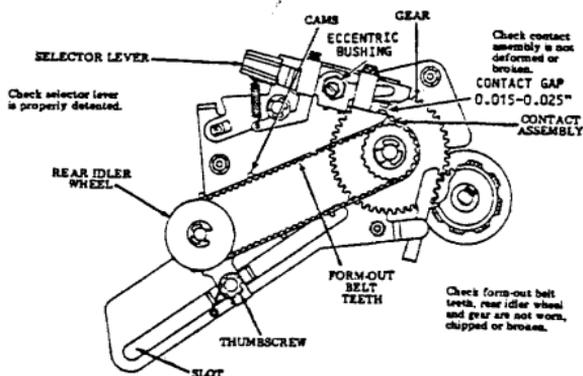
FIG. 22

IOU 37 adjustments are in Tech Memo #25

TELETYPE

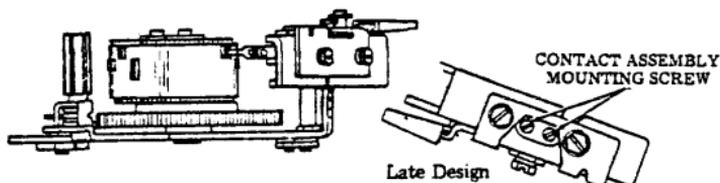
FORM-OUT CONTACT GAP

1. Check that when the form-out contacts are completely open, the gap between the contacts is between 0.015 inches and 0.025 inches.
2. Adjust the contact gap if necessary by turning the eccentric bushing. This adjustment will be finalized in the Form-out Contact to Belt Spacing Section on the next page.



FORM-OUT CONTACT ASSEMBLY LATERAL ADJUSTMENT

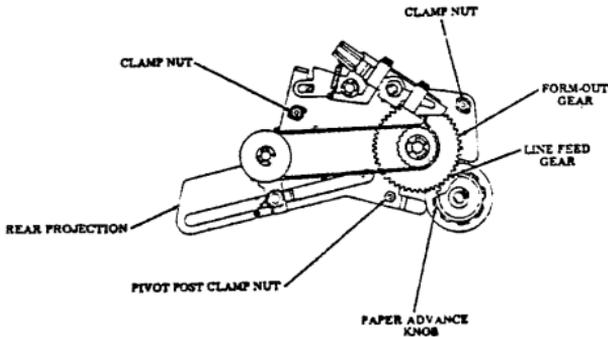
1. Check this adjustment by setting the form-out mechanism to Position 4.
2. Advance the belt manually until one of the short lobes on the belt rests against the end of the form-out contact assembly. Push the line-feed pawls away from the line-feed gear to allow the belt pulleys to turn freely.
3. Center the tip of the contact assembly on the lobe, if necessary. Loosen the contact assembly mounting screws to allow the contact assembly to be moved laterally. The entire form selector assembly will have to be removed on early models.
4. Retighten the contact assembly mounting screws.



TELETYPE

FORM-OUT GEAR BACKLASH

1. Check the backlash (free play) of the form-out gear. Try to turn the form-out gear while holding the line feed gear stationary. A slight amount of backlash should be detectable as the form-out gear is twisted back and fourth.
2. If an adjustment is necessary, loosen the three clamp nuts and move the form-out mechanism forward or backward to allow a slight (and only a slight) amount of backlash between the gear teeth.
3. Retighten the clamp nuts.

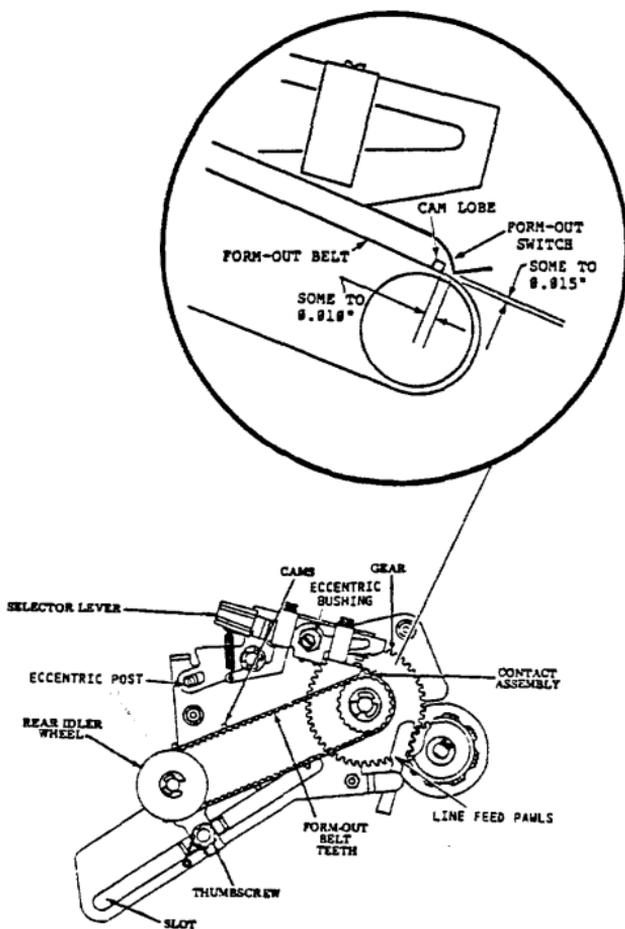


FORM-OUT CONTACT TO BELT SPACING

1. Lift the line feed pawls off the line feed gear and advance the form-out belt until a cam lobe just touches the tip of the form-out contact assembly.
2. Allow the line feed pawls to engage with the line feed gear as the form-out belt is moved slightly back from the form-out contact assembly. The line feed gear should click into position.
3. The clearance between the front of the cam lobe and the tip of the form-out contact assembly should be some to 0.010 inches.
4. The tip of the form-out contact assembly should clear the surface of the belt by some to 0.015 inches.
5. Slightly loosen the screw holding the eccentric bushing and the nut holding the eccentric post. The eccentric bushing primarily adjusts the form-out contact in the forward and reverse directions. The eccentric post primarily adjusts the form-out contact in the up and down positions. However, one adjustment affects the other and they must alternately be turned until they are both correctly adjusted.

TELETYPE

6. If there is not enough adjustment range to meet the above requirements, the form-out gear will have to be disengaged and moved one tooth in either direction. In this case, go back to the Form-Out Gear Backlash Adjustment.



TELETYPE

INTERPOSER BACKSTOP ADJUSTMENT

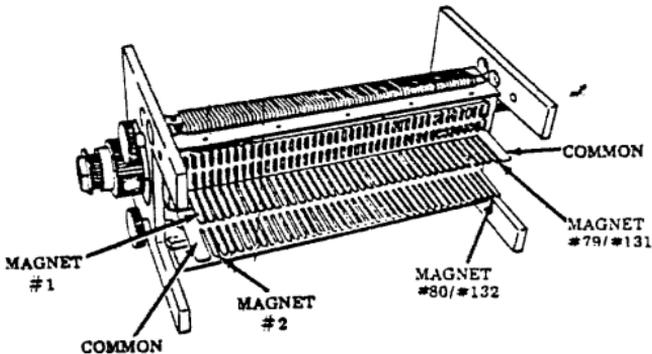
THIS ADJUSTMENT SHOULD ONLY BE DONE IF THE CHARACTERS IN ONE OR MORE COLUMNS ARE NOT PRINTING AND IF ALL OTHER ADJUSTMENTS HAVE BEEN MADE.

In some cases, a weak interposer spring may cause a misalignment of the bottom of an interposer with the tip of its armature. When this happens, the armature is unable to raise the interposer sufficiently to engage the teeth of the impeller. This prevents the interposer from being driven into the hammer, and thus prevents a character from being printed in the hammer's column.

This problem will usually appear as an intermittent absence of a character from a particular column, but in an extreme case, a column may be consistently blank. If a column is consistently blank, it could also be caused by a bad winding in an armature magnet, or by a broken interposer spring. In such a case:

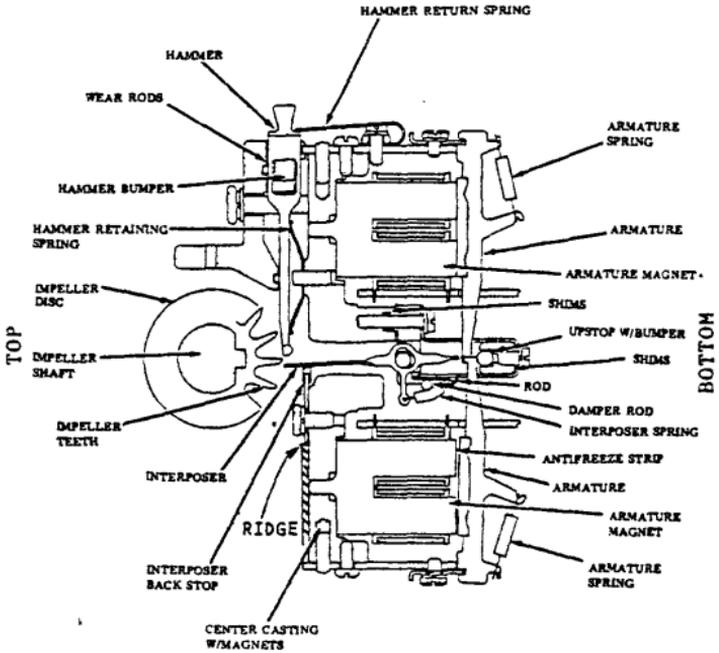
1. Turn off the printer and remove the logic PWA from the underside of the printer.
2. Examine the armatures and the interposers for missing or broken springs.
3. Check the resistance of any suspected coil units. It should measure 50 ohms \pm 2 ohms from the common terminal to the terminal of the coil unit being measured.

When the printer is tilted up exposing the terminals, the upper row of terminals go to the armatures that operate the odd numbered hammers, and the lower row of terminals go to the armatures that operate the even numbered hammers.



TELETYPE

A cross section of the print head assembly is shown below to illustrate what needs to be adjusted and how all the parts function together:



Follow this procedure for the Interposer Back Stop Adjustment:

1. Disconnect the Molex Connectors at the mechanical VFU assembly.

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TELETYPE

2. Remove the four screws at the top of the paper handling assembly. Then lift the paper handling assembly by the handle.
3. The impeller will be exposed and the interposer back stop will be visible behind it. Loosen the screw at each end of the interposer back stop only enough to allow the back stop to be moved with a screwdriver blade.
4. Move the interposer back stop about 1/32-inch towards the the impeller and tighten the back stop screws.

The clearance between the edge of the back stop and the ridge of the printhead casting will vary from one printhead to another. Therefore, no specific gap setting can be given. The edge of the backstop may or may not be parallel to the ridge of the printhead casting.

5. Carefully replace the paper handling assembly. Make sure the line feed pawls are properly aligned with the line feed gear, and make sure the metal paper guide is behind the plastic guides. Screw down the paper handling assembly with at least two screws.
6. Reconnect the Molex Connectors at the mechanical VFU assembly.
7. Run the self test to see if the problem is corrected or improved.
8. If further correction is necessary, all the above steps may be repeated.

IT IS EXTREMELY IMPORTANT NOT TO OVERCORRECT WHEN DOING THE INTERPOSER BACKSTOP ADJUSTMENT. If there is any doubt about this procedure, turn off the printer power and remove the logic PWA from the underside of the printer. This will expose the bottom of the armature assembly. The interposers can be seen at either end of the assembly with the aid of a mirror.

If an interposer at either end of the assembly is not aligned with its respective armature tip, the interposer back stop is definitely adjusted incorrectly. A penlight may be used in addition to the mirror to observe if any of the other interposers are badly out of line.

Finish the adjustment by readjusting the impeller sensor positioning. Refer to Figure 9 on page 1-35:

1. Turn on the power and turn on the TEST Switch.
2. With the printer printing the test character, turn the impeller sensor adjusting screw COUNTERCLOCKWISE until the printer starts missing in one column or more. The printer will begin to sound differently when this happens.
3. Slowly turn the adjusting screw CLOCKWISE until all columns print correctly for at least ten lines.

5/82

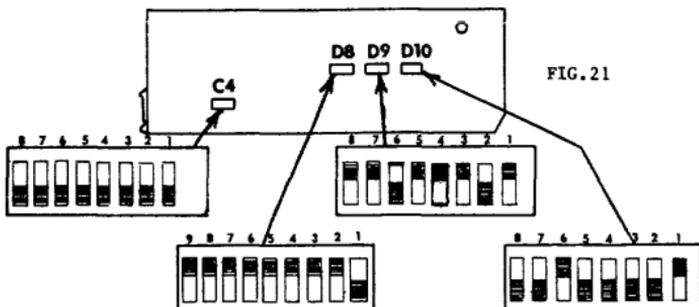
TELETYPE

4. Turn the adjusting screw CLOCKWISE another 2-1/2 turns. This will usually place the impeller sensor in the optimum position, but this adjustment sometimes varies with some printers.

TELETYPE

OPTION SWITCHES FOR 410072 LOGIC BOARD (Fig.21)

Printer Circuit Card Viewed From Beneath Printer - Access to Switches is Through a Cutout in Bottom Pan of Printer.



* Indicates switch in ON position.
 O Indicates switch in OFF position.
 - Position of switch does not affect option.

1. PRINTER RIGHT MARGIN AND FORM WIDTH

Last Char. Printed in Column Number	D8 123456789	D9 12345678	D10 12345678
132	-----**	-----**	*0-00---
121 109 97 85 73	-----**	-----**	**--**---
122 110 98 86 74	-----**	-----**	0*-**---
123 111 99 87 75	-----**	-----**	*0--**---
124 112 100 88 76	-----**	-----**	**--0*---
125 113 101 89 77	-----**	-----**	0*-0*---
126 114 102 90 78	-----**	-----**	*0-0*---
127 115 103 91 79	-----**	-----**	**--*0---
128 116 104 92 80	-----**	-----**	0*-*0---
129 117 105 93 81	-----**	-----**	*0-*0---
130 118 106 94 82	-----**	-----**	**--00---
131 119 107 95 83	-----**	-----**	0*-00---
120 108 96 84	-----**	-----**	*0-00---

To obtain counts:

121 through 132 program as shown.
 109 through 120 program as shown, then operate D9 position 7 OFF.
 97 through 108 program as shown, then operate D9 position 8 OFF.
 85 through 96 program as shown, then operate D8 position 7 OFF.
 73 through 84 program as shown, then operate D8 position 8 OFF.

2. CHARACTER SET

	D8 123456789
a) Printers With 96-Character Set	*0-----
b) Printers With 64-Character Set	0*-----
c) Printers With Extended ASCII Character Set	00-----
d) Printers With Longest Character Set Having Less Than 64 Characters	00-----

TELETYPE

OPTION SETTING FOR THE 410729 LOGIC CARD (2 SWITCH PADS)

- Set the 64 character printer switch as shown in Figure 1.
- Set the 96 character printer switch as shown in Figure 2.

NOTE: This logic board can only be used with the IOU-37.

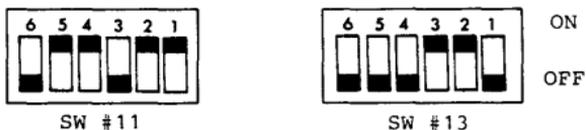


FIGURE 1

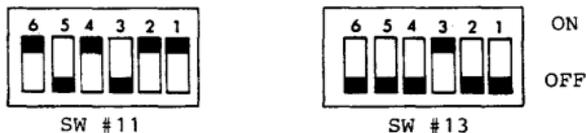


FIGURE 2

TELETYPE

OPTION SETTINGS FOR THE 410072 LOGIC BOARD (4 SWITCH PADS)

IOU-37 OPTION REQUIREMENTS

- Set the 64 character switches (shown in black) as in Figure 1.
- The 96 character switch variations (compared to the 64) are indicated with an X.
- The following switches must be changed; SW D9-1, SW D8-1, and SW D8-2.

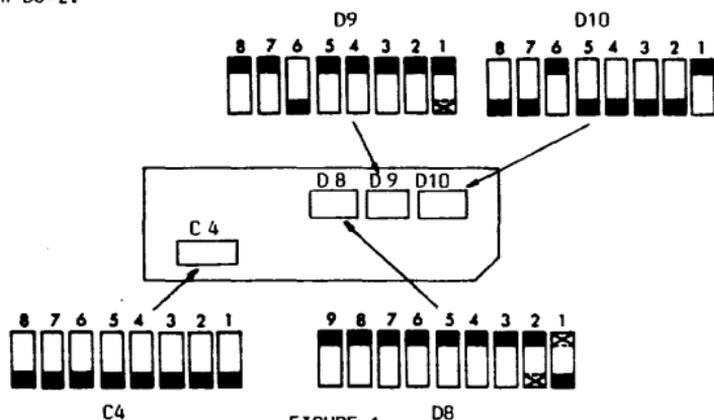


FIGURE 1

IOU-39 AND DTC COM OPTION REQUIREMENTS

- Set the 64 character switches (shown in black) as in Figure 2.
- The 96 character switch variations on SW D9-1, SW D8-1, and SW D8-2, are indicated with an X.

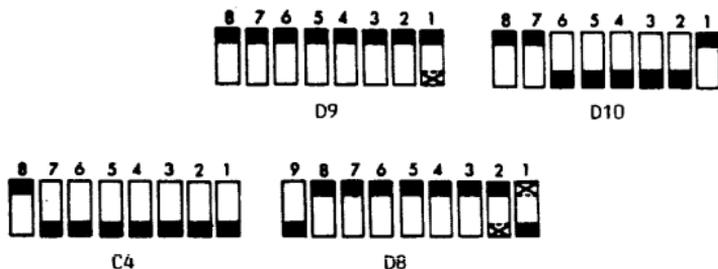


FIGURE 2

TELETYPE

- | | |
|-------------------------------------------------------------------------|-----------------|
| 3. PRINTER LEFT MARGIN AND FORM WIDTH | D8
123456789 |
| a) First Printed Column -- Column 1 | ---****--- |
| b) First Printed Column -- Column 2 | ---*0*--- |
| c) First Printed Column -- Column 3 | ---**00--- |
| d) First Printed Column -- Column 4 | ---*000--- |
| e) First Printed Column -- Column 5 | ---00*0--- |
| f) First Printed Column -- Column 6 | ---000*--- |
| g) First Printed Column -- Column 7 | ---0*00--- |
| h) First Printed Column -- Column 8 | ---*0*0--- |
| i) First Printed Column -- Column 9 | ---00**--- |
| j) First Printed Column -- Column 10 | ---0*0*--- |
| k) First Printed Column -- Column 11 | ---**00--- |
| l) First Printed Column -- Column 12 | ---*00*--- |
| m) First Printed Column -- Column 13 | ---0*00--- |
| 4. SSI/OEM INTERFACE | D8
123456789 |
| a) SSI | -----* |
| b) OEM | -----0 |
| 5. FOLDOVER ON PRINTERS WITH 96-CHARACTER SET | D9
12345678 |
| a) Lower Case and Upper Case Print | 0----- |
| b) Lower Case Prints as Upper Case | *----- |
| 6. FOLDOVER ON PRINTERS WITH 64-CHARACTER SET | D9
12345678 |
| a) Lower Case Prints as Error Symbol | 0----- |
| b) Lower Case Prints as Upper Case | *----- |
| 7. PRINTER PAPER FEED OUT | D9
12345678 |
| a) No Paper Feed Out | ---*----- |
| b) Paper Feed Out on DSR or RM Loss --
16 Lines or One Form. | -00----- |
| c) Paper Feed Out on DSR or LRM Loss or ETX --
16 Lines or One Form. | --*0----- |
| 8. INCOMPLETE FORM SUPPRESSES PAPER ALARM | D9
12345678 |
| a) No (Paper Out Not Gated With Form Out) | ---*----- |
| b) Yes (Paper Out Gated With Form Out) | ---0----- |
| 9. AUX. ALARM | D9
12345678 |
| a) Enable | ---0----- |
| b) Disable | ---*----- |
| 10. IDLE LINE MOTOR CONTROL | D9
12345678 |
| a) Disabled - Motor Held ON Indefinitely
During Idle Line. | ---0----- |
| b) Enabled - Motor Turned Off After 40-second
Idle Line. | ---*----- |

TELETYPE

11. SI/SO DETECTION	D10 12345678
a) SI/SO Detection Not Used	-0-----
b) SI/SO Detection Enables Printing Additional Char.---*-----	
12. PRINTER ERRORED CHARACTER SYMBOL	D10 12345678
a) Printed on Even Parity Error	-----*0-
b) Printed on Odd Parity Error	-----0*-
c) Not Printed on Parity Error	-----**-
d) Prints Extended ASCII Characters (No Parity Check)	-----00-
13. PRINTING OF ESCAPE SEQUENCES SUPPRESSED	D10 12345678
a) Character After ESC Printed as Received	-----0
b) Printing of Character After ESC Suppressed	-----**
14. SPEED SELECTION (applies only if option 4b is selected)	C4 12345678
a) 75 Baud	*0000000
b) 150 Baud	0*000000
c) 300 Baud	000*0000
d) 600 Baud	00*00000
e) 1200 Baud	000000*0
f) 2400 Baud	0000*000
g) 4800 Baud	00000*00
h) 9600 Baud	0000000*

OPTION SWITCHES FOR 410729 LOGIC BOARD (Fig.22)

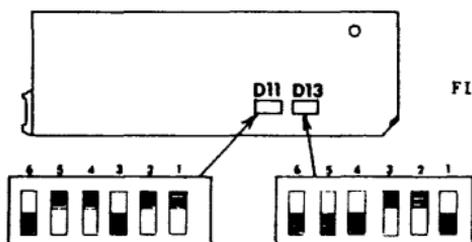


FIGURE 22

1. INCOMPLETE FORM SUPPRESSES PAPER ALARM	D11 123456
a) No (Paper Out Not Gated With Form Out)	*-----
b) Yes (Paper Out Gated With Form Out)	0-----
2. PRINTER ERRORED CHARACTER SYMBOL	D11 123456
a) Printed on Even Parity Error	-*0---
b) Printed on Odd Parity Error	-0*---
c) Not Printed on Parity Error	-**----
d) Prints Extended ASCII Characters- No Parity Chk.	-00---

TELETYPE

3.	PRINTER PAPER FEED OUT	D11 123456	D13 123456
	a) No Paper Feed Out	---*--	0-----
	b) Paper Feed Out on DSR Loss - 16 lines	---0--	0-----
	c) Paper Feed Out on DSR Loss or ETX	---0--	*-----
4.	CHARACTER SET		D11 123456
	a) Printers With 96 Character Set	----0*	
	b) Printers With 64 Character Set	----*0	
	c) Printers With Extended ASCII Character Set	----00	
	d) Printers With Longest Character Set Having Less than 64 Characters	----*0	
5.	FOLDOVER ON UP-LOW PRINTER		D13 123456
	a) Lower Case and Upper Case Print	-0----	
	b) Lower Case Prints as Upper Case	-*-----	
6.	FOLDOVER ON MONOCASE PRINTER		D13 123456
	a) Lower Case Prints as Error Symbol	-0----	
	b) Lower Case Prints as Upper Case	-*-----	
7.	PRINTER MARGIN AND FORM WIDTH		D13 123456
	a) Last Character on Column 132	--*000	
	b) Last Character on Column 131	--0*00	
	c) Last Character on Column 130	---*00	
	d) Last Character on Column 129	---*0*0	
	e) Last Character on Column 128	--0**0	
	f) Last Character on Column 127	---**0*	
	g) Last Character on Column 126	---00*0	
	h) Last Character on Column 125	--0*0*0	
	i) Last Character on Column 124	---*0*0	
	j) Last Character on Column 123	---0***	
	k) Last Character on Column 122	--0***0	
	l) Last Character on Column 121	---****	

TELETYPE

LUBRICATION

General

The printer can be lubricated by positioning it in the ribbon changing (maintenance) position.

Lubricate printer just prior to placing in service or before putting it in storage. The printer should be re-lubricated after it has been in service a few weeks. Thereafter, lubricate mechanisms every 2000 hours of running time.

Apply lubricant to points as indicated.

On small parts, a minimum amount of lubricant should be applied so that the lubricant remains on the parts and does not run off.

Excessive lubricant should be removed with a dry, lint-free cloth.

The following areas must be kept dry, free of all lubricant:

- All electrical components, including terminals.
- All parts normally touched by the operator, including exposed surfaces in ribbon, paper handling areas, and all large flat areas.

The following symbols indicate the quantity of lubricant to be used in a specified area: Symbols 01, 02, 03, etc., refer to 1, 2, 3, etc., drops of oil. The following list of symbols applies to the lubrication instructions and the type of lubricant to be used:

- 0 88970 oil.
- G Apply thin film of 145867 grease.
- S Saturate felt oilers, washers, and wicks with oil.
- D Keep dry, no lubricant permitted.

NOTE: All ball bearings are packed with grease and normally need no re-lubrication. However, if lubrication is required 195298 (Beacon 325) grease should be used. Grease is to be applied 1/64 inch maximum thickness.

TELETYPE

PRINTER

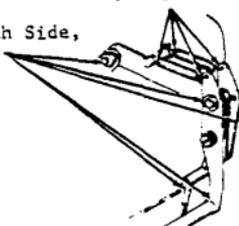
LUBRICATION

Front and Top

01 Springs (Each End,
2 Springs)

01 Pivot (Each Side,
5 Places)

NOTE: The type carrier
must be removed to gain
access to the pad.



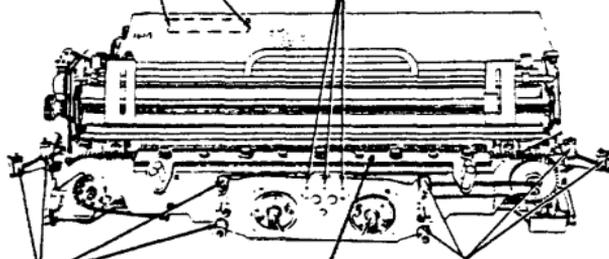
01 Motor Shaft Bearings
(Both Ends)

02 Ribbon Mechanism

01 Ribbon Guide Rollers
(4 Places)

01 Ribbon Guide Rollers
(4 Places)

S Felt Wick Under
Type Carrier



G Front Flange of Left Idler
Sprocket (Rear Surface)

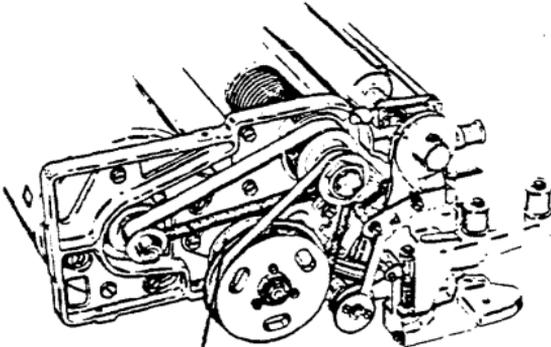


IDLER

TELETYPE

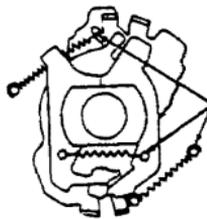
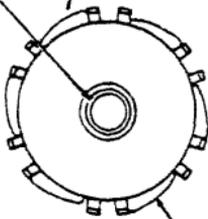
LUBRICATION (Cont)

Left Side



.01 Left Ribbon Guide
Bracket Pivot

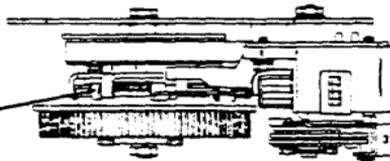
02 Sleeve End
of Shaft



01 Hooks

G Cam Surfaces (6 Places)

01 Paper Feed Clutch
S Felt Wick

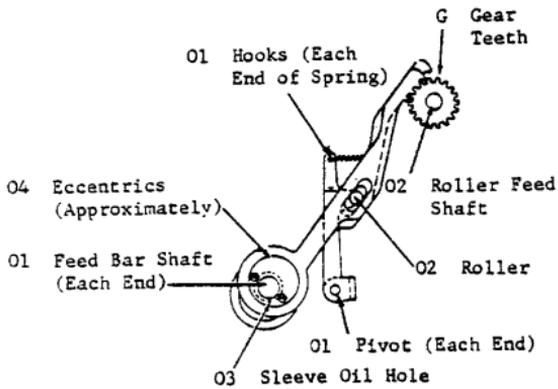
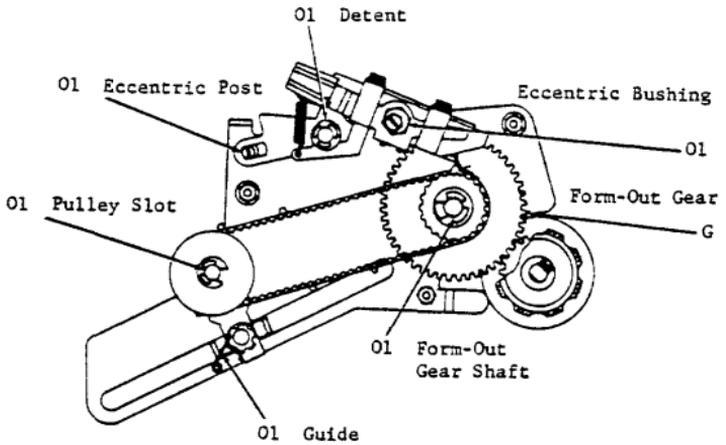


(Top View)

TELETYPE

LUBRICATION (Cont)

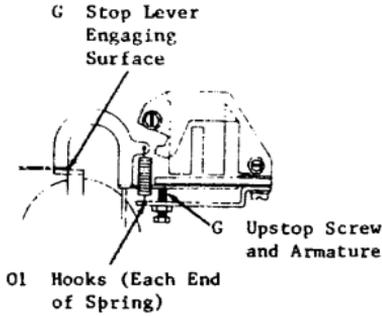
Left Side



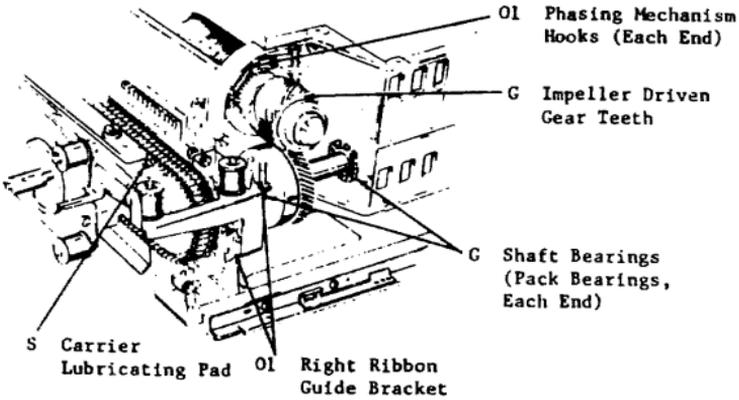
TELETYPE

LUBRICATION (Cont)

Left Side



Right Side



Bits					000	001	010	011	100	101	110	111				
b ₇	b ₆	b ₅	b ₄	b ₃	b ₂	b ₁	Column	Row	0	1	2	3	4	5	6	7
0	0	0	0	0	0	0	SEE CONTROL CHARACTER TABLE				SP	0	@	P	@	P
0	0	0	1	1	1			!	1	A	Q	A	Q			
0	0	1	0	2		"		2	B	R	B	R				
0	0	1	1	3		#		3	C	S	C	S				
0	1	0	0	4		\$		4	D	T	D	T				
0	1	0	1	5		%		5	E	U	E	U				
0	1	1	0	6		&		6	F	V	F	V				
0	1	1	1	7		'		7	G	W	G	W				
1	0	0	0	8		(		8	H	X	H	X		
1	0	0	1	9		)		9	I	Y	I	Y		
1	0	1	0	A		*		:	J	Z	J	Z				
1	0	1	1	B		+		;	K	[	K	[
1	1	0	0	C		,		<	L	\	L	\				
1	1	0	1	D		-		=	M	]	M]			
1	1	1	0	E		.		>	N	^	N	^				
1	1	1	1	F		/		?	O	~	O	~				

BASIC CODE SET FOR 64 CHARACTER PRINTERS

NOTES:

HEXDECIMAL = ASCII COLUMN, ASCII ROW.

IOU's FOR 64 CHARACTER PRINTERS IGNORE BIT 6 (2^5), AND REPLACE IT WITH THE INVERTED BIT 7 (2^6). THIS PRINTS COLUMNS 0 and 1 AS CHARACTERS IN COLUMNS 2 AND 3, AND COLUMNS 6 AND 7 AS CHARACTERS IN COLUMNS 5 AND 6.

ALL BITS ARE ENABLED FOR CONTROL CODES (SEE TABLE).

EXACT CHARACTERS IN POSITIONS 6, 0 AND 7B THRU 7F MAY VARY SLIGHTLY BETWEEN PRINTERS. THESE POSITIONS ARE NOT AVAILABLE ON THE SELECTRIC.

Bits					000	001	010	011	100	101	110	111
b ₄	b ₃	b ₂	b ₁	Column Row	0	1	2	3	4	5	6	7
0	0	0	0	0			SP	0	@	P	\	p
0	0	0	1	1			!	1	A	Q	a	q
0	0	1	0	2			"	2	B	R	b	r
0	0	1	1	3			#	3	C	S	c	s
0	1	0	0	4			†	4	D	T	d	t
0	1	0	1	5			%	5	E	U	e	u
0	1	1	0	6			&	6	F	V	f	v
0	1	1	1	7			'	7	G	W	g	w
1	0	0	0	8			{	8	H	X	h	x
1	0	0	1	9			}	9	I	Y	i	y
1	0	1	0	A			*	:	J	Z	j	z
1	0	1	1	B			+	;	K	[	k	{
1	1	0	0	C			,	<	L	\	l	|
1	1	0	1	D			-	=	M	]	m	}
1	1	1	0	E			.	>	N	^	n	~
1	1	1	1	F			/	?	O	-	o	DEL

BASIC CODE SET FOR 96 CHARACTER PRINTERS

NOTES:

HEXIDECIMAL = ASCII COLUMN, ASCII ROW.

IOU's FOR 96 CHARACTER PRINTERS FORCE BIT 6 TO A 1 WHEN BIT 7 (2⁶) IS 0. THIS PRINTS COLUMNS 0 AND 1 AS CHARACTERS IN COLUMNS 2 AND 3.

ALL BITS ARE ENABLED FOR CONTROL CODES (SEE TABLE).

EXACT CHARACTERS IN POSITIONS 6,0 AND 7B THRU 7F MAY VARY SLIGHTLY BETWEEN PRINTERS. THESE POSITIONS ARE NOT AVAILABLE ON THE SELECTRIC.

DATA PRODUCTS

ADJUSTMENT PROCEDURES FOR DP-2230 SERVO PCB

These adjustments will help to alleviate problems of overprinting with possible hammer faults and/or format errors. Also, print speed can be increased as much as 30%. All adjustments are on the Servo PCB and should be performed anytime Servo PCB is replaced or problems in Servo systems come up.

The adjustments are in order as follows:

6/8 LPI Adjustment

● Scope Settings

CH1 - 0.5 VCM, TP J11-2
CH2 - 0.5 VCM, TP J11-3
Time - 10 MS Div.
Trig - EXT (-), TP J21-1
Vert. Mode - Chop

● 6 LPI Adjustment

Place a loop of single part 11 X 14 paper around drum gate for this adjustment. Establish APT "Print" test, manual section, print E's. Adjust R218 for minimum overshoot and undershoot of both signals. (Refer to Figure 1 below.)



FIGURE 1
6 LPI & 8 LPI PAPER STEP

● 8 LPI Adjustment

Leave all scope settings and TP's as established in 6 LPI adjustment. Place the 6/8 LPI switch on operator panel to the 8 LPI position and start "Print" test. Adjust R204 for minimum overshoot and undershoot of both signals.

DATA PRODUCTS

ADJUSTMENT PROCEDURES FOR DP-2230 SERVO PCB Continued

Slew Speed Adjustment

● Scope Settings

CH1 - 2 VCM, TP J20-4
Time - 1 MS Div.
Trig - INT (-) CH1
Vert. Mode - CH1

● Adjustment Procedure

1. Tape down paper out switches (no paper in printer).
2. Place 6/8 LPI switch in 6 LPI position.
3. Load following test program:
[IPL] 1d009D 4d449D 0000A3 0003A7 [XMIT]
(d - To be replaced by Controller Address.)
4. On Terminate, the tractors will rotate then stop as system checks status, and then rotate again, etc. As tractors are rotating, adjust R206 for 8.1 ms (± 0.2 ms) from trailing edge to trailing edge as indicated in Figure 2 below.

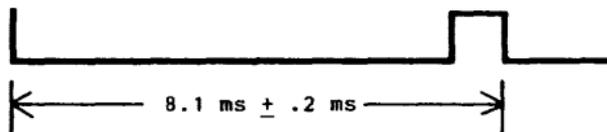


FIGURE 2

Verification Procedure for 6/8 LPI and Slew Speed Adjustment

● Scope Settings

CH1 - 10 VCM, TP J21-1
CH2 - 2 VCM, TP J20-4
Time - 5 MS Div.
Trig - INT (-) CH1
Vert. Mode - Chop

DATA PRODUCTS

ADJUSTMENT PROCEDURES FOR DP-2230 SERVO PCB Continued

Slew Speed Adjustment For 6/8 LPI Continued

● Test Procedure

1. Remove tape from paper out switches and load paper into printer.
2. Establish ATP "Print", manual section, print E's.
3. Look at CH2 and verify that it is 50 ms or less from trailing edge to trailing edge. There are no adjustments to this procedure.
4. If the 6/8 LPI and slew speed are correct, then verification will be correct. Refer to figure 3 for correct adjustment.

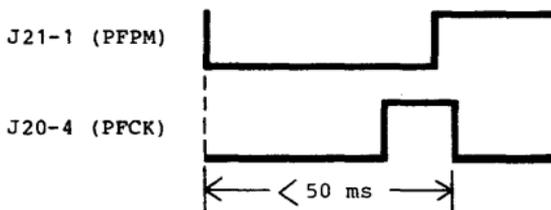


FIGURE 3
PAPER FEED TIMING VERIFICATION

NOTE: If time delay is greater than 50 ms, the paper feed servo needs repair. No further adjustments should be attempted. Replace paper feed servo board and make previous adjustments again.

Move Hammer Bank Left/Right Servo Adjustment

● Scope Settings

- CH1 - 0.5 VCM, TP J3-5
- CH2 - 0.5 VCM, TP J3-3
- Trig - EXT (-), TP J23-2 (Trailing Edge, HI to LO)
- Time - 20 ms Div. (10 ms after signal is established)

NOTE: Signal may be easier to catch if scope is in NORM mode instead of Auto mode.

DATA PRODUCTS

ADJUSTMENT PROCEDURES FOR DP-2230 SERVO PCB CONTINUED

Move Hammer Bank Left/Right Servo Adjustment

● Test Procedure

The test can be done using the ATP test or with the test program written at the end of this procedure. If ATP test is used, a paper loop should be used in the printer. With the test program, no paper is used. (Paper is loaded for Paper Out Switch.)

● ATP Test Procedure

Start ATP Print Test, manual section, print E's. As printer is printing, adjust R145 to resemble Figure 4. Minimize the over/under shoot of signal.

● Test Program Procedure

Load program at Device "Zero". Make sure Paper Out Switches are down, paper or taped. Follow adjustment procedure as above using Figure 4.



FIGURE 4
MOVE (LEFT TO RIGHT) ADJUSTMENT

Final Hammer Bank Servo Adjustment

- Same as previous adjustment except for trigger.
Trig - EXT (+), LO to HI
- Establish test procedure as in previous adjustment and adjust R127 to resemble Figure 5, again minimizing the over/under shoot of the signal.

DATA PRODUCTS

ADJUSTMENT PROCEDURES FOR DP-2230 SERVO PCB CONTINUED

Hammer Bank Servo Adjustment



FIGURE 5

FINAL BALANCE (RIGHT TO LEFT) ADJUSTMENT

NOTE: Test Program for Hammer Bank Servo Adjustment:

```
[IPL] 0088F2200000 0000A8 [XMIT]
```

Enter 2 1/2 CRT Lines of Spaces [XMIT].

```
[IPL] 1d009D 0088F22000Bd 0000A7 [XMIT]
```

(d = Printer Device Number)

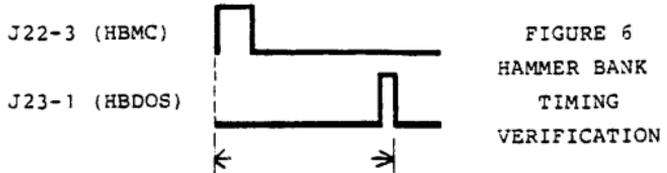
Verification Test of Hammer Bank Servo Adjustments

● Scope Settings

CH1 - 2 VCM, TP J22-3
CH2 - 5 VCM, TP J23-1
Time - 5 ms Div.
Trig. - INT (+) CH1
Vert. Mode - Chop (Place Trigger Mode to NORM)

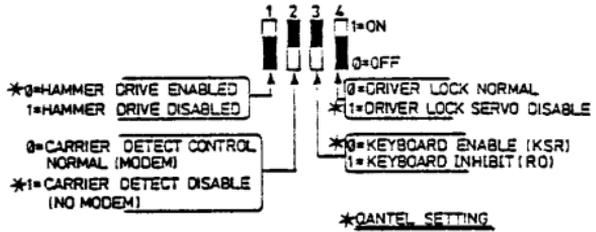
● Test Procedure

Establish ATP Test "Print", manual section, print E's. The signal must be less than 50 ms from leading edge of HBMC to the trailing edge of HBDOS, and should fall between 37-50 ms (refer to Figure 6).

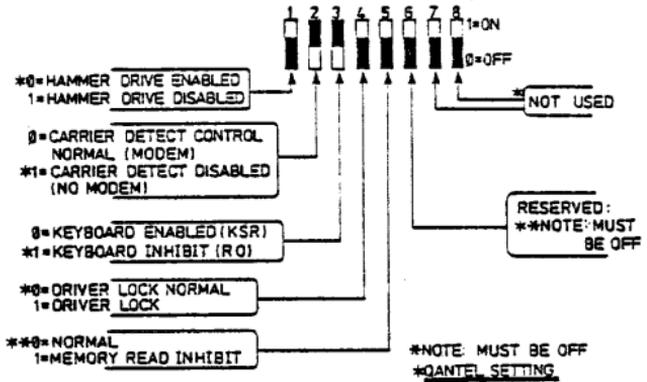


NOTE: If the verification test does not meet these requirements, stop all other tests or adjustments until problem in Hammer Bank Servo System is resolved. Problem is either in previous adjustment, Servo PCB, or Hammer Bank System.

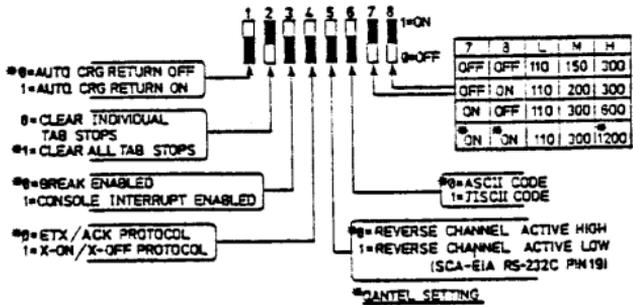
NEC



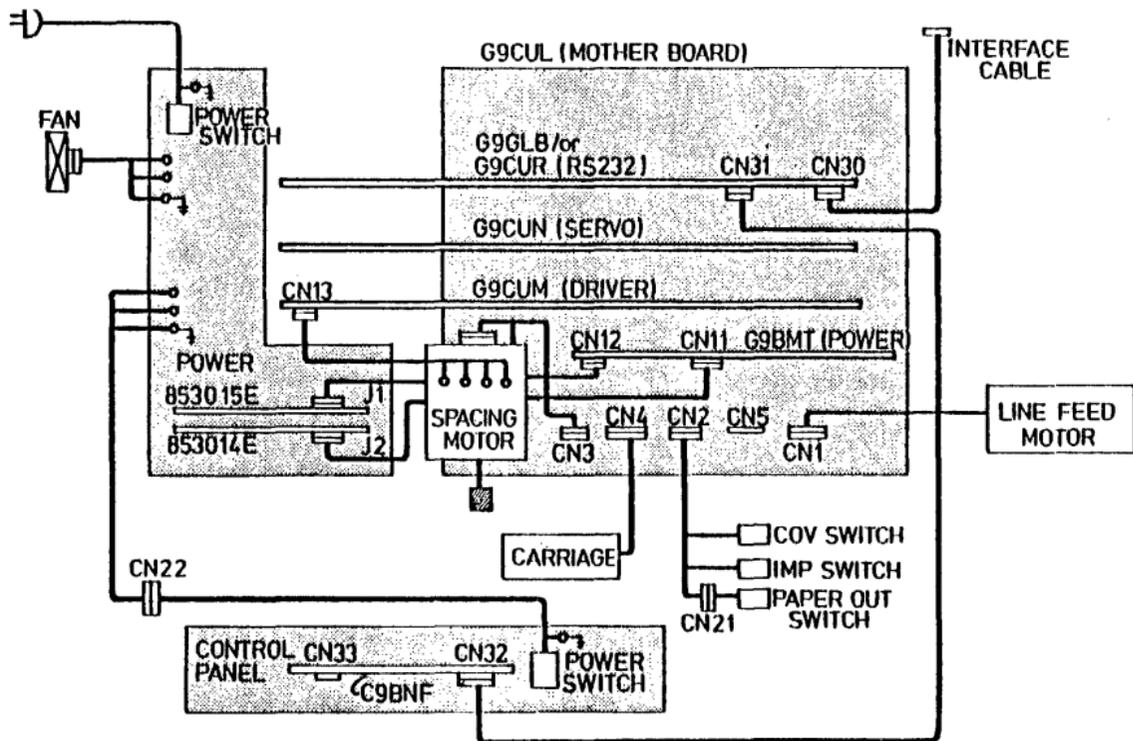
G9CUR Board for the old Processor



G9GLB Board for the New Processor



G9BNF Board



CABLE CONFIGURATION

5100 SERIES PRINTER

UNPACKING

Stand the printer carton on its end, open and remove the foam end piece. The printer may now be lifted from the carton. Next clip the cable tie used to hold the head securely during shipping. Save all packing material for possible return shipment.

CABLING AND SWITCH SETTINGS

The printer can be directly driven by the IOU-39P, or may serve as a slave printer for the CRT2 or the 210 system. The 232/V24 cable is used in all three configurations. This cable is available in four lengths:

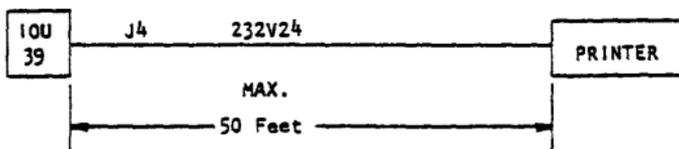
<u>Part Number</u>	<u>Length</u>
42055-001	6 ft.
42055-002	12 ft.
42055-003	25 ft.
42055-004	50 ft.

Note: Greater lengths will require line drivers.

* The 5100 printer can also be cabled to an R.D.I. Box. Refer to pages 1-9D to 1-9G for this configuration.

IOU-39P Interface System Printer-

CONFIGURATION #1 LOCAL (LESS THAN OR EQUAL TO 50 FT)

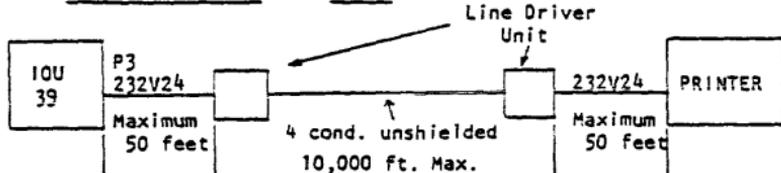


- A Maximum length of 50 ft. of 232V24 cable can be used to connect the Printer and IOU-39.

5100 SERIES PRINTER

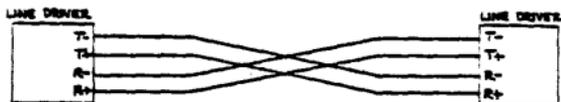
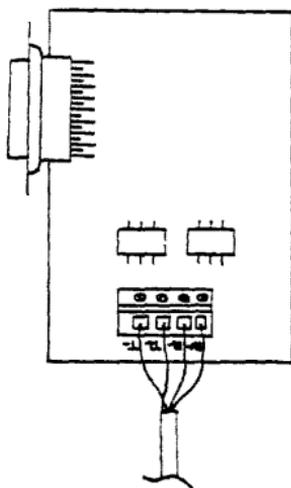
CONFIGURATION #2

LOCAL (Greater than 50 ft.)



- Two line driver units needed: One connects to IOU-39 through 232V24 cable, the other connects to printer through 232V24 cable.
- Note: the P3 connector of the IOU-39 is used in this case.
- Detail on the line driver unit connection is shown below.

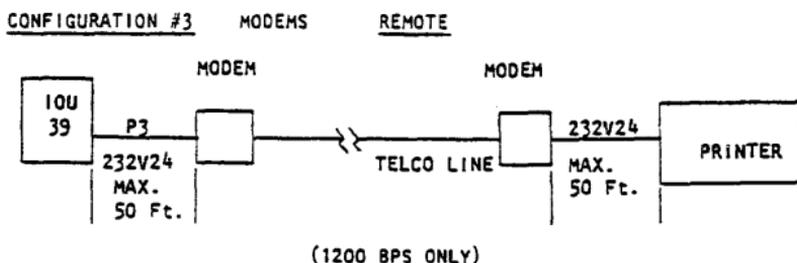
LINE DRIVER UNIT



5100 SERIES PRINTER

- Line driver assembly, box and P.C.B. Part number - M42118-001
- The 4 conductor unshield cable used between line drivers is available in five different lengths:

<u>Part Number</u>	<u>Length</u>
M42851-001	100 ft.
M42851-002	500 ft.
M42851-003	1000 ft.
M42851-004	5000 ft.
M42851-005	10,000 ft.



- If printer to system distance exceeds 2 miles modems are required. Modem communications take place over leased or dial-up lines using asynchronous modems at 1200 BPS. Ordering and installation of modems and phone lines is the responsibility of the customer. Controller and printer are connected to the modems using 232V24 cables.

A) Leased Lines

The suggested modem for leased lines is the Bell 202T with the options listed on the following page.

5100 SERIES PRINTER

Circuit	4-wire, multipoint, private line
Received data squelch	9 msec
Clear-to-send delay	8 msec
Fast carrier detection	IN
Soft carrier turn-off	8 msec
Receive data clamp	IN
Grounding	AB connected to AA
Alternate voice	Optional
Dial backup	Optional
Carrier detector reset	OUT
Continuous carrier	IN at master site, OUT at all slave stations.

B) Dial-up Lines

A pair of dial-up full duplex 2-wire line modems may be used between an IOU-39 controller and a remote site. The suggested modem is the Bell 212A data set with the following options:

CC indication for AL	ON
Speed control	By HS button
Interface controlled Busy	OUT
Transmitter timing	Internal
1200 bps operation	Asynchronous
Character length	10 bit
Receiver responds to DL	OUT
Interface controlled DL	OUT
Loss of carrier disconnect	OUT
Receive space disconnect	OUT
CB/CF indications	Separate
Send space disconnect	OUT
Auto Answer	IN
Answer mode indication-CE	OFF
Speed mode	HIGH
Interface speed indication	OUT
CN and TM assignments	CN25, TM not connected
Grounding	AB connected to AA

5100 SERIES PRINTER

SWITCH SETTINGS - IOU39P

- CONFIGURATION SWITCHES SETTING FOR IOU-39P BOARDS:
IOU39 P and 5100 ROMS must be Rev L or higher.

		IOU-39 CONFIGURATION SWITCHES								
		80	40	20	10	8	4	2	1	
Printer Type	5131 Printer	1	1	0			(1)* 0	0	0	
	1200 BPS				0	1	(1)* 0	0	0	
BAUD RATE	9600 BPS				1	1	(1)* 0	0	0	

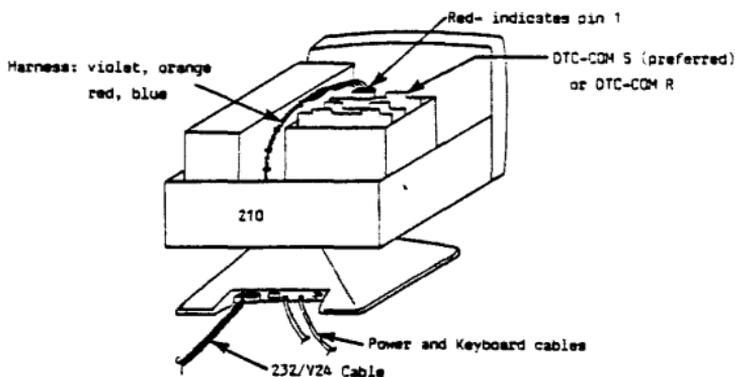
*NOTE: SET SWITCH 4 TO 1 FOR REMOTE AND 0 FOR LOCAL

5100 SERIES PRINTER

210 System Interface Printer

- DTC-COM S (preferred) or DTC-COM R (alternate) is used in any empty slot in the card cage. Place the connector for the board as shown below. (This connector is part of the cable harness inside the 210). Connect 232/V24 extension cable as shown.

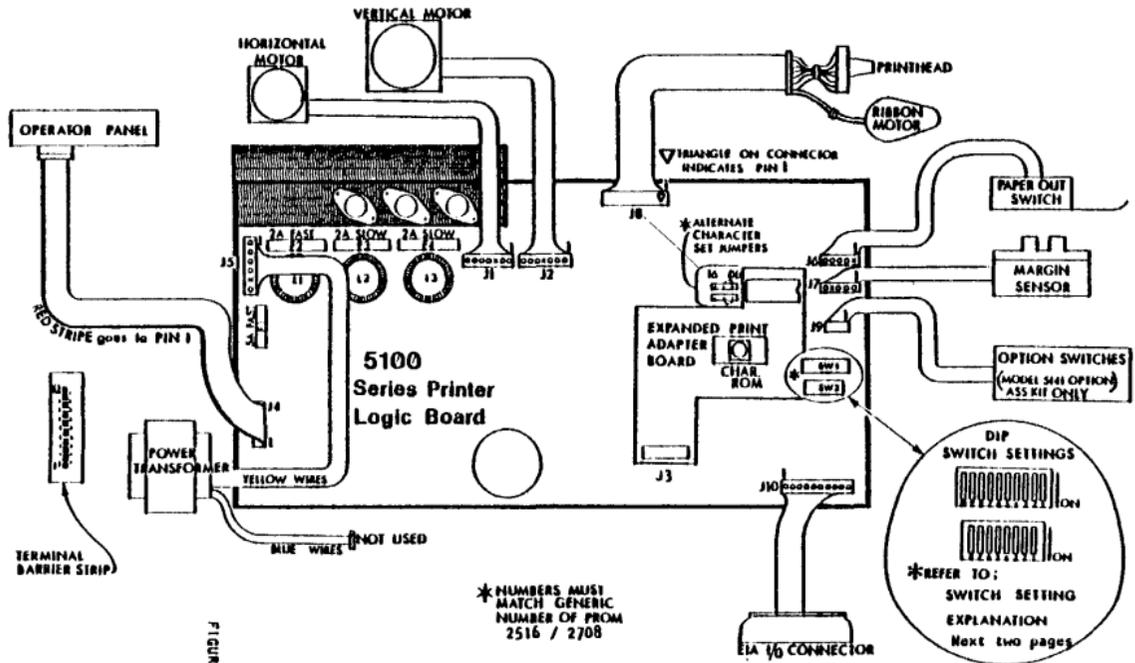
RPTR-11C or later ROMS must be used on the COM S or COM R boards.



Switch Settings DTC-COM S, DTC-COM R

80	ON
40	ON
20	OFF
10	ON
08	ON
04	COM S = ON
	COM R = OFF
02	OFF
01	OFF

1-67



* NUMBERS MUST MATCH GENERIC NUMBER OF PROM 2516 / 2708

FIGURE F

5100 SERIES PRINTER

SWITCH SETTINGS - PRINTER

- Two DIP switch packs are located on the printer board (See Interconnection Diagram, Figure F). The 8 switch pack at 3N establishes UART controls as follows:

0=OFF 1=ON

BPS	SW1	SW2	SW3	SW4
50	0	0	0	0
75	0	0	0	1
110	0	0	1	0
134.5	0	0	1	1
150	0	1	0	0
300	0	1	0	1
600	0	1	1	0
1200	0	1	1	1
1800	1	0	0	0
2000	1	0	0	1
2400	1	0	1	0
3600	1	0	1	1
4800	1	1	0	0
7200	1	1	0	1
9600	1	1	1	0
19.2K	1	1	1	1

SW5	<input type="radio"/> ON = PARITY <input type="radio"/> OFF = NO PARITY
SW6	<input type="radio"/> ON = 2 STOP BITS <input type="radio"/> OFF = 1 STOP BIT
SW7	<input type="radio"/> ON = 8 DATA BITS <input type="radio"/> OFF = 7 DATA BITS
SW8	<input type="radio"/> ON = ODD PARITY <input type="radio"/> OFF = EVEN PARITY

5100 SERIES PRINTER

- The 10 switch DIP pack located at 4N on the Printer logic board (See Interconnection Diagram, Figure F).



5100 SERIES PRINTER

POWER OPTIONS

- The following power options exist:

100 VAC	50/60 Hz
115 VAC	50/60 Hz
220 VAC	50/60 Hz
240 VAC	50/60 Hz

- Printers shipped to international sites may require modification of the line cord wall plug. It is the responsibility of the distributor to install the line cord plug common to their locale.

- Place the proper fuse in the line fuse receptacle located below the power On/Off switch on the back panel.

110 VAC	2A, SLO-BLO, 125 V
115 VAC	2A, SLO-BLO, 125 V
220 VAC	1A, SLO-BLO, 250 V
240 VAC	1A, SLO-BLO, 250 V

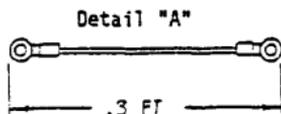
- The following four illustrations show the power option strapping configurations on the terminal barrier strip which is adjacent to the power transformer on the rear panel assembly.
- Two styles of barrier strip jumpers are used for the power option configurations:

Jumper	Part Number
2 position barrier strip jumpers	A11669-001
3 position barrier strip jumpers	A11669-002

5100 SERIES PRINTER

POWER OPTIONS

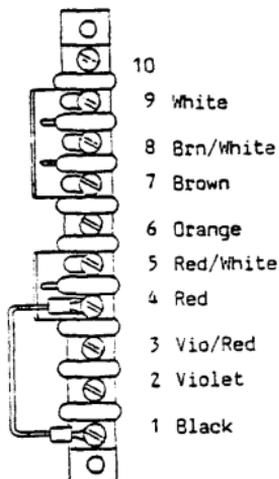
100 VAC
50/60 Hz



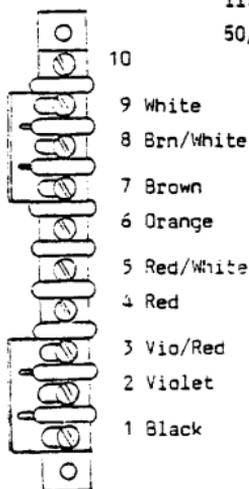
Install a jumper wire as shown in detail "A" from pin #1 to pin #4

Install barrier strip jumpers as shown

Install 2A, SLO-BLO, 125V Fuse in fuse holder on rear panel



115 VAC
50/60 Hz



Install barrier strip jumpers as shown

Install 2A, SLO-BLO, 125V Fuse in fuse holder on rear panel

5100 SERIES PRINTER

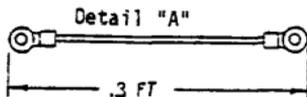
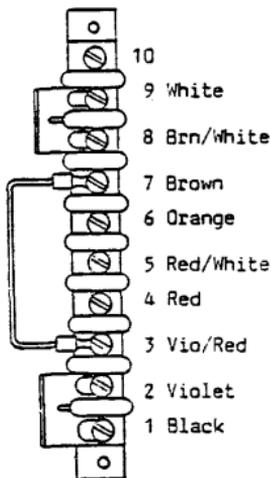
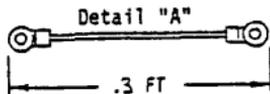
POWER OPTIONS

220 VAC
50/60 Hz

Install a jumper wire as shown in detail "A" from pin #3 to pin #7

Install barrier strip jumpers as shown

Install a 1A, SLO-BLO, 250 V Fuse in the fuse holder



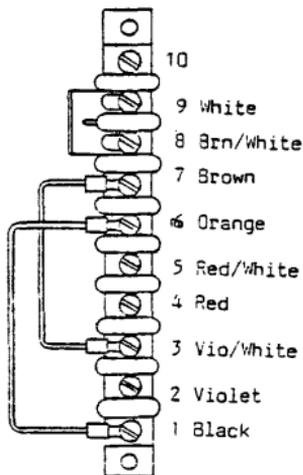
240 VAC
50/60 Hz

Install a jumper wire as shown in detail "A" from pin #1 to #6

Install a jumper wire as shown in detail "A" from pin #3 to pin #7

Install barrier strip jumpers as shown

Install a 1A, SLO-BLO, 250 V Fuse in the fuse holder



5100 SERIES PRINTER

PLATEN ADJUSTMENT

- With the printer assembly removed from the clamshell enclosure, remove the ribbon cartridge from the print head. Rotate the form thickness knob clockwise situating the print head in its closest position relative to the platen bar. Do not change the position of the form thickness knob throughout this adjustment procedure.

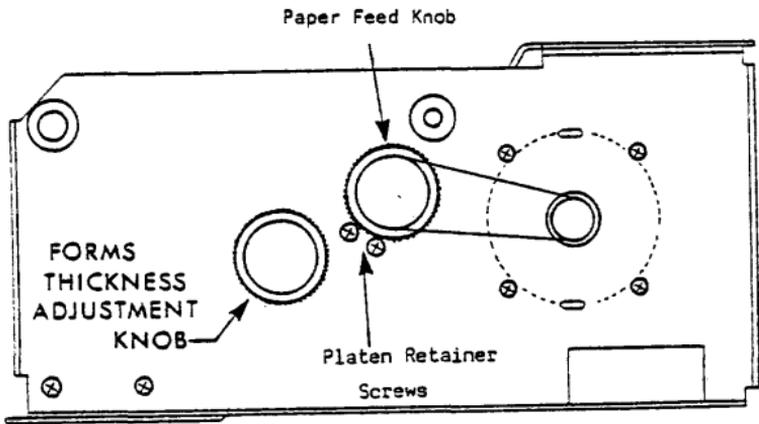


Figure G

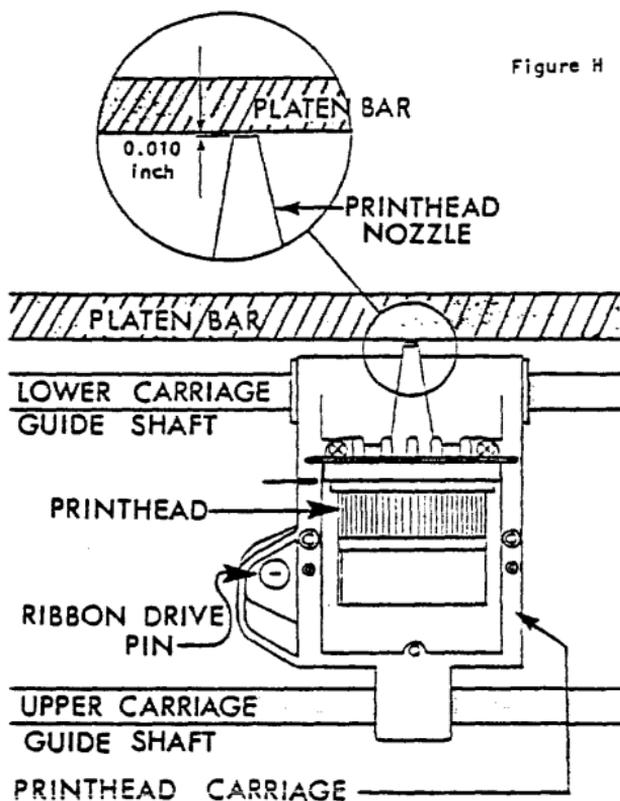
- Loosen slightly the platen retainer screws (2 located on each end of the platen bar) enabling the platen bar to be moved, yet still held in position. (See Figure G). Manually position the print head carriage as far toward the left margin as possible. Using a feeler gauge, align

5100 SERIES PRINTER

PLATEN ADJUSTMENT CONT.

the platen bar to be 0.010 inches from the nozzle of the print head (see Figure H).

- Manually position the print head carriage as far toward the right margin as possible and likewise align the platen bar to a 0.010 inch clearance from the nozzle of the print head using a feeler gauge. The platen retainer screws on the right margin end of the platen bar are now tightened.



5100 SERIES PRINTER

ATP TEST

- Use the ATP program PRINT or QAN 39 for testing.

OPERATING SYSTEM DIAGNOSTIC UTILITIES

- The PRINT program is also available as one of the Operating System Diagnostic Utility programs under the name *PRINT.

SELF TEST

- Depressing the SELF TEST switch while in the OFFLINE mode causes the printer to print the complete character set in bidirectional mode. Momentarily tapping the SELF TEST switch at the end of a print line will cause printing to stop. Depressing the ONLINE switch will also stop the test printing.

5100 SERIES PRINTER

PRINT HEAD TEST PROCEDURES

Shorted coils in the print head can produce the following symptoms: the carriage moves back and forth normally, but the print-wire solenoids don't fire. This is usually accompanied by the failure of fuse F1. The logic board will probably be damaged. In the event of such a failure, both the print head and the logic board should be checked.

To check the print head:

1. Unplug the AC line cord.
2. Unplug the head cable from connector J8.
3. Verify the coil resistances via the head cable P8 according to the following table:

<u>Pin Numbers</u>		<u>Resistance</u>
1 to 2	Ribbon Motor	20-30 ohms
3 to 4	Solenoid #1	3-4 ohms
5 to 6	Solenoid #3	3-4 ohms
7 to 8	Solenoid #5	3-4 ohms
9 to 10	Solenoid #7	3-4 ohms
11 to 12	Solenoid #2	3-4 ohms
13 to 14	Solenoid #4	3-4 ohms
15 to 16	Solenoid #6	3-4 ohms
17 to 18	Solenoid #8	3-4 ohms
19 to 20	Solenoid #9	3-4 ohms

Note: Some method must be used to access the pins on J8, such as a short piece of wire, or sharply pointed ohm meter probes used at the end of the ribbon cable.

5100 SERIES PRINTER

To check the print-wire driver transistors on the logic board:

1. Unplug the AC line cord.
2. Unplug the head cable from connector J8.
3. Test for damaged driver transistors by measuring the resistance from the mounting tabs to logic board ground on transistor Q24 through Q32. This resistance should measure infinity on the 200K ohm scale.

2. CABLE ORIENTATION

1. Pin 1 of the head cable P8, should be indicated by a triangular symbol on the connector, and should mate with pin 1 of J8 which is labelled on the PC board. Since some cables may have P8 installed backwards a resistance check should be made using the table on the previous page.
2. J1, J2, J6, J7 and J10 are keyed and bear a ridge on one side of the molex connector.

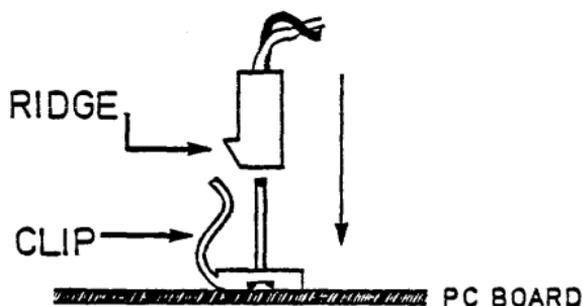


Figure 1
1-77

5100 SERIES PRINTER

3. PC BOARD MOUNTING

To prevent shorts be sure the fibre washers have been installed under the mounting screws when the Logic Board is replaced. Also check to be sure that nylon caps are in place on the standoffs and that the ground lead is not shorting.

4. POWER TRANSFORMER SECONDARY CABLES

1. The cable of yellow wires from the power transformer secondary is routed to connector J5 on all logic boards.
2. The cable of blue wires from the power transformer secondary is routed to the logic board only if a J11 connector exists on the board. On some boards J11 will reside at the end of a short pigtail of wires. Boards not having J11 do not use the blue cable from the power transformer secondary, yet are still totally compatible.

CENTRONICS 702

PRINT HEAD ASSEMBLY

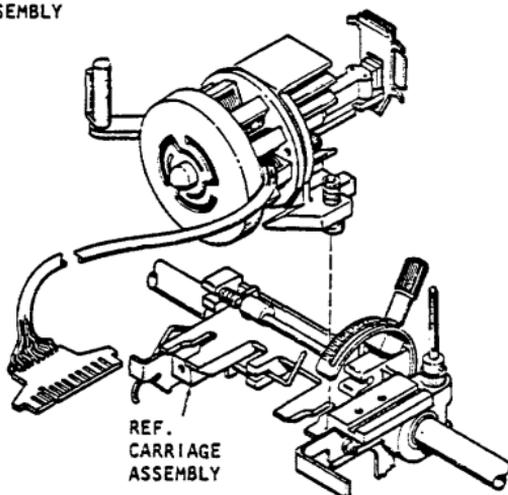


Figure 1
Print Head Assembly

REMOVAL/REPLACEMENT PROCEDURES

TOOLS REQUIRED: None

- Remove the ribbon from the print head ribbon guides.
- Remove the fingerboard P037 on the print head cable from connector J037 on the video amplifier.
- On the left side of carriage assembly release clamping spring tension by pulling spring up and over spring retainer.
- Remove print head by sliding off carriage towards front of printer.

Note: Releasing tension on clamping spring will enable print head to be removed. When installing print head assembly, ensure the clamping spring catches the lip underneath the head, then pull spring up and over spring retainer.

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ADJUSTMENTS

Print Head Penetration

- Loosen penetration control knob and hardware securing head adjusting indicator.
- Move penetration control knob away from platen and as close as possible, but not contacting, the print head.
- Lightly tighten indicator hardware.
- Insert a 0.177mm (0.007 in.) feeler gauge between the print head and platen. Move penetration control knob towards the platen until 0.177mm (0.007 in.) gap is met. Tighten penetration control knob.
- Holding penetration control knob, loosen hardware securing head adjusting indicator and position indicator against penetration control knob.
- Tighten head adjusting indicator hardware.
- Loosen penetration control knob and move back and forth.
- Retighten control knob against indicator and recheck for 0.177mm (0.007 in.) gap.

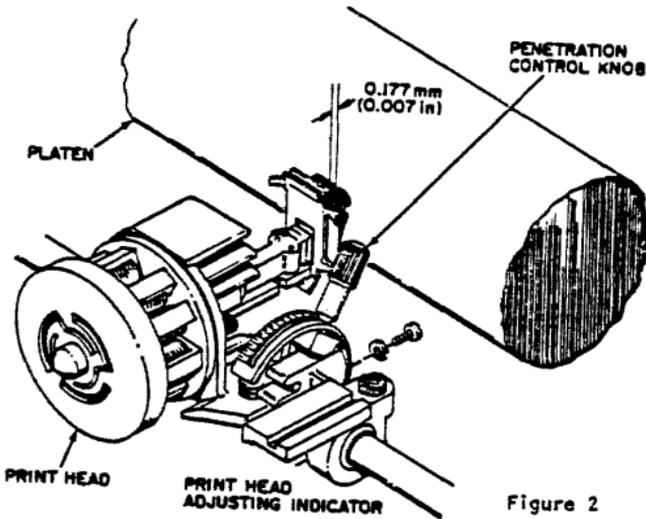


Figure 2

PENETRATION CONTROL ADJUSTMENT PRINT HEAD ASSEMBLY

CENTRONICS 702

VIDEO AMPLIFIER ASSEMBLY

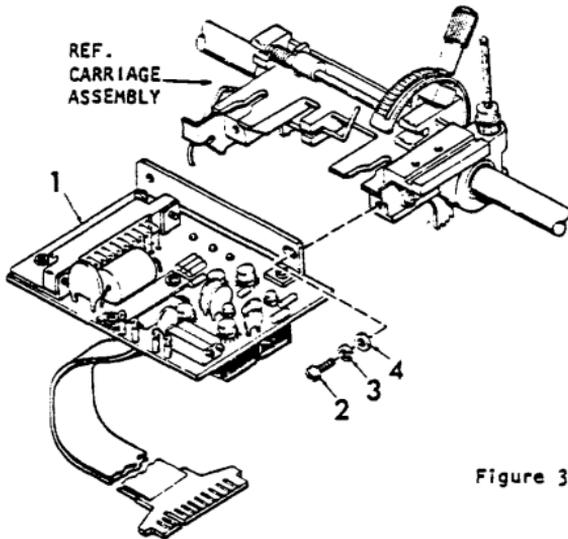


Figure 3

REMOVAL/REPLACEMENT PROCEDURES

TOOLS REQUIRED: Phillips Head Screwdriver.

- Remove print head cable fingerboard P037 from connector J037 on video amplifier.
- Remove connector J036, on cable of video amplifier, from connector P036 on logic board.
- Remove the four carriage solenoid wires attached to the bottom of the video amplifier.
- Remove the two screws (2), lockwashers (3) and flatwashers (4) and remove video amplifier (1) and attaching cable from printer.

ADJUSTMENTS

NOTE: The video amplifier contains an optical pickup assembly which must be adjusted. Steps 1 and 2 detail the mechanical alignment of the pickup assembly, while step 3 outlines

CENTRONICS 702

ADJUSTMENTS (cont.)

the electrical adjustments.

Optical Pickup Alignment With Respect To Timing Fence.

- Loosen the hardware supporting the video amplifier to the carriage.
- Ensure the timing fence is centered in the slot of the optical pickup assembly. If required, loosen optical pickup mounting hardware and position pickup assembly so that timing fence is centered in slot and tighten hardware.
- Ensure the bottom of the optical pickup assembly is parallel with bottom of timing fence, once positioned.
- When above conditions have been met, tighten video amplifier mounting hardware.

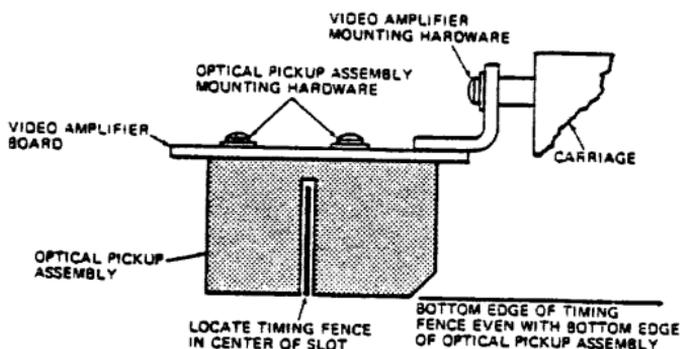


Figure 4

OPTICAL PICKUP ASSEMBLY ADJUSTMENT WITH RESPECT TO TIMING FENCE

CENTRONICS 702

VERTICAL AND HORIZONTAL ALIGNMENT OF OPTICAL PICKUP ASSEMBLY

- Sight right edge of optical pickup assembly and ensure parallel alignment with respect to timing fence encoder lines. If not parallel, loosen right side hardware mounting the video amplifier to carriage and adjust video amplifier until optical pickup assembly is parallel with encoder lines.
- Sight bottom edge of optical pickup assembly and ensure parallelism with bottom edge of timing fence.

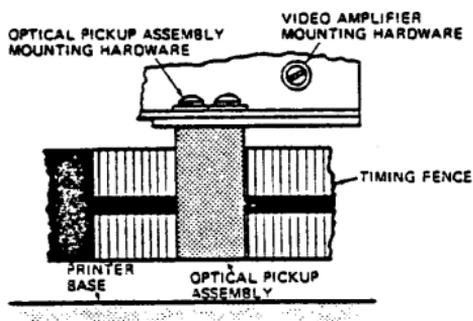


Figure 5

VERTICAL AND HORIZONTAL ALIGNMENT OF OPTICAL PICKUP ASSEMBLY

CENTRONICS 702

ELECTRICAL ADJUSTMENTS OF VIDEO AMPLIFIER

NOTE: The main logic board determines the forward and reverse direction of the print head by comparing the leading and trailing edges of one video channel pulse with the other video channel pulse. The outputs from both channels are adjusted for a 50% duty cycle and a constant 90° phase shift between channels. Both the duty cycle adjustment and the phase adjustment are performed separately as follows.

DUTY CYCLE ADJUSTMENT

- Ensure that the optics block on the underside of the video amplifier board is centered over the timing fence, so that the block does not rub the timing fence as the print head is manually moved right and left.
- Monitor video output V1 at test point E1 on the power driver board while the print head is moving at a constant speed.

Note: The print head can be moved at a constant speed by depressing the OVERRIDE switch while the printer is deselected. This places the printer in the self-test mode.

- Check the duty cycle of the V1 waveform and, if it is not 50% as shown in Figure 6 proceed to next step.
- Stop carriage motion by deactivating self-test mode, turn adjusting pot R4 slightly, reactivate self-test mode, and again recheck for a 50% duty cycle. Repeat until 50% duty cycle is achieved for V1.

Note: If the 50% duty cycle cannot be achieved, check the pulse width and make sure it is constant over the complete travel of the print head. If not, the timing fence should be adjusted so that it is parallel with the guide bars. If the timing fence is adjusted, recheck the duty cycle for the previously set-up video channel.

- Repeat Steps 2 through 4 above while monitoring V2 at E2 and, if necessary, adjust R10 to obtain a 50% duty cycle for V2. Refer to Figure 6.

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PHASE ADJUSTMENT OF VIDEO AMPLIFIER

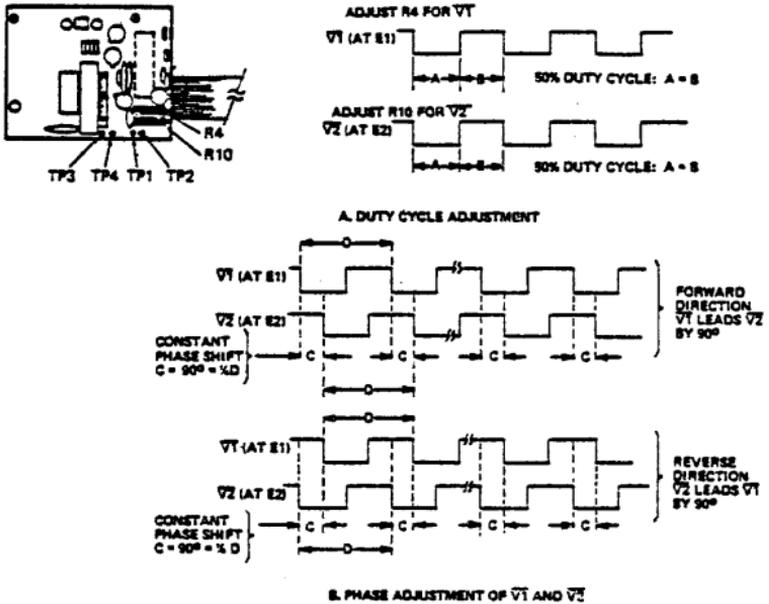


Figure 6

PHASE SHIFT ADJUSTMENT

- Monitor $\overline{V1}$ and $\overline{V2}$ simultaneously at E1 and E2 on the power driver board while the print head is moving at a constant speed (see figure 20).
- Check the phase relationship between $\overline{V1}$ and $\overline{V2}$ as the head moves in both the forward and reverse directions. As shown in Figure 6, the phase relationship between $\overline{V1}$ and $\overline{V2}$ should be a constant 90° phase shift over the complete travel of the print head (i.e., width C equals 90° when it equals $1/4$ width D). If phase adjustment is required, proceed to next step.
- Stop carriage by deactivating the self-test mode, and turn printer power off. Manually move carriage all the way right to the EOP switch.

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PHASE SHIFT ADJUSTMENT (cont.)

- Loosen (approximately one turn) the left side mounting screw which attaches the video amplifier circuit board to the carriage.
- Move left side of the circuit board all the way up until the bottom of the slotted mounting hole touches the mounting screw.
- Turn printer power on, activate self-test mode, and check phase adjustment again. Refer to Figure 6.
- If further adjustment is required, turn printer power off, move left side of board slightly down in the slotted mounting hole and check phase again as in the previous step.
- Repeat the two previous steps until phase adjustment of V1 and V2 is correct.
- When phase is correct, tighten left side mounting screw on video amplifier.

REMOVAL/REPLACEMENT PROCEDURE - Timing Fence Assembly

TOOLS REQUIRED: 3mm Hex Key.

- Loosen the four screws from left and right timing fence mounting brackets and remove fence.

Adjustments

- Loosen four screws mounting timing fence and adjust fence so that the first window is located 106.6mm (4.2 in.) from left frame.

Note: This adjustment allows for the left hand print margin to align with the number 1 on the column scale assembly.

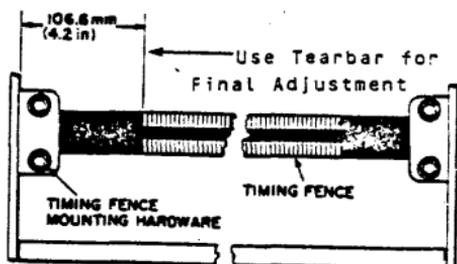


Figure 7 - Timing Fence Assembly Adjustment

CENTRONICS 702

TIMING FENCE ASSEMBLY (cont.)

Preventive Maintenance

- Using soft, clean cloth wipe both sides of timing fence, if necessary use liquid freon.

CAUTION: NEVER USE AN ORGANIC SOLVENT
AS THIS WILL DAMAGE THE TIMING FENCE.

- Inspect for scratches in the encoder lines and proper mechanical alignment on the timing fence.

CARRIAGE ASSEMBLY

Removal/Replacement Procedure

Tools Required: Slotted and Phillips Head Screwdriver Snap Ring Tool.

WARNING: TURN POWER OFF BEFORE REMOVING
CARRIAGE ASSEMBLY

- Move the carriage assembly to the center of the printer.
- Remove the ribbon cartridge assembly.
- Remove the print head and video amplifier assemblies per pages 1-79 and 1-81.
- Remove the power driver board assembly per page 1-99.
- Loosen the carriage drive belt by turning, counter-clockwise, the two adjusting nuts on the idler pulley assembly.
NOTE: The idle pulley assembly is located on the left side of the printer.
- Remove the retaining ring on the left end of the upper guide bar.
- Remove the two screws mounting the upper guide bar to the right frame.
- Loosen the locknut and screw attaching the bottom of carriage to the bottom of the guide bar.
- Remove the upper and lower ribbon drive monofilament from the ribbon drive shaft.

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CARRIAGE ASSEMBLY (cont.)

Removal/Replacement Procedure

- Remove the two screws and lockwashers clamping the carriage drive belt to the carriage assembly.
- While supporting the carriage assembly, slide the upper guide bar to the right through the carriage assembly.

NOTE: Retain the rubber O ring removed from the left end of the upper guide bar.
- Remove the carriage assembly from the printer.

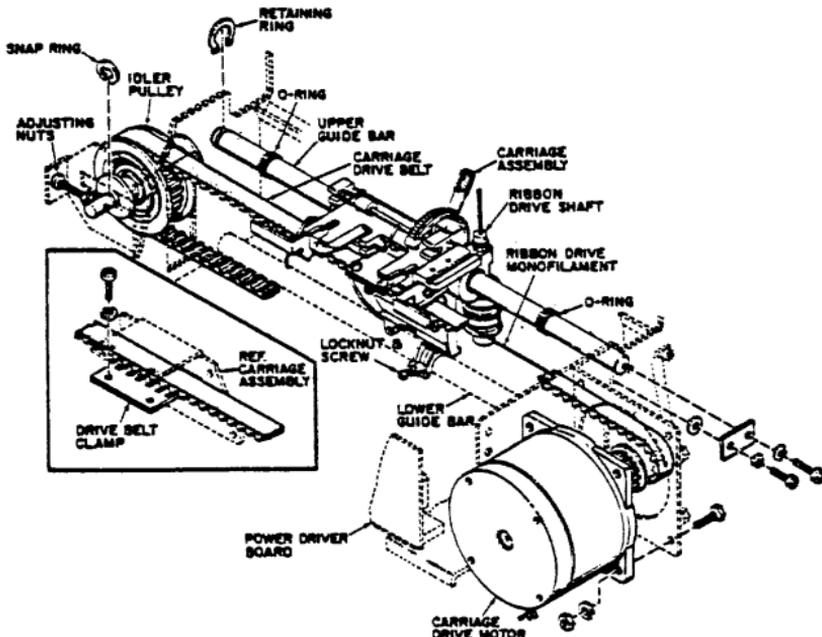


Figure 8

Carriage Assembly Removal/Replacement

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CARRIAGE ASSEMBLY (cont.)

Adjustments

- Adjust ready to print (RTP) actuator arm parallel to and 59mm (2.3 inches) from the upper guide bar.
- Adjust end on print (EOP) actuator arm parallel to and 55mm (2.1 inches) from the upper guide bar.
- Once the actuator arms have been adjusted slowly move the carriage assembly from left to right ensuring the RTP and EOP actuator arms do not contact the RTP and EOP switches.

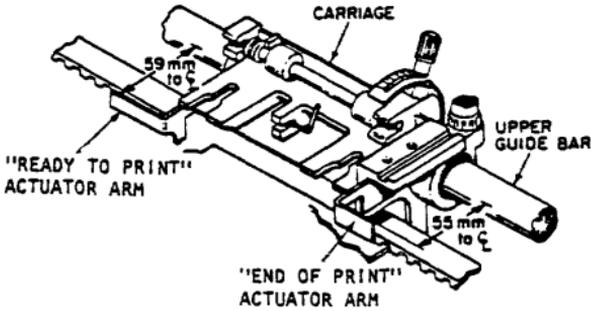


FIGURE 9 RTP AND EOP ACTUATOR ARM ADJUSTMENTS

Preventive Maintenance

- Wipe the upper and lower guide bars clean using a soft clean cloth.

STEPPER MOTOR ASSEMBLY, CARRIAGE DRIVE

REMOVAL/REPLACEMENT PROCEDURE

Tools Required: M5 Nut Driver, Phillips Head Screwdriver.

- Disconnect connector P028 on stepper drive motor from connector J028 on power driver board assembly.

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STEPPER MOTOR ASSEMBLY, CARRIAGE DRIVE

Removal/Replacement Procedure (cont.)

- Loosen tension on main drive belt (#14 in Figure 10) by turning two adjusting screws (8) counter-clockwise.
- Remove the stepper drive motor (1) by removing four screws (2) lockwashers (3) and nuts (4).
- Separate main drive belt (14) from the carriage assembly by removing the main drive belt holder (15) and two screws (16) and lockwashers (17).
- Remove main drive belt and idler pulley (7) by removing two snap rings (12), adjusting screws (8) and slide idler pulley shaft (11) through idler pulley.

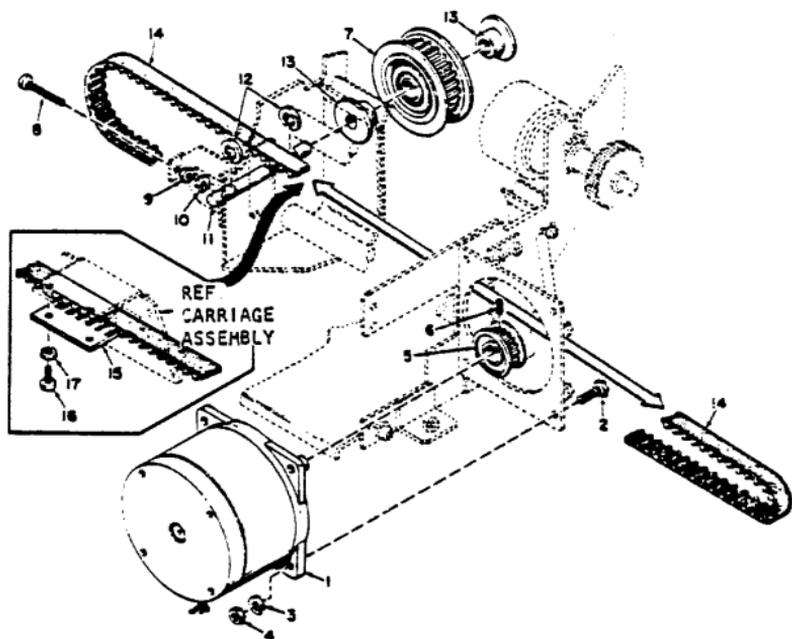


Figure 10 STEPPER MOTOR ASSEMBLY, CARRIAGE DRIVE

CENTRONICS 702

STEPPER MOTOR ASSEMBLY, CARRIAGE DRIVE

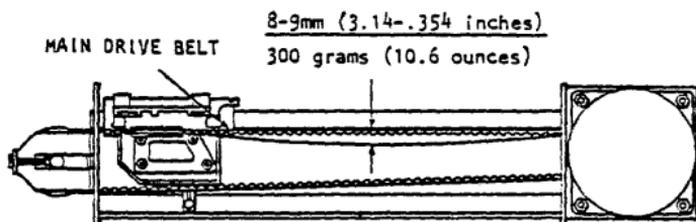


Figure 11

MAIN DRIVE BELT ADJUSTMENT

Adjustments

- With the carriage assembly in the left most position adjust main drive belt to deflect 8 to 9mm (.314 to .354 in.) when a 300 gram (.66 lbs.) load is applied at the center of the belt.

Note: It is best to use a wide load distributed 63.5mm to 76.2mm (2-1/2 in. to 3 in.) over the belt.

STEPPER MOTOR ASSEMBLY, PAPER DRIVE

Removal/Replacement Procedures

Tools Required: M5 Nut Driver

- Disconnect two pin connector P028 of stepper motor assembly from connector J028. (See following page, Figure 12).

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STEPPER MOTOR ASSEMBLY, PAPER DRIVE

Removal/Replacement Procedures (cont.)

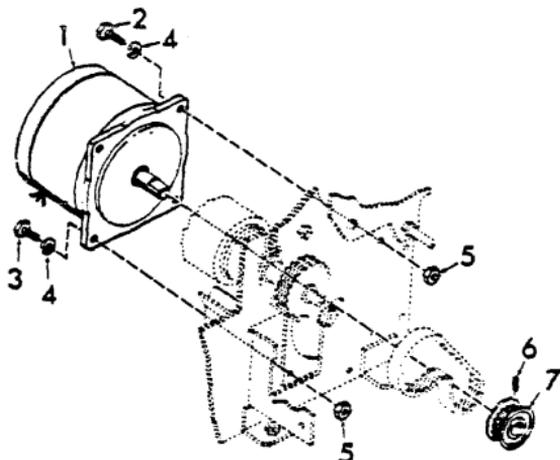


Figure 12
STEPPER MOTOR ASSEMBLY, PAPER DRIVE

- Remove line feed pulley (7) by removing set-screw (6) and sliding pulley off stepper motor shaft.
- Remove four screws (2,3) lockwashers (4) and nuts (5) and remove stepper motor assembly from printer.

Adjustments

- At a point equidistant from the line feed pulley and paper feed pulley, adjust tension of the belt to deflect 4-5mm (.18 inch) with a 300 gram (10.6 ounces) load applied.

Note: The belt tension is adjusted by the tension roller on the right frame.

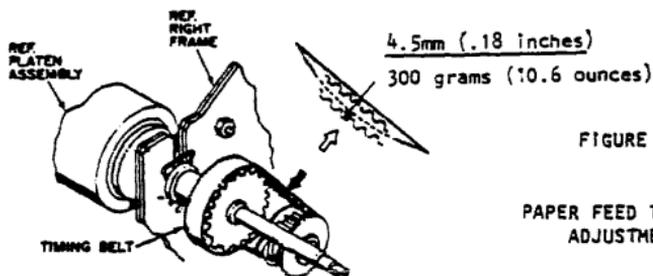


FIGURE 13

PAPER FEED TIMING BELT ADJUSTMENT

CENTRONICS 702

PLATEN ASSEMBLY

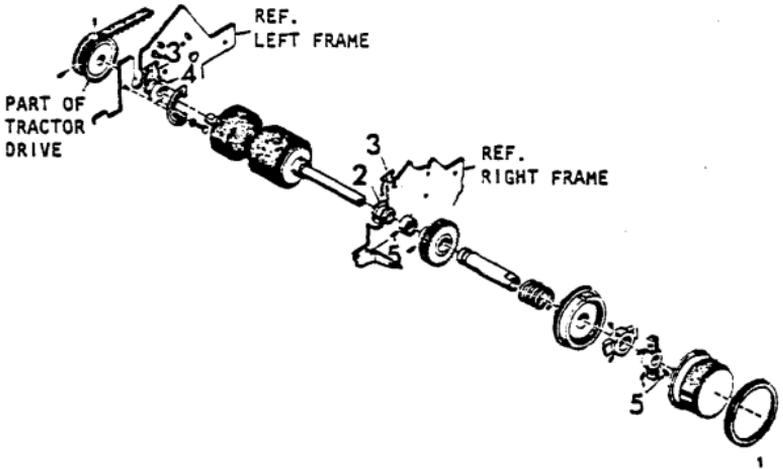


Figure 14
PLATEN ASSEMBLY

Removal/Replacement Procedure

Tools Required: M4 Hex Key, Flat Blade Screwdriver

- Remove the paper feed knob from the right side of the platen assembly.
- Loosen tension of paper feed timing belt and remove timing belt from pulley.
- Remove the two stop collar springs (3) on ends of platen assembly.
- Remove pin tractor drive pulley (5) and timing belt from left end of platen.
- Slide the two brass bushing (2,4) towards the center of the printer and lift platen assembly out of the printer.

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PLATEN ASSEMBLY

Adjustments

The platen assembly must be parallel to the travel of the carriage, if not adjust as follows:

- Operate printer and ensure print quality is uniform for the full 132 character printed.
- If print quality is not uniform, loosen bolt and rotate adjusting plate until platen assembly is parallel to the travel of carriage assembly.
- Once adjusted tighten mounting hardware.

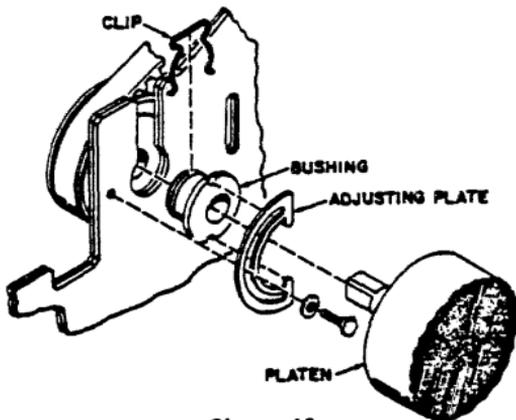


Figure 15
PLATEN ASSEMBLY ADJUSTMENT

Preventive Maintenance

Clean platen assembly using a mild detergent.

TRACTOR DRIVE AND PIN FEED ASSEMBLY

Removal/Replacement Procedure

Tools Required: Phillips Head Screwdriver

Tractor Drive Assembly

- Disconnect connector P044 of harness assembly (9) from connector J044.

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TRACTOR DRIVE AND PIN FEED ASSEMBLY

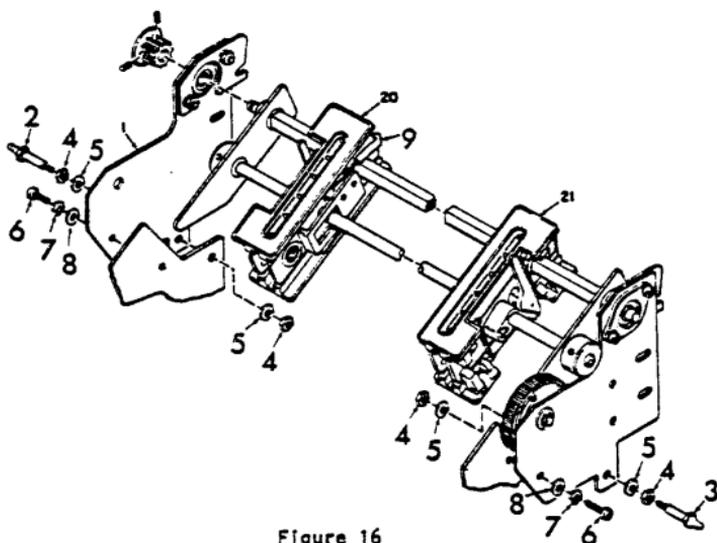


Figure 16

Removal/Replacement Procedure (cont.)

- Remove left (2) and right (3) stud screws, two flatwashers (5) and nuts (4) supporting the sub-tractor drive assembly.
- Remove the two screws (6) lockwashers (7) and flatwashers (8) and remove sub-tractor drive assembly from the printer.

Tractor Units, Left and Right

- Remove the sub-tractor drive assembly per paragraph above.
- Loosen set-screw mounting drive pulley on left side of tractor drive assembly and remove pulley and side plate.
- Loosen set-screw mounting hardware bushing to the left support assembly and remove bushing and support plate.
- Slide the left and right tractor units off drive shaft and support bar of tractor drive assembly.

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TRACTOR DRIVE AND PIN FEED ASSEMBLY

Adjustments

Tractor Drive Belt Tension

- Adjust tension of belt such that when a load of 156-249 grams (5-8 ounces) is applied at the center of the belt, belt deflection will be 6.35mm (0.25 in.).

6.35mm (0.25 inches)
156-249 grams (5-8 ounces)

TRACTOR DRIVE BELT

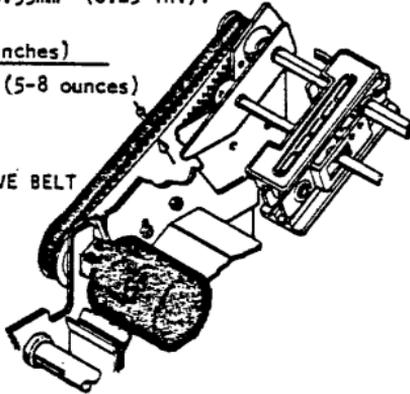


Figure 17 TRACTOR DRIVE TIMING BELT TENSION

Paper Travel

- Using the eccentric knob on the right hand side of the printer, adjust tractor units so that plane of paper travel (top side of tractor unit) is tangent to the platen.

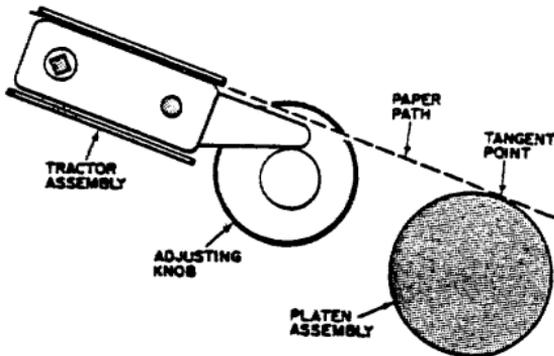


Figure 18 PAPER TRAVEL ADJUSTMENT TRACTOR DRIVE ASSEMBLY

CENTRONICS 702

LOGIC BOARD ASSEMBLY

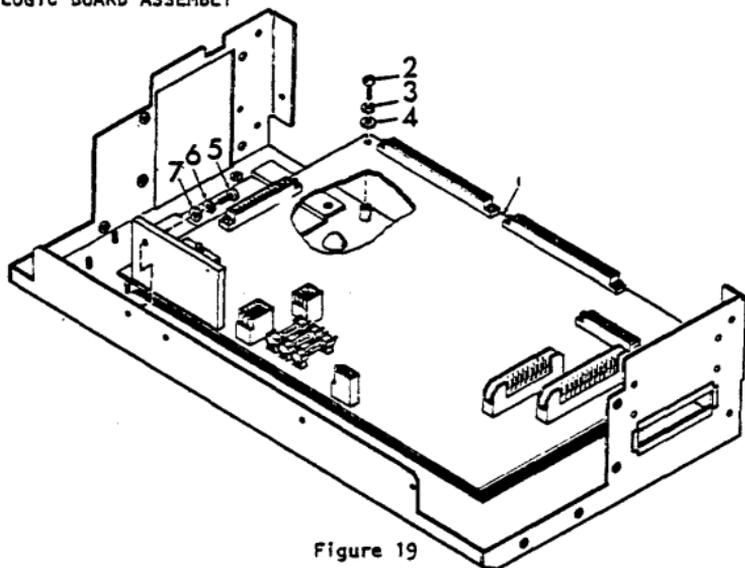


Figure 19

Removal/Replacement Procedure

Tools Required: Phillips Head Screwdriver

- Disconnect all connectors plugged into logic board.
- Remove the three screws (2,5) lockwashers (3,6) and flatwashers, (4,7) and remove the logic board from the printer.

Adjustments

The following electrical adjustments may be required on the main logic board.

<u>Function</u>	<u>Signal Name</u>	<u>Element/Pin</u>	<u>Adjustment Resistor</u>	<u>Pulse Width</u>
+5 Volts	+5V out	Test Point-TP4	R4	Adjust to +5V Level
Print head speeds	-	Me89, pin 10	R40	650-660 usec.
Printer Strobe	PRTSTB	ME73, pin 6	R50	425-450 usec.

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POWER DRIVER BOARD ASSEMBLY

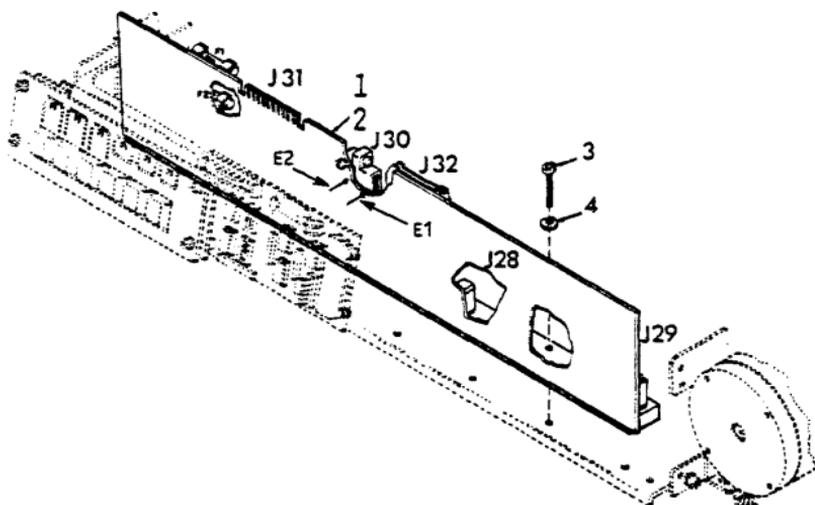


Figure 20

Removal/Replacement Procedure

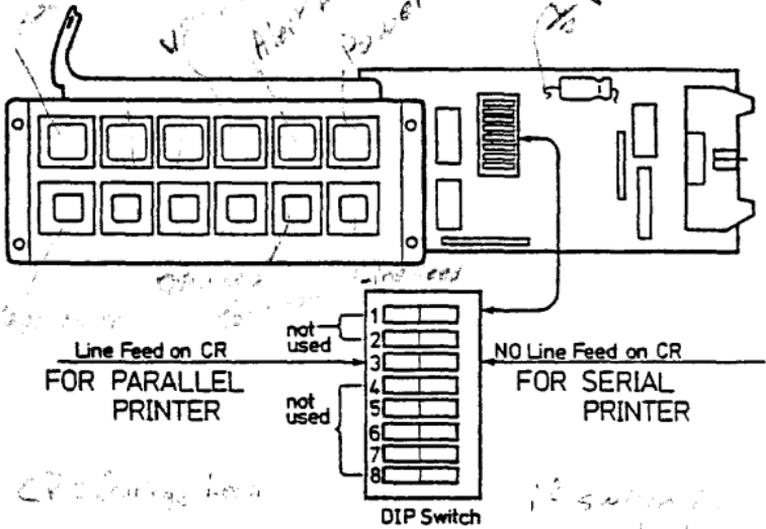
Tools Required: Phillips Head Screwdriver

- Remove the following connectors from one another:

<u>POWER DRIVER BOARD CONNECTOR</u>	<u>DISCONNECT FROM:</u>
J 28	P028 of Carriage Drive Stepper Motor
J 29	P029 of Paper Drive Stepper Motor
J 30	P030 of Video Amplifier Cable Assy.
J 31	P031 of Main Wire Harness (63703112-4001)
J 32	P032 of Control Panel Harness

- Remove the six screws (2) and flatwashers (3) and remove the power driver board from the printer.

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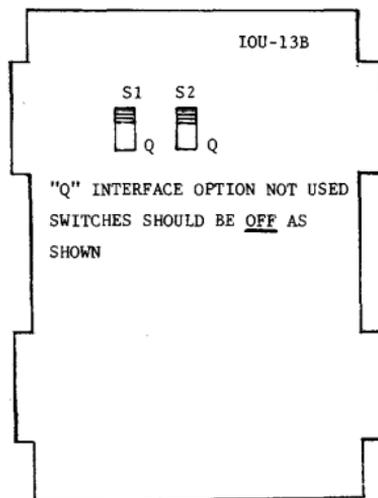
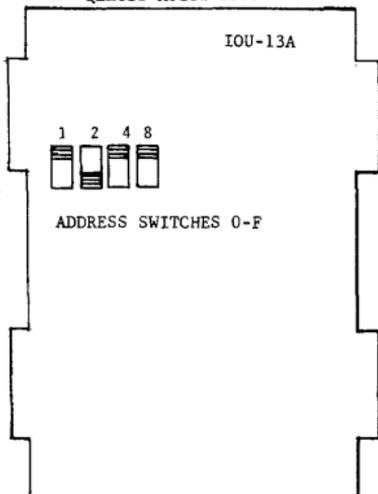
CP-2 loading from

is similar to
writing double quoting
on 12/13/79

Over the one line of ...
 ① ...
 ② ...

**IOU 13
CENTURY 111**

Qantel Model 3000



MAX. PWR. REQUIREMENTS

-12v = .35A
+12v = .10A
+ 5v = 2.19

DISC UNIT PWR

20A for 10 sec.
8A normal

WRITE CONTROL INSTRUCTIONS

1XY9D X = DEVICE ADDRESS
YY = CONTROL BYTE

CONTROL BYTE FUNCTION

01	SET INHIBIT TR. VERIFY
02	SET INHIBIT READ AFTER WRITE CHECK

STATUS IN INSTRUCTIONS

4XY9D X = DEVICE ADDRESS
YY = STATUS BYTE

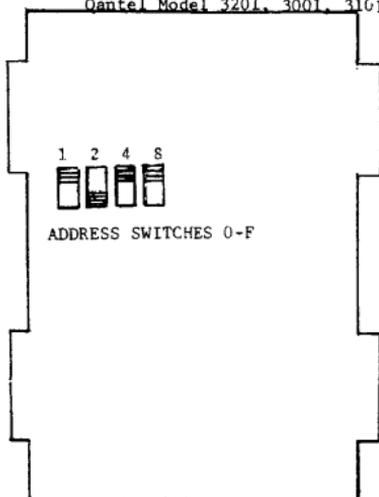
STATUS BYTE MEANING

01	READ BUSY
02	WRITE BUSY
04	END
08	SERVICE REQUEST
10	ERROR
20	MARKED SECTOR
40	INVALID SEEK
80	INOP.

IOU 24

114/6+6

~~Qantel Model 3201, 3001, 3101~~



WRITE CONTROL INSTRUCTIONS

IXYY9D X = DEVICE ADDRESS YY = CONTROL BYTE

CONTROL BYTE	FUNCTION
01	INHIBIT TRACK VERIFY
02	INHIBIT READ AFTER WRITE CHECK
10	Res. Allow Term Int. (resets F1)
14	Set Termination Interrupt

STATUS IN INSTRUCTIONS

4XYY9D X = DEVICE ADDRESS YY = STATUS BYTE

STATUS BYTE	MEANING
01	READ BUSY-----
02	WRITE BUSY-----ABSENCE OF ALL 3 = HEAD IN MOTION
04	END-----
08	SERVICE REQUEST
10	SEEK OR WRITE TERMINATE
20	----SEE BELOW
40	
80	INOP. / PACK OFF

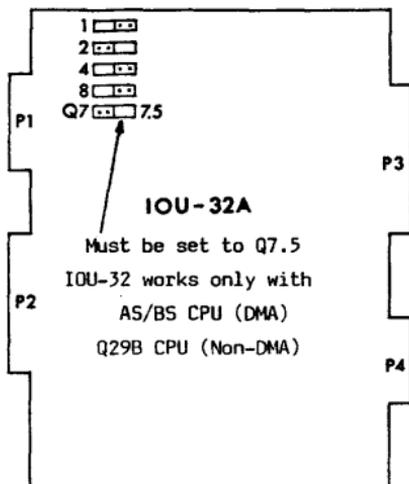
40 - 20 - SEEK - WRITE

0 - 0 -	O.K.	-	O.K.
0 - 1 -	ERROR	-	DEFECTIVE DISC PACK
1 - 0 -	MRKD SCTR-		MARKED SECTOR
1 - 1 -	INV.SEEK -		INVALID SEEK

IOU-32A/B

MEMOREX DISC 25 M/BYTE

MEMOREX DISC 75 M/BYTE



TYPICAL POWER REQUIREMENTS

-12V = .02A

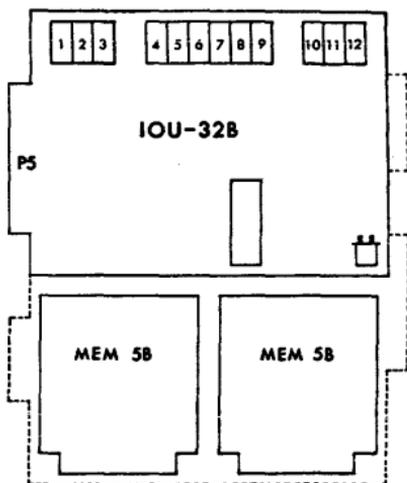
+12V = .26A

+5V = 7.6A

DISC UNIT POWER

START UP: Not to exceed
30A for 18 seconds

NORMAL : 8.0A nominal @
117 VAC



Rom labels lower than Rev. H indicate a DMA IOU-32. To update these controllers for non-DMA operation factory modification is required.

Rom labels Rev. H or higher may be modified from DMA to non-DMA or the reverse by simply changing the ROM's.

ROM NUMBERS ROM LABEL

M1H - M12H = DMA IOU-32

M1H M12H = NON-DMA
NDMA NDMA

IOU-32A/B

WRITE CONTROL INSTRUCTIONS

1dyy9D D=Device Address yy=Control Byte

CONTROL BYTE	FUNCTION
\$01	Inhibit Track Verify
\$02	Inhibit Read-After-Write Check
\$03	Set Memory I/O Mode
\$04	Reset Memory I/O Mode
\$05	Branch to Local Memory
\$n6	Select Drive n
\$07	Set Scanning Mode
\$10	Disable Termination Interrupt
\$14	Enable Termination Interrupt
\$40	Disable Sector Pooling
\$50	Enable Sector Pooling
\$60	Disable Alternate Sectoring
\$70	Enable Alternate Sectoring
\$80	Bypass Sector Pool
\$90	Incremental Seek

After RIO or IPL the controller will have terminal interrupt inhibited, scanning mode enabled, sector pooling enabled, alternate sectoring enabled and read after write check and track verify enabled.

IOMEC (3001, 3101)
TROUBLESHOOTING AID
IOMEC DISC
INTERMITTENT INVALID SEEK/TEMPORARY READ ERRORS

INTRODUCTION

Invalid seek (IVS) and temporary read errors (TMP RD ERR) that are intermittent are frequently caused by electro-mechanical problems rather than electronic failure. Some steps to eliminate this problem are given below.

No attempt should be made to evaluate, test, or adjust a disc unit until it stabilizes with temperature. The pack must run for a minimum of 15 minutes, or more if it was taken from another temperature environment.

TESTING

Intermittent errors should be tested by running the Acceptance Test. The test must run error free overnight to be reasonably sure the problem is fixed.

GENERAL PRECAUTIONS

The following is a list of procedures that will help to minimize disc difficulties.

- The disc pack must be in the same temperature environment for at least one hour, and allowed to spin 15 minutes before use.
- Before writing records or generating disc copies, allow the disc to be 'ready' for at least 5 min.
- When the drive is not in use (disc not spinning), the power switch should be "OFF".
- The disc should be powered from the unswitched outlet to protect against power loss when the disc is running and the system is shut down.

Moving The Drive

The heads must be taped in the retracted position when ever the disc drive is moved. Without power, the heads are extremely free to move and would be damaged if the drive is tilted or moved suddenly.

Protecting The Fixed Disc

The diagnostic tests write on most or all disc areas. The customer information on the fixed disc must be copied (use FILFIL) before running disc tests.

Protecting The C.E. Pack

When the C.E. pack is used for head alignment, the pack must be protected from being written upon. To disable the write circuits, instal a jumper between pins 1 and 2 (the two top pins) on plug B1 of the drive control PCB, A0. With this jumper installed, an attempt to write causes a loss of 'READY'.

Disable Restore by unsoldering the jumper from U7-6 on the motherboard and connecting it to U7-7 (ground).

Spindle Binding must be guarded against by ensuring that the pack is evenly seated on the base. If the motor is started when the spindle is binding, the motor burns up.

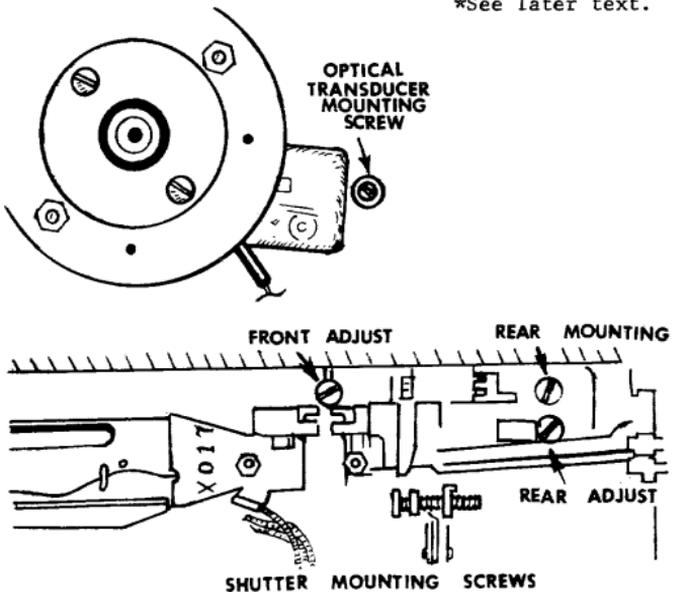
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TROUBLE SHOOTING CHART

The chart below lists things that should be tried before swapping cards. Be aware that the disc may need realignment after some of the mounting screws are tightened.

POSSIBLE CAUSE	CHECK FOR	REFERENCE
Head Misalignment	-Loose base plate screws -Loose opt trnsdcr or shutter -Align with C.E.pk	F.A.#33 Below
Servo misadjusted	-Use Iomec procedure	Manual
Faulty heads	-Dirty heads -Damaged heads	*
R/W card ground	-Gr. strap loose at base plate	*
Head leads binding	-Properly dressed leads	F.A.#31
VCO temp. drift	-Install temp. comp. speed sel. module -Adjust VCO	* *
Servo Actuator side play	-Loose mtg. screws	*
Missing sector pulses	-Install FC0#15	
Sector burst off	-Loose sector trnsdcr. -Adjust with C.E pk.	*
Oscillation in IOU-24A -5v supply	-Instal Rev.F (IOU-24)	F.A.#20

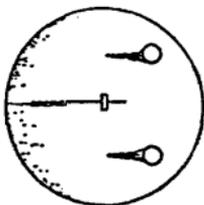
*See later text.



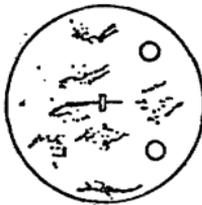
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DIRTY OR DAMAGED HEADS

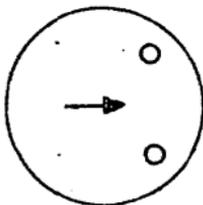
The illustrations below show some examples of head dirt buildup and damage. Clean heads with 91% isopropyl alcohol, and wipe clean. Do not allow alcohol to dry on the surface.



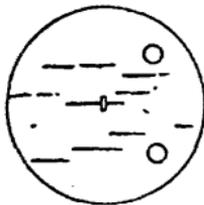
A. Slight oxide buildup.
Head should be cleaned
and used.



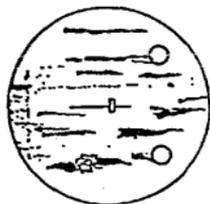
B. Alcohol residue.
Head must be
cleaned.



**C. Oxide buildup
in pole piece.** Head
must be replaced.



D. Slight scratches.
No oxide buildup.
Head is usable.



**E. Oxide buildup due
to scratches.** Head
must be replaced.



**F. Crashed (usually
burned).** Head must
replaced.

IOMECS

GROUND STRAP ON R/W CARDS

Some versions of the R/W card have a ground strap to the base plate. If the screw at the base plate is loose, intermittent errors can occur. Check that the screw is tight whenever there is doubt.

IOU-24C VCO ADJUSTMENT

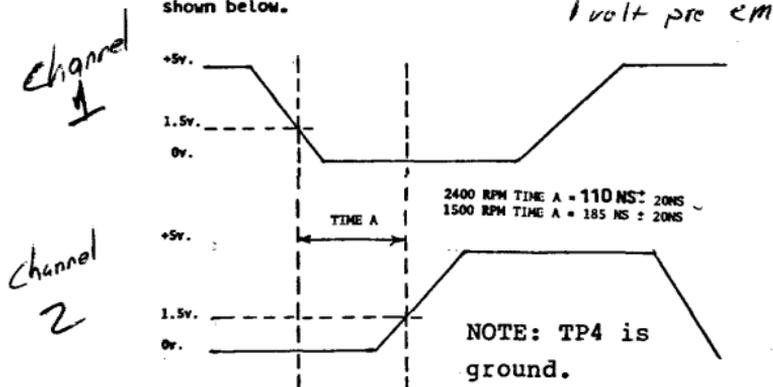
~~Adjust the frequency and phase pots (R15 and R1) fully counterclockwise.~~ **AO**

Connect a DVM probe to Test Point 1.

Adjust R15 (frequency) clockwise until the voltage at TP1 is $.5v \pm .5v$ (0v to 1v).

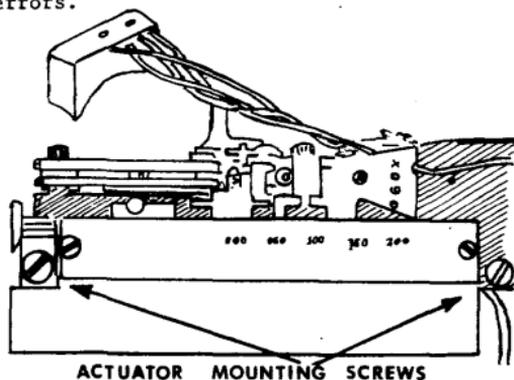
Connect Channel 1 of the oscilloscope to 5C, pin 12. Connect channel 2 to 5C pin 11. Trigger on ch 1, neg. at 50 nsec/cm.

Adjust R1 (phase) until the crossover of the signals is as shown below.



SERVO ACTUATOR SIDE PLAY

The servo actuator mechanism is mounted to the base plate by two screws (see the illustration below). If these screws become loose, there can be intermittent seek and read errors.



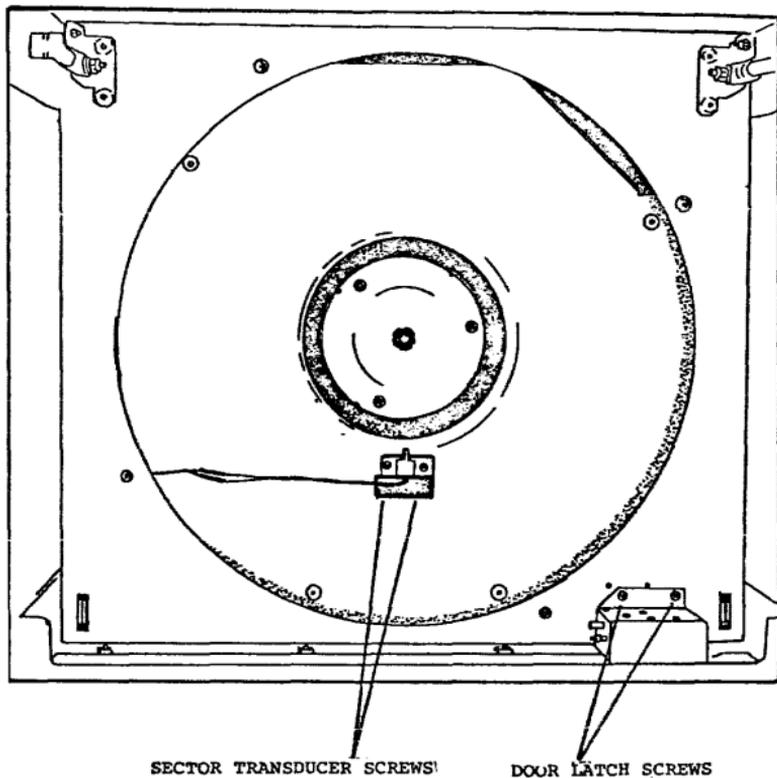
ACTUATOR MOUNTING SCREWS

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IOMEC

MISSING SECTOR PULSES

If the sector transducer is loose or not properly adjusted, one or more sector pulses can be missed, causing seek or read errors. Check that the sector transducer is secure and properly adjusted (see the illustration below). FCO #15 must also be installed in all IOMEC drives.



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IOMEC TROUBLESHOOTING HINTS

1. Slots on the fixed disc sector plate get dirty and miss sector pulses. Revision D to the interface board makes a modification that unloads the heads when a sector count is missed. This means that if the heads seem to unload for no reason, the sector plate on the fixed disc needs cleaning.
2. The fixed disc may become loose and slip on the spindle. The symptom for this is that the disc needs re-initializing every time it is fired up. Change the fixed disc.
3. R 10 on the interface card has been removed to increase the amplitude of the fixed disc sector pulses.
4. Sticking or burned brushes in the servo motor cause failures in the harmonic test. This condition gets worse until the disc fails all of the time. Remove the cap over the brushes, and clean the armature. Sticking brushes are caused by an allen screw that is too long, and presses against the brush holder deforming it.
5. Be sure to check the ECN's for compatibility of the motherboard and the interface card.
6. The new style motor with thermal protection has one less black wire. This motor needs a 40 mfd. capacitor between the red motor lead and pin 2 of the starting relay.
7. R 86 on the power supply board (25ohm 10w) has been removed, and a jumper put in its place. The resistor was added externally to allow heat dissipation. However, with this modification there must also be the fan modification. If there is not, the resistor will become hot enough to unsolder itself.
8. Poor lead dressing on the head wires will cause errors in the harmonic test.
9. Many read/write cards do not have shielding on them. These may work well until something on the card is disturbed (such as replacing a component). Symptoms may then appear that give temporary read errors. This one is very subtle, and is hard to believe when it is encountered.
10. On the old style drives, the head carriage can come off the track in a sideways direction. This happens during service procedures. Check that the carriage is on track before starting the drive.
11. Loose lugs on the filter capacitors may cause ripple. Some screws were too long, leaving the lugs loose when the screw was tight (bottomed).

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12. Rattling during start up is caused by a bad motor start relay.
13. Loosing "Ready" can be caused by one of the following:
 - Cover micro switch
 - Loose fuse in power supply
 - Motherboard
 - Missing sector pulse
 - Power supply failure (low voltage)
 - Unsafe - selecting more than one head
14. Cables can get pinched in the front bezel, or rub against the drive belt. This causes just about any symptom that the machine will ever exhibit.
15. The mask portion of the optics (cylinder seek count) may become loose, or even fall off. This can cause seek errors at a minimum, or complete failure.
16. Servo power can be lost from one of the following causes:
 - No 70% speed signal from the interface card
 - Bad servo 1 or 2 card
 - Q12 and Q13 in the power supply (usually shorted)
 - Relay K1 on the power supply may have dirty or misadjusted contacts.

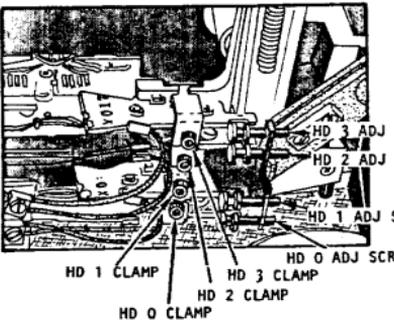
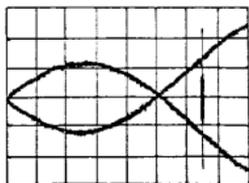
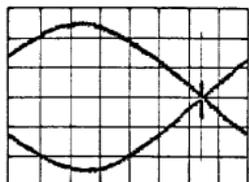
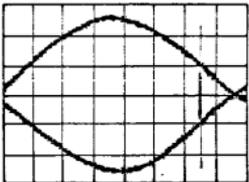
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Removable Disc Head Adjustment

PROCEDURE	REMARKS
<p>1. Remove user cartridge, remove power, and extend drive to obtain access to back of drive.</p> <p>2. Remove drive component cover.</p> <p>3. Connect and set oscilloscope to observe the read test points.</p> <p style="text-align: center;">NOTE</p> <p>Drives below serial number 30400 that do not have F.A. #16 installed, must have U7, pin 6 on the motherboard grounded to prevent restores.</p>	<p>a. Set CARTRIDGE switch to UNLOCK.</p> <p>b. When UNLOCK lamp lights, remove cartridge.</p> <p>c. Set POWER switch to POWER OFF.</p> <p>d. Set ac switch on drive rear panel to OFF.</p> <p>a. Connect CHANNEL 1 to pin 10 of the A2 PC card by attaching a mini test clip to U3, pin 3.</p> <p>b. Connect CHANNEL 2 to pin 11 of the A2 card by attaching a mini test clip to U3, pin 4.</p> <p>c. Attach external sync lead (CHAN A) to TP1 on the A5 card by attaching a 16 pin extender to U12; pin 13 is TP1.</p> <p>d. Set VERTICAL gain to 50 mv/cm (both channels).</p> <p>e. Set TIME BASE to 2 ms/cm.</p> <p>f. Set SYNC to EXT (+), CH A.</p> <p>g. Set MODE to ADD.</p> <p>h. INVERT channel 2.</p>
<p>4. Power up drive, install alignment pack.</p>	<p>a. Set ac power switch (rear) to ON.</p> <p>b. Set power switch to POWER ON.</p> <p>c. Install alignment pack.</p> <p>d. Set cartridge switch to LOCK.</p> <p>e. Attach a 14 pin extender to A5, U24. When the disc is spinning at full speed, attach a ground to pin 11 (pin 7 is ground).</p>
<p>5. Insert SEEK parameters into memory.</p>	<p>a. Enter the following on the console device:</p> <p>(IPL) 0006F30400000000A8 (CR) 1D3032393230 (CR)</p> <p>(IPL) 0006F30500000000A8 (CR) 1D3032393330 (CR)</p> <p>NOTE: The D in the first byte is the disc address. If disc is not at this address, change to suit.</p>
<p>6. Allow ample time for the C.E. pack to equalize in temperature with the drive (minimum of 30 minutes).</p>	<p>a. Length of time required for thermal expansion to equalize depends upon how great the change was in environment from storage to installing.</p>
<p>7. Position the heads to cylinder 146, head #2.</p>	<p>a. Enter the following on the console:</p> <p>(IPL) 0400800000A8 (CR)</p>

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Removable Disc Head Adjustment

PROCEDURE	REMARKS
 <p style="text-align: center;">Adjustment Locations</p>	 <p style="text-align: center;">Head Too Far In</p>  <p style="text-align: center;">Correct Head Alignment</p>  <p style="text-align: center;">Head Too Far Out</p>
<p>8. Display the "cats eyes".</p> <p style="text-align: center;">NOTE</p> <p>The object of this adjustment is to position the alignment mark at the crossover point. Centering the oscilloscope display is not necessary. (Diablo C.E. pack shown, make loops equal <u>length</u> for other type C.E. packs)</p> <p>9. Slightly loosen the clamping screw on head #2. Turn the adjusting screw as required until the alignment mark is positioned as in Figure.</p>	<p>a. Move head #2 adjusting screw clockwise to move crossover to the right.</p> <p>b. Move the adjusting screw counter-clockwise to move the crossover to the left.</p>

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Removable Disc Head Adjustment

PROCEDURE	REMARKS
10. Re-position heads. Check alignment (snug head clamp to prevent movement when the head is seeking)	a. See step 7a. b. If display does not conform, repeat steps 8 and 9.
11. Tighten the head #2 clamping screw. (8 inch/lbs, or firm, but not extra tight)	a. Be sure that tightening the clamp does not change the adjustment. b. When clamp screw is tight, back off the adjusting screw to release pressure on the R/W head.
12. Position the heads to cylinder 146, head #3.	a. Enter the following on the console: (IPL) 0508000000A8 (CR)
13. Compare the display with Figure (opposite step 8). If necessary, adjust head #3, using the same technique as steps 8 thru 11.	
14. Check both heads.	a. Enter program from step 7a (hd.#2). b. Enter program from step 12a (hd.#3).
15. Change scope settings to check Index-to-burst.	a. TIME BASE - 5 usec/cm (CALIBRATED). b. Vertical - .1 v/cm (both chan.)
16. Load seek parameters.	a. (IPL) 0006F30600000000A8 (CR) 1D3030323030 (CR) (IPL) 0006F3070000000000A8 (CR) 1D3030323130 (CR)
17. Seek to cylinder 10, head #2.	a. (IPL) 0608000000A8 (CR)
18. Verify that the timing pulse is delayed 30 ± 5 usec from the start of the sweep (Index)	a. CH 1 - U12, pin 13, A5 card. b. CH 2 - U3, pin 4 c. Time Base - 5 μ sec/cm (Calibrated) d. Vert - CH 1-.2v/cm, CH 2-50mv/cm e. Mode - ADD f. Trig - CH 1 (+) g. Slope - (+) h. Source - INT i. Reset - Invert Switch
NOTE This adjustment is measured from the leading edge of INDEX to the null point between the positive and negative transitions of the timing pulse.	<p style="text-align: right;">Delay RECORDED BIT BURSTS</p>

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Removable Disc Head Adjustment

PROCEDURE	REMARKS
19. Seek to cylinder 10, head #3.	a. Enter the following on the console: (IPL) 0700800000A8 (CR)
20. If required, adjust the delay.	a. Adjust R3 on the Interface board A5. b. If unable to reach acceptable delay, adjust the sector pickup in the removable section, as outlined in the following pages.
21. Power down, and remove all external connections.	
22. Mount a "scratch" cartridge, and allow a minimum 5 minute warm up.	
23. Initialize both the removable and fixed platters with DISCINT.	
24. Exercise the unit with test DISC6.	
25. Load the customer's fixed data on to the fixed platter using FILEFIL.	

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Sector Pickup Adjustment

PROCEDURE	REMARKS
<p>The first four steps of this adjustment must be made if the delay adjustment (step 20 of the Removable Disc Head Adjustment) can not be brought to within specifications.</p> <ol style="list-style-type: none"> 1. Cycle the disc drive down and dismount the pack. 2. Loosen the sector transducer screws (see Figure on pg.2-7) Position the transducer to a point that allows R3 on the Interface card, A5, to be adjusted within specifications, when the pack is mounted and the disc drive is cycled up. <p>NOTE: Be sure the screw holding the transducer to the mounting block is tight.</p> <ol style="list-style-type: none"> 3. Re-tighten the sector transducer screws. 4. Check the adjustment again. 5. Set the oscilloscope to check transducer gain. 6. Check display for 1.2 v (+0,-.1) peak-to-peak. 7. Re-check index-to-burst delay, by repeating steps 15 thru 20 of Removable Disc Head Adjustment. 	<ol style="list-style-type: none"> a. If the display resembles below, move the transducer to the left. <div> </div> b. If the display resembles below, move transducer to the right. <div> </div> <ol style="list-style-type: none"> a. Connect CHAN 1 to pin 5 of pc card A5. b. VERT GAIN - 20mv/cm. c. Time base - minimum. d. Mode - CH 1. <ol style="list-style-type: none"> a. To adjust, loosen Allen lock screw. b. Increase amplitude by moving toward spindle; decrease by moving away.

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ACCESS TIME ADJUSTMENT

- Connect the Channel 1 oscilloscope probe to TP4 (POS DR) on card A4.
- Connect the channel 2 probe to pin E (ACCESS RDY) on card A5.
- Connect the EXT SYNC lead to pin P (SET CYLINDER) on the A5 card.
- Set up the oscilloscope as follows:

CH 1 2v/cm
CH 2 2v/cm
HORIZ 10ms/cm
SYNC = EXT (-)
Mode = Chop

- Power up the system, including the disc drive.
- Enter the following instruction:
IPL 000980000f800000a71d30303030301d3032363830 (TR)
(If the drive is 100 tr/in modify the last 12 digits
to read as follows) 1d3031333430 (TR)

The disc will seek continuously between track zero (sector 0) and track 134 (sector 2680). If the drive is a 100 tr/in, it will seek between 0 and 67 (sector 1340).

The average access time should be 55ms, or 38ms for units with the high speed actuator. If the access time is not acceptable, the adjustment below must be made. If the access time is acceptable, the following adjustment need not be made.

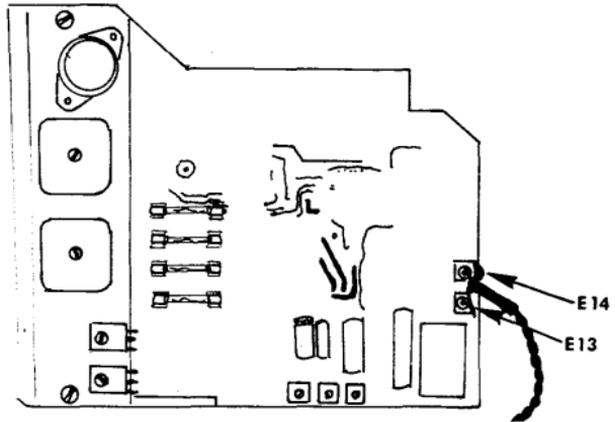
- Move the SYNC lead to pin 4 (LINEAR ZONE ENABLE) on the A3 card. Set the HORIZ time to 5ms/cm.
- Adjust R77 on card A3 to get a waveform similar to those shown below.



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OPTICAL TRANSDUCER/SHUTTER ALIGNMENT

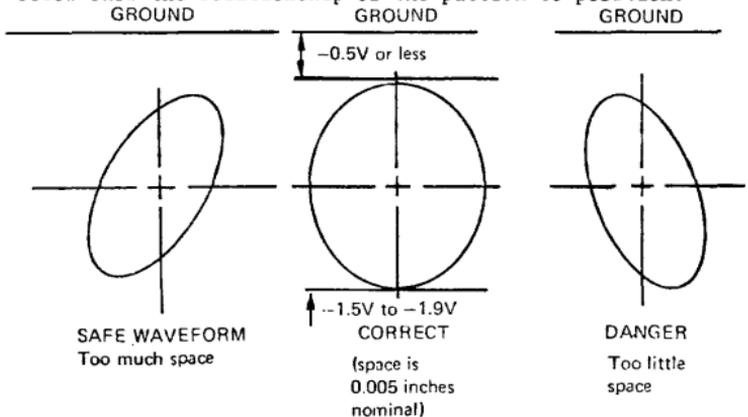
- Disconnect leads E 13 and E 14 from the power supply (see the figure below).



- Connect the CH 1 oscilloscope probe to TP6 on the A4 card.
- Connect the EXT (HORIZ) INPUT from the oscilloscope to TP7 on the A4 card.
- Set the oscilloscope as follows:

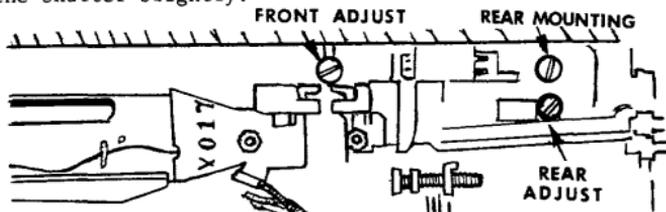
Set ground trace to top graticule of the scope.
Input Selector = dc
CH 1 = .5v/cm
Horiz. = .5v/cm
Time Base = EXT
Coupling = dc
Slope = +
Mode = AUTO

- Move the carriage back and forth between the crash stop and the point just short of the head load position. A lissajous pattern will appear on the scope. The samples below show the relationship of the pattern to position.



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- Adjust for the correct pattern by loosening the front screw (see illustration below) and moving the shutter slightly.



- Position the carriage to cylinder 100, then move the carriage between cylinders 100 and 200. Check the lissajous pattern to be sure that the shutter is not too close. If it is too close, loosen the rear adjusting screw on the shutter and move it away from the actuator motor.
- Position the carriage at cylinder 300, and move between cylinders 300 and 400.
- Adjust the rear of the shutter until the correct pattern appears.
- Move the carriage between cylinders 000 and 400 to verify that the lissajous pattern is correct through the entire travel. Adjust the shutter slightly if necessary until the pattern is correct throughout the full travel.

NOTE:

It is possible to obtain a pattern that is similar to the correct pattern, but is the wrong amplitude. Ignore these positions, and adjust to the right amplitude and shape.

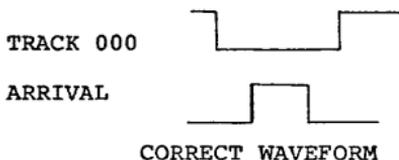
- Connect the CH 1 oscilloscope probe to TP1 on A4 (HOME POSITION).
- Adjust the oscilloscope to detect zero and +5v levels.
- Move the carriage against the crash stop. The HOME signal should go low approximately .020" to .040" before the carriage reaches the stop (each division of the scale is .020").

If necessary, adjust by loosening the transducer mounting screw slightly, and sliding the transducer.

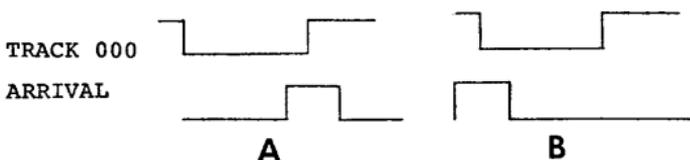
- Connect the CH 1 probe to pin E (TRACK 000) of A4, and set the sensitivity to 5v/cm.
- Connect the CH 2 probe to TP2 (ARRIVAL) on A4, and set the sensitivity to 2v/cm. Trigger from channel 1, slope minus.

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- Manually move the carriage toward the spindle, observing the waveform on the oscilloscope as the carriage moves past track 000. The correct waveform is shown below.



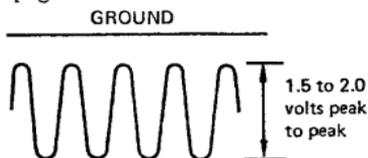
If the waveform is not correct, loosen the transducer mounting screw slightly so that it can be tilted. If the waveform resembles figure A below, lift the rear of the block; if it resembles B, lift the front of the block.



- Connect the CH 1 probe to TP6 on A4, and CH 2 to TP7; set the oscilloscope as follows:

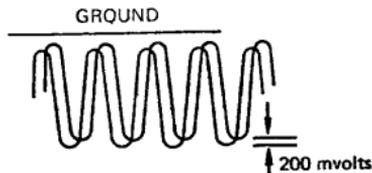
Set the ground traces of CH 1 and CH2 to match.
Sensitivity (both channels) = .5v/cm
Selector = dc
Mode = AUTO
Slope = (+)

- Select CH 1, and move the carriage between cylinders 000 and 400. The waveform should be as shown below, with an amplitude between 1.5 and 2.0 volts. If the pattern is not correct, reset the lissajous pattern as given on the previous pages.



- Select CH 2, moving the carriage the same as before. The pattern should be as shown above, with an amplitude of 1.5v to 2.0v.

- Select both CH 1 and CH 2 (CHOP) moving the carriage as above. The scope pattern should look similar to that to the right. If the difference between the peak amplitudes is greater than 200mv, the lissajous pattern must be adjusted as was described earlier.



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- Connect the channel 1 probe to pin S on A4.
- Move the carriage slowly back and forth through cylinder 000. Verify that the voltage at pin S goes to -2.0 volts as the carriage is moved through cylinder 000.
- Check that the transducer block mounting screw is tight (8-inch/lbs).
- Check head alignment with a C.E. pack.

WESTERN DYNEX

Qantel Model 3001, 3101

WESTERN DYNEX DISC

The following paragraphs are a discussion and instructions concerning the Western Dynex top-load disc unit as configured to the Qantel system. The marketing model number remains the same as for the disc that it replaces: 3001 for the 3+3, and 3101 for the 6+6.

Operation

The operating sequence is interlocked electronically to prevent damage to the unit and disc pack. The following is a reproduction of the general operating instructions that are included with each unit. Failure to follow these instructions can cause an interlock dropout that may appear as a disc failure.

DISC OPERATING INSTRUCTIONS

START/LOAD

- Depress the top portion of the DISC POWER switch. This is a rocker type switch, and is illuminated when it is in the ON position.
- Wait approximately ten seconds for the SAFE indicator to light.
- Insert the disc pack onto the spindle, and place the protective cover from the pack on top of it. The pack protective cover must be turned bottom side up.
- Depress the top portion of the DISC DRIVE switch. The switch should light, and the motor and fan should start.
- Wait until the READY indicator is lit before attempting to read or write. The delay is approximately 90 seconds. During the delay, the speed will increase, then drop to the running level for a time before READY comes ON.

UNLOAD/STOP

- Wait until the disc is off line, i.e. not reading or writing.
- Depress the lower portion of the DISC DRIVE switch. The lamp inside the switch will go OFF and the rotation speed will begin to drop.
- Wait approximately 90 seconds. The SAFE indicator will light, and the mechanical interlock on the protective cover (on top of the disc pack) will release.
- Change or remove the disc pack, returning the pack to its protective cover. A disc pack should remain in the drive at all times when the system is powered down as a protection against dust on the internal working surfaces of the drive.
- To resume operation, START as listed above.
- If the system is to be powered down, depress the lower portion of the DISC POWER switch. The lamp inside the switch will go OFF, and the fan will stop.

NOTE: If an attempt is made to start the drive without the pack protective cover in place, allow disc to stop, turn power OFF, then restart.

WESTERN DYNEX

GENERAL DESCRIPTION

The Western Dynex drive uses a linear motor (voice coil) to position the head carriage. Physical head carriage position is monitored by a transducer that consists of a glass reticule that is marked with the exact track spacing, and a tungsten filament bulb/photo diode arrangement to read the position marks.

Velocity measurement for the head carriage is accomplished by a coil plunger combination that essentially generates voltage with movement. The faster it is moved, the higher voltage is generated. Both position (relative to destination) and velocity are fed to the servo loop for motion control.

The drive, as configured for Qantel, has a spindle speed of 2400 rpm. It uses a 20 sector disc that is electrically counted to ten sectors of data. Conversion to a Western dynex drive is a field change, but requires heavier slide rails, and in some main frames, extensions to the framing itself. Installation is discussed in a later section.

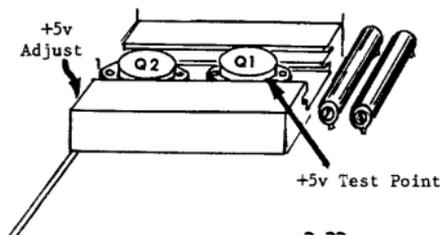
ADJUSTMENTS

Unlike some units, the Western Dynex has demonstrated through experience that once properly adjusted, the drive seldom if ever needs readjusting. The obvious exception to this is when a part needs replacing or repair. All drives are thoroughly checked and adjusted at the factory, and are shipped in top working condition. Installation failures are not likely to be adjustments; the usual installation failure is lack of operating knowledge (causing the interlock to drop out) or a printed circuit board that has become unseated in shipment.

If adjustments are to be made to the drive, follow the instructions exactly, checking the values first, then adjusting only if necessary. Some adjustments affect others, and must be followed by checks in other areas. These will be pointed out in the text where they are needed. Adjust the IOU-24 vco as given on page 2-6.

+5 Volt Check

Before any adjustments are made to other areas, check the plus five volts. The collector (case) of the regulator, **Q1**, can be used as a test point for the +5v. If necessary, adjust as shown in the illustration to ~~5.00 vdc~~ *5.05 vdc*.

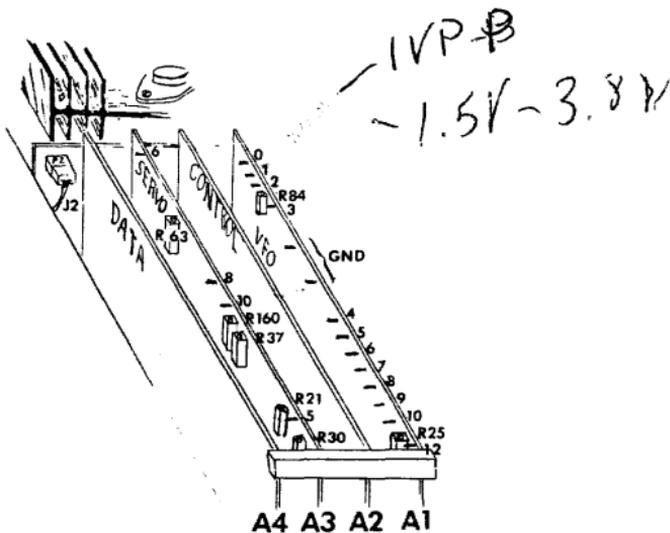


WESTERN DYNEX

Sector/Index Transducers

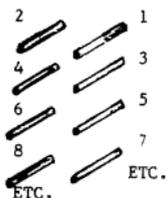
The sector/index transducers are both coil type devices incased in plastic. These seldom if ever need adjustment unless they are physically disturbed by part replacement. The initial mechanical settings are .002" for the fixed disc, and .027" for the removeable disc. Final adjustment is made by voltage measurement as outlined below.

- Place a disc pack or dummy sector ring onto the spindle of the drive.
- Connect an oscilloscope probe to TP 1 on board A1 (see the illustration below).



- With the power off, remove connector J2 from the motherboard. This disables the linear motor power.
- Jumper pin 15 on A3 to ground (see the illustration for pin sequence). This disables the emergency retract circuits.*

Pin 9 of A2 is the same electrical point, and can be used if it is easier to reach with the jumper.



MOTHERBOARD CONNECTOR
(REAR VIEW)

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* Note: it may be easier to jumper TP3 to TP4 on A2 (control card).

WESTERN DYNEX

- Insert spacers between each set of heads to prevent them from loading onto the disc surface. Be careful during all of the following adjustments and checks to avoid touching the disc with the spacers.
- Power up the drive.
- Enable the spindle motor by pushing the positioner forward about $\frac{1}{2}$ inch (no more). Do not push heads off the loading ramps.
- *TP1
Remove* Observe the pattern on the oscilloscope. The voltage should be **1vp-p** \pm 350mv peak-to-peak. The signal polarity must be positive going first, if not, reverse the transducer connector (on the removeable disc).
- *TP2
Fix* Change the oscilloscope probe to TP 2, A1. The signal must be positive going first, and 1.5 to **3.8** volts peak-to-peak. If the signal is negative going first, reverse the transducer leads on the fixed disc.
- If both of the above checks are within limits, retract the positioner, and power down the unit. Replace J2.
- If one or both of the voltages are not within specifications, continue with the steps below.
- Retract the positioner and allow the spindle to come to a stop.
- Loosen the set screw on the transducer that is to be adjusted, and move inward for more voltage, and outward for less voltage.
- Check the voltage by advancing the positioner slightly to activate the spindle motor.
- When the proper setting is achieved, gently tighten the setscrew. Be careful, the transducer case is plastic, and can be broken by overtightening the setscrew. Power down the unit, and replace J2.

SERVO ADJUSTMENTS

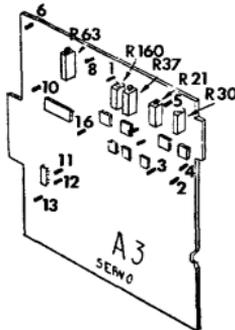
The servo adjustments must be checked before head alignment is attempted. If a C.E. check is made, and the heads appear to be misaligned, adjust the servo first, then check the heads again. The servo circuits are analog, and can drift slightly as they age etc. The heads are a mechanical adjustment, and on this drive, they have little tendency to become misadjusted. The servo checks and adjustments are as follows:

- Disable the linear motor by disconnecting J2 from the motherboard.
- Disable the emergency retract by placing a jumper wire from pin 15, A3 or pin 9, A2 to ground.

WESTERN DYNEX

Index Balance Check/Adjustment

- Connect ch 1 probe to TP 5 on board A3 (see illustration)
- Connect ch 2 to TP 6 (A3).
- Set oscilloscope as follows:
CH 1 **5v/division**
CH 2 **5v/division**
Horiz **1ms/cm**
Auto sync
Chopped
- Power up the drive.
- Manually move the carriage about the index area (the area that would be track -1.5).
- The output of channel 1 (INDEX) should have at least **five** volts change from the high point to the low point. The **5v** includes any crosstalk on the signal and must be centered about ground.
- Adjust **R 30** if necessary to make the signal equal above and below ground. Clockwise adjusts the offset positive, and counterclockwise adjusts negative.
- Verify that the signal on channel 2 (the digital result of the same signal) has an output that transitions from zero to +5v, and changes only once for each direction of movement at track -1.5. The read/write heads must be past the plastic loading ramp when the high to low transition occurs. If not, adjust the position lamp/head as described in a later paragraph.



X + 0° Amplitude and Balance

- Connect the channel 1 oscilloscope probe to TP 1 on A3.
- Connect the channel 2 probe to TP 2 (on A3). Refer to the illustration above for test points and adjustment locations.
- Manually move the carriage while observing the signal on the oscilloscope. The signal should be 9v ($\pm 5\%$) centered about ground. Adjust **R37** (on A3) for amplitude if the 9v peak-to-peak is not within specifications.
- Adjust **R21** (on A3) until the sinewave is within .25v of being symmetrical about ground. Clockwise adjustment offsets the signal positive, counterclockwise offsets the signal negative.
- Observe the signal from TP 2 (ch2). It should be a digital (0 to 5v) signal that approximately corresponds to the crossover of the analog signal from TP 1 (ch 1).

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WESTERN DYNEX

R160

X + 90° Amplitude and Balance

- Connect the channel 1 oscilloscope probe to TP 3 on A3.
- Connect the channel 2 probe to TP 4 on the same board.
- Manually move the carriage back and forth.
- Observe the signal on the oscilloscope. The signal from TP 3 (ch 1) should be from 5v to 25v peak-to-peak, and symmetrical about ground.
- If necessary, adjust R 160 (on A3) until the signal is symmetrical about ground, and within 30% of the peak-to-peak amplitude.
- The signal from TP 4 (ch 2) should be a digital signal (0 to 5v) that approximately corresponds to the crossover of the analog signal.

X + 0° and X + 90° Phasing

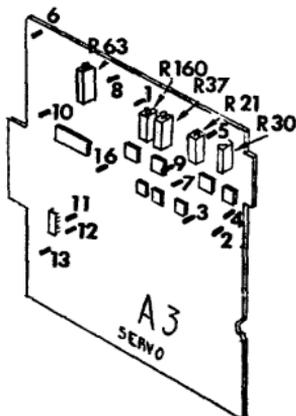
This adjustment is only necessary when the photodiode assembly (the position read head) has been physically moved or replaced. The diode head and lamp replacement is described in a later paragraph.

- Connect the channel 1 oscilloscope probe to TP 3 on A3.
- Connect the channel 2 probe to TP 2 (on A3).
- Set the oscilloscope as follows:
 - CH 1 .2v/cm (10x probe)
 - CH 2 1.0v/cm (10x probe)
 - Horiz .2ms/cm
 - Sync on CH 1 pos
 - Add (CH 1 + CH 2)
- Slowly move the carriage in the direction of the spindle.
- Observe the oscilloscope pattern. The digital signal (added to the analog signal) should occur within $\pm 15^\circ$ of the positive peak of the analog signal.
- When the carriage is moved in the direction away from the spindle, the digital signal should occur within $\pm 15^\circ$ of the negative peak of the analog signal.

WESTERN DYNEX

Up Clock Down Clock

- Connect an oscilloscope probe to TP 11 on A3.



- Set the scope to INTERNAL trigger, negative.
- Manually move the carriage toward the spindle. The scope should display a series of negative going pulses when the carriage is moved toward the spindle.
- Move the oscilloscope probe to TP 12 (just below TP 11).
- Manually move the carriage back and forth. A string of pulses should be generated as the carriage is moving away from the spindle, and no pulses as it is moved toward the spindle.

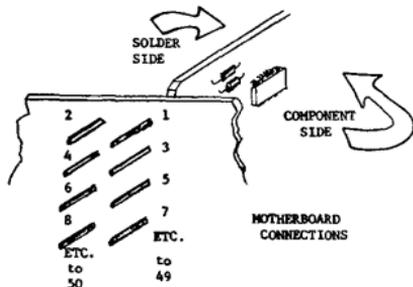
Velocity Reference Adjustment

- Manually retract the carriage, if it is not already retracted.
- Remove the head spacers that were placed there for the previous tests and adjustments.
- With the power removed, reconnect J2 to the motherboard. The location of J2 can be seen in the illustration at the beginning of this section.
- Install a jumper from pin 15, board A3, to ground, or from pin 9, board A2 to ground, or from TP 3 on the Control board to ground.

WESTERN DYNEX

Velocity Reference Adjustment (Continued)

- Connect the I/O cable to either I/O connector, A4 or A5.
- Connect the channel 1 oscilloscope probe to pin 1, A2 (on the motherboard). The motherboard connections as seen from the rear, are odd numbers to the right, even numbers to the left (see below).



- Connect the channel 2 probe to TP 7 on the A3 board (see the illustration on the previous page for TP 3 location).
- Set the oscilloscope as follows:
CH 1 **2v/division**
CH 2 **.5/division**
Horiz **10ms/cm**
- Mount an Acceptance Test Pack on the drive. Or alternately, mount a scratch pack on the drive if the ATP s are to be read from a tape.
- Start the disc drive, and allow it to become ready.
- Initialize the DISC 6 test to the point where the program says: Start test disc x or man section disc x? When using an ATP pack, it is not necessary (during this test) to replace it with a scratch pack.
- On the IPL device (device zero), enter (IPL) 1000A7 (CR). This is an unconditional branch to location 1000 (hex) in memory. At this address in memory the DISC 6 program has placed the Fast Realization of Disc Operation (FRODO) program. The program will respond with "INSTRUCTIONS" and the ENTER lamp will light on the IPL device.
- Enter the following:
ES1 ES2 BL SK1 CSØ4 SK2 CSØ4 EL (Depress FLAG 2, then CR)
Note: spaces can be used between instructions (as shown above), or they can be omitted as desired.

WESTERN DYNEX

Reference Adjustment (Continued)

he entries that were made (on the previous page) translate as follows:

ES1 = Enter seek parameter 1
ES2 = Enter seek parameter 2
BL = Begin loop
SK1 = Seek to parameter 1
CSØ4 = Check for status Ø4 (Ø4 is end, allowing the seek to complete before starting the next seek)
SK2 = Seek to parameter 2
CSØ4 = Wait for end again
EL = End loop (All instructions between BL and EL will be repeated)

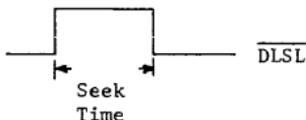
Depressing Flag 2 before transmit causes the FRODO instructions to loop repeatedly until halted by the operator.

Enter the two seek parameters:

RØØØØØ (CR)
RØ256Ø (CR)

The disc should seek continuously between track 0 and track 128.

Observe the oscilloscope (channel 1), and record the seek time (see the illustration below).



IPL, and enter the following:

1000A7 (CR)

The program branches back to FRODO, and prints out "INSTRUCTIONS".

Enter:

ES1 ES2 BL SK1 CSØ4 SK2 CSØ4 EL (FLAG 2) (CR)
RØ256Ø (CR)
RØ512Ø (CR)

This is the same program as before, but with new seek parameters (track 128 to track 256).

Record the seek time as shown above.

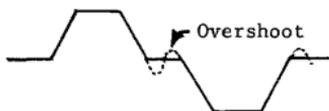
IPL, and enter the same FRODO program as above, but with the following seek parameters:

RØ512Ø (CR) ! Track 256
RØ768Ø (CR) ! Track 384

WESTERN DYNEX

Velocity Reference Adjustment (Continued)

- Record the seek time as before.
- Determine which of the seek times is the shortest time. The shortest seek time should be 34 ms or slightly longer. If it is not, adjust as follows:
 - Perform the seek that had the shortest time.
 - Adjust R63 on board A3 until the seek time is 34ms. Clockwise is slower, counterclockwise is faster.
 - Recheck the other two seek times to verify that the adjustment has not made one of them too short.
- IPL, and branch to FRODO again (i000A7)
- Enter:
ES1 ES2 BL SK1 CS04 SK2 CS04 EL (FLAG 2) (CR)
R00000 (CR)
R08080 (CR)
- Verify that there is no overshoot on the full seek (see the illustration below). Look for this pattern on CH 2.



- If there is overshoot, adjust R63 (on A3) clockwise until the overshoot disappears.
- Move the channel 2 oscilloscope probe to TP 5 on A3.
- Verify that the INDEX signal does not become more positive than minus 1.5v. If it does, replace the servo board, A3.
- Remove the jumper from pin 15, A3, and restore the drive to normal operating condition.

POSITION READ HEAD/LAMP ADJUST **CHECK-- DON'T ADJUST**

This adjustment is only necessary if the position read transducer head or lamp has been physically moved or replaced. When replacing these elements, the lamp filament should be as nearly vertical as possible. The photodiode assembly should also be vertical, with the large dark segment to the bottom (see below).



Dark segment to bottom

- Adjust as follows:

WESTERN DYNEX

POSITION READ HEAD/LAMP ADJUST (Continued)

- Disable the linear motor by disconnecting J2 from the motherboard. The location of J2 is shown in the illustration at the beginning of this section.
- Disable the emergency retract by placing a jumper from A3, pin 15 to ground, or from A2, pin 9 to ground.
- Insert spacers between each set of heads to prevent them from loading onto the disc surface. Be careful during the following tests and adjustments that the spacers do not touch the disc when the head carriage is moved manually.
- Connect an oscilloscope probe to TP 3 on board A3. The location of A3 test points is shown on a previous page.

Lamp Adjustment

- Loosen the lamp setscrew so the lamp can be rotated.
- Manually move the carriage back and forth, observing the voltage pattern on the oscilloscope.
- Rotate the lamp slightly while still moving the carriage. Find the point where the maximum deflection is made. This must be in excess of 5v peak-to-peak (2.5v each way from ground).
- Re-tighten the setscrew, and make the following checks:
 - X + 0° Amplitude and Balance
 - X + 90° Amplitude and Balance
 - X + 0° and X + 90° Phasing
 - Up Clock Down Clock
- If any of the above tests are not within specification, re-position the lamp to another maximum position and repeat the procedure.

Transducer (Diode) Head Adjustment

- Loosen the head setscrew so the head can be rotated.
- While moving the carriage, slightly rotate the head for maximum deflection (the same as in the lamp check above).
- Re-tighten the setscrew, and make all of the checks that are listed in the lamp adjustment above. In difficult cases, the head and lamp may require adjusting in conjunction.

WESTERN DYNEX

Index to Clock Check

R 30

- Check or adjust the velocity reference as given previously.
- Connect the channel 1 oscilloscope probe to TP 6 on A3.
- Connect the channel 2 probe to A3, pin 2.
- Set the oscilloscope to trigger on Channel 1 positive.
- If the DISC 6 test is still in memory, (i.e. the processor has not been powered down since the velocity reference was made) branch to FRODO by entering (IPL) 1000A7.
- If DISC 6 is not in memory, load it from tape or disc, and initialize the test to where it prints "LOAD SCRATCH PACK". If the DISC 6 program was loaded from a disc pack, the pack need not be removed for this test. Instead, IPL, and enter 1000A7 (CR).
- When the FRODO program responds with "INSTRUCTIONS" enter:
BL RES CSØ4 EL
- Observe the oscilloscope pattern. The clock signal (ch 2) must be more than 500 us from the negative (falling) edge of the INDEX signal on TP 6 (ch 1). If it is less than 500 us, adjust R 30 on A3 (400 to 500 is O.K.)
- If R 30 is adjusted, repeat the INDEX BALANCE check (the first servo adjustment) to verify that the index balance **is still between +2v and -3v**. If the index to clock cannot be adjusted without moving the index balance out of limits, the Position Read Head must be rotated slightly (see Position Read Head/Lamp Adjustment).

X + 0° Cell Balance Check

- Check or adjust all other servo settings.
- Connect an oscilloscope probe to TP 1 on board A3.
- With the carriage retracted, the voltage level on TP 1 should be between + 2.5v and - 2.5v. If it is not, the position read lamp must be adjusted (see Position Read Head/Lamp Adjustment).

WESTERN DYNEX

READ/WRITE HEAD ALIGNMENT

NOTE: a jumper is required on the IOU 24C for head alignment.

To ensure that data that is put onto a removable pack by one disc drive is readable by any other drive of the same type requires that the read/write heads are positioned accurately. The fixed disc heads, of course, do not require positional alignment because the platters are not exchanged between units. Whenever a fixed disc or one of the fixed disc heads is changed, initialization is all that is required.

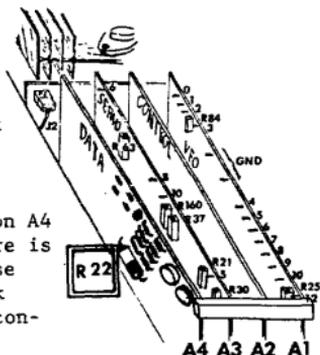
Heads 0 and 1 (top, or removable, platter) must be checked or aligned whenever any mechanical change occurs to the heads, the head carriage, or the position read mechanism. However, before head alignment is started, all servo checks and adjustments must be made.

Head alignment is very sensitive to temperature and environment. The entire disc drive must be stabilized at room temperature (72°F to 82°F) for at least three hours before the alignment is started. This allows all portions of the drive to reach expansion equilibrium.

It is also very important that during the head alignment procedure, the front panel must not support any weight. The unit should be supported by the side rails only.

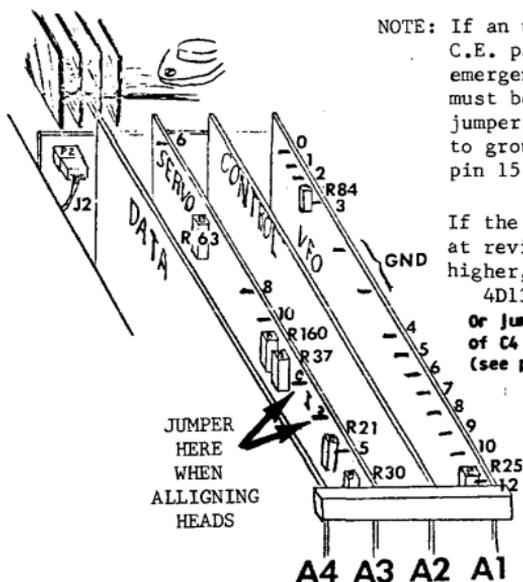
The procedure below covers situations where unknown problems may exist in the drive, and could damage a C.E. pack. Checks are made to verify that the drive is working well enough to install the C.E. pack. If a drive is known to be working, and only needs checking or alignment, the steps that are preceded by an asterisk (*) may be skipped. However, if the drive is at all questionable, the small investment in extra checks will be rewarded by assured protection of the C.E. pack.

- Remove the outer top cover from the drive.
- Remove the smaller plastic cover from over the head carriage region.
- (*) Mount a spare (scratch) pack on the drive.
- (*) Place both protect switches in the PROTECT position.
- (*) Start the disc spinning and wait for 30 minutes for the pack to stabilize.
- (*) Measure the voltage across R22 on A4 (see the illustration). If there is any voltage across R22, the erase circuit is ON, and the C.E. pack must not be mounted until this condition is corrected.
- (*) If there is no voltage across R22, power down the drive, and remove the spare pack.



WESTERN DYNEX

- Mount a C.E. pack on the disc drive, and power up the unit. See note with the illustration, below.
- Allow the C.E. pack to spin for at least 30 minutes before continuing. If the C.E. pack was carried from a different temperature environment, allow one hour. Leave the two plastic covers off during this time.
- Place a short jumper wire across the two points of jumper position 1 on board A3 (servo). These two points are labeled C and 2 (see the illustration). The jumper point 2 is not test point 2 that was shown in the earlier illustrations. The jumper introduces an offset in the



NOTE: If an unsectored C.E. pack is used, emergency unload must be disabled by jumpering A2, pin 9 to ground, or A3, pin 15 to ground.

If the IOU-24C is at revision H or higher, ground 4D13.

Or jumper top of C4 to gnd. (see p. 2-54).

JUMPER
HERE
WHEN
ALIGNING
HEADS

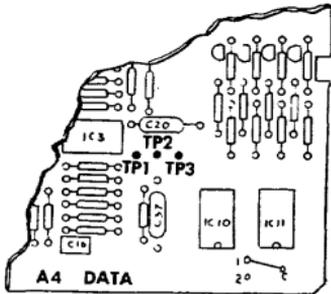
servo control circuit that compensates for the thermal difference of removing the covers. If the jumper is not used during alignment, the heads will drift out of alignment when the covers are replaced.

- Connect the channel 1 oscilloscope probe to test point 12 on board A1 (see the illustration above).
- Set the oscilloscope to measure:

CH 1 **2v/division AC coupled**
 CH 2 **.5v/cm**
 HORIZ **2ms/division uncal.**
 Sync **INT (CH 1) POS**

WESTERN DYNEX

- Connect the channel 2 oscilloscope probe to TP 3 or ~~4~~ on board A4 (see the illustration below).



NOTE:

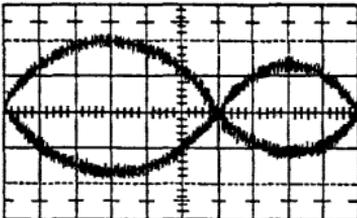
TP3 resides higher on late model P.C. boards.

- Seek to the C.E. track and select the lower head by entering the following program. (IPL)

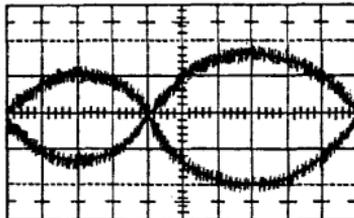
0006800000A81x3032393230

↖ Device number, usually D

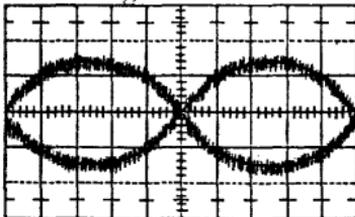
- Observe the pattern on the oscilloscope. Adjust the time base on the oscilloscope to center the "cat's eyes" on the screen. Both loops must be equal when the head is properly aligned. The illustrations below show examples of the patterns that can be expected.



HEAD POSITIONED TOO FAR FROM SPINDLE



HEAD POSITIONED TOO CLOSE TO SPINDLE



HEADS ON TRACK

- If head adjustment is necessary, first disable the emergency retract by jumpering either A2, pin 9 to ground, or jumpering A3, pin 15 to ground.

WESTERN DYNEX

- When the lower head is properly aligned, switch to the upper head by entering the following program.

(IPL) 0006800000A81x3032393330

↙ Device no., usually D

- The pattern should be the same as it was for the lower head. Be sure the emergency retract is disabled before attempting head adjustment.
- When both heads are properly aligned, the index to burst (circumferential alignment) must be checked as follows.
- Move the oscilloscope probe to TP 3 on board A4 (the location of TP 3 is near TP 1, and is shown on the previous page).

- Set the oscilloscope as follows:

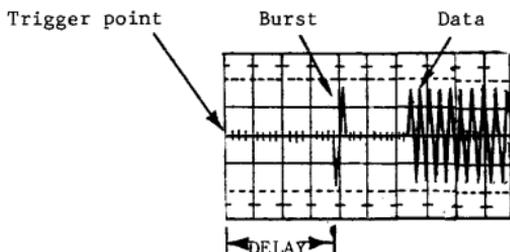
Trigger INT (CH 1) POS
CH 2 20mv/cm (with 10x probe) ;
HORIZ 5us/cm

- Enter the following program:

(IPL) 0006800000A81x3030323030

↙ Device number, usually D

- This program seeks to the burst track and selects the lower head.
- The oscilloscope pattern should be similar to the illustration below. The delay should be $19\mu\text{s} \pm 4\mu\text{s}$. Make a notation of the delay time. For single sector packs $\text{Time} = 19\mu\text{s} + 19 \left(\frac{x}{25\text{ms}} - 1\right)$ where $x =$ measured rotation time.



NOTE: Burst may appear as reversed polarity.

- Select the upper head by entering the following program.

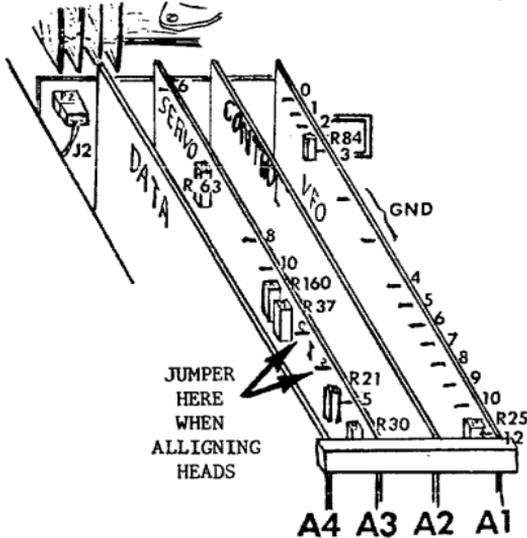
(IPL) 0006800000A81x3030323130

↙ Device number, usually D

WESTERN DYNEX

- Compare the delay of the upper head to that of the lower head (from the previous seek). If the difference is greater than 7 μ s, one or both heads are improperly seated against the side guide block. In that case, the mechanical correction must be made, and the entire alignment check repeated.

If both heads have a delay that is within 7 μ s of each other, but the delay is less than or greater than 19 μ s (\pm 4 μ s), adjust R 84 on board A1 (see the illustration below for the location of R 84). If the range of R 84



is insufficient, do the following:

- Power down the disc, and remove the pack.
- Loosen, but do not remove, the five Allen-head screws that hold the fixed disc cover. Do not loosen the three round head Allen screws that are in the same vicinity.
- Rotate the fixed disc cover (within the allowance of the screw holes) and re-tighten the screws. Clockwise increases the time; counterclockwise decreases the time.
- Re-insert the disc pack and power up and ready the drive.
- Seek to the burst track, as given above, and try again to adjust R 84.
- When the above checks and adjustments are correct, return the disc drive to normal operating status by removing any disabling jumpers, and replacing the covers.

FRODO

FRODO (Fast Realization of Disc Operations) is loaded into memory, and can be used by the operator, any time after START TEST DISC X or MAN SECTION DISC X ? is printed.

FRODO is initialized after an error halt in DISC6 by turning ON Flags 2 and 3 and pressing the ST-SP button. The operator can also enter FRODO by branching to location 1000 in memory at any time.

The program will print "INSTRUCTIONS:" and the ENTER lamp will light. The user program consists of a series of two or three character symbolic codes. Each code causes a specific function. Some codes require following digits as noted in the code description. All codes may be (but need not be) separated by spaces.

Program entry is terminated by turning ON Flag 2 and/or Flag 3 and pressing TERM or TRANSMIT. Flag 2, alone, causes the program to be executed repeatedly at machine speed until stopped by the user. Flag 3, alone, causes the program to halt after each instruction is executed, and repeat until stopped by the user. Flag 2 and Flag 3 cause the program to execute only once at machine speed.

If a code that is entered cannot be recognized, the program will print "illegal entry" and return to the program entry phase.

When an ES1 or ES2 are used in the instructions, the program halts after termination of the instruction entry phase to await the seek parameters. The operator must then enter the seek address (see below).

The symbolic codes for FRODO are explained below.

CODE	DESCRIPTION
ES1	Enter Seek parameter #1. Causes the program to wait in a loop, allowing the operator to enter a seek address that will be used by the SK1 instruction. The address is a 5-digit decimal number that must be preceded by "F" or "R" (fixed or removable) if the disc is a 3+3 or 6+6.
ES2	Enter Seek parameter #2. Same as ES1, except that the number is used by the SK2 instruction.
SK1	Seek 1. A seek using the parameter given above. If no parameter was given, the parameter is read from the first six positions of the write buffer (where it would have been put). These positions will be hex zeros that were set when the program was read into memory.

If one seek follows another, use a CS04 instruction between the two, to allow the seek to complete before the new seek is attempted.

FRODO

- SK2 Seek 2. Same as for SK1, except that parameter #2 is used. When FRODO is loaded, default values for parameter #2 are set to 11111 for 111 discs, 21111 for 114 discs, or 01111 for 5444 discs.
- ED Enter Data. Hex data is read from the terminal. If only one or two bytes (two or four hex digits) are entered, these characters will be propagated through the entire write buffer. Otherwise, up to one typewriter line of data may be placed in the first 64 positions of the write buffer following the seek parameter.
- WRT Write to the disc. Data in the write buffer is written to the disc. The write routine does not include seek or status check.
- RD Read from the disc. The first sixteen bytes of the read buffer are cleared to hex zeros, then data from the disc is entered into those positions. The read routine does not include seek, status check, or data checks.
- CD Check Data. The contents of the read buffer are compared against the contents of the write buffer. Unless the SER instruction has been executed, errors are printed if they occur.
- PWB Print Write Buffer. The contents of the write buffer are displayed. Flag 2 terminates the current line; Flag3 terminates the operation.
- PRB Print Read Buffer. The read buffer is displayed.
- ACS Add Constant to Sector. The sector number in parameter #1 is increased by one. When it overflows from 9 to 0, the head number is increased by one. When the highest allowed seek is exceeded, the program skips to the next symbolic code beyond EL, thus terminating the loop.
- ACH Add Constant to Head. The head number in seek parameter #1 is increased by one. Overflow increases the cylinder number by one. When the highest allowable parameter is exceeded, seek parameter is reset to zero, and the program skips to the next instruction beyond EL, terminating the loop.
- ACT Add Constant to Track. The cylinder number in seek parameter #1 is increased by one. When the highest allowable parameter is exceeded, seek parameter #1 is reset to zero, and the program skips to the next instruction beyond EL, terminating the loop.

MRW - Move Read Buffer²⁻⁴⁰ to
Write Buffer

FRODO

- PCS Print Changing Status. Every 425 microseconds a Status-in instruction is issued to the disc. The status obtained is stored in a stack. If the status changes within 250 milliseconds, the new status is entered in the stack. When status remains constant for more than 250 milliseconds, all of the status bytes obtained are displayed.
- PS Print Status. Status is printed after each completed operation.
- CSxx Check for Status xx. When the status (represented by xx) is reached, the next instruction is executed. If the specified status is not reached within 250 milliseconds, the sector number (in bytes 2-6 of the write buffer) is printed along with the last status byte obtained. Errors are not printed if the SER instruction was executed.
- SOF Skip On Failure. Placed after a CD or CSxx instruction. If a failure occurs, the program skips to the next instruction beyond EL, or if there are no loops, to the beginning of the program.
- SER Suppress Error Report. Instead of displaying errors, signal lamps one and two blink each time an error is made. Error reporting is automatically restored during program entry.
- SR Soft Rom. All seeks issued after this instruction is executed are software programmed, and execute in the micro instruction mode. SR is disabled during program entry.
- ITC Inhibit Track Check. Issues CTL 01 to the controller, causing it to disable (the normal) track check that would be made.
- IRC Inhibit Read Check. Issues CTL 02 to the controller inhibiting the read-after-write check.
- RIO Reset I/O.
- BL,EL Begin Loop, End Loop. Instructions to be repeated are placed between these symbols. The loop continues until:
1. The operator presses Flag 2 or 3, causing the program to fall through EL the next time it is reached.
 2. A CSxx followed by SOF does not detect the expected status, or a CD followed by SOF detects a data error.
 3. An ACS, ACH, or ACT increment seek parameter #1 past the highest valid sector number.
- RES Restore. Sends a series of micro instructions to restore the disc and set the cylinder to 00.

FRODO

SWR	Set Write.
SRD	Set Read.
MWxx	Micro Write. The one byte of hex (represented by xx) is transferred from the processor to the controller.
MR	Micro Read. One byte of data is read from the controller, and typed or displayed.
TER	Terminate.
RS1	Read Status 1. The status byte from the controller is read and displayed.
CTL	Control. Sends the CTL signal to the controller.
RH	Reset Head register. Resets the head register in the controller.
SCxxx	Set Cylinder to xxx. The decimal number represented by xxx is converted to hex, and the cylinder is set accordingly. The highest acceptable value for the 114 and 6+6 is 202.
SHxx	Set Head to xx. The decimal number represented by xx can be 00-09 for the 111, 00-19 for the 114, or 00 or 01 for the 3+3 or 6+6.
SSCx	Set sector to x. The x represents a decimal number of the sector to be set.
SD	Set Difference. Used by the 111 to set the address difference. Not used by the 114. Used for one addressing digit by the 6+6.
SSK	Start Seek.

A practical example of the use of FRODO instructions is given in the Western Dynex portion of this book. In there the instructions are used to allow seek time measurement and test for overshoot. With very little practice, FRODO can be one of your best and easiest tools.

WHD - Write header only

CENTURY 114

The test points and procedures in the following instructions are for the Model "D", covering all machines above serial number 5000. For machines below serial number 5000, settings and test points differences are shown as follows (*05C04).

Remove the front and rear panels by pulling firmly at the top portion of the panel. There are two friction catches toward the top. When these release, the panel swings out at the top, pivoting at the bottom. The panel can then be lifted free of the unit.

The card cage/power supply module at the rear of the unit swings out for access to motherboard test points. The entire module is secured by a large captive screw at the lower left of the module.

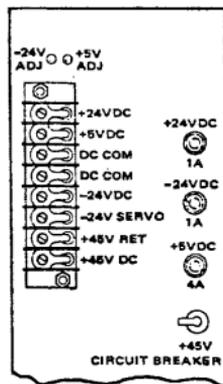
Individual procedures are labeled in the text. Spot checks can be made on any of these single adjustments. However, if adjustments are made, the alignment must be made in the order that is given: Power Supply, Servo, and Read/Write System.

POWER SUPPLY

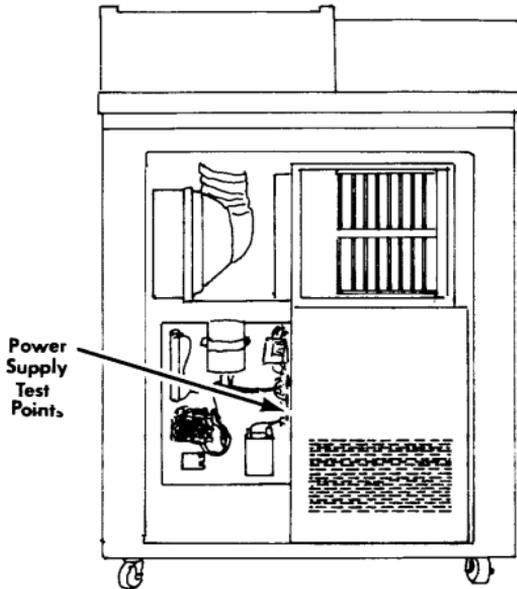
Use the S1 switch inside the lower unit to apply power. Do not activate The operator switch on top. Using a digital voltmeter, check the voltages as shown in the figure and table below. The 36 volts must be checked at the motherboard, 15B53 (see the illustration on the next page for adjustment location).

NOTE
On earlier model units, the physical location of the dc voltage terminals differs from that shown in Figure

Voltage Terminals	Ground Terminal
+5V (± 50 mVdc, adjustable)	DC COM (T52-3)
+24V (± 1.2 vdc)	
-24V (± 0.48 vdc) adjustable	
-24V SVO (± 0.48 vdc) adjustable	
+45V (+2.25, -4.5 vdc)	
+36 vdc (± 1.8 vdc, at 15B53) adjustable	



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SERVO SYSTEM

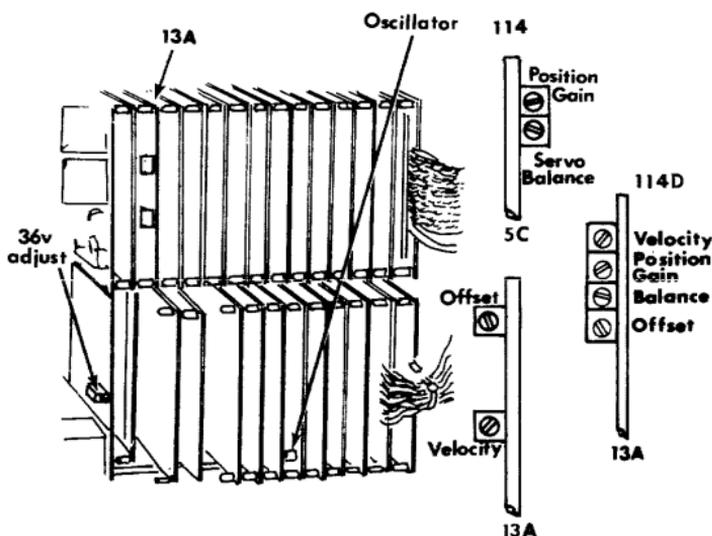
100 KHz Oscillator

Connect the Channel 1 oscilloscope probe to 06B01 (card 6, bank B, pin 01). Gnd. lead to chassis.

- Set the oscilloscope as follows:
 SYNC = INT POSITIVE
 HORIZ = 10 usec/cm
 VERT = 1 v/cm dc
- The display should be a 5v p/p + .05v sinewave centered about ground, with a cycle length of 10 Usec + 1 Usec. If it is not within these limits, adjust the Oscillator control, R6 on

CENTURY 114

card 6B (see illustration). The frequency is not adjustable, and if it is beyond limits, the oscillator card (6B) must be replaced.



Cylinder Transducer Check

- Remove power from the drive by turning S1, on the relay panel at the front of the unit to the OFF position.
- Remove card 15A (servo amplifier) from the unit.
- Remove the top cover (over the servo motor).
- Remove ONE wire (only) from the linear motor.
- Cover the end of the wire to avoid accidental contact.

-----WARNING-----
DO NOT REVERSE THE LINEAR MOTOR
LEADS; it will destroy the drive
and injure nearby persons.

- Connect the oscilloscope CH1 probe to 13A31 (*05C04) (cylinder transducer). This probe stays at this point through the Cylinder Transducer check, the DC Offset adjustment, Servo Balance,

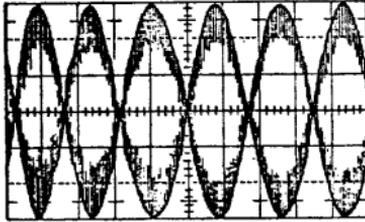
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Position Gain, and Velocity checks.

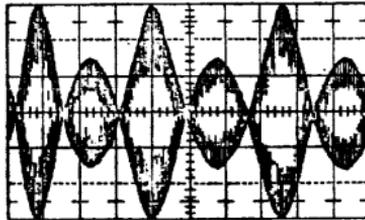
- Be sure to ground the shield connection on the oscilloscope lead.
- Connect the CH2 probe to 05B33 (*11A30)(GTDATN). This probe will not be used until later.
- Connect an external sync lead to 06B01 (Osc).
- Set the oscilloscope as follows:
 - Sync = Ext pos
 - Horiz = 2 ms/cm
 - CH1 = 200 mv/cm
- If it is not already connected, install the I/O cable between the IOU/24 and the drive.
- Return the ac power switch, S1, to the ON position.
- Power up the main processor.
- Power up the drive from the operator panel on top of the unit.
- Wait for the pack to reach speed, and the SELECT LOCK indicator to light.
- Grasping the head carriage toward the rear (near the coil, or bobin), move the heads onto the disc pack.
- While moving the heads back and forth over the entire range, observe the pattern on the oscilloscope. The wave form (shown below) must be $800 + 200\text{mv}$ with less than 20% variation. This movement should be approximately

The waveform illustration is shown on the following page.

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A. Correct



B. Incorrect

between tracks 000 and 202. The end of rack magnets will induce large distortions into the transducer signal. Ignore this effect.

- Manually retract the heads, unloading them.
- Power down the disc unit at the operator panel, and wait for the pack to stop.
- Turn S1, on the relay panel, to the OFF position.
- Re-install the 15A card.
- Re-connect the linear motor lead.

-----WARNING-----

DO NOT REVERSE the linear motor leads; it will destroy the drive and cause personnel injury to anyone nearby.

- Return the S1 switch to the ON position.
- Power up the drive from the operator panel.

CENTURY 114

Set the oscilloscope to:

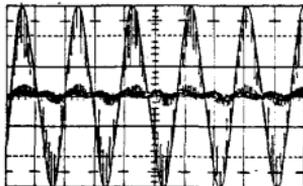
CH 1 = 100 mv/cm

HORIZ = 5 usec/cm

- Load the ATPs from either another disc drive, or from a tape unit.
- Call for the "disc6" test, and initialize to the point where the test asks "manual section disc x?".
- Depress IPL, and enter 1000A7 (TRANSMIT).
- The FRODO portion of the disc6 test will print "instructions".
- Enter:
ES1 ES2 BL SK1 SK2 EL
.Depress F2, then RETURN
- Enter:
00000 (RETURN)
00100 (RETURN)
- The disc will begin a repetitive one cylinder seek.

D.C. Offset

- Observe the pattern on the oscilloscope screen
The correct waveform is shown below.



- Adjust the DC OFFSET (bottom pot on 13A)(*pot closes to pins on 5C) and the SERVO BALANCE (next pot above DC OFFSET)(*top pot on 13A) to make the heavy center line in the display as flat as possible.
- Stop the repetitive seeks by depressing the START/STOP button on the processor.
- With the processor stopped, the heavy line can usually be made a little flatter by slightly adjusting the DC OFFSET and SERVO BALANCE. Do not radically change either control unless the repetitive seek is restarted.

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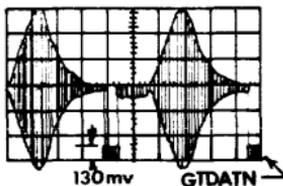
- Start the seek again by depressing the processor START/STOP button.
- Verify that the heavy center line stays flat. If it does not, the adjustments must be repeated.

Position Gain

- Move the oscilloscope sync probe to 09A5 (SKFD).
- Reset the oscilloscope as follows; do not move the CH1 and CH2 probes.

CH1 = 100 mv/cm ac
CH2 = 2v/cm dc
Horiz = 2 ms/cm added
Sync = Ext. Pos.

- Vary the horizontal sweep (uncalibrated) until both forward and reverse waveforms are displayed. The illustration below shows approximately the way it should look.



- Take note of the waveform for comparison to the one that will follow.
- Depress F2 on the controlling terminal, and enter:
40100 (RETURN)
40200 (RETURN)
The disc will start a single cylinder seek between tracks 201 and 202.
- Compare the display to the previous one. They should be nearly identical. If they are not, adjust the POSITION GAIN (2nd pot from top on 13A) (*farthest pot from pins on 5C) slightly to make both waveforms alike. Keep in mind that the GTDATN portion must not exceed 130 mv.
- If adjustment was made, return to the seek between

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cylinders 0 and 1 by pressing F2 on the controlling terminal, and entering:

00000 (RETURN)

00100 (RETURN)

- Alternate between the two one track seeks until both waveforms are alike.

Velocity

- Depress F2 on the controlling terminal, and enter:
00000 (RETURN)

40200 (RETURN)

This creates a repetitive 203 track seek.

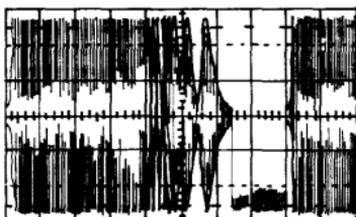
- Reset the oscilloscope to the following; do not change the probe positions.

CH1 = 200 mv/cm

CH2 = 2 v/cm ADD

Horiz = 10 ms/cm Neg. (CAL)

- Adjust the VELOCITY (top pot on 13A)(*bottom pot on 13A) if necessary, to make the GTDATN signal start 65 ms + 5 ms from the beginning of the sweep. The display should look like the illustration below. Change trigger if start point does not "swoop" out as shown.



- Depress F2 and release. Depress F2 again, then F3 and RETURN.

READ/WRITE SYSTEM

Sector And Index Pulses

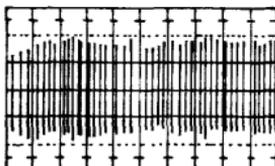
Continue from the tests and adjustments above
(scratch pack mounted and spinning)

- Connect the Channel 1 probe to 06C13 (index/sector)
- Set the oscilloscope controls as follows:
Vert = .5v/cm
Horiz = 5 ms/cm

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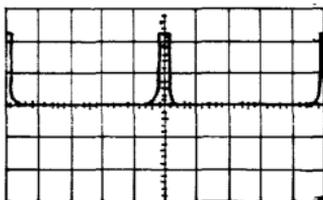
Sync = Int Neg

- The pulses should be 1.3v peak-to-peak minimum, to 2.25v p/p maximum (similar to the illustration below). Ignore the INDEX pulse.



- Move the CH1 probe to 03A30 (index)
- Reset the oscilloscope as follows:
 - Horiz = 5 ms/cm
 - Sync = Internal Pos
 - CH1 = 2 v/cm

The wave should be positive pulses approximately 25 ms apart.



Head Amplitude

- Move the Channel 1 probe to 02C13.
- Connect the Channel 2 probe to 02C15.
- Connect the Sync lead to 07A50 (read gate).
- Set the oscilloscope controls as follows:
 - CH1 = 100 mv/cm ac
 - CH2 = 100 mv/cm ac inverted
 - Sync = Ext. neg.
 - Horiz = .1 ms/cm
 - Mode = Add, inverted
- On the controlling terminal the printout will say, "instructions".

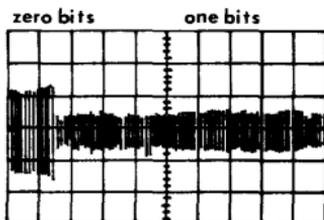
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-----WARNING-----
Keep hands out of head carriage area.

- Enter:
ES1 ED SK1 WRT BL SK1 RD EL
(F2 RETURN)
- Enter:
00000 (RETURN)

The computer will respond with "ED:".
- Enter:
FF (RETURN)

The oscilloscope will display a stream of one bits alternated with zero bits.
- Note the amplitude (in mv) of the one bits (the smaller amplitude).



- If the amplitude is less than 75 mv on a single head, replace the head. However, if several heads show less than the 75 mv reading, the READ pre-amp board for that side may be faulty, and require replacing.
- Depress F2.
- Enter: 00010 (RETURN)
The computer will respond with "ED:".
- Enter: FF (RETURN)
This produces the same pattern as above, but selects the next head.
- Increment to each head by pressing F2 and entering the next higher number, then entering FF for data. Head numbers progress from 00000 to 00090 (head 9), then from 10000 (head 10) to 10090 (head 19).

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- When all heads have been checked at track zero (the previous procedure) depress F2.
- Enter: 29900 (RETURN)
ED: FF (RETURN)

This causes the same pattern of ones and zeros at track 199.

The minimum amplitude for the pattern of 1's must not be less than 75mv.

- Increment to each head as before by adding one, to the head number, then entering FF for data. The head sequence is 29900 (head zero, track 199) through 29990 (head 9, track 199), then 39900 (head 10, track 199) to 39990 (head 19, track 199).

-----NOTE-----
The amplitude of head 19 is usually lower than all of the others, but must be 75mv minimum.

- When all heads are checked, power down the disc drive depressing the POWER ON button.

HEAD ALIGNMENT

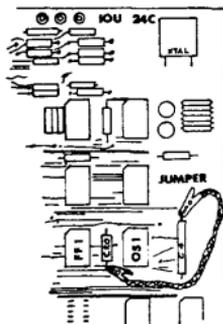
- Remove the power from the disc drive by turning S1 (on the relay panel at the front of the unit) to the OFF position.
- Remove the Write Driver card, 3C, from its slot.
- If the CE pack has only an index slot (no sector slots), card 11B must also be removed.

-----CAUTION-----
If card 11B is removed, only a single slot disc pack can be used. Failure to return the 11B card to its slot before running a sectored disc pack will cause an immediate HEAD CRASH.

- If the IOU-24C controller board is at level G or higher, ground pin 13 on the oneshot

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located at D 9 on the IOU-24C board. (These jumper points are shown in the illustration that follows)



- Depress IPL on the main processor.
- Restore power to the drive by returning S1 to the ON position.
- Mount the CE pack in the drive.
- Power up the unit from the operator panel, and start the disc spinning.

-----NOTE-----
The CE pack must be allowed to equalize in temperature before head alignment is made. This can be as long as an hour if the pack has just come from a greatly different environment.

- If the Disc6 test is not already in main memory, load it and initialize to where the printout reads "manual section disc x?".
- Call in the FRODO subroutine by entering (IPL) 1000A7 (TRANSMIT)
- When the program prints "instructions" enter:
ES1 BL TSP SK1 ACH RIO EL (F3 RETURN)
- Enter:
07300 (RETURN)

The START/STOP lamp will light.

- Depress the ST/SP button on the processor. The seek parameter will be printed out.

CENTURY 114

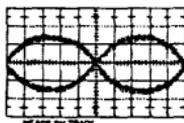
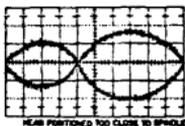
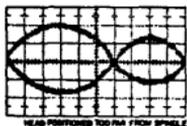
-----WARNING-----

Keep hands and tools clear of the head carriage when depressing ST/SP. At various stages in the program, the heads will quickly restore or seek, and can cause serious injury.

- Connect the oscilloscope CH 1 probe to 02C13.
- Connect the CH 2 probe to 02C15.
- Set the oscilloscope as follows:
 - CH 1 = 100mv/cm
 - CH 2 = 100MV/CM INV. ADD
 - Horiz = 2mv/cm
 - Sync = Ext Pos (on 03A30, INDEX)
- Noting the warning above, depress ST/SP until the heads seek (to track 73). Head zero will be selected.
- Observe the pattern on the oscilloscope. It will have a pattern that resembles a figure eight, or sometimes called cats eyes. This figure is sometimes difficult to see until the oscilloscope brightness is adjusted to the right level.

Some examples of the the "cats eyes" display are shown below. The sweep time on the oscilloscope may require adjustment to center the display on the screen.

Proper head alignment is shown when both loops are equal. The loops need not be the same amplitude, as long as they are the same length. If the loops are less than 100 mv, do



a weak head check for the head that is selected. Do not adjust the head if the loops are within 10% of each other (2 small

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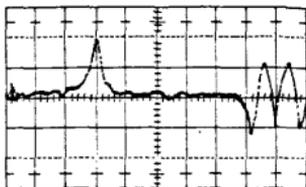
divisions on the oscilloscope).

- To select the next head, depress the ST/SP button four times. This can be done to select each head in order.
- If after checking all heads, a particular head must be selected, use the following procedure.
 - Depress F2
 - Depress ST/SP repeatedly until the ENT lamp on the entry station lights.
 - Enter the head number, retaining the track address of 73. For example, head #3 would be 07330; head #15, 17350.
- After the address is entered, press (F3) RETURN, then ST/SP until the seek is made.
- Adjust any heads that may require it. Adjust as follows:
 - Loosen each of the four screws, but retighten the screw slightly to allow the head to be moved with resistance.
 - Move the head beyond the proper adjustment using a screwdriver.
 - With a screwdriver, carefully pry the head back to the proper position.
 - Tighten all four screws to 5.5 inch/pounds (use a torque wrench for this).

ITEM HEAD		HEAD ITEM	
1	01	00	2
3	02		
		03	4
		04	2
1	05	HEAD NUMBER TO DISK SURFACE AND HEAD LOCATIONS	
3	06		
		07	4
		08	2
1	09		
3	10	AS VIEWED FROM LINEAR MOTOR	
		11	4
		12	2
1	13		
3	14		
		15	4
		16	2
1	17		
3	18		
		19	4

**Head
Locations**

- . When all heads are aligned or checked, depress F2.
- . Enter:
21890 (F3) (RETURN)
- . Change the oscilloscope sweep to 1 us/cm.
- . Observe the pattern , it should look similar to the following illustration. The seperation of index to burst must be 3 usec. + 2 usec.



- . Verify the above by looking at head 10.
(F2) Enter:
31800 (F3) (RETURN)
- . The pattern should be nearly the same as above.

BOARD FUNCTIONS & INTERCHANGABILITY

BOARD	LOC	111	114	114D	ALT. BD.	PART NO.	DESCRIPTION
AF10	A4	X	X	X		90202	Cyl. Address reg.
AF11	A9	X	X	X		90206	Diff. Counter
AF12	A5	X				90214	Hd. Add. & Decode
AF13	A5		X	X		91069	Hd. Add. & Decode
AL10	A8	X	X	X		90210	Diff. Cntr & Ill. Cyl.
AL11	A7	X	X	X		90246	Cntl. Logic I
AL12	A3	X	X	X		90258	Det. Idx. Speed & Cyl.
AL13	A10	X	X	X		90222	Seek Logic I
AL14	A11	X	X	X		90226	Seek Logic II
AL15	B8	X	X	X		90218	File Unsafe Logic
AL16	B7	X	X	X		90230	Control Logic II
AL19	B12		X	X		91089	Control Logic III
AL20	A6		X	X	DL52	98622	8 Bit Subtractor
AL22	B11		X	X		91725	Sector Gen.
AN18	B4/5	X	X	X		90966	5 v Driver
AN19	B3	X	X	X		90970	5 v Receiver
AP10	B9	X				90306	Lamp Relay Driver
AP14	A15	X	X	X		90559	Servo Amp.
AP16	A14	X	X	X	AP29, DP52	90680	Servo Driver
AP17	C5	X				90789	Demodulator
AP18	B15	X	X	X	AP26, AP47	90904	Reg. Pwr. Monitor
AP21	A13	X	X		AP22	91093	Servo Pre-amp
AP22	A13	X	X		AP21	91097	Servo Pre-amp
AP23	A12		X	X	DP57	14891	D/A Converter
AP24	A12	X				91105	D/A Converter
AP25	C5		X			91109	Demodulator
AP26	B15	X	X	X	AP18, AP47	93059	Reg. Pwr. Monitor
AP28	B14	X	X			91826	Emergency Retract
AP29	A14	X	X	X	AP16, DP52	91933	Servo Driver
AP32	A13			X	DP56	93146	Servo Pre-amp
AP39	B9		X	X		94081	Lamp Relay Driver
AP47	B15	X	X	X	AP18, AP26	97740	Reg. Pwr. Monitor
AR10	A2	X			AR20	90282	Crossover Detector
AR11	C3	X				90298	Write Driver
AR12	C4	X	X	X		90383	Head Select Switches
AR13	C2	X				90389	Read Amp.
AR14		X				90172	Read Pre-amp (L)
AR15		X				90386	Read Pre-amp (R)
AR16			X	X		91126	Read Pre-amp (L)
AR17			X	X		91122	Read Pre-amp (R)
AR18	C3		X	X		91057	Write Driver
AR19	C2		X	X		91061	Read Amp.
AR20	A2	X	X	X	DR53	91065	Crossover Detector
AT10	B6	X	X	X		90266	Osc. & D.C. Pwr. Monitor
AX10	C6	X	X		AX12	90262	Xdcr. Pre-amp, Idx & Cyl.
AX12	C6	X	X		AX10	92303	Xdcr. Pre-amp, Idx & Cyl.
AX14	C6			X		93062	Transducer Pre-amp
AZ16	A6	X				91321	Jumper Module
DL52	A6		X	X	AL20	90974	8 Bit Subtractor
DP52	A14	X	X	X	AP16, AP29	13150	Servo Driver
DP56	A13			X	AP32	14856	Servo Pre-amp
DP57	A12		X	X	AP23	91101	D/A Converter
DR53	A2	X	X	X	AR20	13144	Crossover Detector

PREVENTIVE MAINTENANCE SCHEDULE

	IOMEC	WESTERN DYNEX	CENT. 111	CENT 114/114D
When On Site				
Clean Heads	X	X	X	X
Ck.Lamps/Ind., Switches	X	X	X	X
Every 30 Days				
Clean Heads	X	X	X	X
Ck.Filters/Air Press.	X	X	X	X
Ck.Index Ring Thru Hole	X			
Ck.Lamps/Ind., Switches	X	X	X	X
Clean Heads				X
Cover Microswitch	X			
Every 90 Days				
Cln.Fixed Disc	X	X		
Ck.24A/C Adj. *	X	X		X
Ck. SR8's (See F.A.#50)	X	X	X	X
Ck.Head Alignment *	X	X	X	X
Ck.Sect/Idx.Amp & Idx/burst*	X	X	X	X
Ck.Cyl. Xducer	X	X	X	X
Run Diagnostics	X	X	X	X
Ck.Pack Standoffs	X			
Every 180 Days				
Clean Entire Unit	X	X	X	X
Ck.Pwr.Supply	X	X	X	X
Ck. Osc. *			X	X
Ck. Servo *		X	X	X
Ck.Cln.Lube Carrier/Pos.	X	X	X	X
Ck. Absolute Filter	X			X
Advise Cust. To Have Packs				
Cld.(DO NOT DO IT YOURSELF)	X	X	X	X

* Run diagnostics if any changes or adjustments are made.

MEMOREX

MEMOREX DRIVE ADJUSTMENTS

D.C. VOLTAGES

- Insert a Memorex extender card into the A01 slot. Using a DVM, measure the supply voltages on the extender. They should be:

+15±0.1v on Pins L/R 15

+0.05±0.005v on Pins L/R 25

-5.2±0.005v on Pins L/R 30

-15±0.1v on Pins L/R 35

REAR

	1	50	1	50	-L
A06	R/W	B06	PSER		-R
A05	DETC	B05	VSER		
A04	VFO	B04	NOT USED		
A03	PLOX	B03	SCON	F	A
A02	NOT USED	B02	REGS	N	
A01	NOT USED	B01	INTF A		

CARD CAGE

- Adjust the voltage pots in the pedestal to bring all voltages to within tolerance.

SERVO OFFSET ADJUSTMENT

- Enter the following macro program: **Do not enter spaces unless a Q29 is used.**

IPL

0020A7 (CR) (00020)

1d409D 002980 0040A8 xd3030303030 (CR) (00040)

1d409D 004980 0020A8 xd3330343438 * (XMIT)

d = Controller Address x = Port Address

* If on a 75 MB drive the seek parameter should be:
xd3931333434

Everytime the Start/Stop button is pressed the drive should do a seek between tracks 0 and 348.

- Using a DVM measure the voltage between TP11 on the PSER card and ground, with the heads at the track 0 position.

MEMOREX

SERVO OFFSET ADJUSTMENT Continued

- Use the Start/Stop button to seek to track 348 and again measure the voltage at TP11.
- The voltage measurement should change slightly. The difference measured should be centered around zero volts. Use the small one-turn pot on the PAMP board (visible through a hole on the back of the PDU) to center the offset voltage around zero volts. The voltage difference between tracks 0 and 348 should not be greater than 150mV.

TACH SLOPE ADJUSTMENT

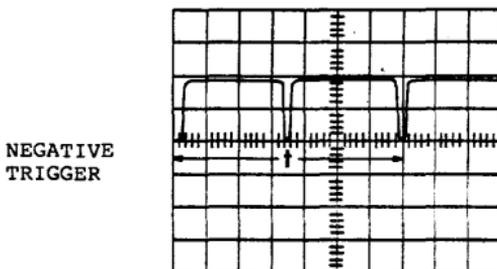
- Set up a scope as follows:
CH1 = 2V / Div
Sweep Rate = 10 ms / Div
Trig Source = CH1
Trig Slope = Neg
Trig Mode = Normal
- Power the drive down and extend the SCON board. Connect the CH1 scope lead to IC 6C-6 or to pin R46 on the SCON board. Power the drive back up.
- Enter the following macro program to cause the drive to alternate seek between tracks 0 and 105:

```
IPL
0020A7 (CR) (00020)
1d409D 004080 1d409D 006080 0020A7 (CR) (00040)
xd3030303030 (CR) (00060)
xd3039323430 * (XMIT)
d = Controller Number      x = Port Number
* For 75 MB drives enter xd3237373230 on the last line instead.
```

MEMOREX

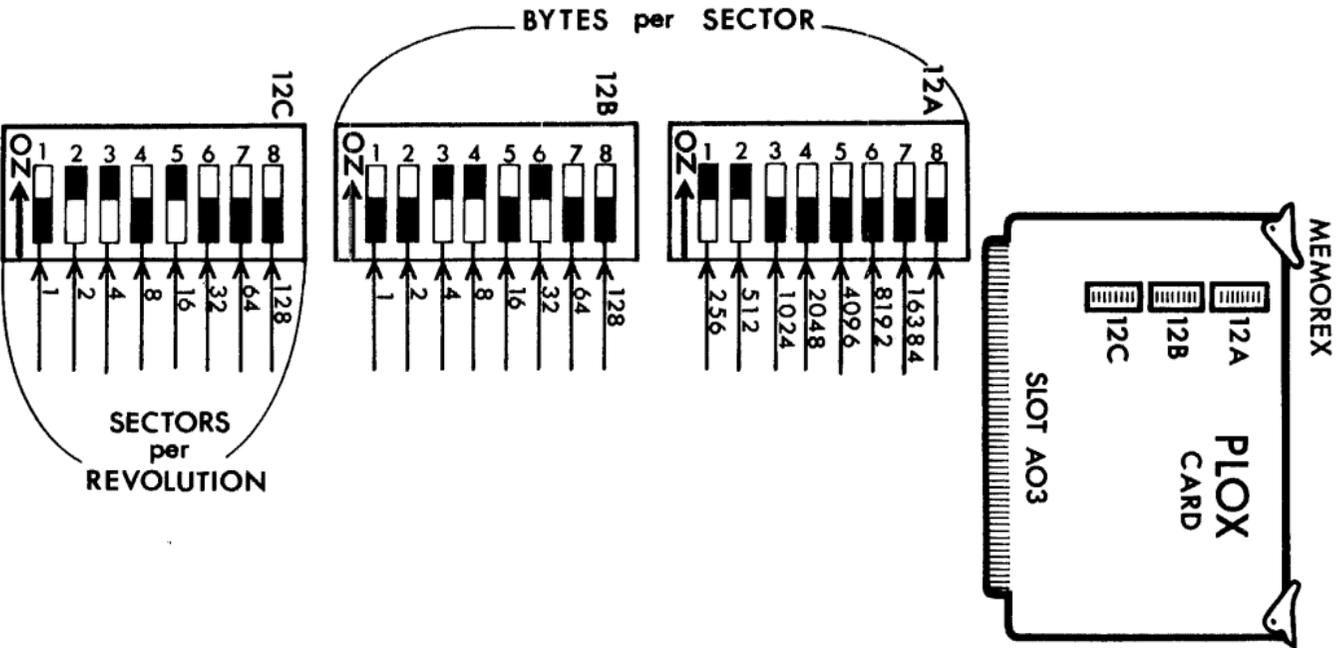
TACH SLOPE ADJUSTMENT Continued

- A scope pattern similar to the one shown below should appear. The two-peak time "t" should be 68 ms for new style servo drives (large bearing cap) or 72 ms for old style servo drives (small bearing cap). Adjust R54 (the largest pot) on the VSER board to bring the seek time to within 45 ms of specification.

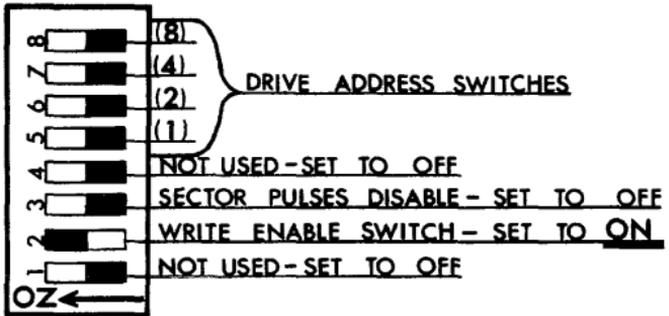
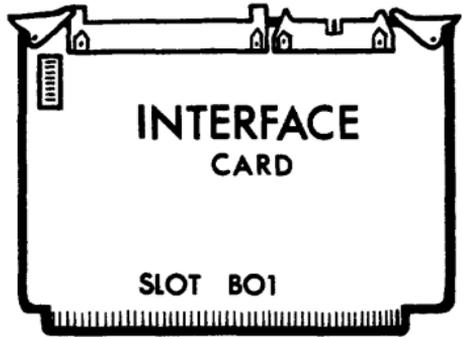


t = 68 ms For New Servo Types

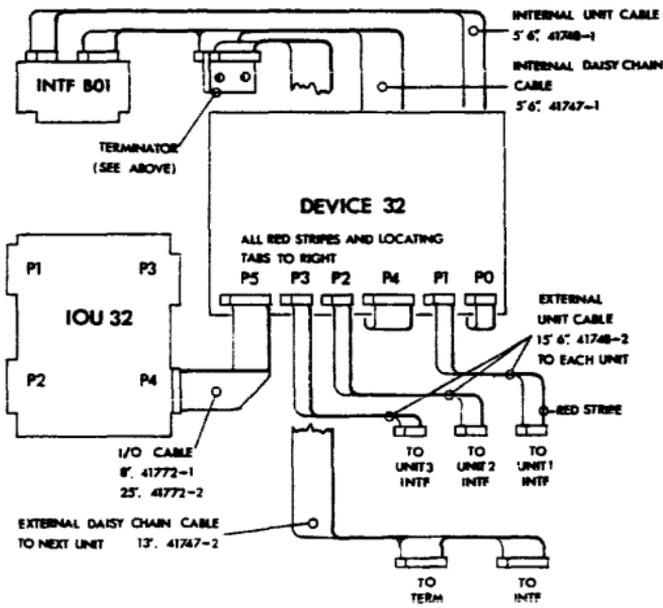
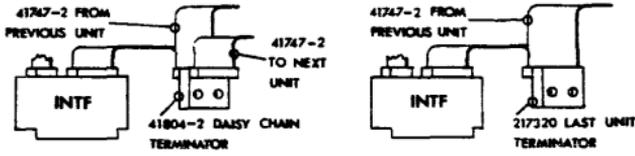
t = 72 ms For Old Servo Types



MEMOREX



*ON = 1
OFF = 0

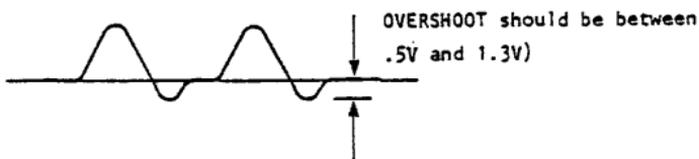


MEMOREX

Servo Loop Gain Adjustment

- Connect scope lead to TP11 on PSER card (Refer to illustration of PSER card below).
- Set oscilloscope as follows:

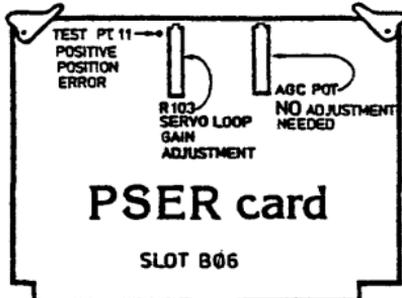
Ch1	1v./cm
Horiz	2ms./cm
Sync	R18 on VSER Card
- Using the colt tester execute routine 24 (incremental seek). (If Colt Tester is unavailable refer to pg. 2-65b).
- Adjust the servo loop gain potentiometer R103 on PSER (Refer to illustration of PSER below) to minimize servo overshoot without causing the servo system to oscillate. The correct adjustment is illustrated below.
CAUTION - DO NOT change the setting of the AGC pot on PSER (R63)



Properly adjusted overshoot

- Run Colt Tester routines 27 and 28 to verify operation.

PSER PWA →



MEMOREX

PSER adjustment without a Colt:

Incremental seeks may be obtained through the use of MXATPH or MXQ29 tests using the following procedure.

- 1) Load MXATPH or MXQ29 Test
- 2) Specify address. Be sure to place an R after the address. This will put the test in Repeat Mode.
- 3) Respond to the questions in the following manner:
 - Select options? Yes
 - FRODO Only? No
 - Print Alt. Sectors? Yes
 - Halt after Error? No
 - Enter iteration count? Yes
 - Manual - (XMIT or CR)
 - Address - FF
 - All remaining Test blocks - (XMIT or CR)
- 4) Proceed with overshoot adjustment.

Note: The drive will do incremental seeks forward and then restore to Cyl# when the max Cyl# is reached. The adjustment waveform is invalid during this short restore period. Make the adjustment while the drive is seeking forward.

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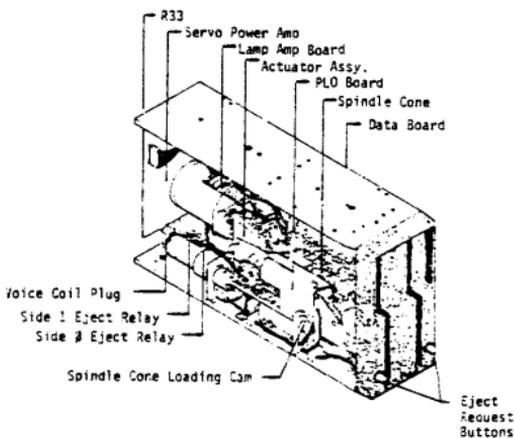
277 DRIVE ADJUSTMENTS

TOOLS NEEDED

- A short flat-bladed screwdriver (for removing the drive from the 210 housing).
- Small flat-bladed screwdriver (for adjusting pots).
- Medium flat-bladed screwdriver (for various mechanical adjustments).
- Allen wrenches (for various mechanical adjustments).
- Oscilloscope with three probes.
- 91% isopropyl alcohol and cotton swabs.

PRELIMINARY SETUP

- Remove the drive from the housing.
- If the alignment ROMs are being used, the drive must be connected to the controller. However, the cabling is often too short and the drive must be set on some object to allow the cable to reach the controller. The top casting will usually be adequate enough for this job.
- Remove the shields if they are used on the drive.



FLOPPY DRIVE LAYOUT

PERSCI 277

277 DRIVE ADJUSTMENTS

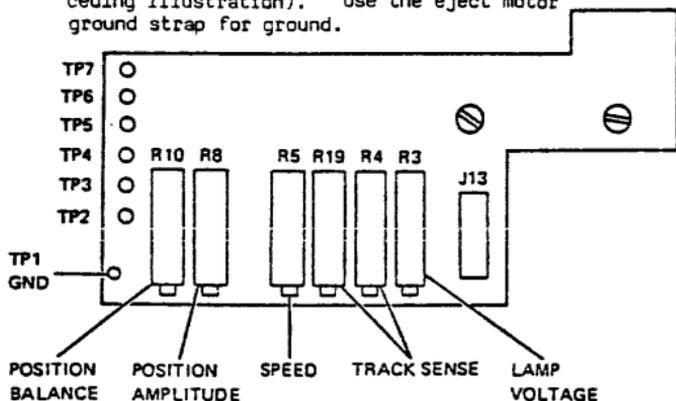
SERVO ADJUSTMENTS

Quick Reference

REF. TO STEP	ADJUSTMENT	POT	TEST POINT	SETTING
1.1	Track Sense Ampl.	R4	TP6	-1.75V Change when moving from track 43 to 44.
1.2	Track Sense Bal.	R19	TP6	-1.25V With positioner anywhere between track 44 and the spindle.
1.3	Fine Position Ampl.	R8	TP2	3.3V op $\pm 0.3V$ when positioner is moving.
1.4	Fine Position Bal.	R10	TP2	Centered about ground $\pm 0.1V$ when positioner is moving.
1.5	Seek Symmetry	R33	SEEK COMPL. *	Same seek times for forward and reverse when doing alternate seeks between tracks 51 and 52.
1.6	Seek Speed	R5	SEEK COMPL. & TP2	No overshoot while doing alternate seeks between tracks 51 and 52. Maximum allowable seek time is 12ms, minimum is 10ms.

* Use the test point on the exerciser or P1-10 on the drive interface connector.

NOTE: All pots and test points are on the Lamp Amplifier board except R33, which is on the servo board. (Refer to preceding illustration). Use the eject motor ground strap for ground.



LAMP AMPLIFIER BOARD

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277 DRIVE ADJUSTMENTS

SERVO ADJUSTMENTS

1.1 TRACK SENSE AMPLITUDE

- Set up a scope as follows:
 - CH1 : 0.5V/cm, DC coupled
 - Channel Select: Ch. 1
 - Sweep Rate : 1 ms/cm
 - Trig. Mode : Auto
 - Trig. Source : Normal
- Observe TP6 on the scope.
- Make the positioner cross over tracks 43 and 44 by unplugging the voice coil and moving it by hand.
- Plug the voice coil back in and perform one of the following:
 - a) Use the ALRM command DT to alternate seek between tracks 32 and 64, or
 - b) use the exerciser to alternate seek between tracks 40 and 47.
- Adjust R4 so the waveform is 1.75V peak-to-peak.

1.2 TRACK SENSE BALANCE

- Use the same scope setup as in step 1.1.
- Adjust R19 to make the negative portion of the display -1.25V. Be sure the ground is calibrated correctly.

1.3 FINE POSITION AMPLITUDE

- Use the same scope setup as in step 1.1.
- Observe TP2 on the scope.
- Move the positioner back and forth by:
 - a) Unplugging the voice coil and moving it by hand.
 - b) Using the ALRM command DP to alternate seek between tracks 0 and 8. Voice coil must be plugged in.
- Adjust R8 to get a 3.5v - 3.8vp-p waveform.

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277 DRIVE ADJUSTMENTS

SERVO ADJUSTMENTS

1.4 FINE POSITION BALANCE

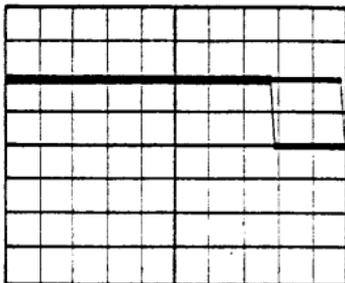
- Use the same scope setup as in step 1.1.
- Be sure the ground is calibrated correctly.
- Adjust R10 to balance the signal about ground $\pm 0.1V$.

1.5 SEEK SYMMETRY

- Set up a scope as follows:
CH1 : 0.5V/cm, DC coupled
CH2 : 2.0V/cm, DC coupled
Channel Select: Ch. 2
Sweep Rate : 1 ms/cm
Trig. Mode : Normal
Trig. Source : Ch. 2
Trig. Slope : Positive
- Connect Ch. 1 to TP2.
- Connect Ch. 2 to seek complete using either the exerciser test point, Pin 10 on the interface connector, or P8, Pin 2.
- Do an alternate seek between tracks 51 and 52 by,
 - a) using the alignment ROM command SY or
 - b) using the exerciser.
- Observe Ch. 2. There should not be any jitter on its trailing edge. If the trailing edge is not visible adjust the scope's sweep rate calibration until the edge can be seen.
- Adjust R33 on the Servo Board to eliminate the jitter as in the illustration on the following page.
- Use 10X to increase visibility of jitter.

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277 DRIVE ADJUSTMENTS

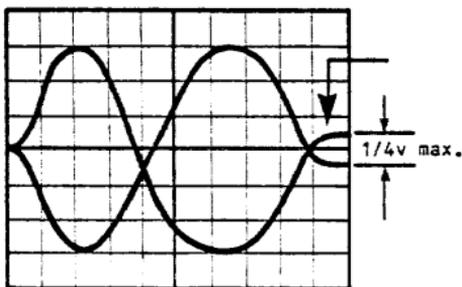


ADJUST R33 UNTIL TRAILING EDGES CONVERGE

SERVO ADJUSTMENTS Continued

1.6 SEEK SPEED

- Use the same setup as in step 1.5.
- Observe Ch. 2 and adjust R5 to make the seek complete signal high, 10 ms. The Seek Time must not exceed 12 ms. If jitter appears on the trailing edge, go back to step 1.5.
- Change the channel select to Ch. 1 and look for overshoot as illustrated below.



OVERSHOOT

- Observe the trailing portion of the waveform, if it is not visible adjust the scope's sweep rate calibration until it can be seen.

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277 DRIVE ADJUSTMENTS

SERVO ADJUSTMENTS

1.6 SEEK SPEED Continued

- If overshoot is visible, adjust R5 to slow down the seek speed until the overshoot is eliminated.
- Recalibrate the scope and check the seek time on Ch. 2.

1.7 DIRTY SCALE CHECK

- Restore the positioner to the track 0 position and move the positioner slowly by hand out to the spindle and back.
- Sudden changes in resistance (which may feel like a bump or dent in the positioner guides) indicates a dirty spot on the tach scale.
- When unsure whether the bump is a dirty tach or a physical problem in the positioner, power the drive down and move the positioner by hand. If the symptom goes away it is a dirty scale problem. Use a dry swab to clean the scale.

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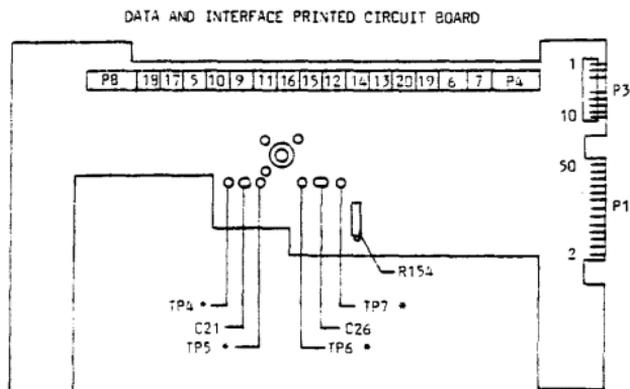
277 DRIVE ADJUSTMENTS

MECHANICAL ADJUSTMENTS

Quick Reference

REF. TO STEP	ADJUSTMENT	PROCEDURE
2.1 or 3.1	HEAD RESOLUTION	Rotate head pad for high Frequency amplitude $\geq 90\%$ Low Frequency amplitude at track 76 and High Frequency amplitude $\leq 95\%$ Low Frequency amplitude at track 1. Use an unformatted diskette.
2.2 or 3.2	HEAD UNLOAD	Adjust the pickup ball and/or head penetration so the read data is reduced by at least 50% when the head unloads.
2.3 or 3.3	CONE CHECK	Less than 15% amplitude modulation on read data after several ejects and insertations.
2.4 or 3.4	RADIAL ALIGNMENT	Smaller cats eye lobe $\geq 95\%$ of the larger cats eye lobe when on track 38.

- * In all cases use TP4 and TP5 for Side 0 read signal and TP6 and TP7 for Side 1 read signal. Use the eject motor ground strap for ground.
On radial alignments use index (P11-2 on Side 0 and P9-2 on Side 1) for scope sync.



- * Across C21, C26 for data stream monitoring. Older version drives below level K1 may not have these test points.

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277 DRIVE ADJUSTMENTS

MECHANICAL ADJUSTMENTS

DATA BOARD CONNECTOR DEFINITIONS

(Refer to Data and Interface PCB illustration on the previous page.)

<u>COMMON</u>	<u>SIDE 0</u>	<u>SIDE 1</u>
P1 I/O Cable	P11 Index Transducer	P9-
P3 Power Input	P12 Index LED	P10
P4 Spindle Power	P14 Head Load Solenoid	P13
P5 Spindle Servo	P16 R/W Head	P15
P6 Data Separator	P18 Eject Motor	P17
P7 Positioner Servo Power	P20 Write Protect	P19
P8 Positioner Servo		

The system may be forced to IPL to Side 1 by exchanging P11/P9, P14/P13, and P16/P15. To read and write with Side 0/1 exchanged, the write protect lines P20/P19 must also be exchanged.

2.1 HEAD RESOLUTION - SIDE 0

- Set up a scope as follows:

CH1 : 0.1V/cm AC coupled
CH2 : 0.1V/cm AC coupled, Inverted
Channel Select: Add
Sweep Rate : 1 ms/cm
Trig. Mode : Auto
Trig. Source : Normal

- Connect Ch. 1 to TP4 on the Data Board and Ch. 2 to TP5. Use the eject motor ground strap as the scope's ground point.
- Insert a test diskette into the Side 0 slot. The diskette should have a double frequency pattern written on track 1 and 76. This can be accomplished by writing a standard 1's and 0's pattern with the exerciser or by first seeking to track 1 (S1 option) and then using the W01 option with the alignment ROMs.

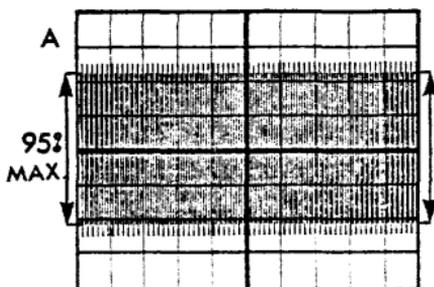
NOTE: Writing the above pattern will ruin the soft-sectoring on the diskette, making it useless for all other purposes.

- Seek to track 1 and observe the scope pattern. It should be similar to the illustration on the following page. The inner envelope amplitude should be less than 95% of the outer amplitude.

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277 DRIVE ADJUSTMENTS

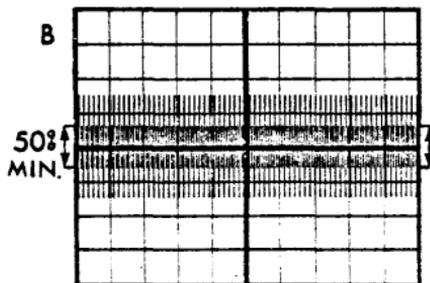
MECHANICAL ADJUSTMENTS



HEAD RESOLUTION AT TRACK 1

2.1 HEAD RESOLUTION - SIDE 0 Continued

- Seek to track 76 and observe the scope pattern. It should be similar to the illustration below. The inner envelope amplitude should be greater than 50% of the outer amplitude.



HEAD RESOLUTION AT TRACK 76

- If either of the above checks fail, slightly increase the Pressure Pad pressure by hand. The signal should improve; if it does not, the head or diskette is bad. If the signal improved, rotate the head pad slightly and again increase the pressure. Continue this process until a minimum change in signal quality is observed.

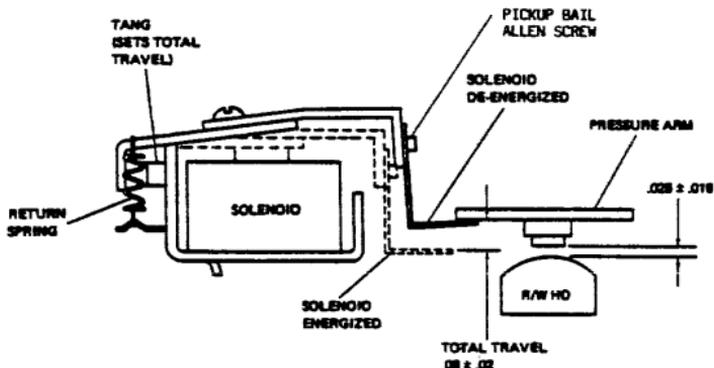
PERSCI 277

277 DRIVE ADJUSTMENTS

MECHANICAL ADJUSTMENTS

2.2 HEAD UNLOAD - SIDE Ø

- Use the same scope setup as in step 2.1.
- Load and unload the head, both tracks Ø and 76 by using either the exerciser head load switch or the alignment ROM HD option.
- When the head is unloaded, the read signal on the scope should drop by 50% or more.
- If the read signal did not decrease enough, lift the Pressure Pad Arm by hand (illustrated below) to determine whether the unload bail or the head penetration is at fault.



- If the signal did not improve, the head penetration is too great and little may be done to correct the problem.
- However, if the pickup bail is at fault adjust it using a (3/32") allen wrench.

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277 DRIVE ADJUSTMENTS

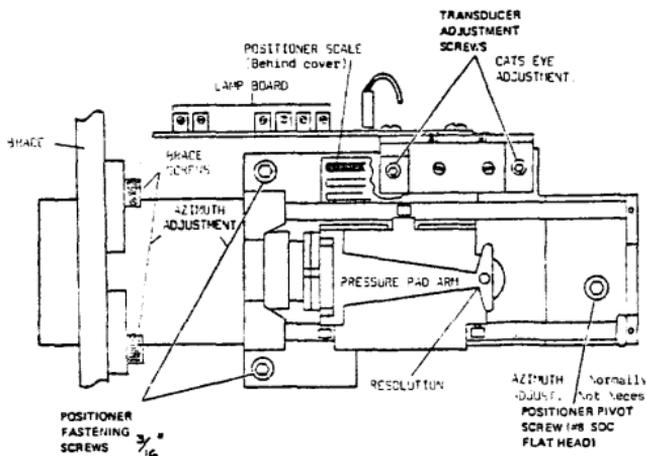
MECHANICAL ADJUSTMENTS

2.3 CONE CHECK - SIDE Ø

- Use the same scope setup as in step 2.1.
- Eject and reinsert the diskette several times and observe the read signal at track Ø.
- The signal should never have more than 15% amplitude modulation. If it does, either the positioning cone is bad or the diskette hole is worn.

2.4 RADIAL ALIGNMENT - SIDE Ø

- Use the same scope setup as in step 2.1 except sync. external on Side Ø index (P11 Pin 2) and set the sweep rate to 20 ms/cm.
- Seek to track 38 by using the exerciser or the S38 option in the alignment ROM.
- Insert an alignment diskette and observe the cat's eye pattern on the scope. The smaller lobe must have 95% or more of the larger lobe's amplitude.
- If realignment is needed, remove the optical slide cover and loosen the two 3/32" allen screws holding the optical transducer assembly as illustrated below.



PERSCI 277

277 DRIVE ADJUSTMENTS

MECHANICAL ADJUSTMENTS

2.4 RADIAL ALIGNMENT - SIDE 0 Continued

- Reinsert the alignment diskette and gently move the optical transducer assembly, using the Lamp Amplifier Board as a handle.
- When proper alignment has been achieved, eject the alignment diskette and tighten down the mounting screws.
- Recheck the alignment before replacing the slide cover.

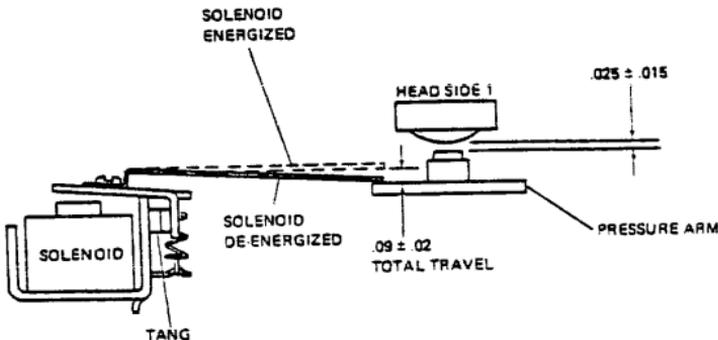
3.1 HEAD RESOLUTION - SIDE 1

NOTE: The Side 1 alignment depends on the Side 0 alignment being properly adjusted. DO NOT attempt to adjust Side 1 without first checking Side 0.

- Follow the same procedures outlined in step 2.1, except use TP6 and TP7.

3.2 HEAD UNLOAD - SIDE 1

- Follow the same procedures outlined in step 2.2, except use TP6 and TP7.
- The head penetration can be adjusted on Side 1 by using the head penetration adjustment screw as shown in the following illustration.



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277 DRIVE ADJUSTMENTS

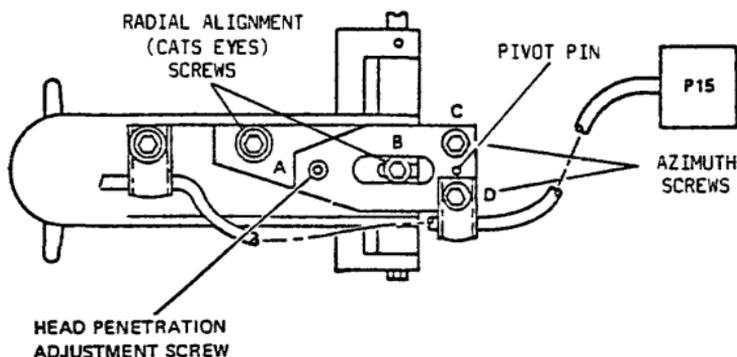
MECHANICAL ADJUSTMENTS

3.3 CONE CHECK - SIDE 1

- Follow the same procedures outlined in step 2.3, except use TP6 and TP7.

3.4 RADIAL ALIGNMENT - SIDE 1

- Follow the same procedures outlined in step 2.4, except use TP6 and TP7.
- Sync. externally on P9-2 for Side 1 Index.
- The Side 1 head may be moved into alignment by loosening the two $3/32$ " allen screws as shown below.



NOTE: Be careful to keep the head seated against its upper mounting surface to avoid Azimuth misalignment.

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277 DRIVE ADJUSTMENTS

PLO ADJUSTMENTS

Quick Reference

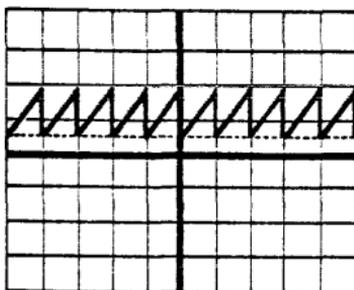
REF. TO STEP	ADJUSTMENT	TEST POINT	POT	PROCEDURE
4.1	Free Running Frequency	TP3	R16	Adjust for 1 MHz \pm 1 us. without a diskette present.
4.2	Frequency Fine Adjust	TP2	R16	Adjust to bring control voltage as close to ground as possible with diskette present.
4.3	Phase	TP6 TP7	R4	Adjust phase to center trailing edge in the data window while reading a formatted diskette.

4.1 FREE RUNNING FREQUENCY

- Set up a scope as follows:

CH1 : 2V/cm DC coupled
Channel Select: Ch. 1
Sweep Rate : 1 μ s/division
Trig. Mode : Normal
Trig. Source : Ch. 1
Trig. Scope : Negative

- Adjust R16 (R41 on later revisions) on the PLO card for a sawtooth waveform (illustrated below) with a one microsecond period on TP3.* There should not be a diskette inserted in the drive during this adjustment.



*Measure the period over ten cycles to insure accuracy.

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277 DRIVE ADJUSTMENTS

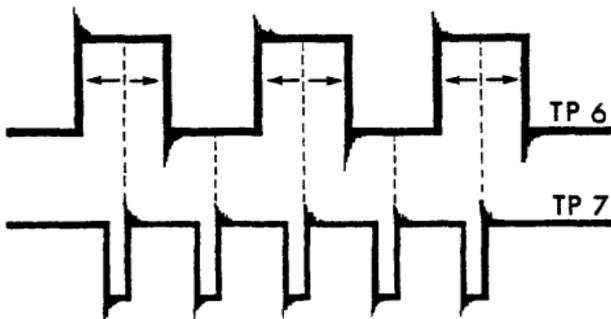
PLO ADJUSTMENTS

4.2 FREQUENCY FINE ADJUSTMENT

- Move the Ch. 1 probe to TP2 on the PLO Board.
- Change the vertical sensitivity to 0.1V/cm, DC Coupled.
- Insert a formatted diskette.
- Select Side 0 and seek to Track 0.
- Fine-adjust R16 to center the noise band around 0 volt. Make sure the scope ground is properly calibrated.
- The sawtooth frequency may no longer be 1.0 MHz after performing this adjustment. Readjust if necessary.

4.3 PHASE ADJUSTMENT

- Insert a formatted diskette and read track 0.
- Change the Ch. 1 vertical sensitivity to 2.0V/cm.
- Setup Ch. 2 to 2.0V/cm, DC Coupled and set the channel select switch to ALT.
- Move the Ch. 1 probe to TP6 and the Ch. 2 probe to TP7. The scope display should be similar to the one shown below.



- Adjust R4 to center the trailing edge of the Ch. 2 signal between the rising and falling edges of the Ch. 1 signal.

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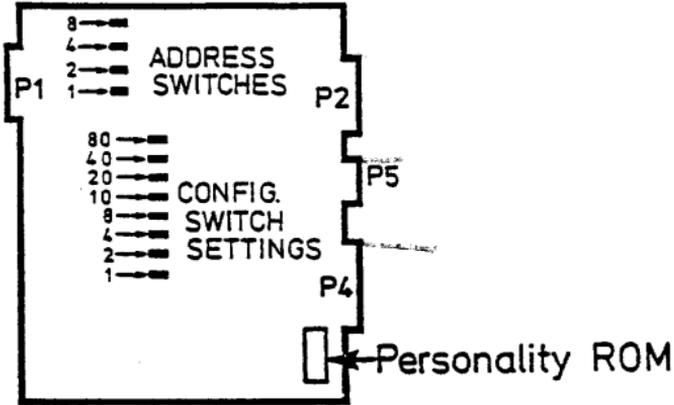
277 DRIVE ADJUSTMENTS

ADDITIONAL ADJUSTMENTS

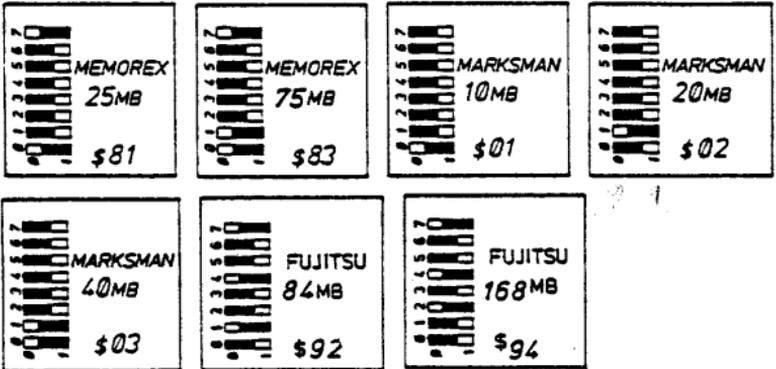
● The following adjustments may need to be checked under rare circumstances. Refer to FA 101C for details.

- 1) Spindle Instantaneous Speed Variation (ISV) Check
- 2) Spindle Speed Check
- 3) Azimuth Alignment (Side 0 and Side 1)

IOU 42



CONFIGURATION SWITCH SETTINGS



0 = OFF
1 = ON

Personality ROM

	Memorex	Marksman/Fuji
Label	42MEM(y)	42MRK(y)
Part Number	0415 1030 A42671-001	0415 1030 A42671-002

y = Rev Level

IOU 42

WRITE CONTROL INSTRUCTIONS

1dyy9D d = Controller Address yy = Control Byte

Control Byte	Function
\$01	Inhibit Track Verify
\$02	Inhibit Read After Write Check
\$03	Set Memory I/O Mode
\$04	Reset Memory I/O Mode
\$05	Jump to Memory Location \$4200
\$10	Disable Termination Interrupt
\$14	Enable Termination Interrupt
\$60	Disable Alternate Sectoring
\$70	Enable Alternate Sectoring
\$7F	Send Identification String
\$99	Incremental Seek
\$A0	Move ROM Version to Status 0
\$B0	Reset Status 0 to 04
\$B 7D	Add n times 100,000 to Next Seek Parameter

STATUS IN INSTRUCTIONS

4dyy9D d = Controller Address yy = Test Bit Value

Status Byte	Function
\$80	See Table on Next Page
\$40	
\$20	
\$10	Seek or Write Terminated
\$08	Service Request
\$04	End
\$02	Write Busy
\$01	Read Busy

IOU 42

Bit			Read	Write
80	40	20		
0	0	0	OK	OK
0	0	1	Hard Error	Defective disc pack
0	1	0	Marked Sector	Marked Sector
0	1	1	Invalid Seek	Invalid Seek
1	0	0	Inoperable	Inoperable
1	0	1	Sector Should be in Map but is not	Sector Should be in Map but is not
1	1	0	Undefined	Undefined
1	1	1	Error While Alternating	Error While Alternating

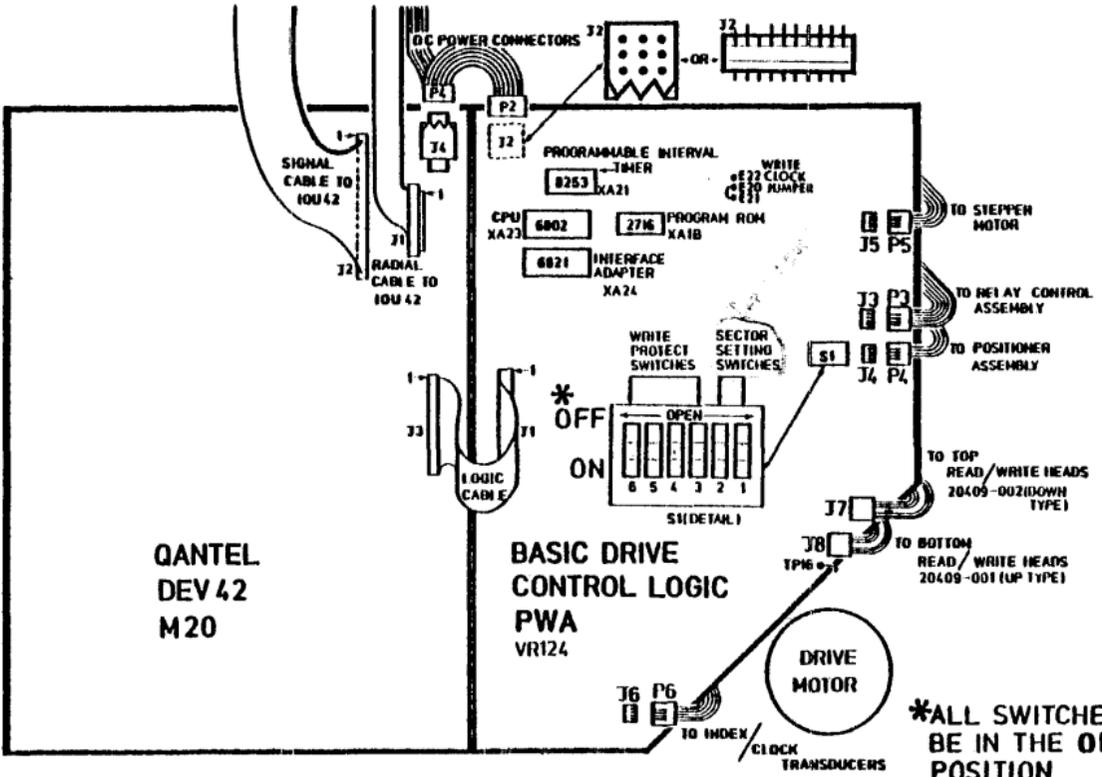
Read Status 2

xydy86 d = Controller Address yy = Test Bit Value
 x = Don't care

IOU 42 Returns \$FD status on RS2

20 MB SEALED DISC CABLE DIAGRAM

2-85



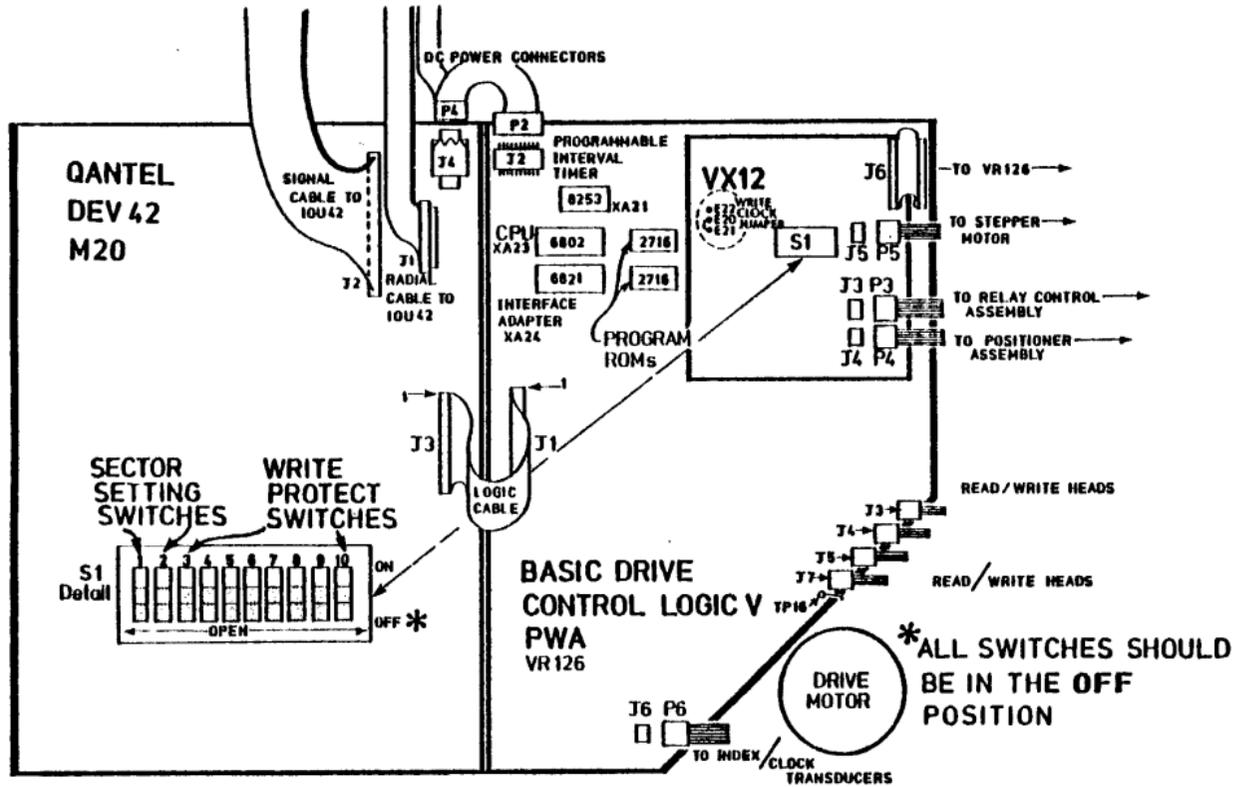
QANTEL
DEV 42
M20

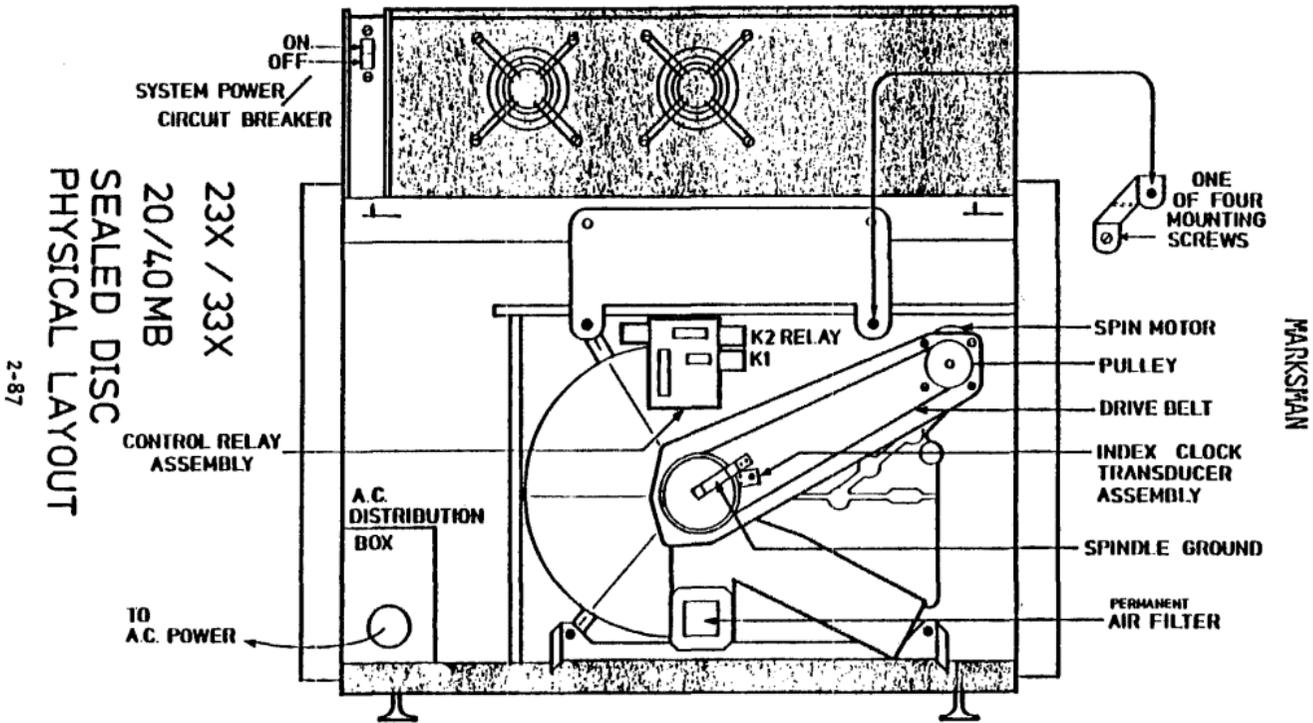
BASIC DRIVE
CONTROL LOGIC
PWA
VR124



***ALL SWITCHES SHOULD BE IN THE OFF POSITION**

40 MB SEALED DISC CABLE DIAGRAM





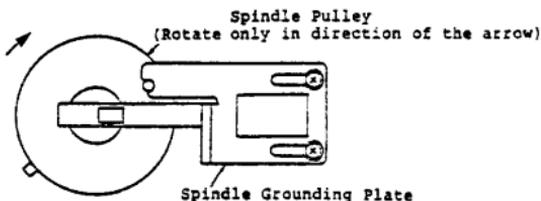
FUJITSU

INITIAL SETUP OF THE FUJITSU DISC DRIVE

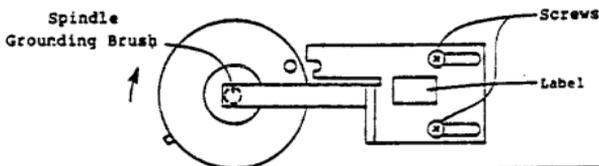
NOTE: BEFORE you apply power to the disc drive, be CERTAIN that the Spindle Lock, Motor Lock, and the Actuator Lock are all released.

Unlocking the Spindle

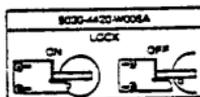
The spindle lock is located at the bottom of the spindle. The spindle lock must be released by loosening the two screws as shown below. Be certain to slide the lock back on BOTH screws so that the spindle grounding brush is centered on the spindle shaft. Do not allow the plate to move while tightening the screws.



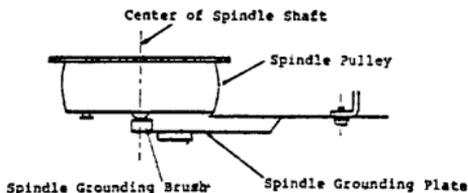
SPINDLE LOCKED



SPINDLE RELEASED



LABEL DETAIL

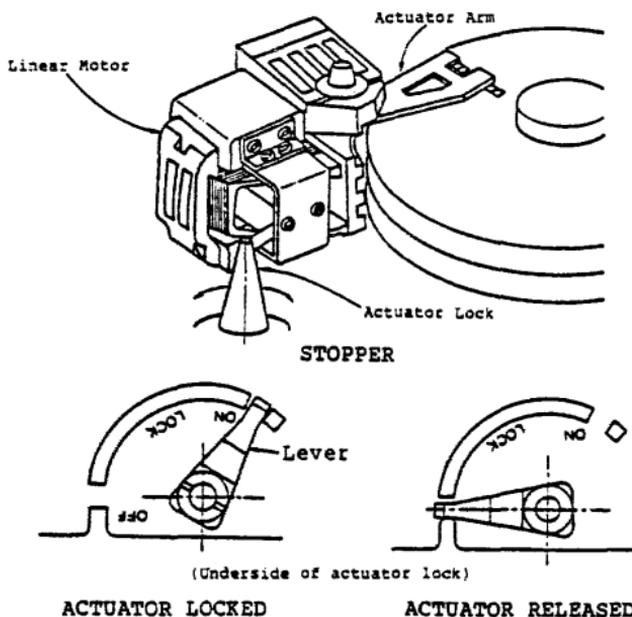


SPINDLE RELEASED - SIDE VIEW

FUJITSU

Unlocking the Actuator

The actuator must be released by rotating the lock as shown below. The lock can be seen through the top of the disc enclosure. The actuator locking lever can be reached directly beneath the lock, under the disc enclosure (see the illustration below).

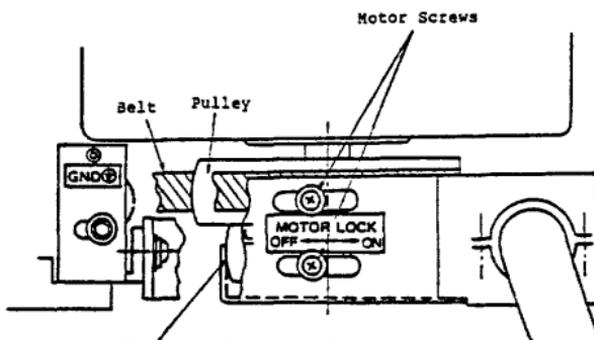


FUJITSU

Unlocking the Spindle Motor

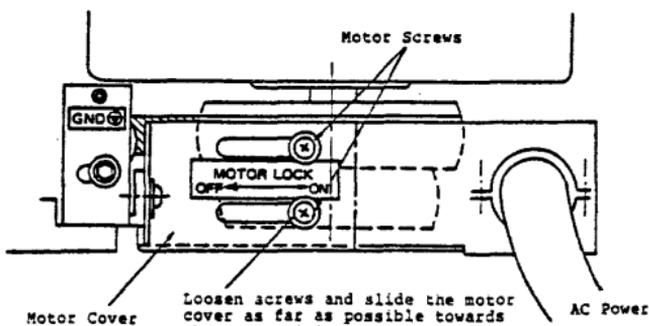
To unlock the motor, loosen the two screws that hold the motor cover against the pulley and slide the motor cover to the left as far as it will go. With the motor lock in the "off" position, as shown in the illustrations below, tighten the screws.

MOTOR LOCKED



ONLY USED FOR MOVING THE DRIVE
Loosen screws and slide motor
cover as far as possible
towards the ON position.

MOTOR UNLOCKED

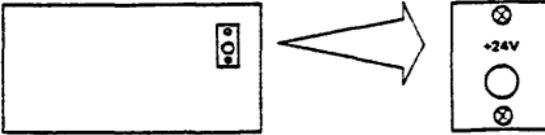


Loosen screws and slide the motor
cover as far as possible towards
the OFF position.

FUJITSU

+24V DC Select

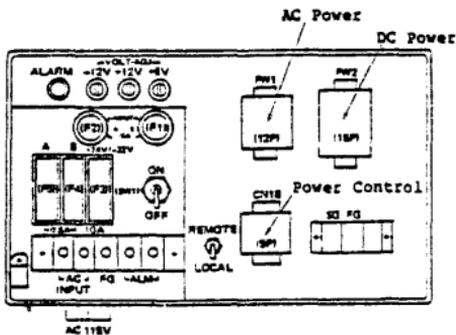
Confirm that the +24vdc is selected by the switch on the rear side of the power supply unit as shown below:



Note: There should be a restraining bracket holding the select switch in the +24v position. If there is no bracket and/or the switch is not in the +24v position, the unit has probably been severely damaged. DO NOT APPLY POWER IN THIS CASE. Call Tech Support.

Power Cable Connection

The Fujitsu Disc Drive utilizes three power cables that run from the power supply. The AC cable runs from PW1, the DC cable runs from PW2, and the Power Control cable runs from CN18 as shown below. Three of the wires that run from CN18 merge with the harness that runs to front panel connector J1. The other three wires in this harness must be connected to CN1 on the motherboard which is under the card cages. CN1 must be reached from underneath the disc drive. For operation, SW1 (the main power switch) should be switched on and the other switch should be in "remote." **WARNING** SW1 must be turned off before any PWAs can be removed.



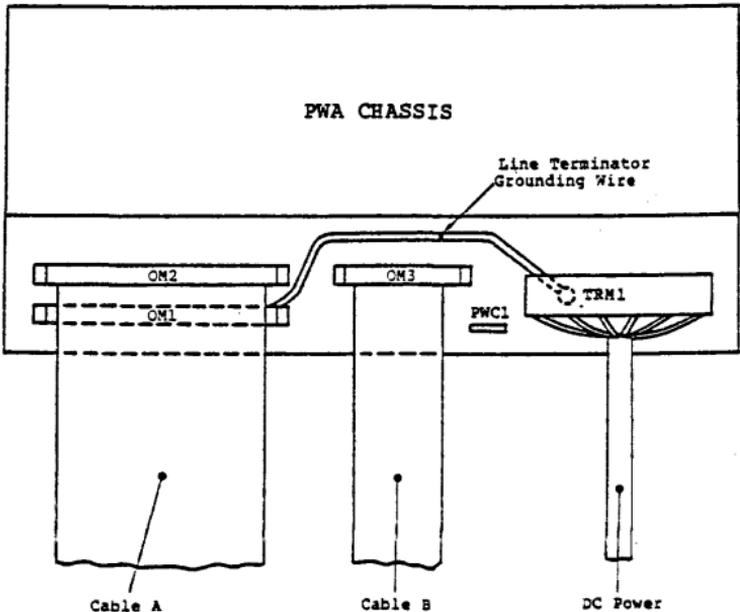
FUJITSU

DC Voltage Adjustment

Using a DVM, measure the DC voltages at TRM1 (on the card cage motherboard) shown in the illustration below. Adjust the voltages as necessary by turning the respective potentiometers, which are located on the power supply chassis. These potentiometers are shown in the previous illustration.

Interface Cabling

The illustration below shows the PWA chassis at the front of the disc drive and the cable connections to it. The interface cabling consists of two cables, "A" and "B." Cable A is to be connected to OM2, and Cable B is to be connected to OM3. A line terminator is to be connected to OM1. The grounding wire from the line terminator must be connected to the signal ground at TRM1(-2). Be sure that the small connector coming from the TRM1 harness is connected to PWC1.



FUJITSU

Maintenance Aid Display and Switches

The switches on the PWA chassis function as follows:

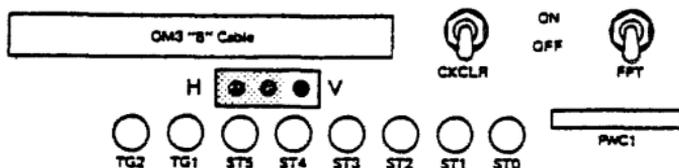
CKCLR - This is a momentary contact switch that resets a Device Check Status. Note that if a fault persists, it will not be reset.

FPT - This Switch inhibits any write operation, and it should normally be in the off position.

H-V - This jumper switch must be set in the H (for horizontal mounting) position.

The illustration below shows the location of the switches and diagnostic LEDs. The table defines the LED signal configurations.

Note: TG2 "ON" and TG1 "OFF" indicates "No Fault."



FUJITSU

TABLE OF ERROR CODES

Unit Status	Error Code	TG2	TG1	ST5	ST4	ST3	ST2	ST1	ST0	Error/Fault
Not Ready Status	00/02	0	0	0	0	0	0	(*2) X	0	Not Power Ready
	01/03	0	0	0	0	0	0	X	1	Not Speed OK
	05/07	0	0	0	0	0	1	X	1	Not GBENB
	0D/1F	0	0	0	0	1	1	X	1	Not START
	1D/1F	0	0	0	1	1	1	X	1	Not STARTP
	3D/3F	0	0	1	1	1	1	X	1	Initial Seek Time Out (*1)
Device Check Status	41	0	1	0	0	0	0	0	1	Control Check 1
	42	0	1	0	0	0	0	1	0	Control Check 2
	44	0	1	0	0	0	1	0	0	Read/Write Check 1
	48	0	1	0	0	1	0	0	0	Read/Write Check 2
	50	0	1	0	1	0	0	0	0	Read/Write Check 3
	60	0	1	1	0	0	0	0	0	Read/Write Check 4
Seek Check Status	C1	1	1	0	0	0	0	0	1	Seek or RTZ Time Out
	C2	1	1	0	0	0	0	1	0	Seek Guard Band
	C4	1	1	0	0	0	1	0	0	Linear Mode Guard Band
	C8	1	1	0	0	1	0	0	0	RTZ Outer Guard Band
	00	1	1	0	1	0	0	0	0	Over Track Crossing Pulse
	E0	1	1	1	0	0	0	0	0	Illegal Cylinder Address

*1) Error Code "3F" activates DVCK status, which is issued to the control unit and lights the DVCK LED on the optional front panel.

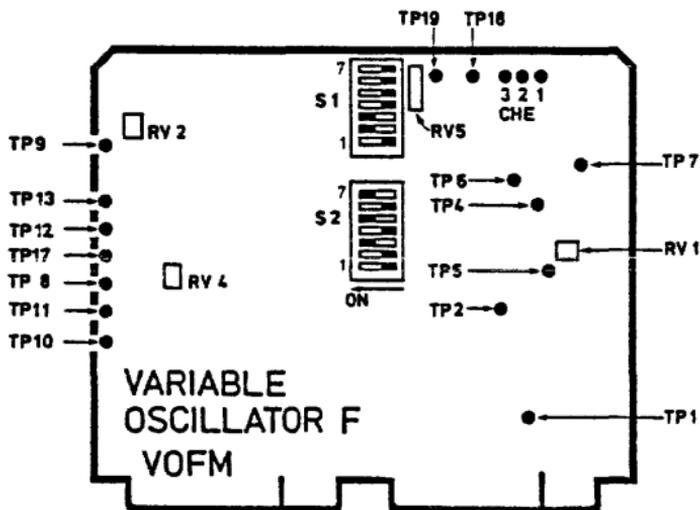
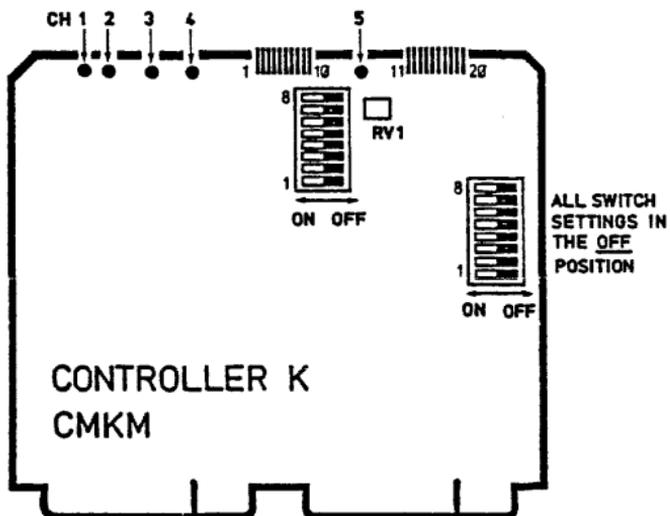
*2) "X" is irrelevant.

NOTE: TG2 ON and TG1 OFF indicates "No Fault."

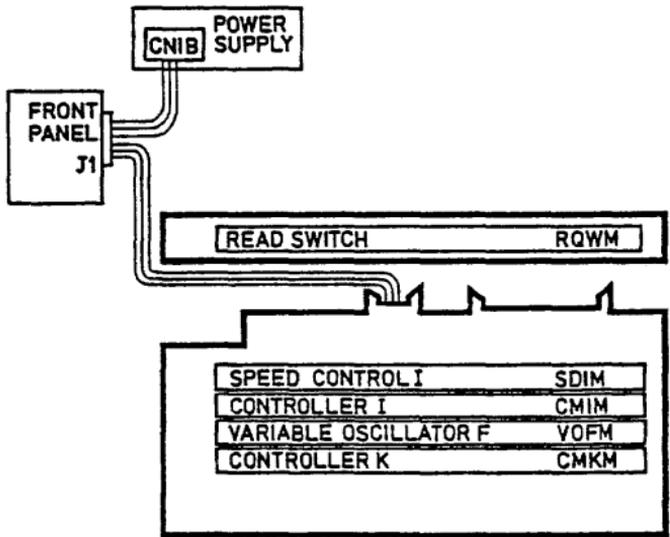
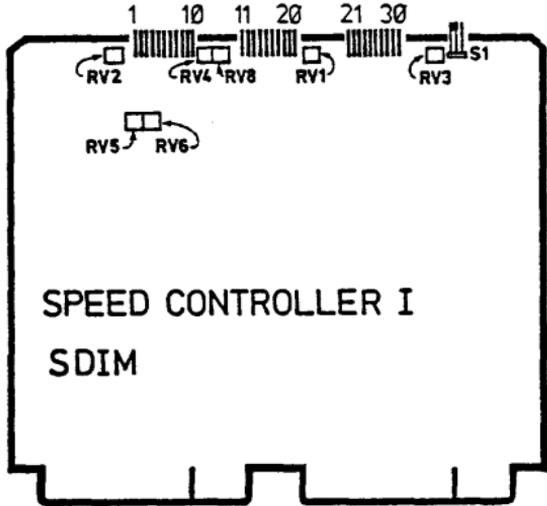
FUJITSU

SWITCH SETTINGS AND SERVO ADJUSTMENTS

Be sure that the switches on the CMKM, VOFM, and the SDIM boards are set as shown in the following illustrations.



FUJITSU



● ● ● ● ● ● ● ●

CARD CAGE MAP

FUJITSU

Note: All of the following adjustments are to be made on the SDIM board. Potentiometers rotate only 3/4 of a turn.

Position Signal Adjustment on SDIM (servo) Board

- Set up the scope as follows:
CH 1 1 v/cm (10x probe), DC coupled
CH 2 1 v/cm (10x probe), DC coupled
Trigger on CH 1 Pos.
Horizontal 5ms/cm
- Type in the alternate seek instruction to seek between cylinders 0 and 512 as shown below:

For 168 mb:

(IPL) Q0020 004080 1d1D9D 006080 0020A7 (CR)

Q0040 0d3030303030 (CR)

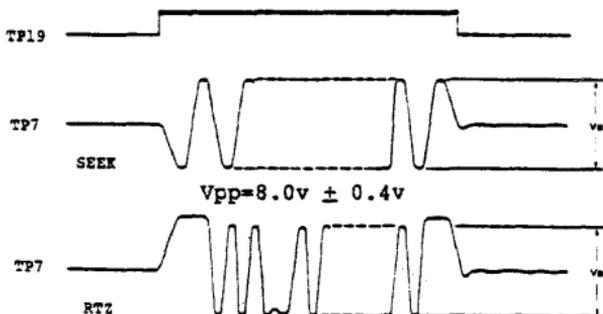
Q0060 0d3232383830 (XMIT)

Note: d = device number.

For 84 mb: Omit 1d019D and change Q0060 to 0d3631343430

- Connect the channel 1 oscilloscope probe to TP19 on the SDIM (servo) board.
- Connect the channel 2 oscilloscope probe to TP7 on the same board.
- Observe channel 2 and adjust RV2 until the signal is $8.0v \pm 0.4v$ peak-to-peak.

Note: If adjustments are so far off that the alternate seek will not run, use the RTZ (return to zero) command by repeatedly hitting IPL. Watch the scope and do the RV2 adjustment as described above. This should allow you to adjust the position signal accurately enough to allow the alternate seek to run.



FUJITSU

Overshoot Adjustment on the SDIM (servo) Board

- Leave the scope probes and scope settings as they were for the previous adjustment.
- Start with the same scope settings that you used for the above tests.
- Issue the alternate seek command as shown below to seek between cylinders 0 and 8:

For 168 mb:

(IPL) Q0100 012080 014080 0100A7 (CR)

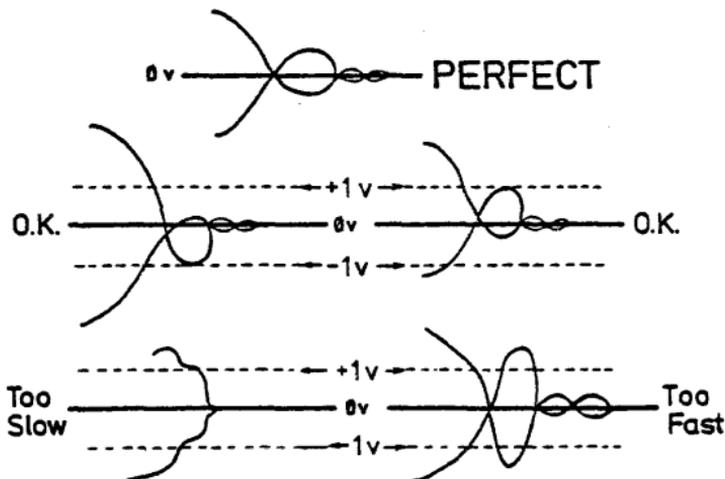
Q0120 0d3030303030 (CR)

Q0140 0d3031393230 (XMIT)

Note: d = device number.

For 84 mb: Change Q0140 to 0d3030393630

- Center the channel 2 trace about ground and then set the channel 2 scope voltage selector to .5v/cm. Set the horizontal sweep selector to 1ms/cm to superimpose the forward and reverse overshoot traces.
- Adjust RV4 so the larger of the two overshoot signals is 1.0v above or below ground. (as shown in the illustration). Set the adjustment as close as possible to $\pm 1.0v$ (be sure not to exceed 1.0v) as fastest seek times occur as 1.0v is approached.

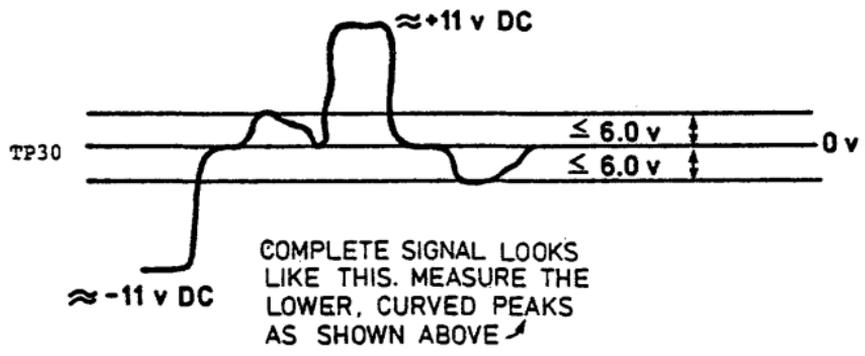
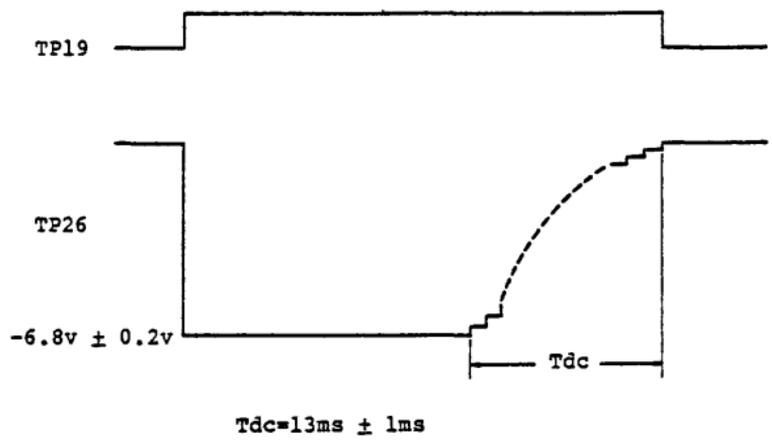


FUJITSU

Positioning Time Adjustment on the SDIM (servo) Board

- Use the alternate seek command as shown at the beginning of the "Position Signal Adjustment" section to seek between cylinders 0 and 512 (if the processor has been running continuously since the beginning of these adjustments, IPL and branch to address 0020 by typing: 0020A7 [XMIT]).
- Leave the channel 1 probe on TP19. Set the channel 2 voltage selector to 1v/cm and the horizontal sweep to 2ms/cm.
- Connect channel 2 (DC coupled) to TP26 and trigger on the negative edge of the channel 1 signal or on the positive edge of the channel 2 signal (one may be easier to sync on than the other).
- Observe channel 2 and adjust the deceleration time (T_{dc}) to $13ms \pm 1ms$ by turning RV1. Be sure the entire waveform is visible on the scope. Be certain that both the horizontal and vertical are accurately calibrated, as this is a very critical adjustment.
- Connect channel 2 of the oscilloscope to TP30 and keep the channel 1 probe connected to TP19. Trigger on the positive edge of the signal on channel 1.
- Observe channel 2. Turn the channel 2 voltage sensitivity to 5v/cm and the horizontal sweep to 5ms/cm. If the horizontal time base is uncalibrated, it will enable observation of the entire waveform.
- Check the Vdc amplitude (deceleration amplitude) of the signal on channel 2. It must be 6.0v or less. Adjust RV1 only if the signal is greater than 6.0 volts. This will slightly increase the deceleration time measured at TP26, but this is acceptable.
- Go back and check the overshoot adjustment. Readjust if necessary (IPL and branch to 0100-- by typing: 0100A7 [XMIT]-- to seek from 0 to 8).

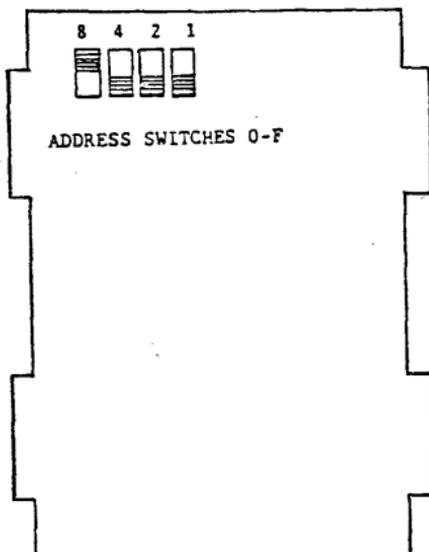
FUJITSU



IOU-4 PERTEC

QANTEL MODEL 5200

NOT READ-AFTER-WRITE



MAX. PWR. REQUIREMENTS

-12v= .03A
+ 5v= 1.69

Tape Unit Pwr.

115 vac 60 Hz
2.0A for .1 sec.
0.8A normal

800 BPI 12.5 IPS MAGNETIC TAPE MODULE

WRITE CONTROL INSTRUCTIONS

1XYY9D X = DEVICE ADDRESS YY = CONTROL BYTE

CONTROL BYTE	FUNCTION
-----------------	----------

00	SET ERASE
01	SET CHECK READ
02	SET BACKSPACE
03	SET REWIND

STATUS IN INSTRUCTIONS

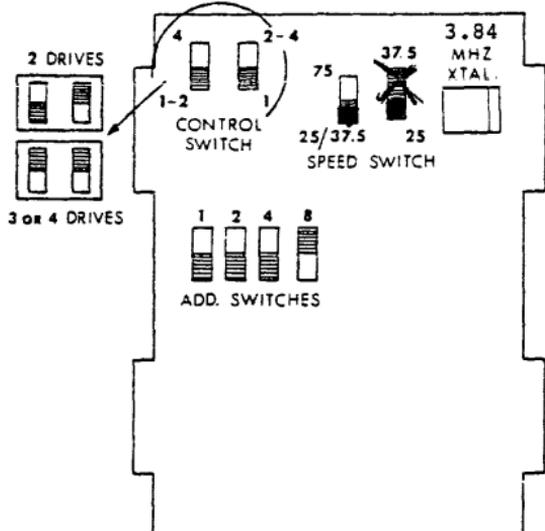
4XYY9D X = DEVICE ADDRESS YY = STATUS BYTE

STATUS BYTE	MEANING
----------------	---------

01	READ BUSY
02	WRITE BUSY
04	END
08	SERVICE REQUEST
10	MAGNETIC TAPE ALARM (ERROR)
20	ILLEGAL BLOCK LENGTH
40	E.F.M. / E.O.T. / LOAD POINT
80	INOP.

IOU-20A/B
KENNEDY / PERTEC
800 BPI READ-AFTER-WRITE

QANTEL MODEL 5201



MAX. PWR. REQUIRED

+5v = 2.38A

TAPE DRIVE PWR.

Kennedy
115 vac 60 Hz
4.2A for .1 sec.
2.5A normal

Pertec
115 vac 60 Hz
5.0A for .1 sec.
2.5A normal

NOTES:

IOU-20 CAN DAISY CHAIN UP TO 4 MAG TAPE UNITS. THE SWITCHES TELL THE SYSTEM THE NUMBER OF DRIVES ATTACHED.

THE IOU -20 CAN HANDLE EITHER 25 ips 37.5 ips or 75 ips.

WRITE CONTROL INSTRUCTIONS

1XYY9D X = DEVICE ADDRESS YY = CONTROL BYTE

CONTROL BYTE	FUNCTION
00	SET ERASE
01	SET CHECK READ
02	SET BACKSPACE
03	SET REWIND
04	SET UNLOAD (REWIND AND OFF LINE)

STATUS IN INSTRUCTIONS

4XYY9D X = DEVICE ADDRESS YY = STATUS BYTE

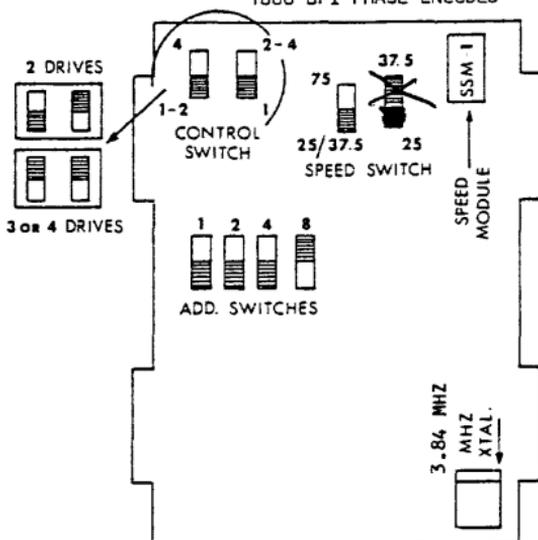
STATUS BYTE	MEANING
01	READ BUSY
02	WRITE BUSY
04	END
08	SERVICE REQUEST
10	ERROR
20	ILLEGAL BLOCK LENGTH
40	B.O.T. / E.O.T. / LOAD POINT
80	INOP.

IOU-21A/B
KENNEDY / PERTEC
 1600 BPI PHASE ENCODED

QANTEL MODEL
 5211, 5212

MAX. POWER
 REQUIREMENTS

+12v = .01A
 + 5v = 3.78A
 TAPE DRIVE PWR.
Kennedy
 115 vac 60 Hz
 4.2A for .1 sec.
 2.8A normal
Pertec
 115 vac 60 Hz
 2.0A for .1 sec.
 1.0A normal



NOTES:

THE IOU-21 CAN DAISY CHAIN UP TO 4 MAG TAPE UNITS. THE SWITCHES TELL THE SYSTEM THE NUMBER OF DRIVES ATTACHED.

THE IOU -21 CAN HANDLE EITHER 25 ips 37.5 ips or 75 ips.

WRITE CONTROL INSTRUCTIONS

1XYY9D X = DEVICE ADDRESS YY = CONTROL BYTE

CONTROL BYTE	FUNCTION
00	SET ERASE
01	SET CHECK READ
02	SET BACKSPACE
03	SET REWIND
04	SET UNLOAD (REWIND AND OFF LINE)

STATUS IN INSTRUCTIONS

4XYY9D X = DEVICE ADDRESS YY = STATUS BYTE

STATUS BYTE	MEANING
01	READ BUSY
02	WRITE BUSY
04	END
08	SERVICE REQUEST
10	UNCORRECTABLE ERROR
20	ERROR CORRECTION PERFORMED
40	B.O.T. / E.O.T. / LOAD POINT
80	INOP.

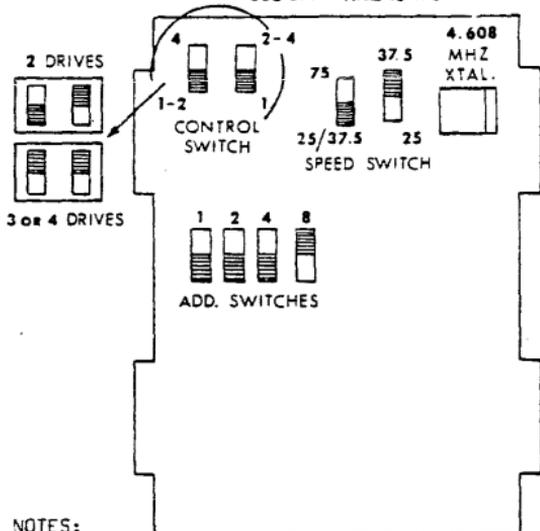
00 *General status 3-3*

IOU-20A/B

DIGI-DATA

800 BPI NRZ 45 IPS

DANTEL MODEL
5203



MAXIMUM
POWER REQUIREMENT

+12v = .01A
+ 5v = 3.78A

TAPE DRIVE POWER
115 vac 60 Hz
1.73A NORMAL

NOTES:

THE IOU-20A CAN DAISY CHAIN UP TO 4 MAG TAPE UNITS.
THE SWITCHES TELL THE SYSTEM THE NUMBER OF DRIVES ATTACHED.
THE IOU-20A CAN HANDLE EITHER 25 ips, 37.5 ips, or 75 ips.

WRITE CONTROL INSTRUCTIONS

$1dy9D$ d = DEVICE ADDRESS yy = CONTROL BYTE

CONTROL BYTE	FUNCTION
00	SET ERASE
01	SET CHECK READ
02	SET BACKSPACE
03	SET REWIND
04	SET UNLOAD (REWIND AND OFF LINE)

STATUS IN INSTRUCTIONS

$4dy9D$ d = DEVICE ADDRESS yy = STATUS BYTE

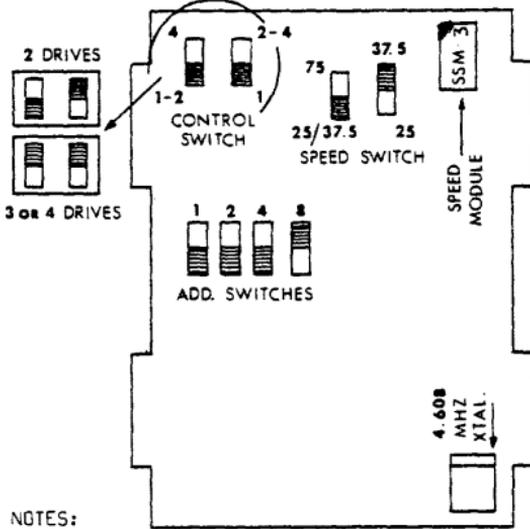
STATUS BYTE	MEANING
01	READ BUSY
02	WRITE BUSY
04	END
08	SERVICE REQUEST
10	ERROR
20	ILLEGAL BLOCK LENGTH
40	B.O.T. / E.O.T. /
80	INOP.

IOU-21A/B

DIGI-DATA

1600 BPI P.E. 45 IPS

QANTEL MODEL
5213



MAXIMUM
POWER REQUIREMENT

+12v = .01A
+ 5v = 3.78A

TAPE DRIVE POWER
115 vac 60 Hz
1.73A NORMAL

NOTES:

THE IOU-21A CAN DAISY CHAIN UP TO 4 MAG TAPE UNITS.
THE SWITCHES TELL THE SYSTEM THE NUMBER OF DRIVES ATTACHED.
THE IOU-21A CAN HANDLE EITHER 25 ips, 37.5 ips, or 75 ips.

WRITE CONTROL INSTRUCTIONS

1dyy9D d = DEVICE ADDRESS yy = CONTROL BYTE

CONTROL BYTE	FUNCTION
00	SET ERASE
01	SET CHECK READ
02	SET BACKSPACE
03	SET REWIND
04	SET UNLOAD (REWIND AND OFF LINE)

STATUS IN INSTRUCTIONS

4dyy9D d = DEVICE ADDRESS yy = STATUS BYTE

STATUS BYTE	MEANING
01	READ BUSY
02	WRITE BUSY
04	END
08	SERVICE REQUEST
10	UNCORRECTABLE ERROR
20	ERROR CORRECTION PERFORMED
40	B.O.T. / E.O.T. / END FILE
80	INOP.

PERTEC

PERTEC TRANSPORT ALIGNMENT

The mechanical / electrical adjustments for the Pertec 5200 (800 BPI, 12.5 IPS), 5201 (800 BPI, 25.0 IPS) and the 5211 (1600 BPI P.E., 25 IPS) are included in the following instructions.

Each check and/or adjustment should be performed in the order that it is given. This is important, as most adjustments affect much or all of the alignment that follows.

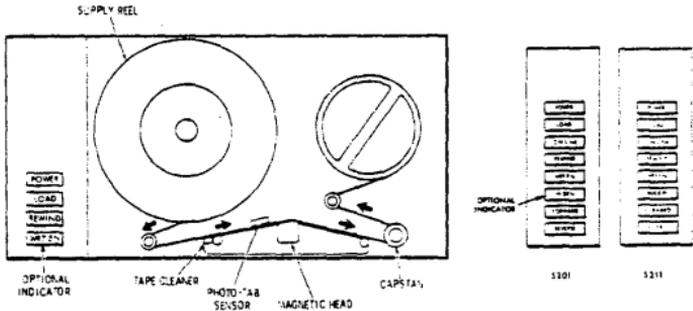
In most cases the minimum and maximum acceptable limits for adjustments will be defined within their particular adjustment procedure. If a value is checked and falls within the acceptable limits, no adjustments should be attempted. However, if a value does not fall within the acceptable limits, then and only then, should the adjustment be performed.

INSPECTION - 5200, 5201, and 5211

Careful inspection of the transport will actually save time and prevent minor problems from becoming major.

Visually inspect and check the following:

- Inspect the Head and all Tape Guides; the Tension Arms for travel; Capstan; Roller Guides; and all Push Buttons.



5200
FIGURE 1

- Inspect all P.C. Boards; verify that they are properly seated.
- Inspect Arm Optics and miscellaneous Mechanical Items in back.
- Inspect all Molex Connectors (if any of the individual pin connectors have separated, crimp them back together).

PERTEC

ELECTRICAL ADJUSTMENTS - 5200

POWER SUPPLY

The +5V and -5V regulators are located on the Tape Control A Board, see Figure 2 below.

- With the power on, use a DVM to measure the voltage between TP9 (+5V) and TP7 (0V, ground). The voltage should fall between +4.85V and +5.15V.
- If the voltage in the previous step doesn't fall within the specified limits, adjust R1302 to +5V as seen on TP9.

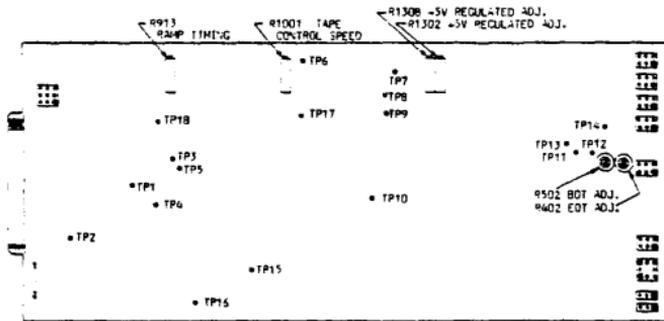


FIGURE 2

- Now use the DVM to measure the voltage between TP8 (-5V) and TP7 (0V, ground). The voltage should fall between -4.85V and -5.15V.
- If the voltage in the previous step doesn't fall within the specified limits, adjust R1308 to -5V as seen on TP8.

EOT/BOT

NOTE: On all Control Boards the EOT/BOT pots must be adjusted for zero ohms resistance before performing adjustments on the EOT/BOT Amp Board.

- Load a scratch tape.
- With the power ON, the tape should be tensioned but not at Load Point.

PERTEC

ELECTRICAL ADJUSTMENTS - 5200

EOT/BOT CONTINUED

- Using a DVM, connect the probes to TP24 (ground) and TP1 (on the EOT/BOT amp board). See Figure 3.
- If necessary, adjust R3 (on the amp board) to obtain between +4V and 4.25V on TP1.

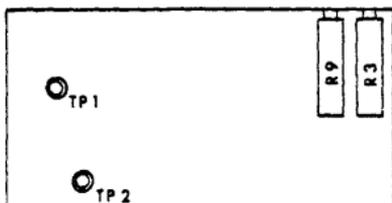


FIGURE 3

- Again, using a DVM, connect the probes to TP24 (ground) and TP2.
- If necessary, adjust R9 (on the amp board) to obtain between +4V and 4.25V on TP2.

RAMP

- Load a scratch tape and apply power to the drive.
- Depress and release the LOAD control two times. The tape will advance to the Load Point and stop.
- IPL the system and from device zero enter the following program:

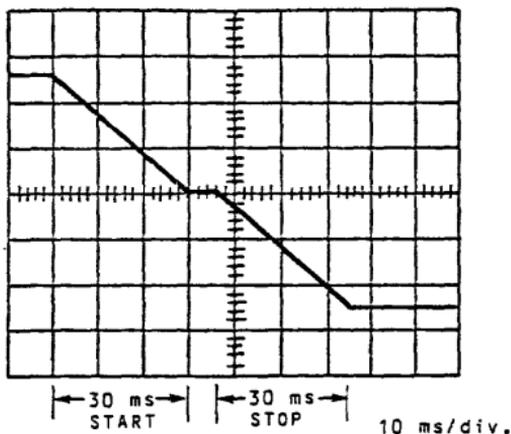
```
0010F30100000010F20100Bd1d029D0006A7 (d = Device)
TRANSMIT
ENTER 32 F's
TRANSMIT
```

PERTEC

ELECTRICAL ADJUSTMENTS - 5200

RAMP CONTINUED

- Connect the scope probes to TP7 (ground) and TP6 (on the Tape Control A Board, refer to Figure 2).
- Observe the drive hubs, they should be rotating back and forth.
- The wave form (as viewed on the scope) should fall 30 ms ± 1 , level off to zero and fall another 30 ms ± 1 . The entire wave from should fall 60 ms. See Figure 4.



- If the wave form does not meet the values as stated above, adjust R913 on the Tape Control A Board until it is corrected.

SPEED

- Mount a SKEW tape on the transport.
- To advance the tape, IPL the system and from device zero enter the following program:
0010F201000d0000A7 (d = Device)
TRANSMIT
- If the system is not available for use, load a SKEW tape and then manually advance the tape beyond Load Point. If tape tension is lost, press Load Point twice and the tape will advance.

PERTEC

ELECTRICAL ADJUSTMENTS - 5200

SPEED CONTINUED

- Connect the scope probes to TP5 (ground) and TP603 (Data A Board). See Figure 5.

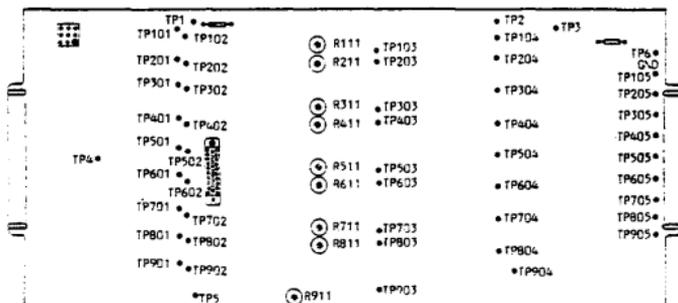


FIGURE 5

- The wave form (as viewed on the scope) should appear as in Figure 6. The distance between the peaks must be $.2\text{ms}$.

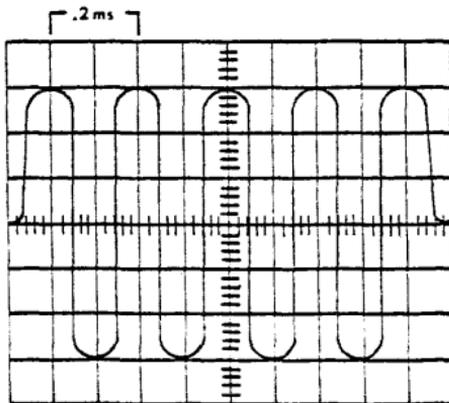


FIGURE 6

- If the wave form does not meet the above value adjust R1001 on the Tape Control A Board until it is corrected. Refer to Figure 2.

PERTEC

ELECTRICAL ADJUSTMENTS - 5200

READ AMPS

- Load a scratch tape.
- Advance the tape to Load Point.
- IPL the system and from device zero enter the following program:
0010F30100000010F20100Bd0006A7 (d = Device)
TRANSMIT
Enter - 32 F's
- Allow the program to run for a good portion of the tape. This procedure creates an 'all ones' tape.
- Rewind the tape back to the Load Point.
- IPL the system and from device zero enter the following program:
0010F201000d0000A7 (d = Device)
TRANSMIT
- Connect the scope probes to TP5 (ground) and TP103 (Data A Card). Refer to Figure 5.
- The wave form (as viewed on the scope) should appear as in Figure 7. The distance from peak-to-peak must fall between 10.0V to 11.0V.

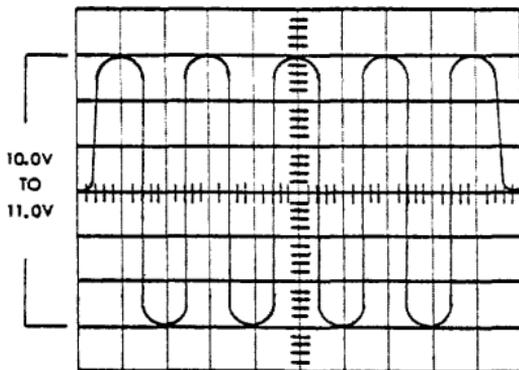


FIGURE 7

PERTEC

ELECTRICAL ADJUSTMENTS - 5200

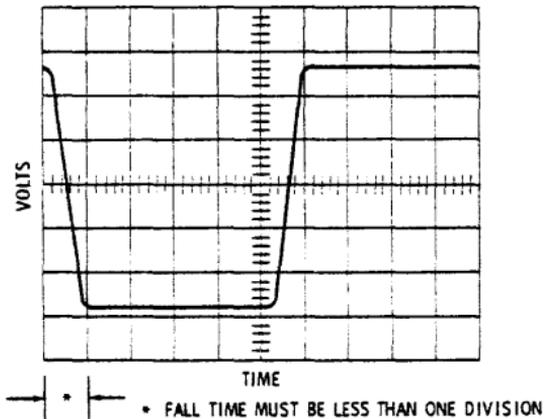
READ AMPS CONTINUED

- All Read Test Points must be checked in the manner described above. Check points TP103-TP903 (on the Data A Board).
- If any of the wave forms do not meet the above value, adjust the proper pot R111-R911 on the Data A Board until they are corrected.

SKEW

- Mount a SKEW tape on the transport.
- Advance the tape to Load Point.
- Connect the scope probes to TP5 (ground) and TP3 (Data A Board).
- Display one full waveform, as in Figure 8.

FIGURE 8



- The distance between the rise and the fall cannot be more than five (5) of the small divisions.
- Perform the adjustment by shimming one of the guides on either side of the head. ONLY SHIM ONE OF THE GUIDES. There should never be shims under both guides.

PERTEC

ELECTRICAL ADJUSTMENTS - 5201 AND 5211

POWER SUPPLY

The +5V and -5V regulators are located on the Tape Control B1 Board (see Figure 9).

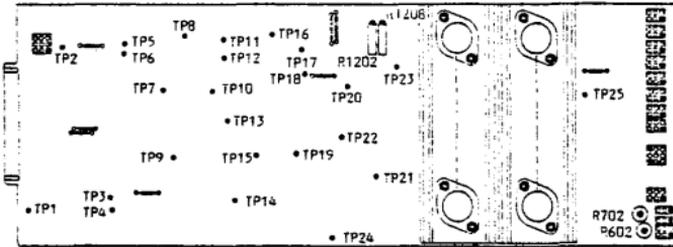


FIGURE 9

- With the power ON, use a DVM to measure the voltage between TP17 (+5) and TP24 (0V, ground) on the Tape Control Board. The voltage should fall between +4.85V and +5.15V.
- If the voltage did not meet the above values, adjust R1202 (+5) on the Tape Control Board to +5V as seen on TP17.
- Now use the DVM to measure the voltage between TP23 (-5V) and TP24 (0V, ground) on the Tape Control B1 Board. The voltage should fall between -4.85V and -5.15V.
- If the voltage in the previous step did not fall within the specified limits, adjust R1208 on the Tape Control B1 Board (Figure 9) to -5V as seen on TP23.

EOT/BOT

NOTE: On all Control Boards the EOT/BOT pots must be adjusted for zero ohms resistance before performing adjustments on the EOT/BOT Amp Board.

- Load a scratch tape.
- With the power ON, press the LOAD control one time. The tape should be tensioned but not at load point.

PERTEC

ELECTRICAL ADJUSTMENTS - 5201 AND 5211

EOT/BOT CONTINUED

- Using a DVM, connect the probes to TP11 (ground) on the Data C9 Board (Figure 10) and TP1 on the EOT/BOT Amp Board (see Figure 11).

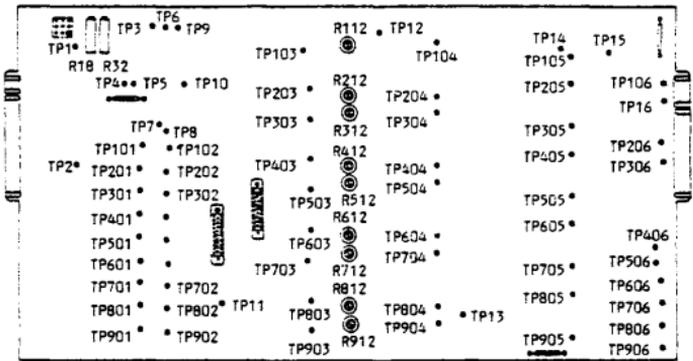


FIGURE 10

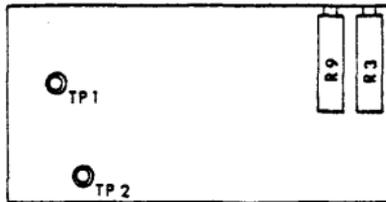


FIGURE 11

- If necessary adjust R3 (on the Amp Board) to obtain between +3.95 and 4.05V on TP1.
- Again, using a DVM, connect the probes to TP11 (ground) on the Data C9 Board and TP2 on the EOT/BOT Amp Board.

PERTEC

ELECTRICAL ADJUSTMENTS - 5201 AND 5211

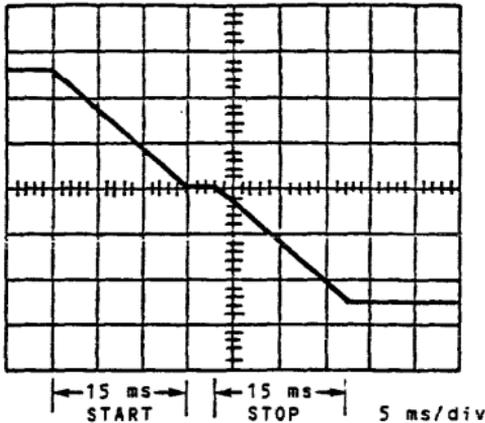
EOT/BOT CONTINUED

- If necessary adjust R9 (on the Amp Board) to obtain between +3.95V and 4.05V on TP2.

RAMP

- Load a scratch tape and apply power to the drive.
- Depress and release the LOAD control two times. The tape will advance to Load Point and stop.
- IPL the system and from device zero enter the following program:
0010F30100000010F20100Bd1d029D0006A7 (d = Device)
TRANSMIT
Enter 32 F's
TRANSMIT
- Connect the scope probes to TP11 (ground) on the Data C9 Board (Figure 10) and TP18 on the Tape Control B1 Board (Figure 9).
- The wave form (as viewed on the scope) should fall 15ms \pm 1, level off to zero and fall another 15ms \pm 1 (see Figure 12).

FIGURE 12



- If the wave form does not meet the values as stated above, adjust R1113 on the Tape Control B1 Board (Figure 9) until it is corrected.

PERTEC

ELECTRICAL ADJUSTMENTS - 5201 AND 5211

SPEED

- Mount a SKEW tape on the transport.
- To advance the tape, press the FORWARD button.
- Connect the scope probes to TP11 (ground) and TP603 on the Data C9 Board (refer to Figure 10).
- The wave form (as viewed on the scope) should appear as in Figure 13. The distance between the positive peaks must be .1 ms.

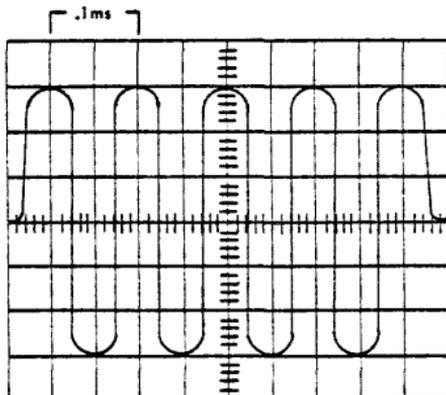


FIGURE 13

- If the wave form does not meet the above value adjust R1501 on the Tape Control B1 Board (Figure 9) until .1 ms between peaks is obtained.

READ AMPS

- Load a scratch tape.
- Advance the tape to Load Point.
- IPL the system and from device zero enter the following program:
0010F30100000010F20100Bd0006A7 (d = Device)
TRANSMIT; Enter 32 F's; TRANSMIT

PERTEC

ELECTRICAL ADJUSTMENTS - 5201 AND 5211

READ AMPS CONTINUED

- Allow the program to run for a good portion of the tape. This procedure creates an 'all ones' tape.
- Rewind the tape back to Load Point.
- Connect the scope probes to TP11 (ground) on the Data C9 Board (Figure 10) and the following test points, depending upon which drive is being adjusted:
 - 5201 - TP103 on the Data C9 Board.
 - 5211 - TP104 on the Data H Board (see Figure 14).

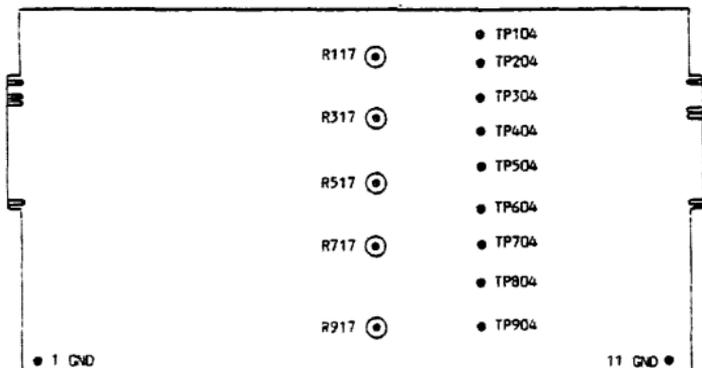


FIGURE 14

- Take the transport OFF LINE and push the FORWARD button.
- The wave form (as viewed on the scope) should appear as in Figure 15. The distance from peak-to-peak must fall between the following voltages:
 - 5201 - 10.0V to 11.0V
 - 5211 - 5.0V to 6.0V
- Check all the Read Amp Test Points as described above. The following Test Points must be checked:
 - 5201 - TP103 to TP903 on the Data C9 Board.
 - 5211 - TP104 to TP904 on the Data H Board.

PERTEC

ELECTRICAL ADJUSTMENTS - 5201 AND 5211

READ AMPS CONTINUED

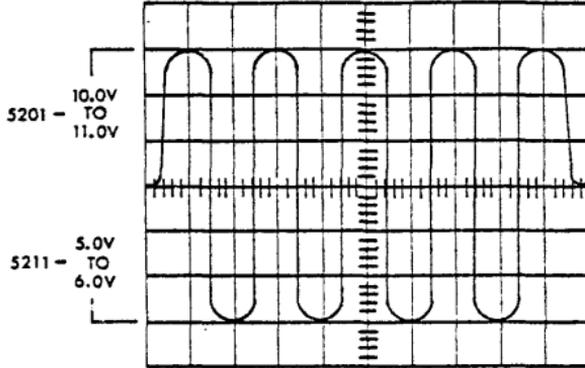


FIGURE 15

- If any of the wave forms do not meet the correct values, adjust the proper pot until it is corrected.

5201 - R112 to R912 on the Data C9 Board

5211 - R117 to R917 on the Data H Board

READ STATICISER DENSITY - 5201 TRANSPORT ONLY!

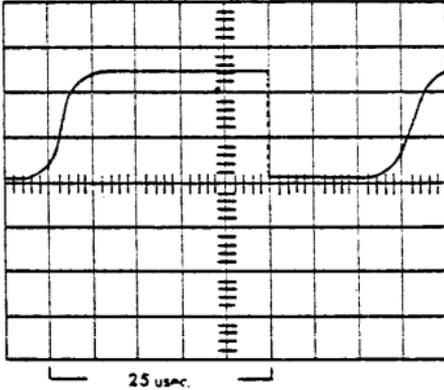
- Generate an 'all ones' tape as in the Read Amp procedure.
- Rewind the tape back to Load Point, take OFF LINE and push the FORWARD button.
- Connect the scope probes to TP11 (ground) and TP10 on the Data C9 Board (Figure 10).
- Observe the wave form at TP10. It should appear as in Figure 16.
- Adjust R32 on the Data C9 Board to obtain 25 usec. However, do not exceed 26.3 usec maximum or 23.7 usec minimum.

PERTEC

ELECTRICAL ADJUSTMENTS - 5201 AND 5211

READ STATICISER DENSITY CONTINUED

FIGURE 16



WRITE SKEW - 5201 TRANSPORT ONLY!

- Generate an 'all ones' tape.
- While the tape is writing and On Line, connect the scope probes to TP11 (ground) and TP15 on the Data C9 Board (Figure 10).
- Observe the wave form at TP15. It should appear as in Figure 17.

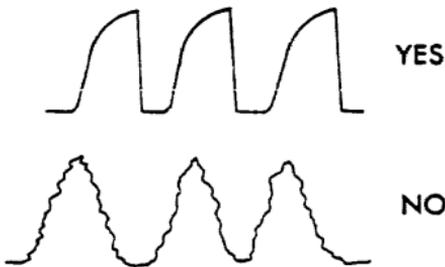


FIGURE 17

PERTEC

ELECTRICAL ADJUSTMENTS - 5201 AND 5211

WRITE SKEW CONTINUED - 5201 TRANSPORT ONLY!

- If necessary, adjust R18 on the Data C9 Board until the waveform appears as in Figure 17.

SKEW

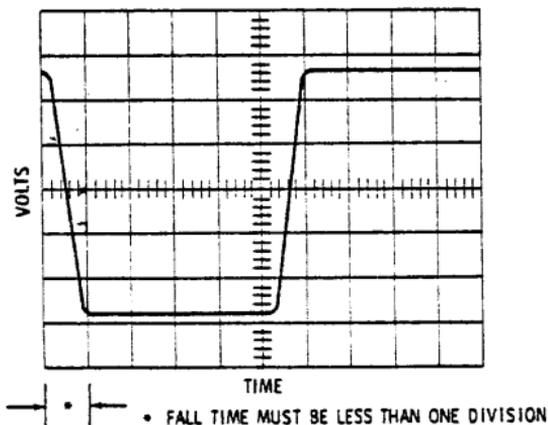
- Mount a SKEW tape on the transport.
- Advance the tape to Load Point.
- Connect the scope probes to TP11 (ground) and the following test points:

5201 - TP15 on the Data C9 Board

5211 - TP10 on the Data H Board.

- Display one full waveform as in Figure 18.

FIGURE 18



- The distance between the rise and the fall cannot be more than five (5) of the small divisions.
- Perform the adjustment by shimming one of the guides on either side of the head. ONLY SHIM ONE OF THE GUIDES. There should never be shims under both guides.

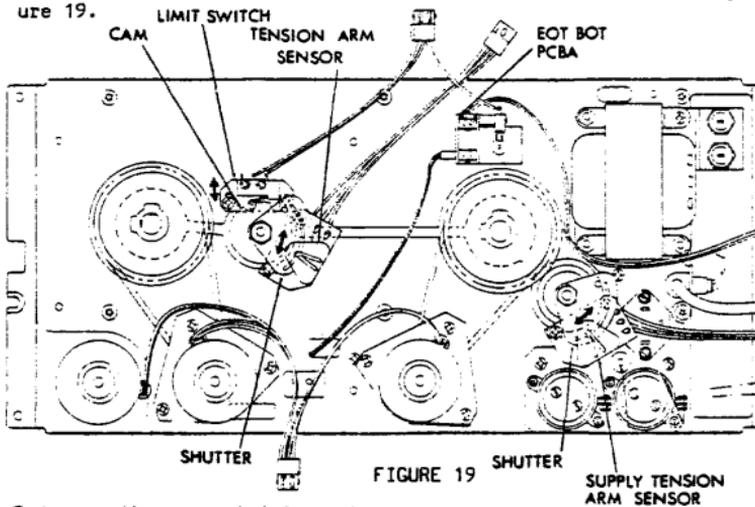
PERTEC

MECHANICAL ADJUSTMENTS - 5200, 5201 AND 5211

NOTE: Before attempting any of the following adjustments, thoroughly clean the tape path and then check the transport for proper operation. If a problem exists, proceed with the necessary adjustment.

TENSION ARM LIMIT SWITCH

Observe the Tension Arm as it is resting against its backstop. Perform the following adjustment if the position of the limit switch roller in relation to the cam, does not appear as in Figure 19.



- Loosen the cam retaining set-screw.
- Rotate the cam on its shaft until the limit switch roller is in the position shown in Figure 19.
- Tighten the cam retaining set-screw.

NOTE: The set-screw must be tightened sufficiently to prevent rotation of the cam when the tension arm strikes against its backstop.

PERTEC

MECHANICAL ADJUSTMENTS - 5200, 5201, AND 5211

TENSION ARM LIMIT SWITCH CONTINUED

- The limit switch plate should be rotated to a position where the limit switch trips when its roller is one-half of the distance up the slope from its rest position.
- The switch should be closed when the roller moves on the cam lobe between the semi-circular cutouts.

TENSION ARM SENSORS

NOTE: The +5V and -5V Regulators, Ramp Timing and Tape Speed must be correctly adjusted before adjusting the tension arm sensor.

- Remove tape from the transport.
- When adjusting the sensors, they should be shielded from high concentrations of light.
- Loosen the retaining nut securing the optical shutter to the tension arm shaft. See Figure 19.
- Loosen the nut so that the shutter can be rotated by hand, yet tight enough to prevent the setting from changing when the nut is tightened.
- Apply power to the transport.
- Rotate the shutter until moving the tension arm to the middle of its range stops reel motion.

NOTE: The LOAD control must be continuously depressed or the Limit Switch shorted to perform this procedure.

REEL SERVO BELT TENSION

- Loosen the three screws that secure the motor mounting plate to the deck standoffs.

PERTEC

MECHANICAL ADJUSTMENTS - 5200, 5201 AND 5211

REEL SERVO BELT TENSION CONTINUED

- Adjust the pulley so that the timing is snug. Note the last belt tooth that is completely seated in a slot on the large pulley. See Figure 20.

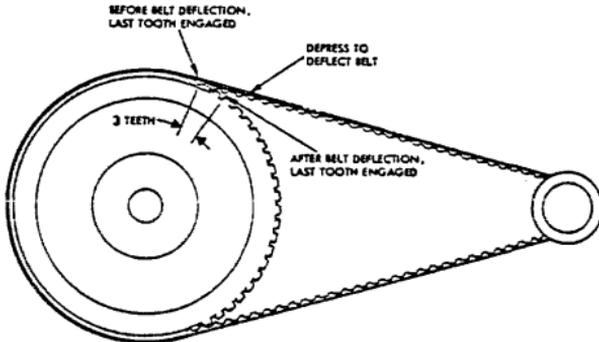


FIGURE 20

- Count two to three teeth from the last engaged tooth. Hold the large pulley to ensure that it does not turn. Depress the toothed belt at the point between the second and third tooth with sufficient force to deflect the belt against the gear.
- Adjust the drive motor assembly so that the second tooth is firmly engaged in a slot on the large pulley, but the third tooth is not engaged.
- Tighten the three screws on the motor mounting plate.

TAPE CLEANER

- Remove the screw holding the tape cleaner to the transport and loosen the two screws which hold the cleaner blade to the housing.
- Use a cotton swab moistened in isopropyl alcohol to clean the blade and housing.
- Be sure that the tape cleaner blade surface is parallel to the tape when mounted on the deck.

KENNEDY

The following instructions include mechanical and electrical adjustments for both the 300 bpi and 1600 bpi Kennedy tape transports. All of the mechanical adjustments are identical between the two types of recording systems, and most of the electrical adjustments are also the same. Where differences exist between types, the differences are indicated within the text.

Make each check or adjustment in the order that it is given, checking and/or performing all of the adjustments that follow. This is important, as most adjustments affect much or all of the alignment that follows.

Access to the internal test points and adjustments (on the printed circuit cards) is gained from the front (operator side) of the transport. To expose the printed circuit boards, release the captive screw directly below the head assembly, and swing the entire panel and mechanism outward.

MECHANICAL ADJUSTMENTS

The following adjustments are used to align the tape handling hardware. Before making the adjustment, check for proper operation as described at the beginning of each procedure. Adjust if needed, but only when needed.

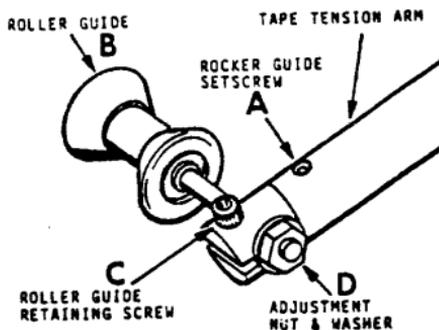
Tape Path

- Tape should wind evenly on the center of the takeup reel with no tendency to pile up toward one side or the other.

The tape should enter the roller guides correctly, exerting equal pressure on both the inside and outside edges of the tape.

Adjust as follows:

- Remove the roller guide that is to be adjusted.
- Temporarily replace the guide with a short length (about 4") of 18-8 or other non-magnetic stainless steel ground stock that is .1875" (3/16") diameter.
- Loosen the roller guide adjustment lock screw (A in the drawing below) slightly until the rod can be moved with moderate pressure.



KENNEDY

- Thread the recording tape over the rod.
- While holding the rod, run the tape forward. Adjust the angle by tilting the rod back and forth until the tape has equal tension toward the edges, and enters the guides (or reel) properly.
- When the rod is positioned correctly, tighten the lockscrew. Leave the tape threaded for adjustment below.

Replace and Adjust Roller Guide (after adjusting angle, above)

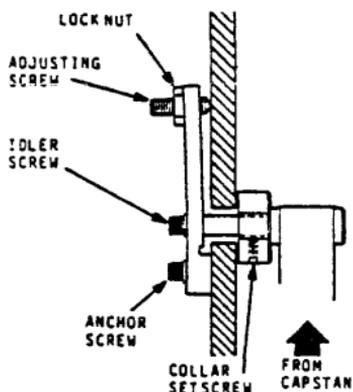
- Loosen the roller guide retaining screw (item C in the illustration on the previous page). Do not loosen item A.
- Insert the roller guide shaft until part of the threaded portion of the shaft protrudes from the other side. Then lightly snug the clamping (retaining) screw, C.
- Place several number 10 flat washers over the threaded portion of the shaft, and install a 10-32 nut.
- Using the 10-32 nut as a fine adjustment, tighten until the roller is aligned (centered on the tape). If this adjustment is moved too far, loosen the clamp screw (C) again and the 10-32 nut to re-position the shaft for another try.

Idler Alignment

- The tape should track at the same place on the capstan during forward and backward operation.

Adjust as follows:

- Loosen the locknut on the idler adjustment screw (see the illustration below).

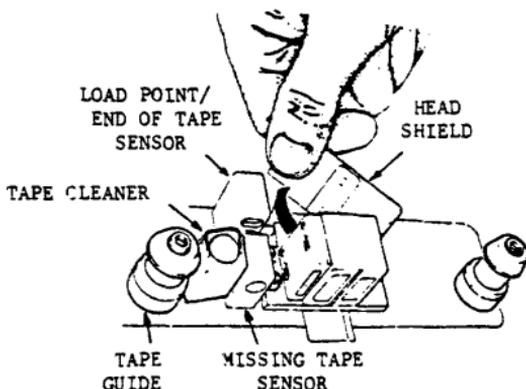


KENNEDY

- Loosen the collar setscrew (refer to the illustration on the previous page).
- Adjust the idler adjusting screw until the tape tracks at the same place on the capstan in either direction.
- Re-tighten the collar screw and the locknut.

Head Face Shield Adjustment

- Remove the tape from the transport and lift the shield as shown in the illustration below.



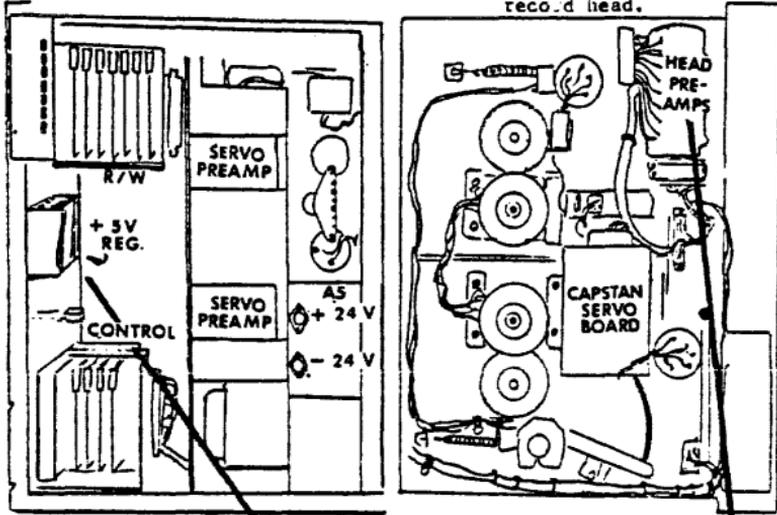
NOTE: Head cover removed for clarity.

- Loosen the stop screw on the face shield.
- Insert .006" thickness of tape (three layers of .002" tape) between the shield surface and the head. Do NOT use feeler gauges; metal will destroy the head by scratching it.
- Compress the shims firmly by holding the shield toward the head, and tighten the the stop screw.
- Lift the shield and remove the tape pieces.

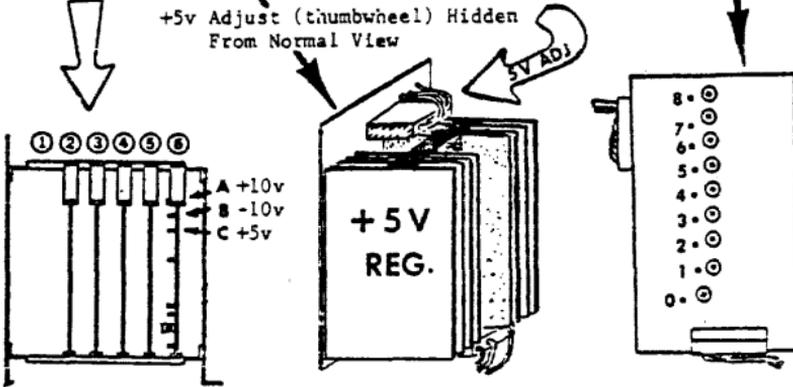
KENNEDY

ELECTRICAL ADJUSTMENTS AND CHECKS

000 PI Write Deskew
switch settings for
record head.



+5v Adjust (thumbwheel) Hidden
From Normal View



Preamp Adjustments and
Test points

Power Supply Voltage Checks

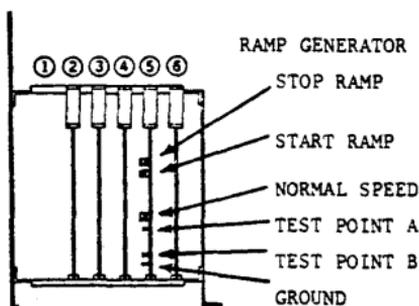
Power supply voltages should be checked at the test points shown in the illustrations above. The plus and minus 24v (case of Q8 and Q9 on A5) will be a nominal $\pm 26v$ under light load. The 10v supplies should be regulated to within $\pm .5v$. The +5v should be adjusted if necessary to within $\pm .25v$.

KENNEDY

Tape Speed

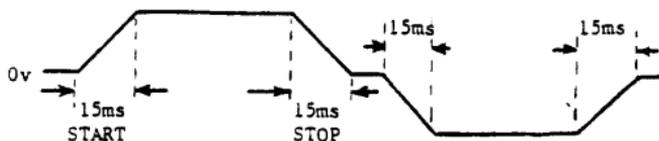
The following adjustment is one of the most important and most neglected of the entire procedure. The adjustment is exactly the same for 800 bpi and 1600 bpi transports. The 800 bpi Skew Master tape is used for both types.

- Mount the Skew Master tape onto the transport.
- Connect an oscilloscope probe to one of the preamplifier test points. The preamplifier printed circuit board is located on the back of the "swing out" portion of the transport front panel (shown on page 3-7).
- Start the tape reading in a forward direction.
- Adjust the NORMAL SPEED pot, R14, on the Ramp Generator printed circuit board until the waveform shows 100usec for each sinewave. The sinewave may not be entirely stable on the screen because of small rapid speed variations.



Ramp Time

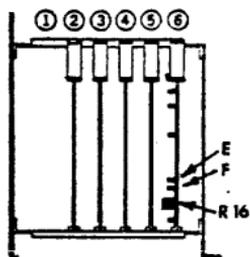
- Load a scratch tape onto the transport, and place the unit ON LINE.
- Connect an oscilloscope probe to TEST POINT A (see the illustration above).
- From system device zero, enter the following program:
0020f30100000100a7 CARRIAGE RETURN or TERMINATE
0010f20a00bx1x029d0010f20a000xlx029d0109a7 CARRIAGE RET.
or
TERMINATE
x = Tape controller device number.
- The waveform should appear as shown; adjust the START and STOP ramp times by using pots R3 and R4 (labeled START and STOP in the illustration above).



KENNEDY

Photo Sensor

- Verify by looking at the light source that both lamps are lit.
- Connect a dc voltmeter between test points E and F on the sensor amplifier/driver module (see below).



NOTE
Tape should NOT be mounted in the drive for this check or adjustment.

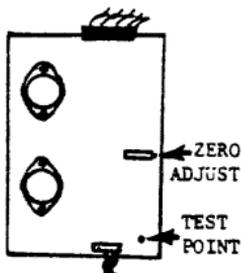
- Vary potentiometer R16 until there is zero voltage between the two points.

Capstan Servo

- Test the capstan for proper operation as follows:
The capstan should never "creep" when it should be standing still.
Load a tape and advance to the LOAD point. Gently grasp the capstan and try to rotate it in either direction. The resistance to rotation should be the same in both directions. A small "dead" zone should be felt midway between the resistance to rotation.

Adjust as follows:

- With the tape at LOAD point, adjust the ZERO ADJUST potentiometer until there is zero volts between TPA and chassis ground.



CAPSTAN
SERVO
LOAD

KENNEDY

Reference Frequency (1600 bpi Transport Only)

- Load a scratch tape onto the transport (include a Write Enable ring).
- Place the transport into the TEST MODE.
- Place an oscilloscope probe on TEST POINT A of the READ CONTROL printed circuit board.
- Depress the WRITE TEST button on the test panel.
- Adjust the REFERENCE FREQUENCY, R1, on the READ CONTROL board until the frequency is 320 kHz, or 3.1usec for a single cycle.

Read Level

- Load a scratch tape (with a Write Enable ring) onto the transport. DO NOT USE THE SKEW TAPE.
- Place an oscilloscope probe on the test point for Read Preamplifier Channel 1. The Read Preamplifier test points and adjustments are on the back of the "swing out" panel (see illustration on page 3-7).
- Place the transport into TEST MODE.
- Depress the WRITE TEST and FORWARD RUN buttons.
- Adjust the potentiometer to make the signal $5v \pm 0.0v$ for 1600 b.p.i. drives or $9v \pm 0.0v$ for 800 b.p.i. drives.

Notes:

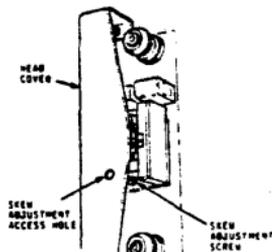
1. There will be some crosstalk noise from the write heads, ignore this effect.
 2. The amplitude is approximately 10% higher in the Read-After-Write mode because of magnetic remnance in the write and erase heads.
- Adjust the remaining channels by moving the test probe to each channel and adjusting in the same manner.

Skew Adjustment

- Load the Skew Master tape onto the transport and place the unit into the TEST MODE.
- Place an oscilloscope probe on the test point at the bottom of the test panel.
- Depress FORWARD RUN. The pattern will be a grouping of nine pulses that are repeated (similar to that below).



- Adjust the skew until the grouping is as small as possible.

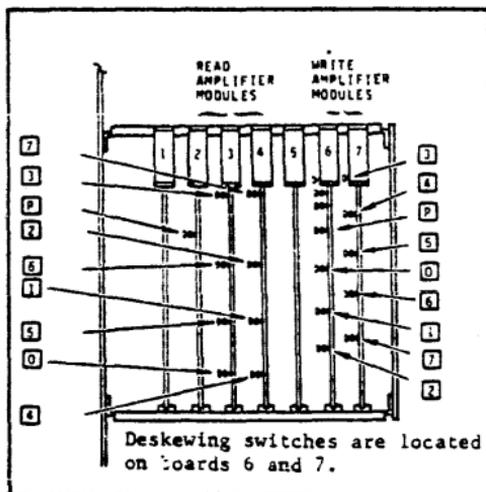


KENNEDY

Write Skew (800 bpi Transports Only)

The write skew is a digital delay that is controlled by a four-switch selector for each channel that is adjusted. All channels are referenced to the P (parity) channel which has no adjustment.

- Perform the Read Skew adjustment as given on the previous page. Connect an oscilloscope probe to the P (parity) channel on the Write Amplifier Module. See the illustration below for test point locations.
- Mount a scratch tape on the drive. Be sure that the scratch tape contains a Write Enable ring.
- Connect a second oscilloscope probe to the CH 5 test point. Channel 5 is one of the outermost channels on the tape.
- Set the oscilloscope to trigger on the P channel test point (CH 1, INT), and ALTERNATE sweep.
- With the unit in the TEST MODE, depress WRITE and FORWARD RUN.
- Set the CH5 deskewing switches for a minimum separation between the two displayed peaks.
- Move the probe from CH5 to CH4. Channel 4 is the other outer extreme track on the tape.
- Use the CH4 deskewing switches to minimize the separation between peaks.
- Adjust each channel in the same way as above.



DIGI-DATA 1730

DIGI-DATA TRANSPORT ALIGNMENT

The mechanical / electrical adjustments for the 800 bpi and 1600 bpi Digi-Data tape transports are included in the following instructions. Most of the adjustments for the two types of transports are the same. However, some differences do exist and are noted in the text.

Each check and/or adjustment should be performed in the order that it is given. This is important, as most adjustments affect much or all of the alignment that follows.

INSPECTION

Careful inspection of the transport will actually save time and prevent minor problems from becoming major.

Visually inspect and check the following:

- Inspect Flux Gate and Heads; both Tension Arms for travel; Reel Hub; all Tape Guides; and all Push Buttons.

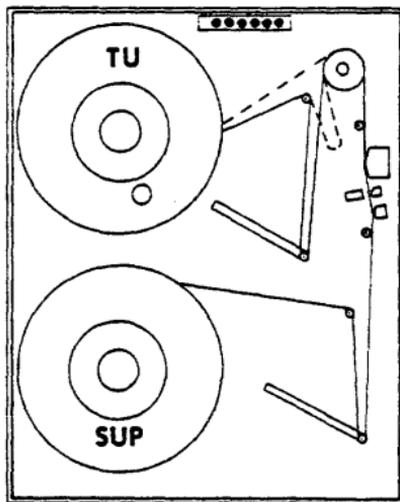


FIGURE 1

- Inspect EOT/BOT Sensor; the BEC P.C. Board (on back of panel); all the Boards, verify seating and that boards are held in with (2) screws; and inspect the EOT/BOT pots on the RA-16 card (Verify that they are turned counter-clockwise, all the way).

DIGI-DATA 1730

NOTE: To gain access to the MC-17 card, remove the two screws holding the card cage and swing it open.

CAUTION should be taken when replacing the screws if the power is ON.

- Inspect Arm Optics; miscellaneous Mechanical Items in back; the Harness (wire) in order; and the Write Enable Assembly.

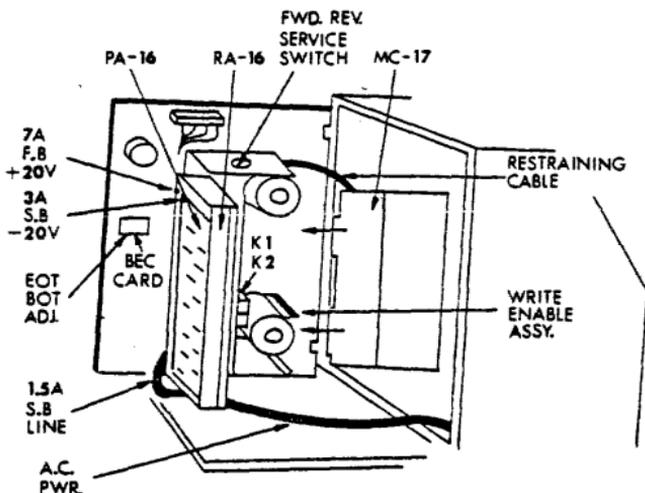


FIGURE 2

INITIAL OFFLINE CHECK AND ADJUSTMENT

Check that the input voltage noted on the transports model number tag and the actual line voltage at the intended installation agree. If not, refer to the Table below (Figure 3) to rearrange the transformer taps. The transport is supplied with a standard U.S. power cord and polarized 3-prong plug. In other countries it may be necessary to remove this plug and install the locally required power plug.

TRANSFORMER PRIMARY CONNECTIONS ON TB1

	HIGH SIDE	GROUND	LOW SIDE			
VOLTAGE RANGE	TB1-1	TB1-2	TB1-3	TB1-4	TB1-5	TB1-6
95-115 VAC	BRN, YEL	-	RED, GRN	(ORN)	(BLU)	-
105-125 VAC	BRN, YEL	-	ORN, BLU	(RED)	(GRN)	-
195-235 VAC	BRN	-	GREEN	RED, YEL	(ORN)	(BLU)
205-245 VAC	BRN	-	GREEN	ORN, YEL	(RED)	(BLU)
215-255 VAC	BRN	-	BLUE	ORN, YEL	(RED)	(GRN)

FIGURE 3

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- Check all three fuses visually. (Refer to Figure 2)
- Check/Adjust +12V, $\pm 1V$ (after 10 min. warm-up)(Refer to Fig.4)
- Check -12V and +5V, for $\pm 5\%$.
- Check +5(s)V for 4.5 - 5.5.
- Check ARM P.C. for 5.6V.

You May Ground The Meter To The Chassis.

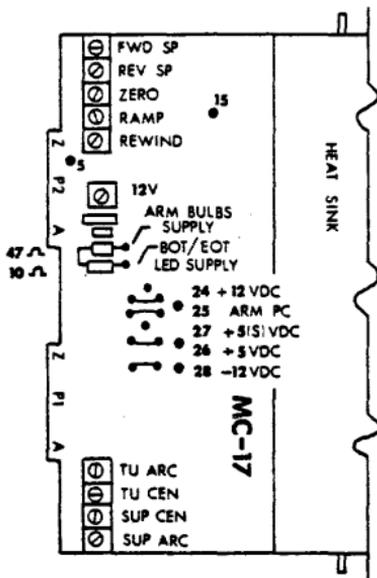


FIGURE 4

EOT/BOT SENSOR

- Thread a 10.5" reel of brown tape on drive and "load".
- Warm up for at least (1) minute.
- Locate the three-position service switch (see Figure 2) and run the tape forward away from the BOT mark.
- Refer to Figure 2 for BEC card location and check the voltage from ground to the EOT and BOT test points. It should be about 8.0 volts. If you use black tape it should be about 9.0 volts. See Figure 5 for EOT/BOT test point locations.

TP 7 - to ground supply 3.0V (centered)
 TP 8 - to ground take up ³⁻³⁵ " 5/82
 Photo cell disc adjustment

DIGI-DATA 1730

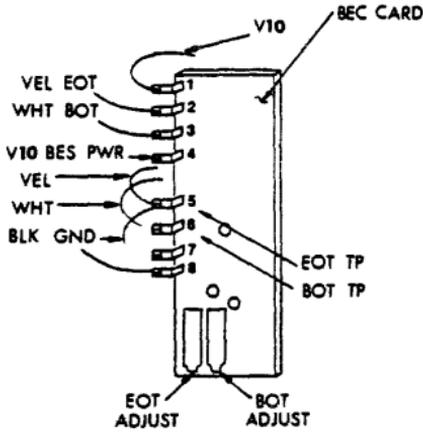


FIGURE 5

NOTE: The BOT and EOT pots on the RA-16 (1600 bpi Figure 6) card and the RC-11 (800 bpi Figure 16) card must be turned all the way counter-clockwise before you adjust the pots on the BOT/EOT Sensor card.
DO NOT REMOVE ANY CARD FOR (1) MINUTE AFTER THE POWER IS OFF!

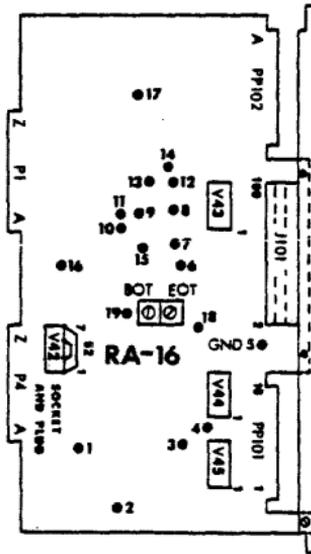


FIGURE 6

DIGI-DATA 1730

EOT/BOT SENSOR CONTINUED

- Push Rewind (hold the button for one second). After the tape has reached load point, check the ON/OFF LINE pushbutton switch by pressing it repeatedly and verifying that the associated indicator light alternately glows and is extinguished.
- With the transport ON LINE, verify that the service switch is inoperable.
- With the transport OFF LINE, move the service switch to the FORWARD position. After several feet of tape have run onto the take-up reel, return the service switch to the NORMAL position; tape motion should cease.
- Move the service switch to the REVERSE position. After several feet of tape have run onto the supply reel, return the switch to the NORMAL position; tape motion will again cease.

CAUTION: The service switch ignores the BOT and EOT markers.

- Use the service switch to run the tape forward again. Visually check all the tape path components for smooth operation.
- Check the arm positions, (1) maximum positions for forward and reverse, and (2) mid positions for stopped.
NOTE: The punch marks on deck.
- Perform the previous two steps near EOT.
- After stopping the tape, place the transport ON LINE, then press the REWIND pushbutton switch. The transport will go OFF LINE and the tape will rewind until the BOT reflective marker is sensed. When rewinding, the tape will overshoot the load by several inches, and then return forward to the exact load point location.
- Use the service switch to again run fifty to a hundred feet of tape onto the take-up reel. Return the service switch to the NORMAL position. Press the REWIND switch. After the tape has reached the full rewind speed, press the POWER switch off. The transport should stop smoothly without spilling the tape. Do this several times; make sure the tape stays on the guides.
- If possible perform the previous step on a small reel that is almost empty.
- Press the POWER switch on again. Press LOAD and REWIND simultaneously; continue to hold them down until the transport begins to rewind.

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EOT/BOT SENSOR CONTINUED

- After the tape has returned to the load point, press REWIND again. The tape should unload at slow speed.
- Remove the tape from the transport.
- Important!! Since the service switch must be in the NORMAL position for normal on-line operation, make sure that is where you left it.

PRELIMINARY REEL SERVO SETUP

ADJUST ONLY IF DRIVE DOES NOT FUNCTION PROPERLY.

- Put a piece of tape in the EOT/BOT Sensor and depress the LOAD button. The take-up and supply reel motors should rotate as long as the button is depressed.
- Hold the supply tension arm in the center of the available arc.
- Depress LOAD and ON LINE simultaneously. Verify that this causes the capstan motor to halt.
- With the supply motor turning and the arm held center, adjust the SUP CEN potentiometer to make the supply reel motor stop turning. See Figure 4 for the location of all pots and test points.

NOTE: The capstan must not be turning.

- Secure the supply arm so it cannot return to the rest position. A write ring looped around the arm roller and the nearby tape guide is a convenient way to accomplish this.

NOTE: If the supply arm is accidentally moved to either extreme of the operating arc, it will trip a microswitch which shuts down all motors. If this occurs, secure the supply arm, and press LOAD to start the motors. Then press LOAD and ON LINE to halt the capstan motor. The capstan motor must be halted to properly perform the preliminary arm centering adjustment.

- Check both extremes by doing the above.
- Hold the take-up tension arm in the center of its available arc and adjust the TU CEN pot to make the take-up reel motor stop turning.
- Load a scratch tape and press LOAD. The tape should advance to BOT and halt. If the arms move out of range and shut down the machine, adjust the TU ARC and/or SUP ARC pots counter-clockwise to keep the arms within the operating area (see Figure 4).

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PRELIMINARY REEL SERVO SETUP CONTINUED

- Run the machine forward and reverse with the service switch. If the arms move out of range, adjust the pots to keep the arms within the operating area. This is a preliminary adjustment. NOTE: Use the punch marks on the front deck.

REEL SERVO ADJUSTMENT

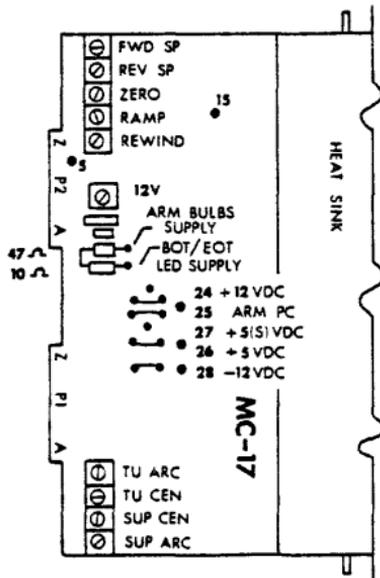
- Load the transport with a small or practically empty reel of tape. Press LOAD. The tape should advance to BOT and halt.
- Run the machine forward and reverse with the service switch. Adjust the CEN and ARC pots for each arm to position them exactly at the locations indicated by the punch marks on deck. Make repeated small adjustments of the two pots, checking the forward and reverse position of the arm after each adjustment. The ARC pot is used to move the two arm positions apart, the CEN pot shifts both positions in a common direction.

CAPSTAN SERVO ADJUSTMENT

The following adjustments must be performed after replacement of the capstan motor-tachometer or the MC-17 card.

- Connect a DVM to TP15. This point is indicated on the MC-17 card drawing, Figure 7. This Figure shows all the test points and potentiometers used in this procedure.

FIGURE 7

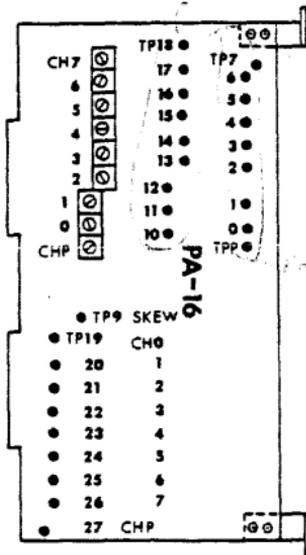


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CAPSTAN SERVO ADJUSTMENT CONTINUED

- Turn on the tape transport.
- Adjust the ZERO pot to get zero volts on the meter.
- Put the meter on TP5, on the MC-17 card.
- Forward speed. Load a SCRATCH TAPE on the machine. Press LOAD, and wait for the tape to halt at BOT.
- Place the service switch in the forward position. Adjust the FWD SP pot for the proper voltage on TP5, as per table next to motor.
- Repeat for reverse speed.
- ~~Repeat for rewind speed.~~
- Load a SKEW TAPE.
- Set the scope to (2V/cm, ⁵⁰2us/cm) TPO-7 or TPP (on PA-16, Figure 8) and measure speed for a 55.55 microsecond period to verify the adjustments.
- Repeat for reverse speed.
- Repeat for rewind, except verify for 16.67us. Set the scope to (10V/cm, 2us/cm).

FIGURE 8



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READ SKEW MEASUREMENT AND ADJUSTMENT

- Following replacement of the tape head or any tape guiding component, check the transport skew. A master skew tape is required (800 cycles per inch).
- Set the scope for 1 μ s/cm and 1V/cm.
- 1600 BPI - Connect the scope probe to skew TP9 on the PA-16 card.
- 800 BPI - Connect the scope probe to the right side of diode CR108, labeled STP on the RC-11 card. (See Fig. 15)
- With a master skew tape loaded, IPL the system and enter 00000d (d = device) on the CRT and TRANSMIT. A staircase wave-form (see Figure 9) should be displayed, with the first positive step triggering the oscilloscope sweep. The time between the first and last step represents the total read skew and should be less than 3.3 microseconds.

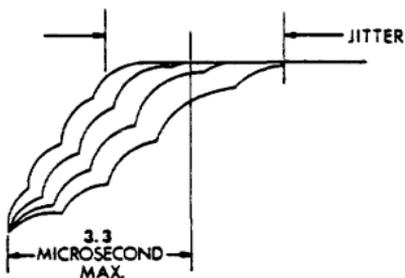


FIGURE 9

- If the skew exceeds the specification by a large amount, check the head mounting screws and head orientation. The direction of the skew may be determined by simultaneously observing TP4 and TP5 on an oscilloscope.

NOTE: ADJUST THE SKEW ONLY WHEN ABSOLUTELY POSITIVE IT IS REQUIRED.

- If the skew is excessive, determine which of the two tracks (4 or 5) arrives first.

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READ SKEW MEASUREMENT AND ADJUSTMENT CONTINUED

- 1600 BPI - (See Figure 8) To establish which track arrives first, position the scope probes as follows:
 - CH1 - TP4 on the PA-16 board (Track 4).
 - CH2 - TP5 on the PA-16 board (Track 5).

- 800 BPI - (See Figure 16) To establish which track arrives first, position the scope probes as follows:
 - CH1 - The right hand side of R406 on the RC-11 board (Track 4).
 - CH2 - The right hand side of R506 on the RC-11 board (Track 5).

- Correct the skew by inserting precision shims between the recorder front plate and one of the two spring loaded tape guides. If track 4 arrives first; shim the guide on the supply reel side of the head.

- If track 5 arrives first, shim the guide on the take-up side of the head. A shim thickness of 200 microinches will change the skew by approximately 15% of the specification. Shim only one guide. After installation of the shimming, check SKEW TP to ensure that the machine is now within specifications.

CONNECTION TO CONTROLLER AND ADJUSTMENT

NOTE: DO NOT PLUG OR UNPLUG ANY CABLE OR P.C. BOARD IN THE DRIVE FOR (1) MINUTE AFTER TURNING OFF THE POWER.

- Set the switches on the IOU-21A as shown on Page ~~24~~ 2-5

- Plug in 4.608 MHz crystal and 45 IPS speed module into IOU-21. (Speed module has two .0027 microfarad caps and one 56 picofarad cap).

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CONNECTION TO CONTROLLER AND ADJUSTMENT CONTINUED

- Connect the cable to IOU-21.

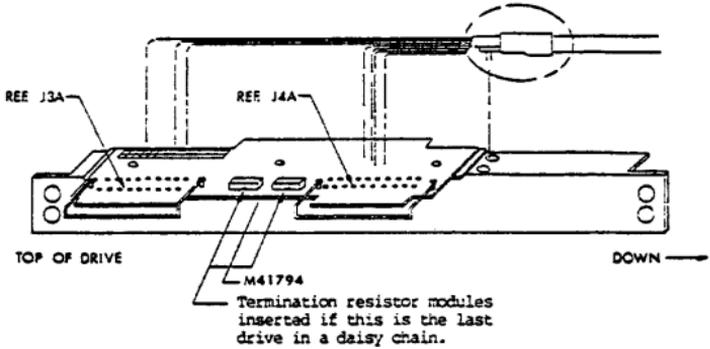


FIGURE 10

- Route the cables up through the base. Connect the other end of the cable (P.C. Board) into the back of the drive. Squeeze the "DEV 45" into the J101 connector on the RA-16 card (refer to Figure 6), and attach it to the chassis with screws.

If this is the last transport, insert resistor modules.

If another transport is used put on extension cable.

TO NEXT TRANSPORT

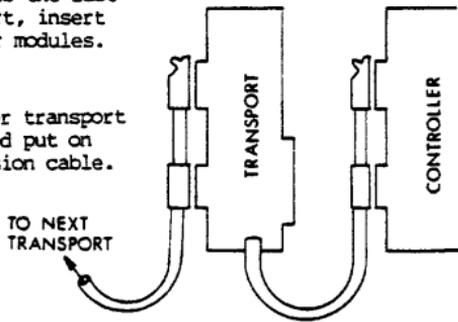


FIGURE 11

DIGI-DATA 1730

CONNECTION TO CONTROLLER AND ADJUSTMENT CONTINUED

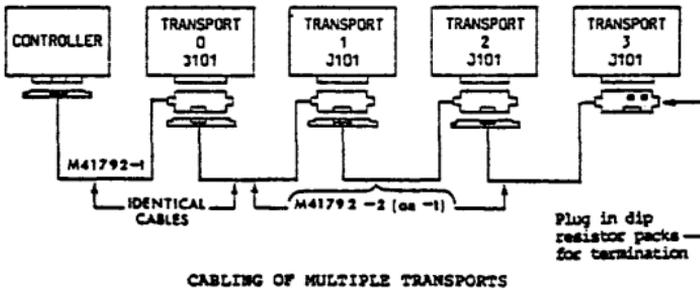


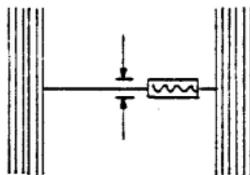
FIGURE 12

FLUX GATE

- The flux gate is a hinged shield located directly in front of the tape head and provides magnetic shielding between the write and read gaps. Its adjustment should be checked following head replacement or if errors are occurring in the Read-After-Write mode. The drive must be operating and writing "burst ones" (16 chars.) patterns to properly check the flux gate position.
- Load a scratch tape.
- [IPL]
0010F2000ABd0000A7FFFF (F's to end of line)
(d = DEVICE ADDRESS)
[Transmit]
- Set the scope to (2ms/cm, 1V/cm)
- Put the scope on TPO. (Refer to Figure 8)
- Measure the cross talk. (See Figure 13)
- Repeat the above two procedures for TP1-7 and TPP.

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FLUX GATE CONTINUED



MAXIMUM IS .5V

FIGURE 13

- When you lift the flux gate, the signal should increase (.8 - 1.9V).
- If the waveform exceeds the specification, readjust the flux gate by loosening the two screws securing it to the front plate. Move it to obtain the smallest possible peak-to-peak signal. The shielding material must not touch the tape. The top of the flux gate rests against the edge of the head. Adjust the assembly so that it is parallel to the head, and as close as possible without interfering with the tape motion. Tune for minimum cross talk amplitude by shifting the assembly from side-to-side very slowly to locate the optimum position.
- Then carefully tighten the two mounting screws and verify that the assembly is still at the optimum position.

RAMP ADJUSTMENT

- With the test switch, move the tape forward a few feet.
- [IPL]
0100F20000Bd1d029D0000A7
(d = DEVICE ADDRESS)
[Transmit]
- The tape will vibrate and creep forward.
- Set the scope.
Uncalibrate verticle and .5V/cm
TRIG - or + to see all parts of wave form.

NOTE: Adjust the verticle wave form height to (4) divisions.
(See Figure 14)

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RAMP ADJUSTMENT CONTINUED

- Observe TP5 on the MC-17 card and adjust the ramp pot for 7.5ms ramp time.

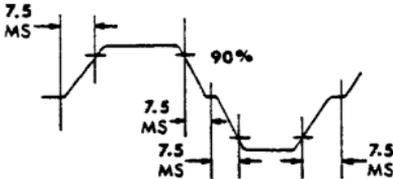


FIGURE 14

READ AMPLIFIER GAIN ADJUSTMENT

- Load a scratch tape.
- Advance the tape to LOAD point.
- IPL the system and from device zero enter the following program:

```
0010F3010000010F20100Bd0006A7
(d = DEVICE)
[Transmit]
Enter - 32 F's
```
- Allow the tape to write for 30 to 60 seconds. This procedure creates an all ones tape.
- Rewind the tape back to the LOAD point.
- IPL the system and from device zero enter the following program:

```
0010F2010000d0000A7
(d = DEVICE)
[Transmit]
```
- 1600 BPI - Connect the scope probe to TPP and adjust the voltage with the respective pot. (Refer to Figure 8) Adjust for a maximum of 6 volts peak-to-peak.

DIGI-DATA 1730

READ AMPLIFIER GAIN ADJUSTMENT CONTINUED

- Repeat the above procedure for TP0-7.
- 800 BPI - Connect the scope probe to R106 on the RC-11 board and adjust the respective pot (R111). Adjust for a maximum of 6 volts peak-to-peak.
- Repeat the above procedure for TP R206 through TP R906, adjusting each respective pot as necessary. (See Figure 15)

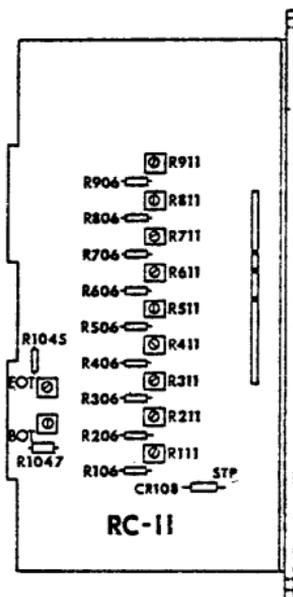


FIGURE 15

NOTE: Check/adjust the EOT/BOT on the RC-11 board ONLY when the board has been replaced. See Page 3-16 for proper adjustment of EOT/BOT sensor.

CLEANING

Careful attention should be given to the performance of the daily cleaning instructions. Small particles of dust and oxide from the tape will cause data errors and possibly permanent damage to the magnetic tape.

DIGI-DATA 1730

CLEANING CONTINUED

Daily Cleaning of Head and Guides

Perform the following procedure after every eight hours of system use, or after every reel of tape if system use is infrequent.

- Remove tape from the transport.
- Moisten Q-Tip applicator, cotton swab, or any lint-free clean cloth with isopropyl (91%) alcohol.
- Lifting the flux gate clean the head(s), then the two tape guides.
- Clean the tape cleaner, the tension arm rollers, and the stationary rollers. (Excessive liquid is not required!)

Weekly Cleaning of Capstan

Clean the capstan outer surface weekly following this procedure:

- Moisten Q-Tip applicator, cotton swab, or cloth with water.
USE ONLY WATER!!
- Rotate the capstan with one hand on the center shaft (not the outer surface, as it may be accidentally deformed, while holding the cleaning implement with the other hand against the outer surface.
- Dry in a similar fashion.
- If the capstan outer surface shows signs of cracking or polish advise the maintenance engineer.

CHECK OUT ON THE SYSTEM

- Close the transport and tighten thumbscrews (hand tighten only).
- Run ATP Test
 - Run Manual;
 - INOP Test: (one time)
 - Timing Test: (one time)
 - End of Tape Test: (two times)
 - Run Automatic Test: (10 iterations) (On full 10.5" reel)
 - Run Automatic Test: (4 iterations) (On mostly empty 7.5" reel)

DIGI-DATA 1730

PARTS REPLACEMENT

Tension Arm Roller

The current practice of replacing the entire tension arm assembly when the arm roller malfunctions is unnecessary and can possibly create skew problems.

The part number for the arm roller assembly is; 4110051-0001. To remove/replace a binding or noisy arm roller see Figure 16 and perform the following steps.

- Remove the 4-40 screw from the center of the arm roller.
- Pull off the arm roller; watch for any shims.
- Slip on the replacement roller. Insert and tighten the screw, check height.
- Load the tape and use the service switch to verify proper operation.

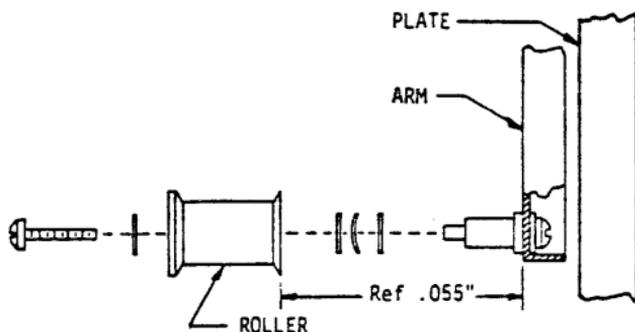


FIGURE 16

1740 DIGI-DATA

POWER SUPPLY

The transport has four regulated voltages, two of which are adjustable. Max AC ripple is 50 mV p-p.

- 1) Connect voltmeter between TP10 (gnd) & TP5 (+5) on the MC18 card. Adjust R62 to obtain $+5 \pm 0.05$
- 2) Adjust potentiometer R52 to obtain $+12V \pm 0.05$ between TP10 & TP2 (+12). See fig 20.
- 3) Verify that the voltage at TP3 is $+5 \pm 0.1$ and that the voltage at TP6 is -12 ± 0.6 .

CAPSTAN SERVO ADJUSTMENT

These adjustments determine the transport's tape speed and tape acceleration.

ZERO ADJUSTMENT

Load a reel of magnetic tape to BOT. With no tape motion, adjust R46 (ZERO) to achieve a reading of $0.00V \pm 0.01$ between TP7 and TP10 of MC18.

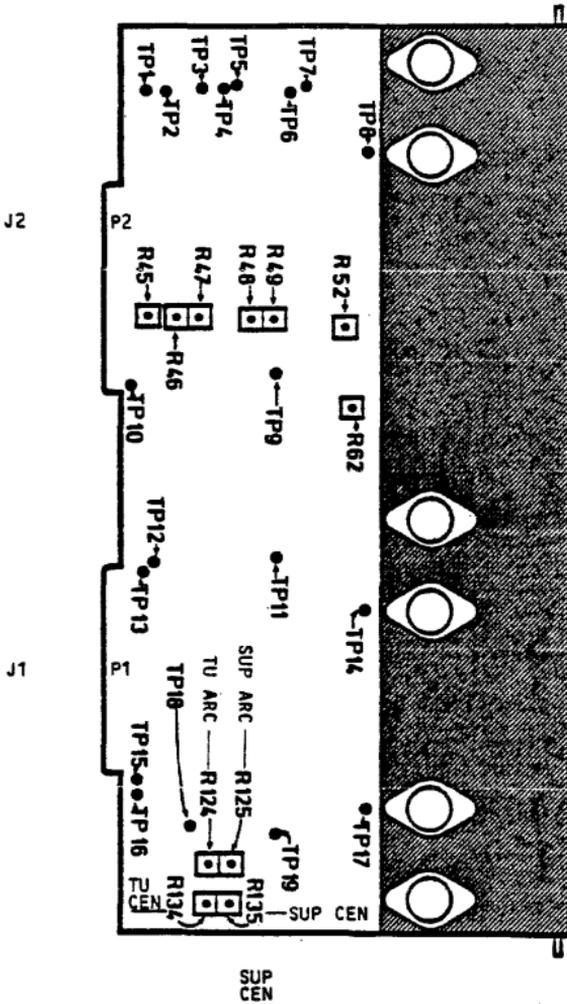
SPEED ADJUSTMENT

The transport's forward and reverse speeds are each adjustable with a unique potentiometer. The rewind speed, since it is directly proportional to the reverse speed, requires no adjustment. THESE ADJUSTMENTS SHOULD BE PERFORMED WHEN REPLACING THE MOTOR CONTROL CARD, MC18.

- 1) Locate the round label affixed to the capstan tachometer. This label indicates the voltage readings at TP1 (tachometer feedback) when the factory technician properly adjusted the forward and reverse speeds at the time of manufacture.
- 2) Connect an accurate voltmeter between TP10 (GND) and TP1 of MC18.
- 3) Move tape forward using the service switch. Adjust R48 to duplicate the voltage preceded by an "F" on the capstan label.
- 4) Switch tape motion to reverse, using service switch, and adjust R49 to duplicate the voltage preceded by an "R" on the capstan label.

Note: The service switch ignores the BOT marker.

ASSEMBLY MOTOR CONTROL

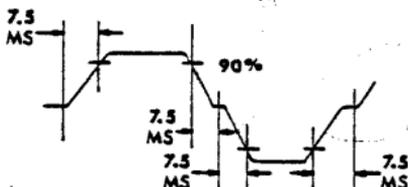


MC18 PWA
 Fig 20
 5/82

RAMP ADJUSTMENT

This procedure requires the use of an oscilloscope.

- 1) Load a reel of scratch tape to BOT and place the transport on line.



RAMP TIMING WAVEFORM
Fig 21

- 2) IPL the system and from device zero enter the following program:

```
0100F20000Bd 1d029d 0000A7 [XMIT]
d=Device address
```

- 3) Trigger the scope negative on TP12 of the MC18 card and view TP1.
- 4) Uncalibrate the scope amplitude, and position the trace such that the 90% amplitude point of the start ramp may be easily ascertained. See figure 21.
- 5) Adjust the RAMP potentiometer, R45, to achieve a ramp time of 7.5 milliseconds as shown in the figure.
- 6) Trigger the scope positive and view the stop ramp. Verify that it is approximately equal in time to the start-ramp time.

Note: The tape should be creeping forward.

PHOTODISK ALIGNMENT

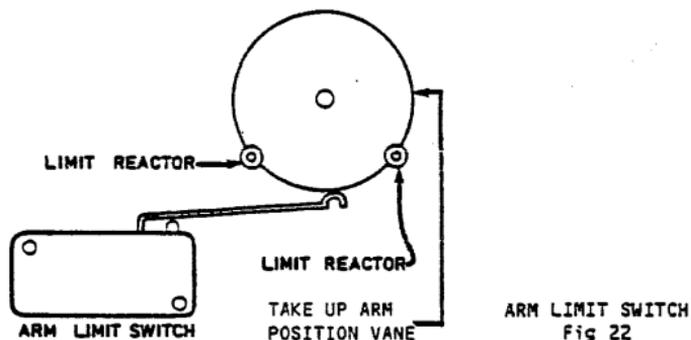
- 1) Power up, but do not load tape.
- 2) Connect a voltmeter between ground and TP16 (supply photocell) or TP15 (take-up photocell) on the MC18 card.
- 3) With your hand hold the appropriate arm in the approximate center of its operating arc.

4) The voltmeter should read $2.7V \pm 0.1$. If not loosen the photodisk and rotate it until the meter does read $2.7V$.

ARM LIMIT SWITCH ALIGNMENT

Photo disk alignment must be checked before performing this adjustment. Refer to figure 22 with regard to this alignment.

1) Insure that the screws holding the microswitch in place are tight. Power off the unit.



2) Connect an ohmmeter between the two connected lugs of the switch.

3) Lift the take-up arm off its stop. The meter should go from "short" to "open" before the first dimple (punch on deck plate) is reached. Release the arm, the meter should return to "short".

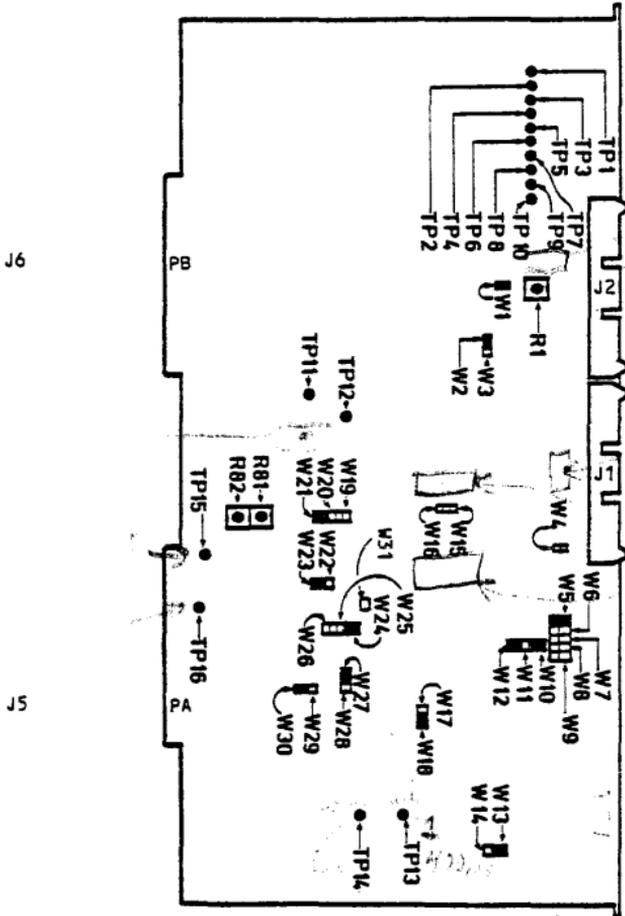
4) Move the take-up arm to the opposite end of its arc. The meter should go from "open" to "short" after the second dimple is passed. Bring the arm back again and the meter should indicate "open" before the same dimple is reached.

5) If the conditions indicated in steps 3 and 4 do not exist, loosen and move the appropriate arm limit reactor(s) on the take-up photodisk to achieve those conditions. DO NOT move the entire photo disc.

ARM POSITION ADJUSTMENTS

1) Load the transport with a scratch tape. The tape should advance to BOT and halt.

ASSEM. DUAL WRITE CONTROL CARD



Write/Control Card

Fig 23
5/82

2) Run the machine forward and reverse with the service switch. Adjust the CEN and ARC pots for each arm to position them exactly at the locations indicated by the punch marks on the deck-plate. Make repeated small adjustments of the two pots, checking the forward and reverse position of the arm after each adjustment. The ARC pot is used to move the two arm positions apart, the CEN pot shifts both positions in a common direction.

BOT/EOT SENSOR ADJUSTMENTS

These adjustments are required whenever either the write/control card or the BOT/EOT sensor assembly is replaced. Only a voltmeter is needed.

1) Power up and wait at least one minute for warm-up before performing the voltage measurements indicated in the following steps.

2) Thread magnetic tape on the unit and turn the reels so that the tape is taut through the BOT/EOT sensor. Insure that neither the BOT nor the EOT reflective tab is located within the sensor assembly.

3) Connect the voltmeter between ground and TP15 on the write/control card and adjust R81, the BOT potentiometer, so that the meter reads at least +9 volts.

4) Connect the voltmeter between ground and TP16 on the write/control card and adjust R82, the EOT potentiometer, so that the meter reads at least +9 volts.

5) Remove the magnetic tape from within the sensor assembly. The voltages at TP15 and TP16 must drop below +1 volt.

FILE PROTECT ALIGNMENT

The point of depression at which the ring-detecting plunger actuates the RING IN microswitch must be set when the file-protect assembly is replaced.

1) Power off and no tape loaded.

2) Connect an ohmmeter between the two connected lugs of the RING IN (WRT EN) microswitch. The meter should indicate an "open".

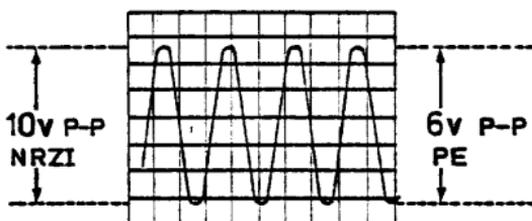
3) Depress the plunger which protrudes through the deck-plate. The meter should indicate a "short" when the plunger reaches the inner lip of the supply hub.

4) If necessary loosen the set screw in the plunger cam and move the cam on the plunger so that the condition described in step 3 is obtained.

5) Disconnect the meter. Power up, load a reel of tape with a write enable ring installed and verify that the solenoid retracts the plunger fully when the LOAD pushbutton is pressed, and that the WRT EN indicator lamp is illuminated.

READ GAIN ADJUSTMENTS

The gain of the read pre-amps must be adjusted when the read card or the magnetic tape head is replaced. In making these adjustments a reliable scratch tape should be used. DO NOT use a master alignment tape (skew tape).



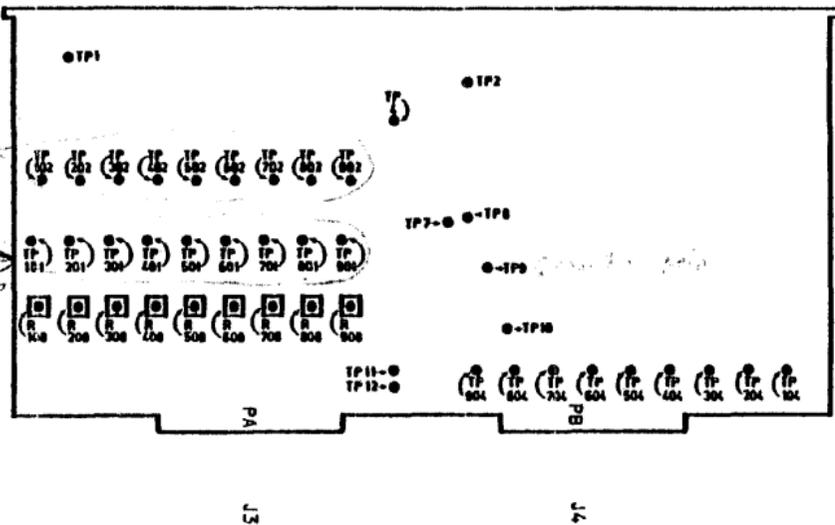
Read Gain Waveform
Fig 24

PE READ GAIN (1600 BPI)

Any transport capable of reading phase encoded tapes should be adjusted by means of the following procedure.

- 1) Write an all ones tape using the program shown on page 3-063.
- 2) After writing and rewinding the tape to load point, IPL the system and enter the program for reading an all ones tape.
- 3) Tape should rewind automatically and continue running to allow you to make the following adjustments without continually checking the front of the drive to see if tape is about to run out.
- 4) View TP102 with an oscilloscope and adjust potentiometer R108 to obtain a 6 volt peak-to-peak signal. See fig 25 for location of test points and pots.

ASSEMBLY PE READ CARD



Read card
Fig 25

1740 DIGI-DATA

5) Repeat step 2 for each of the remaining eight channels (TP202 and R208, TP302 and R308, etc.).

NRZI READ GAIN

To adjust the read amplifier gains on a transport capable of reading ONLY NRZI tapes, perform the following procedure:

- 1) Load a scratch tape on the drive and place the unit ON LINE.
- 2) IPL the system and from device zero enter the program to write an all ones tape. Refer to program on page 3-063.
- 3) After writing and rewinding the tape to load point. IPL the system and enter the program for reading an all ones tape. Refer to page 3-063.
- 4) Tape should rewind automatically and continue running to allow you to make the following adjustments without continually checking the front of the drive to see if tape is about to run out.
- 5) View TP101 of NRZI read card with an oscilloscope and adjust potentiometer R108 to obtain a 10 volt peak-to-peak signal. Refer to figs 24 & 25
- 6) Repeat step 2 for each of the remaining channels (TP201 and R208, TP301 and R308, etc.).

READ SKEW MEASUREMENT AND ADJUSTMENT

Following replacement of the tape head or any tape guiding component, check the transport skew. A master skew tape and an oscilloscope are required.

1) Set the scope for 1us/cm sweep time and 1V/cm vertical deflection.

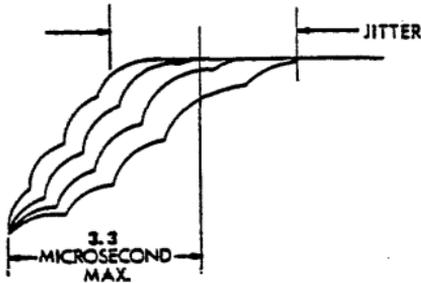
1600 BPI - Connect the scope probe to TP9 (skew) on the PE read card.

800 BPI - Connect the scope probe to the anode side of diode CR109 on the NRZI read card.

2) With a master skew tape loaded, IPL the system and enter 10000d0000A7 (d=device) on device zero and TRANSMIT. A staircase wave-form (see fig 26) should appear, with the first positive step triggering the oscilloscope sweep. The time between the first and last steps represents the total read skew and should be less than 3.3 microseconds.

1740 DIGI-DATA

NOTE When you reach the end of the skew tape you should reverse the tape at slow speed to keep from stretching it. The program to reverse the tape is this: 1d029D 0000A7. Do not REWIND skew tape.



Skew waveform
Fig 26

3) If the skew exceeds the specification by more than 1 microsecond check the head mounting screws and head orientation.

NOTE: ADJUST THE SKEW ONLY WHEN ABSOLUTELY POSITIVE IT'S NECESSARY.

4) If the skew is excessive, determine which of the two tracks (4 or 5) arrives first.

5) Before concluding that one of the tape guides needs to be shimmed make the following checks.

- a) Verify that the tape has been properly threaded.
- b) Clean all tape-handling components.
- c) Check each tension arm roller for axial play. The roller should not move up and down. Horizontal tilt is normal. If either roller exhibits vertical play, remove and replace it. Arm roller height is adjustable with the center screw.
- d) Check the stationary rollers for the absence of vertical play, and replace either if necessary. Stationary roller height is also adjustable with the center screw.

e) Check the tape guide springs for freedom of movement. When depressed and then released the bottom flange should snap up to its original position. If the flange's movement feels spongy or sticks, remove, disassemble, and clean the tape guide. Recommended solvents are heptane and alcohol.

6) If none of the above is the cause of the skew problem then tape guide shims must be added or removed. A small label on the rear of the front plate near the head indicates which guide, if either, was shimmed at the time of manufacture and how much it was shimmed. To determine which guide to shim perform the following. Press lightly on the outside edge of the tape near each tape guide in turn. The guide where the skew is worsened by this pressing is the one which must be raised.

NRZI SKEW GATE ADJUSTMENT (800 bpi)

This adjustment is required whenever the read card is replaced on any transport capable of reading NRZI tapes. The SKEW GATE is a one-shot which defines the time during which all the data bits in a character must arrive; it is triggered by the first bit to arrive. Nine-track ANSI standards require that all bits arrive within 34% of the character period.

1) Read any tape. View TP6 on the NRZI-read card with an oscilloscope.

2) Adjust the width of the skew gate (TP6) wave-form with potentiometer R27 to achieve a 10us signal width.

CROSS-FEED MINIMIZATION

If errors are occurring in the read-after-write mode, or if a dual gap head is replaced, some adjustment of the "flux gate" may be necessary to minimize the cross-feed between the write and read stacks.

1) Verify that the gain of each read pre-amplifier is properly adjusted; refer to pages 3-063 of this section.

2) Note the position of the density select plug jumper located next to the service switch on the write/control card. If this jumper is not in W19 then move it from W20 or W21 to W19 for the duration of this adjustment. Refer to fig 23 for location of W19, W20 & W21.

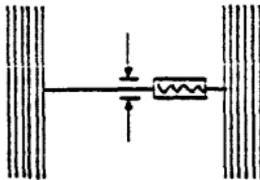
3) Turn power on, and thread a scratch tape on the transport without going around the capstan.

4) Refer to page 3-063 to write all "ones" tape at 800 BPI or a 3200 FRPI tape 1600 BPI. Press the LOAD pushbutton switch and the reel motors will apply tension to the tape and the capstan

1740 DIGI-DATA

will rotate CCW. Press LOAD and ON LINE simultaneously to simulate BOT detection; the capstan will stop and then start forward again as the pushbuttons are released. The write circuits are now active. However, since the tape is not moving the read circuits cannot really read-after-write, and therefore, any activity in the read channels is cross-feed from the write circuits.

5) With an oscilloscope view the pre-amplifier output TP101 of the Read Card. The peak-to-peak signal must not exceed .5 Volts P-P. Refer to Fig 27.



MAXIMUM IS .5V

Flux Gate Adjust
Fig 27

6) If signal amplitude exceeds the specification in step 5 loosen the two screws which hold the "flux gate" assembly to the plate. Move the assembly slowly from side to side noting the position which results in the smallest peak-to-peak cross-feed signal. The assembly should be parallel to the head and as close as possible to it without touching the tape.

7) When the optimum position for minimum cross-feed has been determined, tighten the two mounting screws; then verify that the assembly has not shifted while tightening the screws. View also TP201 through TP901 and verify that these signals are within the maximum values indicated in step 5.

8) Turn off power, remove the tape, and return the density select plug jumper to W20 or W21 if previously moved in step 2.

***** HELPFUL PROGRAMS *****

WRITING OF ALL ONES TAPE

³ 4000FC1000870011 ³ 4000F21000Bd ³ 0008A7 FF [XMIT]
 wait for most of tape to be [IPL]
 written ... then [XMIT] [IPL]
³ 0001F2000CbD ³ 1d039D ⁴ 0000A8 13

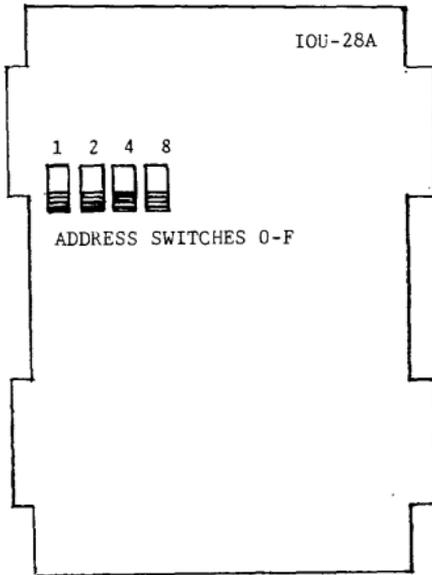
READING ALL ONES TAPE

⁴ 10000d ⁴ 4d409D ⁴ 0000A4 ⁴ 1d039D ⁴ 0000A7 [XMIT]

This procedure will read the tape looking
 for End Of File marks. Upon finding one,
 the tape will rewind and begin reading
 again until stopped by the IPL button.

IOU 28 CRT

Qantel Model 4011, 4021



MAX. PWR. REQUIREMENTS

-12v = .50A

+12v = .10A

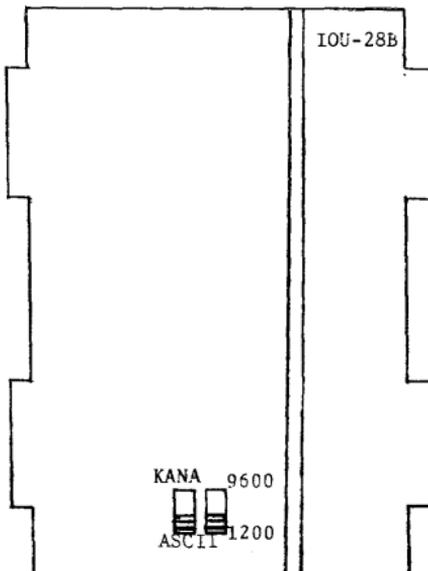
+ 5v = 2.69A

TERMINAL PWR.

115 vac 60 Hz

2.0A for .1 sec.

1.0A normal



NOTE:

SELECT PROPER BAUD RATE ON THE I/O
CARD IN THE TERMINAL ALSO.

IOU 28 CRT

Qantel Model 4011, 4021

IOU-28A/B

QCRT 2 (BLACK AND GREEN SCREEN)

WRITE CONTROL INSTRUCTIONS

1XY9D X = DEVICE ADDRESS YY = CONTROL BYTE

CONTROL BYTE	FUNCTION
00	RESET INTERRUPT
10	RESET ALLOW TERMINATION INTERRUPT
14	SET ALLOW TERMINATION INTERRUPT
2N	POLL TERMINAL "N"
30	START SCANNING(BEGIN WITH NEXT SEQUENTIAL TERMINAL AFTER STOP).
50	SEND MEMORY CONTENTS ON NEXT READ INSTRUCTION

STATUS-IN INSTRUCTIONS

4XY9D X = DEVICE ADDRESS YY = STATUS BYTE

STATUS BYTE	MEANING
01	READ BUSY
02	WRITE BUSY
04	END
08	SERVICE REQUEST
10	INTERRUPT (FLAG 1)
20	FLAG 2
40	FLAG 3
80	Slave printer inop

READ STATUS 2

YXY86 X = DEVICE ADDRESS Y = DON'T CARE

THE READ STATUS 2 INSTRUCTION HAS NO MEANING IN THE TYPEWRITER MODE ON THE QCRT. IN DIRECT ACCESS MODE, THE STATUS 2 BYTE HAS THE FOLLOWING MEANINGS:

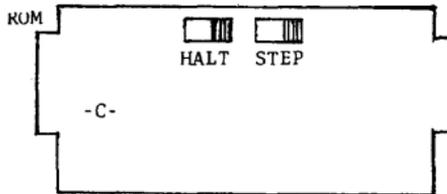
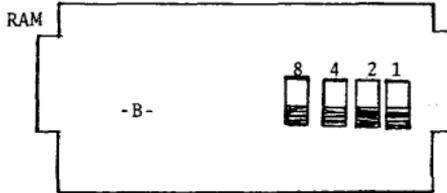
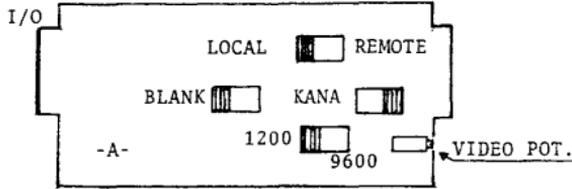
STATUS BYTE	OPERATION IN PROGRESS	CAUSE OF INTERRUPT
0N	SCAN	ALL 16 TERMINALS TIMED OUT
1N	SCAN	READ REQUEST
4N	READ	READ COMPLETE
6N	READ	READ OVERFLOW
7N	READ	ERROR OR TIMEOUT
8N	WRITE	WRITE COMPLETE
BN	WRITE	ERROR OR TIMEOUT
CN	POLL	POLL COMPLETE
DN	POLL	READ REQUEST
EN	POLL	TERMINAL BUSY
FN	POLL	ERROR OR TIMEOUT

N = TERMINAL NUMBER

IOU 28 CRT

QANTEL 4001

CRT-1



- A- LOCAL / REMOTE SELECT REMOTE FOR MODEM USE
ALSO 1200 BAUD
BLANK ILLIMINATES DISPLAY OF MEMORY
POSITIONS WITH SUPPRESS BIT
PRESENT
- KANA SET TO KANA FOR JAPANESE
CHARACTER GENERATOR.
- 1200/9600 SELECT TRANSMISSION RATE
- B- STANDARD ADDRESS SWITCHES 0-F
- C- HALT & STEP USED TO HALT EXECUTION OF ROM
INSTRUCTIONS AND STEP SINGLE
INSTRUCTION AT A TIME.

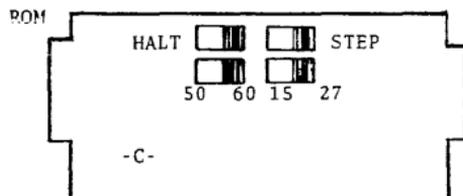
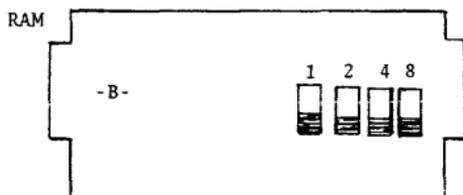
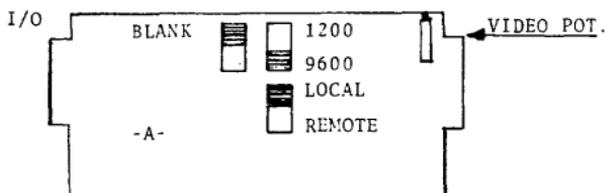
NOTE:

CRT-1 HAS TWO-LINE, NON-BLINKING CURSOR

IOU 28 CRT

QANTEL 4011
4021

CRT-2



- A- BLANK ILLIMINATES DISPLAY OF MEMORY POSITIONS WITH SUPPRESS BIT PRESENT.
1200/9600 TRANSMISSION RATE SELECTION.
LOCAL/REMOTE SELECT REMOTE FOR MODEM USE.
ALSO 1200 BAUD
- B- STANDARD ADDRESS SWITCHES 0-F
- C- HALT & STEP HALTS ROM EXECUTION AND ALLOWS SINGLE STEPPING OF ROM INSTRUCTIONS.
50-60 Hz POWER SOURCE SELECTION
15-27 LINES SCREEN SIZE SELECT.

NOTE:

CRT-2 HAS SINGLE-LINE, BLINKING CURSOR.

IOU-39T

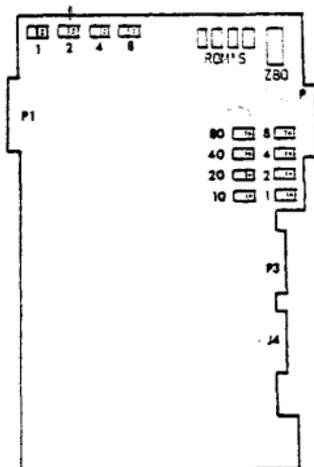
TYPICAL POWER REQUIREMENTS

-12V = .100A

+12V = .150A

+5V = 1.5A

CONFIGURATION SWITCHES

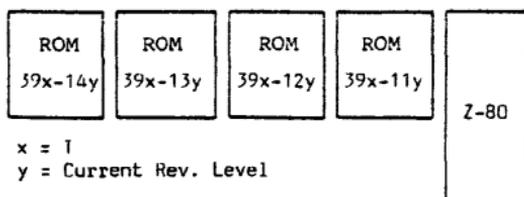


\$1, \$2, \$4, and \$8 should be set to the highest terminal address connected in the network. The system terminal addresses should be sequential (beginning with 0). This saves time by limiting controller scanning to only the terminal addresses connected. If the configuration switches are set for the highest terminal address of 0, the controller scans all the 16 possible terminal addresses when in scan mode.

\$10 is not used and should be set to the 0 position.

<u>\$40</u>	<u>\$20</u>	<u>Delay</u>	<u>Installation Type</u>
OFF	OFF	15ms.	Local installations operating at 19,200 or 9600 baud.
OFF	ON	50ms.	Most installations where modems are employed (4800, 2400, 1200 baud).
ON	OFF	150ms.	If low speed modems are used (600, 300 baud) and in some cases where higher speed modems are used with limited Telco facilities that impose a high propagation delay.
ON	ON	500ms.	Should only be used for modem links where severe propagation delays occur.

IOU-39T



WRITE CONTROL INSTRUCTIONS

1dyy9D d = Device Address yy = Control Byte

STATUS BYTE:	FUNCTION
\$00	Reset Interrupt
\$10	Reset Allow Termination Interrupt
\$14	Set Allow Termination Interrupt
\$2N	Poll Terminal 'N'
\$30	Start Scan
\$40	Reset Print Complete
\$50	Send Memory
\$60	Diagnostic Write

STATUS IN INSTRUCTIONS

4dyy9D d = Device Address yy = Test Bit Value

STATUS BYTE:	FUNCTION
\$80	IPL Mode : CRT \emptyset INOP
	SCAN Mode: Video Printer INOP
\$40	FLAG 3
\$20	FLAG 2
\$10	Termination (Interrupt)
\$08	Service Request
\$04	End
\$02	Write Busy
\$01	Read Busy

IOU-39T

READ STATUS 2

xddy86	d = Device Address	yy = Test Bit Value
	x = Don't Care	
CONTROL BYTE	FUNCTION	
\$A0	After IPL or Reset I/O: Mode of Operation	
\$1N	SCAN: Read Request (On CRT indicated: N)	
\$2N	SCAN: Print Complete	
\$3N	SCAN: Read Request & Print Complete	
\$4N	READ: Complete	
\$6N	READ: Overflow	
\$7N	READ: Timeout/Error	
\$8N	WRITE: Complete	
\$BN	WRITE: Error	
\$CN	POLL: Complete	
\$DN	POLL: Read Request	
\$EN	POLL: Printer Busy	
\$FN	POLL: Error	

QANTEL VIDEO TERMINAL

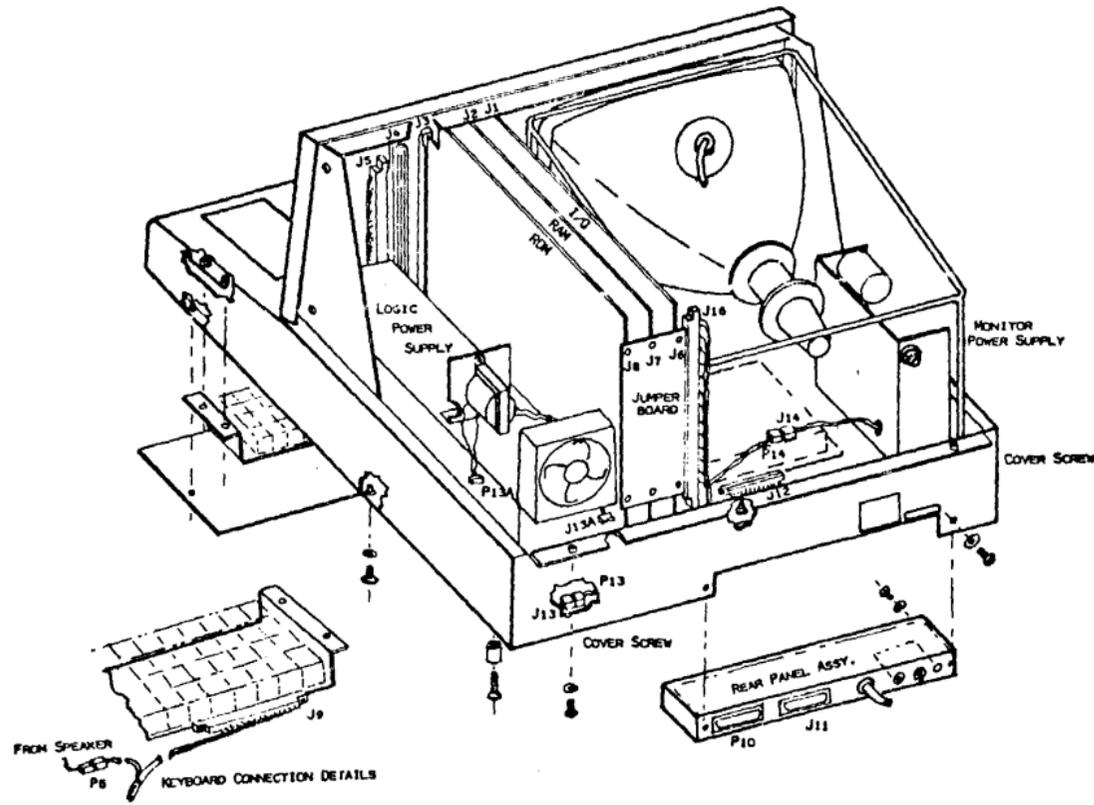
REMOVE/REPLACE/REPAIR

SAFETY NOTES

The internal components of the CRT terminal contain some voltages that, if contacted, could cause severe discomfort or personal injury. These circuits are well protected with insulation when the unit leaves the factory, but later damage or disassembly of a live unit could expose a hazardous condition.

Always remove all power (unplug the power cord) when disassembling a portion of the terminal. Inspect the entire unit for damage to protective insulation, and replace or repair any wiring or connectors that are damaged.

The picture tube of the monitor unit is protected from damage on the face by a bonded safety shield. Never replace the tube with a variety that does not contain this shield. Use care when the cover is off the unit to avoid damage to the glass. A scratch or sharp blow can sometimes cause a tube to implode. In effect, an implosion resembles a small explosion, sending glass particles in all directions.



IOU 28 CRT

DISASSEMBLY

TOP COVER

- Remove the two cover screws under the rear ledge of the cover assembly (see the illustration).
- Grasp the cover just above the chassis level, and slide it about 2 inches or more toward the rear (away from the tube face).
- Press the sides inward at the front edges, releasing the retainers, then lift the cover straight up and away from the unit. Set the cover in a safe place where it will not be damaged or fall and damage something else.

REMOVE PRINTED CIRCUIT CARDS

- Remove power from the unit by switching the power switch OFF or unplugging the line cord.
- Remove the jumper board at the rear of the printed circuit cards (near the power supply fan). This jumper is best removed by gently pulling alternately at the top and bottom. Place the jumper card where it cannot be damaged or the contacts become dirty.
- Remove the desired printed circuit card by lifting gently on the loose end of the card, then pulling toward the rear of the unit.

REMOVE MOTHERBOARD

- Remove all of the printed circuit cards.
- Disconnect J5, allowing it to lay to one side.
- Remove the four pan-head screws that hold the motherboard.
- Lift the motherboard from the unit.

REMOVE THE LOGIC POWER SUPPLY

- Remove all of the printed circuit cards.
- Disconnect P13 and P13A (the two smaller connectors, one at the side and one toward the rear of the unit).
- Remove the four retaining screws for the power supply at the bottom of the unit. To remove these screws, slide the power supply end of the terminal over the end of the workbench or table until the screw heads can be reached. It is not recommended that the unit be tilted up to reach the screws, as the power supply may fall into the monitor when the screws are released.

REMOVE THE MONITOR ASSEMBLY

- Tip the terminal up so that the two retaining screws that are near the bottom center of the unit can be removed. Remove these two screws only, then set the terminal back down.
- Slide the rear edge of the terminal to the edge of the table or workbench so that the rear panel assembly extends over the edge.
- Remove the two screws at each side of the rear panel assembly (on the rear surface of the terminal).
- Allow the rear panel assembly to move down and to the rear (out of the way).
- Remove the two remaining monitor mounting screws that were exposed by moving the rear panel assembly.
- Unplug all electrical connections to the monitor assembly.
- Lift the monitor assembly up and back (away from the bezel).

IOU 28
CRT

REMOVE THE MONITOR HIGH VOLTAGE ASSEMBLY

- Loosen the monitor assembly as if it were being removed. It will not be necessary to disconnect the internal electrical connections.
- Lifting the monitor assembly up, remove the two nuts at the bottom of the chassis (under the high voltage assembly).
- Set the monitor assembly back down.
- Unplug the two low voltage connectors (P104 and P105) from the high voltage module.
- Disconnect the high voltage lead from the tube (the one that goes into the top of the tube).

WARNING

When disconnecting the high voltage lead, grasp only the insulated portion of the connection. Under some conditions, the picture tube will retain a charge in the same way as a capacitor.

REMOVE THE KEYBOARD ASSEMBLY

- Slide the keyboard portion of the terminal partially over the edge of the table or workbench.
- Remove the protective panel from below the keyboard by removing the two screws that hold the front rubber feet and the panel.

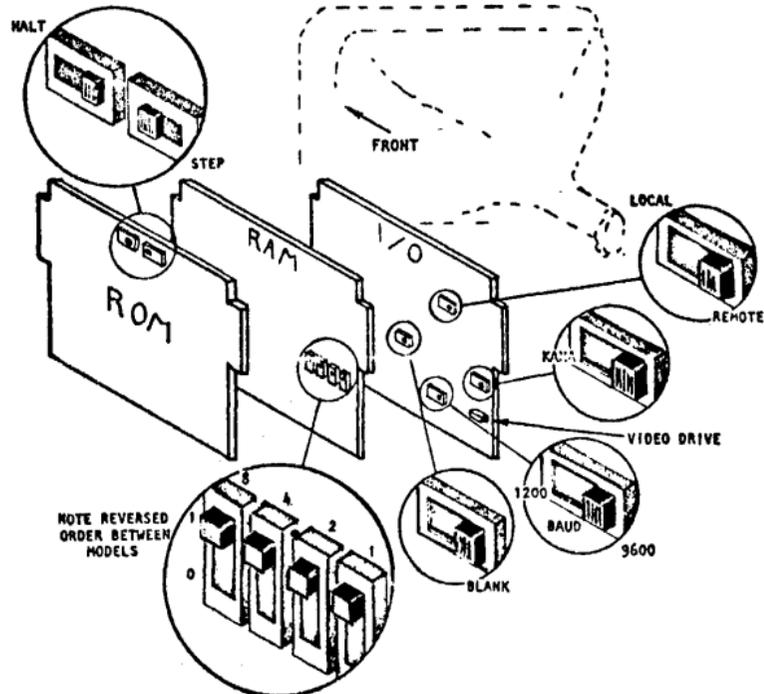
CAUTION

The speaker wires will allow only about 6" of panel movement. Disconnect P5 (speaker wires) if the panel is to be moved farther.

- Loosen and remove the four screws that fasten the keyboard assembly to the main frame.
- Disconnect the small connector to the speaker (P5) and the larger connector at the edge of the keyboard assembly.

REPLACE THE INDICATOR LIGHT

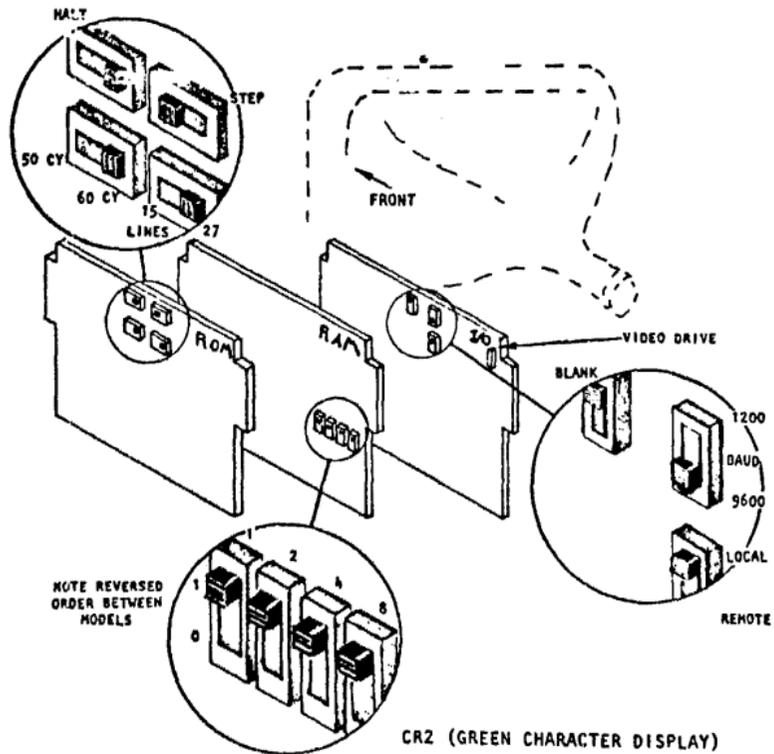
- Remove the motherboard.
- Remove the indicator lights by carefully unplugging the LED unit from the motherboard. Be sure, when replacing the indicator, that the LED contact marked + is inserted into the + socket on the motherboard.



ALL MODELS WITH WHITE CHARACTER DISPLAY

CRT 1
IOU 28
CRT

4-13



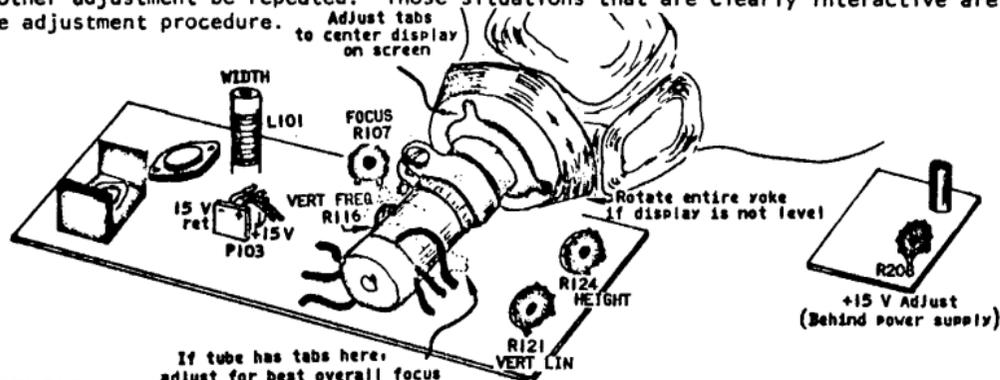
CR1 210U 28
CRT

SWITCH	OPERATION
HALT	Test switch that is used for troubleshooting. It stops the normal logic processing within the CRT. Logic sequences can be stepped through one micro-Instruction at a time by using the STEP switch.
STEP	Test switch that is used in conjunction with the HALT switch. When the HALT switch is in the HALT position, move the the STEP position and then return to step the microprogram one instruction at a time.
50/60 CY	Changes the internal timing to be compatible with the power line frequency.
15/27 LINES	Allows full screen display of 27 lines or limits the logic to 15 lines of display and memory (the unused memory is physically removed in the 15-line units).
ADDRESS	These switches set the terminal address as seen by the controller (not the IOU device address as seen by the CPU). The subordinate order is reversed from one model to the other but up is always ON. The illustration shows the terminal address as hexadecimal F.

BLANK	When the switch is set to the BLANK position (as shown in the illustration), all characters that contain a blanking bit will not be displayed on the screen. When set away from the BLANK position, all characters except space characters will be displayed. Invalid characters, such as control characters, are displayed as blanks. Blanks that are used to fill a suppressed background field are displayed when the switch is away from the BLANK position.
BAUD	Sets the baud rate of the CRT input and output data lines. If the LOCAL/REMOTE switch is in the REMOTE position, the baud rate must be set at 1200. LOCAL baud rate can be 1200 but preferably should be 9600. All terminals that are connected to the same IOU controller (either directly or through modems) must be set to the same baud rate.
LOCAL/REMOTE	Changes the I/O characteristics of the CRT unit. The LOCAL position is used where all units of one controller are directly attached through cables (within a maximum of 2000 feet). REMOTE must be used on all terminals of a controller that has one or more terminals that are remote enough to require a modem. When the REMOTE setting is used, the baud rate for all terminals that are connected to the same controller must be set to 1200.
AUXMODE (15-line white display only)	Enables an auxiliary ROM that is programmed for the Katakana keyboard. This ROM is not present in an ASCII terminal. However, if the AUXMODE switch is enabled in an ASCII terminal, certain Greek letters and some special symbols will be displayed when the LTRS key is in the down position. Releasing the LTRS key will not automatically release the condition; either SHIFT or RETURN must be depressed to exit the special character condition. The AUXMODE switch should normally be OFF in an ASCII terminal.

ADJUSTMENTS

This section describes adjustments that are normally only performed by field engineering personnel. External operator adjustments are described in the OPERATION section of this manual. All adjustments within this section require that the CRT has power, the cover is off and is not online. These steps are not repeated for each procedure. Each adjustment is complete and independent in itself, but many adjustments are either directly or subtly interactive and may require that another adjustment be repeated. Those situations that are clearly interactive are indicated in the adjustment procedure.



+15 V ADJUSTMENT

Power supply voltage is extremely important for proper display monitor operation. Always check the power supply voltage and low/high load regulation when random errors or failures are indicated. Use a good quality 20,000 Ω /volt meter (or better) to measure the voltage when adjusting.

Make the +15 volt adjustment as follows:

- Attach the measuring probes at P103 (see the illustration for location of P103). The positive probe connects to the orange wire; the return connects to the black wire.
- Adjust R208 (on the small PC board behind the monitor power supply) until the measured voltage is as close as possible to 15.00 volts.

VERTICAL FREQUENCY

The vertical frequency is the synchronism that keeps the screen from "rolling." Center the adjustment as follows:

- Slowly move the control (R116) in one direction until the screen begins to roll. Note the position of the control.
- Slowly move the control in the opposite direction until the screen begins to roll in the opposite direction. Note the position of the control.
- Return the control to the midpoint between the two extremes.
- Check the vertical linearity; this adjustment may have affected it.

TILT (LEVEL)

If the top and bottom lines of the display are not level with the bezel (facemask), adjust as follows:

- Slightly loosen the yoke clamp screw (on the neck of the tube). Loosen only as much as necessary to allow movement of the yoke yet retain a firm "drag."
- Rotate the entire yoke assembly slightly until the top and bottom of the display are level.
- Carefully re-tighten the clamp screw until the yoke is again secure. Do not over tighten, as the tube can be broken.
- It may be necessary to adjust centering when tilt has been corrected.

VIDEO DRIVE

The video drive adjustment is located at the rear edge of the I/O card. Proper adjustment is essential for clear, undistorted character display. The control is at the top of the card, slightly above the rear jumper board connector. On the older white character display models, the adjustment is located on the rear of the I/O card but is below the jumper board connector. The adjustment requires only a small screwdriver and is performed as follows:

- Disconnect the I/O cable at the rear of the terminal.
- Enter several groups of semicolons (;) at various places on the screen. Be sure there are some at the top, mid screen, and the bottom.
- For CRT 2, use a short jumper wire, touching momentarily from +5V to pin 11 on chip 2A.
- For CRT 1, momentarily touch from pin 2 of chip 2 to ground (5V return).
- When the jumper is touched, the screen display will reverse to a background display; the semicolons will remain as background displays.
- Adjust the video drive (on the I/O board) clockwise until the character intensity becomes bright enough to cause a ghost or shadow beside the character elements.
- Move the adjustment counterclockwise until the shadow disappears and the character is clear. If the adjustment is moved too far in a counterclockwise direction, the characters will fade into the background.
- Clear the screen by simultaneously depressing SHIFT and F2.

HEIGHT AND VERTICAL LINEARITY

These two adjustments are so interdependent that neither can be adjusted without affecting the other. Make sure the vertical frequency is electrically centered (as described in a previous paragraph) before adjusting the vertical linearity, as the vertical frequency being off has a tendency to "squeeze" the screen.

- Fill the screen with upper case letters. Hs, Ms, or Ws are best, because they fill the character space, making it easier to see linearity problems.
- Adjust the height control (R124) until the display fills the screen. If either the top or bottom has a larger space, re-center the display.
- Adjust the linearity control (R121) until the letters are the same height on all lines. The total display height will increase or decrease as linearity is adjusted; ignore this effect temporarily.
- Re-adjust the height until the display again fits the vertical space on the screen.
- It may be necessary to alternate between linearity and height, making smaller and smaller adjustments each time.

CENTERING

To center the display on the screen, rotate the two tabs that are located on the deflection yoke until the display is centered. Each tab moves the display at an angle as compared to vertical or horizontal. By moving one, then the other, and both in conjunction, the display can be centered. After the display is centered, the focus, width, and height may need adjustment.

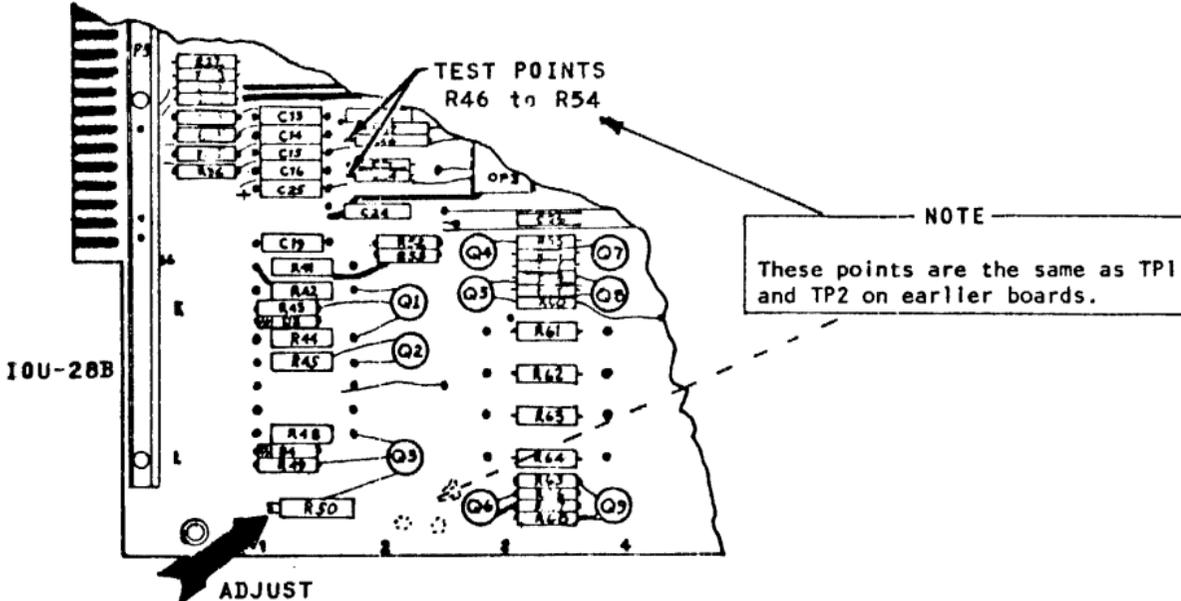
NULL ADJUSTMENT (10U-28B)

This adjustment is made at the factory and normally will not require attention. However, if a terminal-to-10U (one way) communication problem is encountered, the null should be checked. Measure with the most sensitive scale of an oscilloscope or the best VOM that is available. Do not make any adjustment if there is no deflection when the test points are contacted. The measurement and adjustment (if necessary) should be made after the 10U-28 has stabilized to the normal system operating temperature for the system in which it will operate. Proceed as follows to measure and/or adjust.

- Set the measuring device to the lowest (most sensitive) dc scale.
- Touch the positive and return test leads to each other, and carefully note the zero indication. If an oscilloscope is used, use both channels. Set to A + B, and move the display to center screen.
- Attach or touch the leads to the points shown in the illustration below. Polarity of the leads is not important. There should be no deflection in either direction when these points are measured with the 10U-28 under powered up conditions.

10U 28
CRT

IOU 28 CRT



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Revised 3/77

- Adjust R50 if necessary to make the test points exactly zero in reference to each other. The adjustment will cause a voltage swing to positive or negative; null to zero as nearly as possible.

FOCUS

Before adjusting the focus control, adjust the BRIGHTness control at the operator level that it will normally be set.

- Adjust the focus control (R107) for the best character definition over the entire screen. Sometimes a portion of the screen focuses at a different adjustment than the rest. In that case, the adjustment is a compromise for the best overall effect.

If the monitor tube has a second set of tabs like those that are used for centering, the overall focus can be adjusted to a better degree. These tabs will be located toward the connector end of the tube.

- Rotate one tab, then the other, then both in conjunction, while watching the screen for the focus across the entire screen.

WIDTH

The width coil can only be adjusted by using a .100 inch hex tool that is made of plastic. This size tool is a common standard for TV adjustments and can be purchased at most electronic parts stores. Never attempt this adjustment using a screwdriver; the powered iron slug will break, making it necessary to replace the entire assembly. Metal, such as an Allen wrench, affects the electrical field, making it impossible to properly adjust the width.

- Using a .100 inch plastic hex tool, adjust the width of the display until it is within a small margin of both edges. The adjustment is made by rotating the threaded slug inside the coil, making it move in or out of the coil area.
- If one edge of the display is closer than the other, re-center the display.

Bits				Column	000	000	001	010	011	100	101	110	111		
b ₇	b ₆	b ₅	b ₄	b ₃	b ₂	b ₁	Row	0	1	2	3	4	5	6	7
							0	0 (ESCAPE)							
			0	0	0	0	0	NULL	ρ	BLANK	0	@	P	,	p
			0	0	0	1	1	SET CURSOR	σ	!	1	A	Q	a	q
			0	0	1	0	2	SEND TEXT	γ	"	2	B	R	b	r
			0	0	1	1	3	ETX	υ	#	3	C	S	c	s
			0	1	0	0	4	ESCAPE	φ	\$	4	D	T	d	t
			0	1	0	1	5	CLEAR SCREEN	χ	%	5	E	U	e	u
			0	1	1	0	6	CLEAR F'G'ND SOUND ALARM	ψ	&	6	F	V	f	v
			0	1	1	1	7	B'KG'ND FOLLOWS	ω	'	7	G	W	g	w
			1	0	0	0	8	RESTORE CURSOR	Ω	|	8	H	X	h	x
			1	0	0	1	9	F'G'ND FOLLOWS	√	)	9	I	Y	i	y
			1	0	1	0	10	ROLL UP	→	*	1	J	Z	j	z
			1	0	1	1	11	ROLL DOWN	←	+	;	K	E	k)
			1	1	0	0	12	SUPPRESSED BACKGROUND FOLLOWS	†	.	<	L		l	l
			1	1	0	1	13	LINE FEED	‡	-	=	M	J	m)
			1	1	1	0	14	SEND MEMORY KANA FOLLOWS	Σ	.	>	N	⌈	n	~
			1	1	1	1	15	PRINT SCREEN	≈	/	?	O	-	o	.

VIDEO TERMINAL

IOU 28
CRT

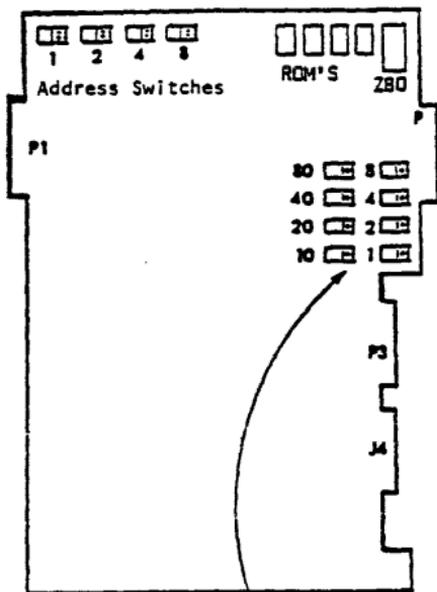
VT3

VT3 Hardware Installation

1. Install IOU39Q's (for VT3) per customer installation specs.
2. Set IOU39Q switches per page 4-25.
3. Install cables, line drivers, hub units, terminals and terminators per pages 4-26 thru 4-30.
4. Set switches on VT3 Logic boards per page 4-31.
5. Check VT3 power supply per page 4-33.
6. Check/perform VT3 monitor adjustments per pages 4-33 thru 4-37
7. Perform VT3 Manual test per page 4-38.
8. Run CRT3 and ACRT3 ATP's

Remember that a VT3 is a Type 4 terminal when running the CFIG program.

IOU - 39Q SWITCH SETTINGS FOR VT3



CONFIGURATION SWITCHES

ON \$80 - Set to a one in all IOU39Q - VT3 configurations

\$40
 \$20 - Terminal response Time-out delay.

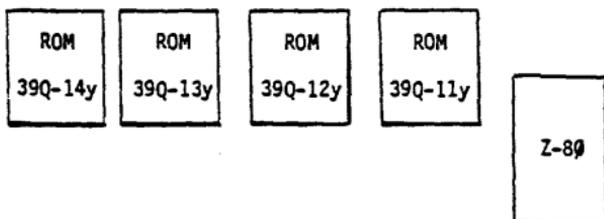
*Time-out for non-modem installation

\$40	\$20	TIMEOUT	TYPICAL BAUD RATE
* 0	0	15 msec	19,200 - 9,600
0	1	50 msec	
1	0	150 msec	4,800 - 2,400 1,200 - 600
1	1	500 msec	300

\$10
 \$08
 \$04
 \$02
 \$01 - Switches should be set to the highest terminal address connected in the network. The system terminal addresses should be sequential (beginning with 0).

VT3

IOU-39Q Switch Settings for VT3 continued



y = Current Rev Level

I/O Cable Part Numbers

● On 9xx/14xx Systems:

IOU to Hub Unit, Line Driver, VT3, Modem, IOU 40, RDI
Printer, or VT3 to VT3

RS232/V24 cable:

6 ft.	42055-1
12 ft.	42055-2
25 ft.	42055-3
50 ft.	42055-4

● On 2xx/3xx Systems:

IOU to Hub Unit, Line Driver, Modem or IOU 40

EIA/4F cable

12 ft.	43207-1
25 ft.	43207-2
50 ft.	43207-3

IOU to VT3, RDI, Printer

EIA/4m cable

12 ft.	43102-1
25 ft.	43102-2
50 ft.	43102-3

VT3

I/O Cable Part Numbers Continued

VT3 to VT3

RS232/V24

6 ft.	42055-1
12 ft.	42055-2
25 ft.	42055-3
50 ft.	42055-4

Hub Unit to Line Driver cable

100 ft.	42851-001
500 ft.	42851-002
1000 ft.	42851-003
5000 ft.	42851-004
10000 ft.	42851-005

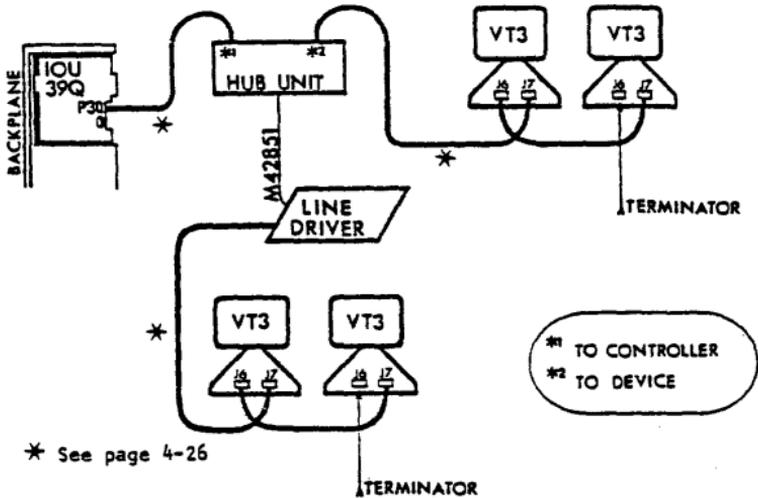
VT3 CONFIGURATION GUIDE

VT3's attached to a single IOU-39Q may be arranged in the configurations described in the following section. A network involving one IOU-39Q may contain a maximum of 31 VT3's. All Baud Rates should be identical within the network as set by jumper switches J1 through J7. (See diagram on following page.)

VT3

VT3 CONFIGURATION GUIDE

HUB UNIT NETWORK

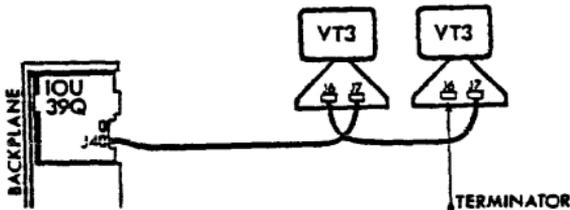


- In conjunction with Line Drivers, the Hub Unit extends the range of direct strings (1 mile at 19,200 bps; 2 miles at 9600 bps).
- Allows more than one string of VT3's to be connected.
- Connection between Hub Unit and Line Driver should be 4-wire cable (M42851).
- A maximum of 7 Line Drivers may be attached to the Hub Unit.
- Additionally, a local string, without a Line Driver, may be attached.
- Maximum communication speed: 19,200 bps.
- IOU-39Q timeout at 19,200 bps: 15 milliseconds.
- Terminator plugs must be attached to female connector of the last VT3 in all strings.

VT3

VT3 CONFIGURATION GUIDE CONTINUED

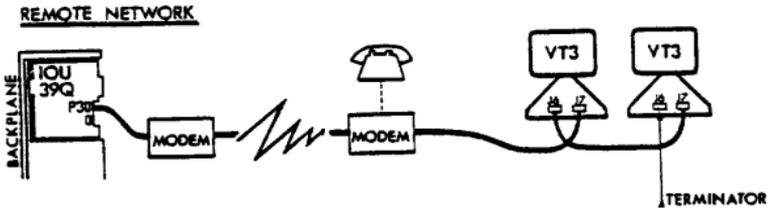
DIRECT STRING NETWORK



- A string of 1 to 31 VT3's connected by 232/V24 cables.
- Total length of string no more than 250 feet.
- No more than 50 feet between individual VT3's.
- Communication speed: 19,200 bits per second.
- IOU-39Q timeout: 15 milliseconds.
- Terminator plug (M42540-001) must be attached to female connector of the last VT3 in the string.

VT3

VT3 CONFIGURATION GUIDE CONTINUED

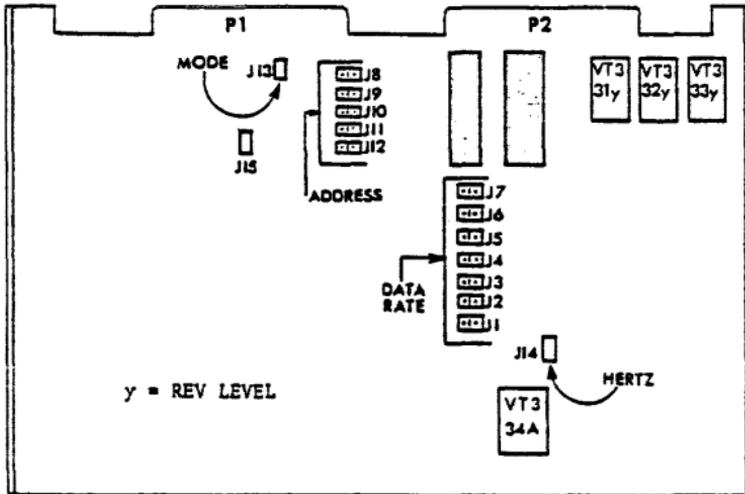


- For longer distances than 1 mile (or 2 miles at 9600 bps), a Remote Network is necessary.
- Asynchronous modems (or Sync. modems with Async. to Sync. Converter) link the IOU39Q and the remote site.
- A string of VT3's may be attached to modem.
- Communication speed is dependent on modem type.
- IOU39Q timeout is dependent on modem speed and line conditions. (See page 4-25).
- Terminator plugs must be installed in the last VT3 in each string.

Note: When communicating over "Leased Line" Modems there may be more than one remote (slave) modem.

VT3

JUMPER SETTINGS FOR VT3 LOGIC BOARD



Jumper J1 through J7 determine Baud rate. Install only one jumper.

J1	19.2K Baud*
J2	9600 Baud
J2	4800 Baud
J4	2400 Baud
J5	1200 Baud
J6	600 Baud
J7	300 Baud

* Denotes typical jumper placement for USA, non-modem installations.

The VT3 device address jumpers J8 through J12 determine the VT3 address. Allowable addresses are \$00 to \$1E. NEVER address a VT3 to \$1F (all switches installed).

J8	\$01
J9	\$02
J10	\$04
J11	\$08
J12	\$10

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VT3

Jumper Settings for VT3 Logic Board Continued

The remaining jumpers J13 through J15 set mode control.

(* Denotes typical jumper placement for USA, non-modem installations).

J13	installed	=	Default is 64 char/line*
	removed	=	Default is 80 char/line
J14	installed	=	60 Hertz*
	removed	=	50 Hertz
J15	removed	=	Normal Operating Position
	installed	=	Once installed shift/F2 must be depressed to initiate <u>TEST</u> mode.

- When in TEST mode the following changes in operation occur:

- When polled with its address the terminal will display a slash (/) between F2 and F3 on the control line.
- When the "clear" key is depressed a lower case alpha character will be displayed to the right of F3 on the control line. This alpha character corresponds to the terminal's address in the following manner:

<u>addr.-char.</u>	<u>addr.-char.</u>	<u>addr.-char.</u>
Ø - a	B - l	16 - w
1 - b	C - m	17 - x
2 - c	D - n	18 - y
3 - d	E - o	19 - z
4 - e	F - p	1A - {
5 - f	Ø - q	1B - |
6 - g	11 - r	1C - -
7 - h	12 - s	1D - }
8 - i	13 - t	1E - ■
9 - j	14 - u	
A - k	15 - v	

VT3

Monitor Adjustments

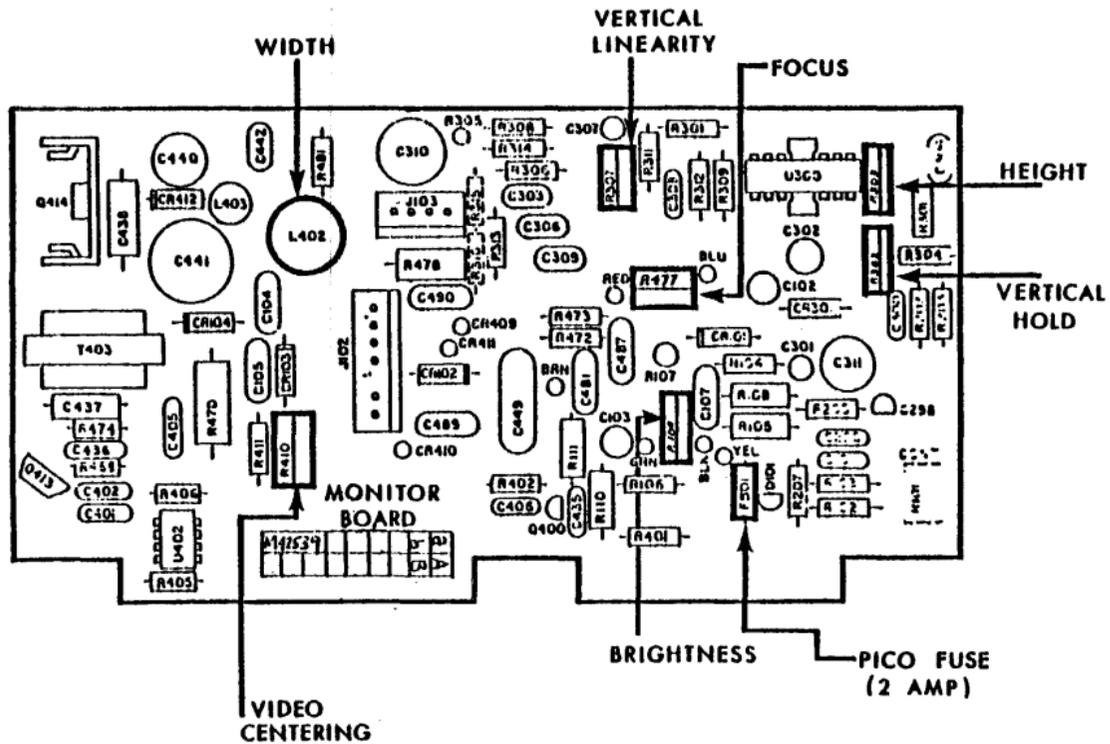
● Component Access

- 1) Twist two zues fasteners on back of cover $\frac{1}{2}$ turn. Cover should now slide back and off.
- 2) There are four screws securing the logic card to the VT3 frame. Remove the two screws nearest the front and loosen the two screws nearest the rear of the unit. Tilt logic card to upright (or personally preferred position) and tighten two rear screws to hold card in place.

● Power Supply

- 1) Check for +5, +15, and -12 supplies at pins 3, 5, & 6 respectively on P1 of the logic card. (Refer to next page).
- 2) There are no adjustments to the PS9. If any of the supply voltages drift more than 5% at their respective test points replace the entire Pan Assembly Pin, 42198-001.

R11 - 5V - 4.75 to 5.25 3A
R6 - +15V - 14.85 to 15.15 1.5A
Fixed -12V - 10.8 to 13.2 .05A



VT3

P1 CONTROL LOGIC BOARD

PIN #1	GND	PIN #2	GND
3	+5V	4	+5V
5	+15V	6	-12V
7	V+(for line driver)	8	V- (for line driver)
9	XMITD (TD)	10	REOTOS (RTS)
11	CLRTOS (CTS)	12	RCVDD (RD)
13	RDY (DTR)	14	
15		16	
**	17 CLOCK+	**	18 ALARM-
**	19 DKEY+	**	20 K.B.STROBE+
	21	**	22 GND
*	23 VIDEO		24 GND
*	25 DRVC-	*	26 GND
*	27 DRHC+	*	28 GND
	29		30
	31		32
	33 +5V		34 +5V
	35 GND		36 GND

** To Keyboard * To Monitor

Video Monitor Board

● Vertical Hold

- 1) Vertical Hold keeps screen from rolling. Adjust as follows:
Rotate R 302 (V. Hold) toward rear of unit. Display should be rolling. Slowly rotate R 302 in opposite direction until display stabilizes and then continue to rotate R 302 approximately 1/8 turn further.

● Vertical Linearity & Height

The height adjustment makes the space at the top and the bottom of the screen equal. The vertical linearity adjustment makes the letters the same height on all lines.

- 1) Fill the screen with upper case letters. Hs, Ms, or Ws are best because they fill the character space, making it easier to see linearity problems. Also, turn on Flags 2 & 3.

VT3

Vertical Linearity & Height continued

- 2) Adjust the height control R(303) until the display fills the screen.
- 3) Adjust the linearity control R(301) until the letters are the same height on all the lines. The total display height will increase or decrease as the linearity is adjusted; ignore this affect temporarily.
- 4) Readjust the height until the display again fits the vertical space on the screen.
- 5) It may be necessary to alternate between linearity and height, making smaller and smaller adjustments each time.

● Horizontal Linearity

Only make this adjustment when necessary. The horizontal linearity adjustment makes the characters on the left and right side of equal height and removes any curvature of the characters.

- 1) Slightly loosen the yoke clamp screw (on the neck of the tube). Loosen only as much as necessary to allow movement of the yoke, yet retain a firm "drag".
- 2) Move the sleeve under the yoke forward or backward. The sleeve should not have to be moved very far in or out.
- 3) Make sure the letters are straight across and are not curved at the edges.

● Adjust Squareness

If the top and bottom lines of the display are not level with the facemask, adjust as follows:

- 1) Slightly loosen the yoke clamp screw (on the neck of the tube). Loosen only as much as necessary to allow movement of the yoke, yet retain a firm "drag".
- 2) Rotate the entire yoke assembly until the top and bottom display are level.
- 3) Carefully re-tighten the clamp screw until the yoke screw is secure. Do not over tighten, as the tube can be broken.

VT3

Adjust Squareness continued

- 4) It may be necessary to adjust centering when squareness has been corrected.

● Horizontal Width

The width coil can be adjusted by using a .100 hex tool that is made of plastic. Never attempt to do this adjustment using a screwdriver; the metal affects the electrical field making it impossible to properly adjust the width.

- 1) Using a .100 hex tool, adjust the width of the display until it is within a small margin of both edges. The adjustment is made by rotating the threaded slug inside the coil L(402), making it move in or out of the coil area.

● Centering

- 1) Adjust R(410) to the center of its adjustment rotation.
- 2) To center the display on the screen, rotate the two tabs that are located on the deflection yoke until the display is centered. Each tab moves the display at an angle compared to vertical or horizontal. By moving one, then the other, and both in conjunction, the display can be centered, the focus, width and height may need adjustment.

● Brightness

- 1) Adjust R(1) on back of pan assembly for maximum brightness. Then adjust R(109) on monitor board until raster disappears. Next adjust R(24) video gain, on the main logic card for optimum clarity. Then readjust R(1) on pan assembly for desired brightness.

● Focus

- 1) Adjust R(407) for optimum focus.

VT3

VT3 MANUAL TEST

1. Turn the VT3 on. After approximately 30 seconds, the cursor will appear in the upper left corner as a space blinking foreground/background.
2. Press A on the keyboard. The letter A should be displayed in the upper-left corner and the cursor is advanced one position left.
3. Press RETURN on the keyboard. The cursor should move to one line below the A.
4. Press F2 on the keyboard. F2 is displayed in background on the bottom screen line (control line). Press F2 again and it should disappear. Repeat with F3.
5. Press TAB. The cursor should disappear. Press A and the VT3 will beep. Press SHIFT/F2 and the VT3 will beep, clear the screen, and the cursor will blink in the upper-left corner.
6. Verify that the following keys repeat after a short delay:---

SPACE

BACKSPACE

SHIFT/BACKSPACE

INS CHAR

SHIFT/INS CHAR

7. The keyboard repeat function is activated by simultaneously pressing SHIFT and the '.' in the numeric cluster. Verify that the next key entered repeats. (It cannot be a control key.)

VT3

VT3 Manual Test continued

8. Verify that the LTRS key toggles the upper/lower case for alphabetic characters.
9. Press each non-control key on the keyboard (with and without the SHIFT) and verify that the correct character is displayed on the screen. Refer to the Serial Keyboard Specifications for the keyboard being tested, e.g., U.S. Domestic and Kana (A30761). On the Kana VT3, verify each key in both Alpha and Kana modes.
10. Set the jumper so that the VT3 is in 64 character default mode. Press SHIFT/F2 and enter some characters to verify the mode. Set the jumper for 80 character mode, press SHIFT/F2, and verify the 80 character mode. Be sure to return the VT3 to 64 character default afterwards.

ATP Checkout

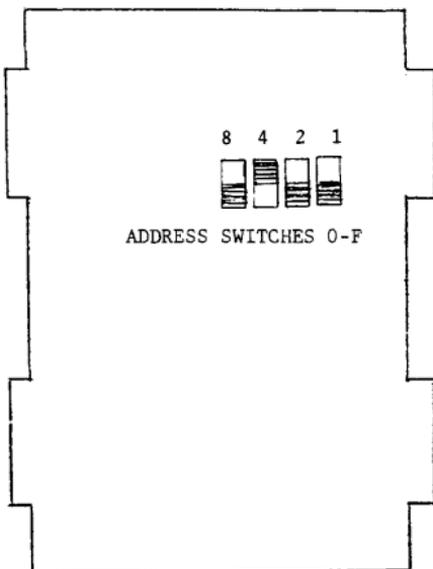
- The VT3 may be tested by the following two ATP's.
 - CRT3 (use operating procedure for CRT 2 ATP)
 - ACRT3 (use operating procedure for ACRT)

Operating System Tests

- Many BEST packs contain *VT3 providing the ability to test the VT3 in the BEST environment.

IOU 6 DATA PROD. CARD RDR.

Qantel Model 5300



MAX. PWR. REQUIREMENTS

-12v = .30A

+12v = .16A

+ 5v = 2.54A

+26v = .59A

CARD RDR. PWR.

115 vac 60 Hz

5.0A for .1 sec.

2.4A normal

WRITE CONTROL INSTRUCTIONS

1XY9D X = DEVICE ADDRESS YY = CONTROL BYTE

CONTROL BYTE	FUNCTION
--------------	----------

N/A

STATUS IN INSTRUCTIONS

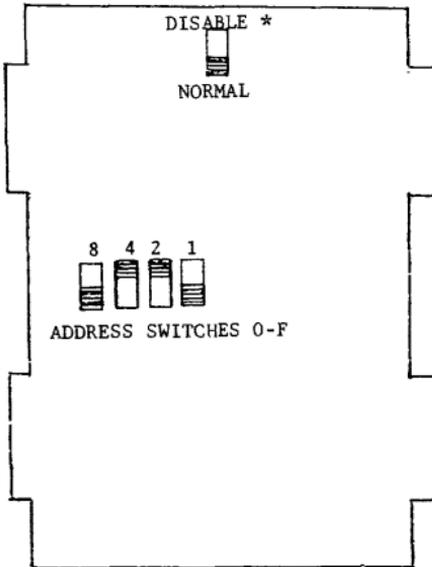
4XY9D X = DEVICE ADDRESS YY = STATUS BYTE

STATUS BYTE	MEANING
01	BUSY READING
02	BUSY OFF LINE
04	END
08	SERVICE REQUEST
10	READ ERROR
20	FEED ERROR
40	HOPPER EMPTY / STACKER FULL / HOLD
80	DEVICE INOP.

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IOU 26 PDI CARD RDR.

Qantel Model 5301



MAX. PWR. REQUIREMENTS

-12v = .16A
+12v = .12A
+ 5v = .79A

CARD RDR. PWR.

115 vac 60 Hz
3.0A for .1 sec.
1.55A normal

* DISABLES ERROR STATUS FOR NON-HOLLERITH CHARACTERS.

WRITE CONTROL INSTRUCTIONS

1XYY9D X = DEVICE ADDRESS YY = CONTROL BYTE

CONTROL BYTE	FUNCTION
-----------------	----------

02	SET READ BINARY
04	RESET ALLOW TERMINATION INTERRUPT
0C	SET ALLOW TERMINATION INTERRUPT

STATUS IN INSTRUCTIONS

4XYY9D X = DEVICE ADDRESS YY = STATUS BYTE

STATUS BYTE	MEANING
----------------	---------

01	READ BUSY
02	N/A
04	END
08	SERVICE REQUEST
10	INTERRUPT
20	READ CHECK
40	DEVICE HOLD
80	DEVICE INOP.

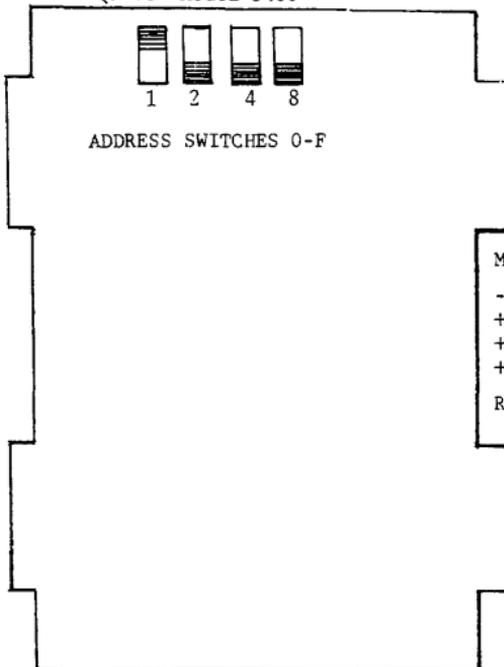
Bits					Column	0	1	2	3	4	5	6	7	
b ₇	b ₆	b ₅	b ₄	b ₃	b ₂	b ₁	0	0 ₁	0 ₁ 0	0 ₁ 1	1 ₀ 0	1 ₀ 1	1 ₁ 0	1 ₁ 1
b ₄	b ₃	b ₂	b ₁	Row	0	1	2	3	4	5	6	7		
0	0	0	0	0	NUL	DLE	SP	0	@	P	'	p		
					<small>12-0-1-8-9</small>	<small>12-11-8-9</small>	<small>BLANK</small>	0	<small>4-8</small>	<small>11-7</small>	<small>1-8</small>	<small>12-11-7</small>		
0	0	0	1	1	SOH	DC1	!	1	A	Q	a	q		
					<small>12-1-9</small>	<small>11-1-9</small>	<small>12-7-8</small>	1	<small>12-1</small>	<small>11-8</small>	<small>12-0-1</small>	<small>12-11-8</small>		
0	0	1	0	2	STX	DC2	"	2	B	R	b	r		
					<small>12-2-9</small>	<small>11-2-9</small>	<small>7-8</small>	2	<small>12-2</small>	<small>11-9</small>	<small>12-0-2</small>	<small>12-11-9</small>		
0	0	1	1	3	ETX	DC3	#	3	C	S	c	s		
					<small>12-3-9</small>	<small>11-3-9</small>	<small>3-8</small>	3	<small>12-3</small>	<small>0-2</small>	<small>12-0-3</small>	<small>11-0-2</small>		
0	1	0	0	4	ESC	DC4	\$	4	D	T	d	t		
					<small>7-9</small>	<small>4-8-9</small>	<small>11-3-8</small>	4	<small>12-4</small>	<small>0-3</small>	<small>12-0-4</small>	<small>11-0-3</small>		
0	1	0	1	5	ENQ	NAK	%	5	E	U	e	u		
					<small>0-5-8-9</small>	<small>5-8-9</small>	<small>0-4-8</small>	5	<small>12-5</small>	<small>0-4</small>	<small>12-0-5</small>	<small>11-0-4</small>		
0	1	1	0	6	ACK	SYN	&	6	F	V	f	v		
					<small>0-6-8-9</small>	<small>2-9</small>	<small>12</small>	6	<small>12-6</small>	<small>0-5</small>	<small>12-0-6</small>	<small>11-0-5</small>		
0	1	1	1	7	BEL	ETB	'	7	G	W	g	w		
					<small>0-7-8-9</small>	<small>0-6-9</small>	<small>5-8</small>	7	<small>12-7</small>	<small>0-6</small>	<small>12-0-7</small>	<small>11-0-6</small>		
1	0	0	0	8	BS	CAN	!	8	H	X	h	x		
					<small>11-6-9</small>	<small>11-8-9</small>	<small>12-5-8</small>	8	<small>12-8</small>	<small>0-7</small>	<small>12-0-8</small>	<small>11-0-7</small>		
1	0	0	1	9	HT	EM	!	9	I	Y	i	y		
					<small>12-5-9</small>	<small>11-1-8-9</small>	<small>11-3-8</small>	9	<small>12-9</small>	<small>0-8</small>	<small>12-0-9</small>	<small>11-0-8</small>		
1	0	1	0	A	LF	SUB	*	10	J	Z	j	z		
					<small>0-5-9</small>	<small>7-8-9</small>	<small>11-4-8</small>	2-8	<small>11-1</small>	<small>0-9</small>	<small>12-11-1</small>	<small>11-0-9</small>		
1	0	1	1	B	VT	ESC	+	11	K	[	k	[
					<small>12-3-8-9</small>	<small>0-7-9</small>	<small>12-6-8</small>	<small>11-6-8</small>	<small>11-2</small>	<small>12-5-8</small>	<small>12-11-2</small>	<small>12-0</small>		
1	1	0	0	C	FF	FS	,	12	<	L	l	l		
					<small>12-4-8-9</small>	<small>11-4-8-9</small>	<small>0-3-8</small>	<small>12-4-8</small>	<small>11-3</small>	<small>0-2-8</small>	<small>12-11-3</small>	<small>12-11</small>		
1	1	0	1	D	CR	GS	-	13	=	M	m	m		
					<small>12-5-8-9</small>	<small>11-5-8-9</small>	<small>11</small>	<small>6-8</small>	<small>11-4</small>	<small>11-2-8</small>	<small>12-11-4</small>	<small>11-0</small>		
1	1	1	0	E	SO	RS	>	14	N	^	n	n		
					<small>12-6-8-9</small>	<small>11-5-8-9</small>	<small>12-3-8</small>	<small>0-6-6</small>	<small>11-5</small>	<small>11-7-8</small>	<small>12-11-5</small>	<small>11-0-1</small>		
1	1	1	1	F	SI	US	/	15	O	_	o	DEL		
					<small>12-7-8-9</small>	<small>11-7-8-9</small>	<small>0-1</small>	<small>0-7-8</small>	<small>11-6</small>	<small>0-5-8</small>	<small>12-11-6</small>	<small>12-7-9</small>		

ASCII/HOLLERITH CODE CHART

IOU 2 ROYTRON

PAPER TAPE READER/PUNCH

Qantel Model 5400



MAX. PWR. REQUIREMENTS

-12v = .20A
+12v = .17A
+ 5v = .63A
+26v = .92

RDR/PUNCH PWR.

115 vac 60 Hz
3.0A for .05 sec.
1.5A normal

WRITE CONTROL INSTRUCTIONS

N/A

STATUS IN INSTRUCTIONS

4XYY9D X = DEVICE ADDRESS YY = STATUS BYTE

STATUS
BYTE

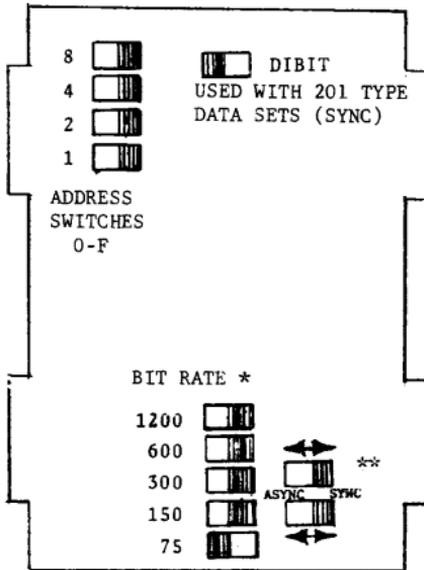
MEANING

01	READ BUSY
02	WRITE BUSY
04	END
08	SERVICE REQUEST
10	N/A
20	READER INOP.
40	PUNCH INOP.
80	INOP.

5/82

IOU 3 COMMUNICATIONS

Qantel Model 6000



MAX. PWR. REQUIREMENTS

-12v = .09A
+12v = .09A
+ 5v = .58A

* SELECT ONLY ONE AT A TIME
** BOTH SWITCHES MUST BE IN SAME DIRECTION

WRITE CONTROL INSTRUCTIONS

1XY9D X = DEVICE ADDRESS YY = CONTROL BYTE

CONTROL BYTE	FUNCTION
01	NB1
02	NB2
04	NB4
08	NB8
10	DPR
20	CRQ
40	CD

STATUS IN INSTRUCTIONS

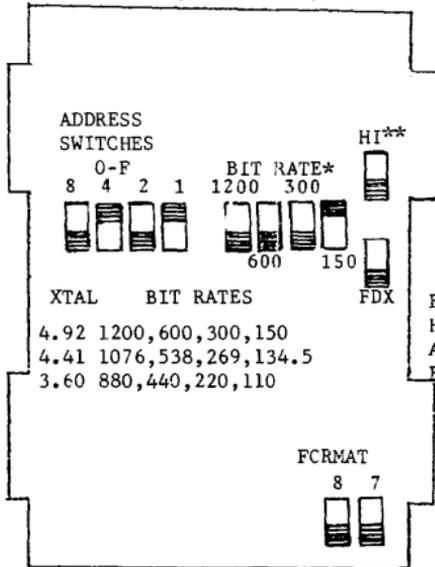
4XY9D X = DEVICE ADDRESS YY = STATUS BYTE

STATUS BYTE	MEANING
01	CFS
02	N/A
04	N/A
08	READ SERVICE REQUEST
10	INTERRUPT
20	CCS
40	N/A
80	END TIME OUT

5/82

IOU 11 BUFFERED COMMUNICATIONS

Qantel Model 6100, 6200



MAX. PWR. REQUIRED

- 12v = .18
- +12v = .13
- + 5v = 1.32

FULL DUPLEX-
HOLDS REQUEST TO SEND
AND CLEAR TO SEND TRUE
FOR 4-WIRE OPERATION.

FORMAT

- 7 & 8 DN= 1 START,
8 DATA, 2 STOP BITS
(TELETYPE)
- 7 DN 8 UP= 1 START,
8 DATA, 1 STOP BIT.
- 7 & 8 UP= 1 START,
7 DATA, 1 STOP BIT
(8TH DATA BIT MUST
BE A 1, SUPPLIED BY
PROGRAM).

* SELECT ONLY ONE AT A TIME.
MUST BE 1200 FOR 11B OR 11C.

** PART OF RATE SELECTION, SET TO HI FOR 402 OPERATION.

WRITE CONTROL INSTRUCTIONS

1XY9D X = DEVICE ADDRESS YY = CONTROL BYTE

CONTROL BYTE	FUNCTION
01	1 = SET SELECTED F.F. 0 = RESET SELECTED F.F.
02	SELECT INHIBIT INTERRUPT F.F.
04	SELECT MODE F.F.
08	RESET INTERRUPT
10	SET DIAL

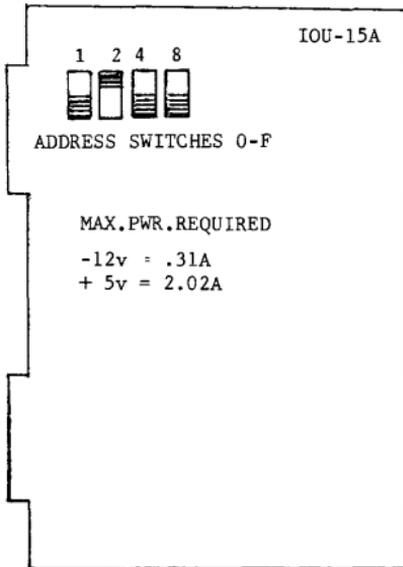
STATUS IN INSTRUCTIONS

4XY9D X = DEVICE ADDRESS YY = STATUS BYTE

STATUS BYTE	MEANING
01	N/A
02	WRITE BUSY
04	END
08	SERVICE REQUEST
10	INTERRUPT
20	FULL
40	EMPTY
80	NO DATA TIME OUT

IOU 15
COMMUNICATIONS
 MICROPROCESSOR

Qantel Model 6201



WRITE CONTROL INSTRUCTIONS

1XYY9D X = DEVICE ADDRESS
 YY = CONTROL BYTE

CONTROL FUNCTION
 BYTE

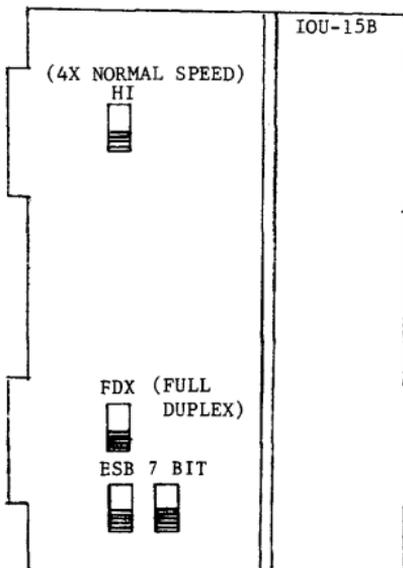
01 SET RUN AND RESET INT
 02 SET SIGNAL F.F.
 04 P MINUS 1

STATUS IN INSTRUCTIONS

4XYY9D X = DEVICE ADDRESS
 YY = STATUS BYTE

STATUS MEANING
 BYTE

00 READ BUSY
 02 WRITE BUSY
 04 END
 08 SERVICE REQUEST
 10 INTERRUPT
 20 SIGNAL F.F.
 40 N/A
 80 N/A



MAX. PWR. REQUIRED

-12v = .07A
 +12v = .06A
 + 5v = .90A

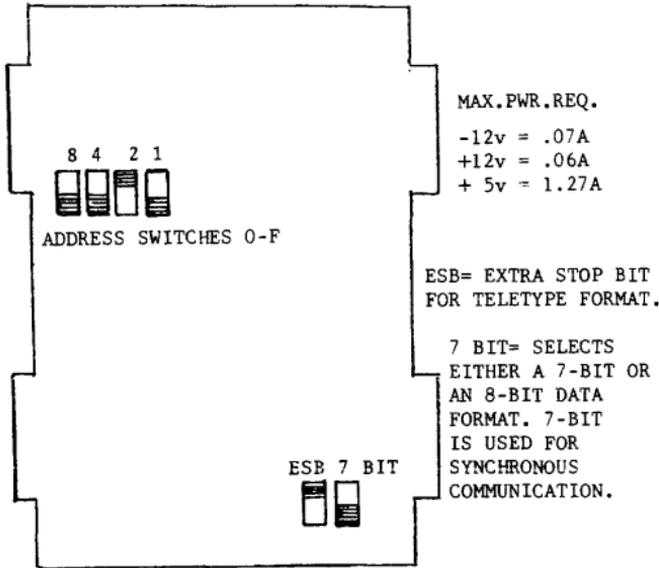
FULL DUPLEX HOLDS
 REQUEST TO SEND &
 CLEAR TO SEND TRUE
 FOR 4-WIRE OPERATION.

7 BIT SELECTS EITHER
 A 7-BIT DATA FORMAT
 OR AN 8-BIT FORMAT.

ESB= EXTRA STOP BIT FOR TELETYPE FORMAT.

IOU 22 PARALLEL COMMUNICATIONS

Qantel Model 6202



WRITE CONTROL INSTRUCTIONS

1XY9D X = DEVICE ADDRESS YY = CONTROL BYTE

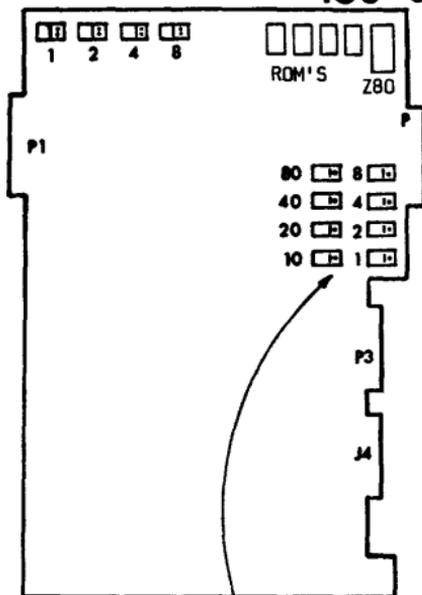
CONTROL BYTE	FUNCTION
00	RESET BYTE MODE
01	SET BYTE MODE
02	RESET SYNC MODE
03	SET SYNC MODE
04	RESET 1/8 SPEED
05	SET 1/8 SPEED
06	RESET 8X SPEED
07	SET 8X SPEED
08	RESET CALL REQUEST
09	SET CALL REQUEST
0A	RESET ALLOW INTERRUPT
0B	SET ALLOW INTERRUPT
0C	RESET INTERRUPT
0D	GIVE NEW SYNC
0E	RESET DATA HI SPEED SYNCHRONUS
0F	SET DATA HI SPEED SYNCHRONUS

STATUS IN INSTRUCTIONS

4XY9D X = DEVICE ADDRESS YY = STATUS BYTE

STATUS BYTE	MEANING
01	N/A
02	N/A
04	TRANSMIT SERVICE REQUEST
08	READ SERVICE REQUEST
10	INTERRUPT
20	EVEN PARITY IN TRANSMIT REGISTER
40	ENEN PARITY IN RECEIVE REGISTER
80	END TIME OUT

IOU-39Q



TYPICAL POWER REQUIREMENTS

-12V = .100A
 +12V = .150A
 +5V = 1.5A

CONFIGURATION SWITCHES

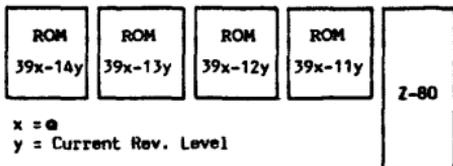
\$80 — MASTER DEFAULT should be set if the IOU-39Q is at address \emptyset in the backplane with terminal device \emptyset (the IPL device) connected.

\$40 — RECEIVE TIMEOUT
 \$20

2^x	2^y	TIMEOUT
\emptyset	\emptyset	15 msec
\emptyset	1	50 msec
1	\emptyset	150 msec
1	1	500 msec

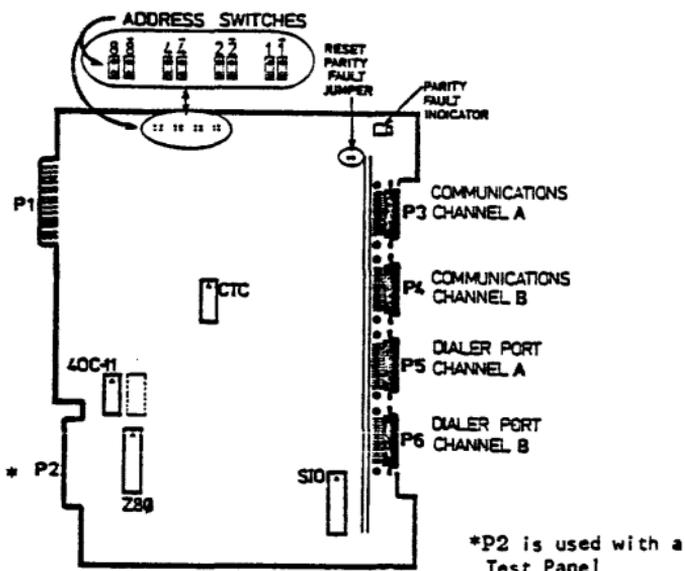
\$10
 \$08
 \$04 — SLAVE TERMINAL ADDRESS
 \$02
 \$01

Used only when the IOU-39Q is used in Slave Mode. Addresses \$ \emptyset 1 through \$1F may be used.



x = \emptyset
 y = Current Rev. Level

IOU 40



STATUS IN Instructions

4dyy9D d = Device Address yy = test bit value

Status Byte:

- 01 Read Busy
- 02 Write Busy
- 04 End
- 08 Service Request
- 10 Interrupt (if enabled)
- 20 Channel A Termination signal
- 40 Channel B Termination signal
- 80 RAM Parity Error

READ Status 2

xdyy86 d = Device Address yy = test bit value

Hardwired to SA3

WRITE CONTROL Instructions

1dyy9D d = Device Address yy = Control Byte

Control Byte: 1st = High RAM address
 2nd = Low RAM address



PROCESSOR

CENTRAL PROCESSING UNIT

The Central Processing Unit (CPU) coordinates program activities by manipulating (add, subtract, edit, etc.), storing (read/write), and moving data. Each function is accomplished by stepping through micro-instruction routine from a Read Only Memory (ROM).

The CPU always operates from macro, or machine language, instructions. Macro instructions can be entered in hexadecimal form directly from a peripheral, but are usually created by a compiler or assembler (QIC or QBAL).

Each macro instruction contains the initial address for a ROM routine. The ROM address is loaded into a counter that is incremented one count at a time, or reloaded with a new ROM address if the ROM routine requires a branch within the ROM program.

During the course of a macro instruction, the CPU generates and stores certain results. Some of these results are placed into flip-flops, some into hardware registers, and some are placed into the lower addresses of main memory. The hardware registers are assigned alphabetic names (A, B, P, etc.) and the portion of memory that is used for temporary storage is called Reserved memory.

Reserved Memory

Reserved memory is not exclusive, protected, or separate from main memory as the name implies. It is the first (lowest) 32 bytes in memory, designated as addresses 0 to 31. Bytes, as referred to in this text, are a set of eight bits. These 8 bits may translate to an ASCII character, but are always stored in memory as the two 4-bit characters of a hexadecimal notation pair. Specific areas of reserved memory are used for each type of storage. The areas and use are listed below.

AREA	USE
0000-000F	Accumulator positions, a scratch pad area for the results of multiple add instructions, etc. When a single address instruction is used, the implied second operand is the accumulator and its contents.
0010-0011	Stores the current program address while the CPU is servicing an interrupt.
0012	Stores the contents of the condition switches (flip-flops) Carry, Minus, and Non-zero. Also contains the Interrupt Enable bit.
0013-0014	The address in these two bytes will replace the current program address when an interrupt is recognized.

PROCESSOR

Reserved Memory (Continued)

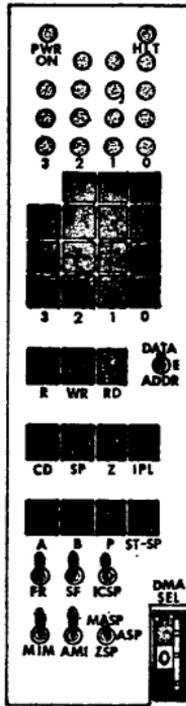
AREA	USE
0015-0016	One count more than the final address at the conclusion of an I/O operation. During an I/O operation, as data is taken from or placed into memory, the address count is incremented. When the last transfer is completed, the address is incremented once more, and the count is stored. The programmer can use this for self-terminating, continuous, non-counting I/O instructions.
0017	Stores the I/O status byte when a Status-In instruction is executed.
0018-0019	Q5 only: Stores the current program address when a Branch instruction is executed. Q6, 6.5, 7, and 7.5: Contains the "Match" address for the following instructions. Search Equal (SEQ) Search Equal L&R (SER, SEL) Search Unequal L&R (SNR, SNL)
001A-001D	Micro program utility area.
001E-001F	Q-29 P.C. before soft IPL

Test Panel

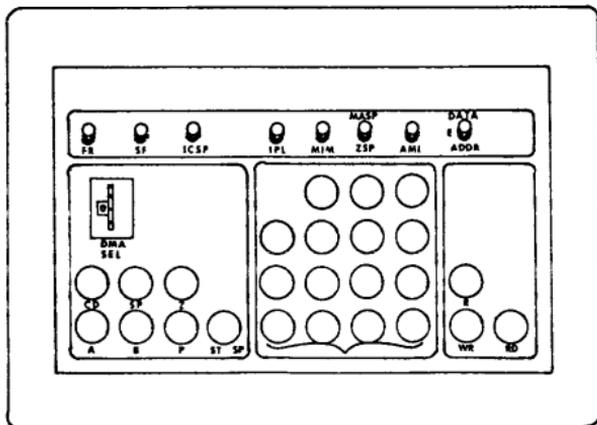
The test panel has the ability to suspend normal timing, and stop processor actions so they can be examined. Test panel displays include the major hardware registers, and the contents of any byte in memory. The test panel is primarily used to examine processor actions as they are being performed. Selectively, the processor can be made to stop at each micro instruction, or at the end of each macro instruction. In either case, the operator must manually step to the next instruction. Using the test panel as a tool, and by knowing what should be each register at different times, the field engineer can isolate difficult hardware or program problems. The test panel operator controls and indicators are shown and described in the illustrations and tables that follow.

Some test panel functions are different when a test panel is modified and placed into a 7.5 (model 1300) processor.

PROCESSOR



TEST PANEL
CONFIGURATIONS



PROCESSOR

Test Panel (Continued)

NAME	FUNCTION
FR Function Repeat	A two-position switch, when in the FR position, repeats the current micro instruction continuously. When the SF switch (2) is in the SF position, the micro instruction will only be repeated when the ST-SP switch (13) is pressed.
SF Single Function	A two position switch, when in the SF (single function) position, enables the ST-SP switch (13) to perform one micro instruction at a time. If the SF switch is turned ON when the processor is running, processing halts after the current micro instruction is executed.
ICSP Instruction Complete Stop	A two position switch, when in the ICSP (Instruction Complete Stop) position, causes the processor to halt after executing and completing the current macro instruction. The ST-SP switch (13) is used to fetch and execute the next instruction.
IPL Initiate Program Load	Momentary-contact switch, provides a general reset to the processor. The IPL routine generates an instruction to read hex (without count) from device zero to memory location zero.
MIM Micro Instruction Mode	A two-position switch, when in the MIM position, places the processor control into the micro instruction mode. Micro instructions are then taken from main memory, rather than from a ROM.
MASP/ZSP Memory Addr. Stop/Z Reg. Stop	A three position switch. When in the MASP position, the processor will execute instructions at full machine speed, until it is required to read/write to whatever address is selected on the switch/lamps (12). The read or write is executed, but the processor is halted at that micro instruction. The read/write address may come from the A, B, or P register. In the ZSP position, the processor will proceed at full machine speed until a micro instruction is fetched by the Z register from a ROM address that is the same as that selected by the switch lamps (12). However, the A, B, and P registers will also halt processing if their contents compare with the switch lamp settings. This is to allow the processor to stop at a particular micro instruction when it is in the MIM mode. To avoid confusion, keep all r/w program at memory addresses above 1000. The center switch position allows the processor to proceed normally, unless the single function or instruction stop switches are in use.

PROCESSOR

Test Panel (Continued)

AMI Address Modification Inhibit	A two position switch. When in the AMI position, prevents incrementing the selected address when either the WR (11) or RD (10) switch is depressed. The AMI switch also controls a periodic READ function to dynamically display the contents of a location. Do NOT operate either the RD (10) or WR (11) switch when the processor is running, and this switch is in the AMI position.
DATA/E/ADDR	A three position switch to control the display or entry of data and addresses. Is used in conjunction with the RD (10), WR (11), SWITCH/LAMPS (12), Z, P, and SP controls.
R Reset	Push-button switch. When pressed, resets any data or addresses that are selected on the switch/lamps. When the switch/lamps are reset, the lamps are not lit (zero state).
RD	A momentary-contact switch. When depressed, reads from a previously selected address in memory. Displays the data in the two least significant columns of the switch/lamps (only if the DATA/E/ADDR switch is in the DATA position). The selected memory address is then automatically incremented by one count, unless the AMI switch is ON.
WR	A momentary-contact switch. Writes whatever data is selected on the switch/lamps, to a previously selected position in memory. The selected memory address is then automatically incremented by one count, unless the AMI switch is ON.
SWITCH/LAMPS	<p>Four columns of lighted push-button switches. Each column represents four binary bits, with the lower-right bit being the least significant. The lamp is lit when the bit position is in the "1" state. The switch/lamps are used as follows:</p> <ol style="list-style-type: none">To address any location in main memory by placing the DATA/E/ADDR switch in the ADDR position, and select the desired address.To read the contents of the selected position in memory by setting the DATA/E/ADDR switch to the DATA position. Data is displayed in the two least significant (right hand) columns.To alter (place data into) memory at the selected location by placing the DATA/E/ADDR switch in the DATA position, selecting the character code in the two least significant columns of the switch/lamps, and depressing the WR switch.To display the contents of the E register (the micro instruction that is being performed) by placing the DATA/E/ADDR switch in the E position.

PROCESSOR

Test Panel (Continued)

- ST-SP** A momentary-contact switch that will halt the processor at the end of the current macro instruction. It will restart processing if in a halt condition, by initiating the next instruction. If the SF (2) switch is ON, ST-SP must be depressed for each micro instruction. If SF is OFF, and ICSP is ON, ST-SP is depressed for each macro instruction.
- Z** A momentary-contact switch that will display the contents of the Z register (the micro instruction address) on the switch/lamps if the DATA/E/ADDR switch is in the ADDR position.
- P** A momentary-contact switch that will display the contents of the P register (program address) on the switch/lamps if the DATA/E/ADDR switch is in the ADDR position.
- SP** A momentary-contact switch that will enter the address that is displayed (selected) on the switch/lamps if the DATA/E/ADDR switch is in the ADDR position.
- B** A momentary-contact switch that displays the 15 low-order bits of the B register on the switch/lamps if the DATA/E/ADDR switch is in the ADDR position.
- A** A momentary-contact switch that displays the 15 low-order bits of the A register on the switch/lamps if the DATA/E/ADDR switch is in the ADDR position.
- CD** A momentary-contact switch that displays the contents of the C and D registers on the switch/lamps if the DATA/E/ADDR switch is in the DATA position.
- DMA** A 10-position thumbwheel switch. Selects one of nine direct memory access devices. When the wheel is moved from zero, all processing stops in the devices and the processor. The ST-SP switch will allow all devices and the processor to perform one micro instruction at a time. The A, B, Z, and P registers of the selected direct memory access device can be displayed on the switch/lamps instead of the processor registers.
- SEL**
- Direct**
- Memory**
- Access**
- Select**

PROCESSOR

MEMORY ORGANIZATION AND INSTALLATION

AR/BR

- The first 16k of memory must reside within one (either) of the MEM slots in the mainframe. It will be either a MEM 3 with the HI/LO switch set to LO, or the lower two MEM 5B cards on a MEM 5AP.
- If a fully configured MEM 5AP board (containing 4 MEM 5Bs) is used, it must reside in one (either) of the MEM slots, and the other MEM slot must remain empty. Additional memory can be added, but only in slots IOC1 or IOC2 (max. 16k each).
- Only one fully configured MEM 5AP is allowed in 7.0 or lower processors (model 1200 or lower).
- LO memory in either of the IOC slots, or greater than 32k total in the MEM slots causes random processor errors. LO memory can be a MEM 3 with the switch set to LO, or a MEM 5AP with one or both MEM 5B boards in the lower position.
- The lowest 16k of memory is designated as **bank A**, and is available regardless which upper memory **bank** is selected. After a reset (RIO) or IPL, the second 16k of memory, **bank C**, is automatically selected along with **bank A**. Memory beyond 32k is selected by **bank** switching instructions as follows:

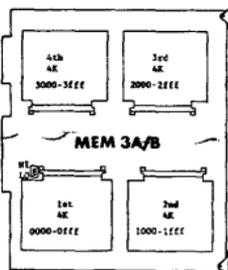
0000AC = Access A and C (used to return to C)
0000AD = Access A and D (third 16k of memory)
0000AE = Access A and E (fourth 16k of memory)

NOTE: **Bank** switching instructions should only be issued by a program running in the A **bank** (first 16k) of memory.

MEM 3

Mem 3 boards accommodate up to four 4k modules (MEM 3B) of 4k each. Addresses within the card are shown below. Except for the first 16k of memory (addresses 0000-3FFF) in the MEM slot, the switch must be in the HI position.

HI mem
LO mem



NOTE: While MEM 3 boards will operate in the 900 and 950 processors (6.5 backplane) the BEST operating system requirements make this combination impractical.

PROCESSOR

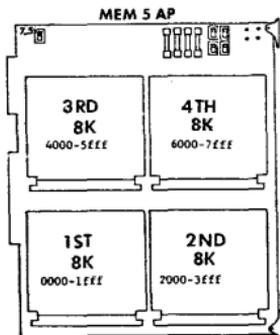
MEM 5AP

MEM 5AP boards will accommodate up to four modules (MEM 5B) of 8k each. It also has the capability of parity checking and storage. The MEM 5AP addresses within the board are shown in the illustration below.

NOTE:

The parity reporting portion of the MEM 5AP appears to the processor as an I/O device. If the MEM 5AP address switches are set to the same address as an IOU, the IOU will not function.

Set 7/7.5 switch DOWN (7 position) for Q6, Q6.5, and Q7.
Set in UP position (7.5) for all others.



Parity checking and reporting are distinctly separate from memory operation, and the memory is not affected or inhibited in any way by the parity circuits. However, IOUs can be affected if the MEM 5AP address switches are improperly set. Parity is always generated, and is stored as a ninth bit when data is put into memory. Odd parity is normal, but even parity can be set by microinstruction for special diagnostics. Parity errors are not reported or stored (fuses blown) unless enabled by write control instructions. However, many programs and diagnostics "arm" the memory automatically, using these write control instructions.

If parity checking is used, the memory must be written into in every location (initialized) to assure that every position has proper parity. The disc loader, LOADQ, automatically initializes the memory and enables both parity checking and error storage.

Parity error storage physically blows a fuse, which in turn causes an LED indicator to light. There is one fuse/indicator circuit for each 8k module.

The device control instructions are as follows: **1dyy9D**

- 20 Resets 'Allow Parity Check' (disables checking)
- 21 Enables Parity Check
- 40 Inhibit Interrupt
- 41 Allow Interrupt. When parity error is found when checking is enabled, Interrupt is raised to the processor.
- 61 Enables parity error storage.

Address switches for the parity reporting portion of the MEM 5AP board are arranged as shown below.



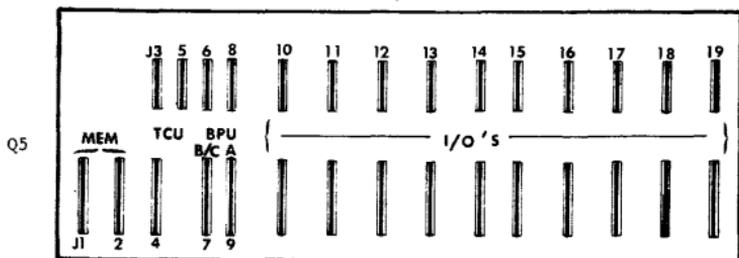
Switches are shown set to address 5.

Status - In Instructions 4dtt9D (d = device number)	
tt	
\$01	0
\$02	0
\$04	1
\$08	Even Parity
\$10	Parity Error
\$20	Which Chip Group on 5B
\$40	See Below
\$80	See Below

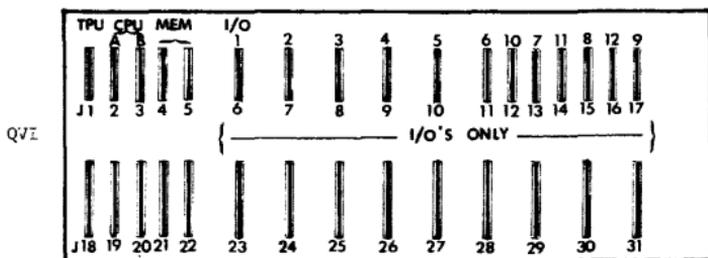
\$80	\$40	Which Mem 5B
0	0	First
0	1	Second
1	0	Third
1	1	Fourth

NOTE: Normal Status is \$E4.

PROCESSOR



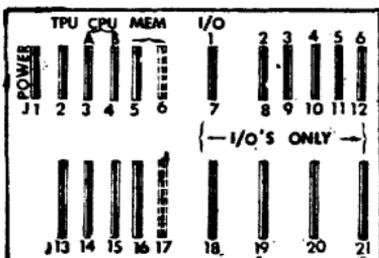
Q5 BACKPLANE



Q6 BACKPLANE

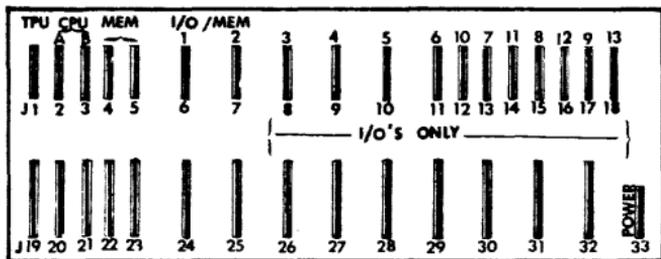
TPU-Test panel unit

AR/B → 800
 900
 AR/BR → 950
 960
 AS/BS



Q 6.5 BACKPLANE

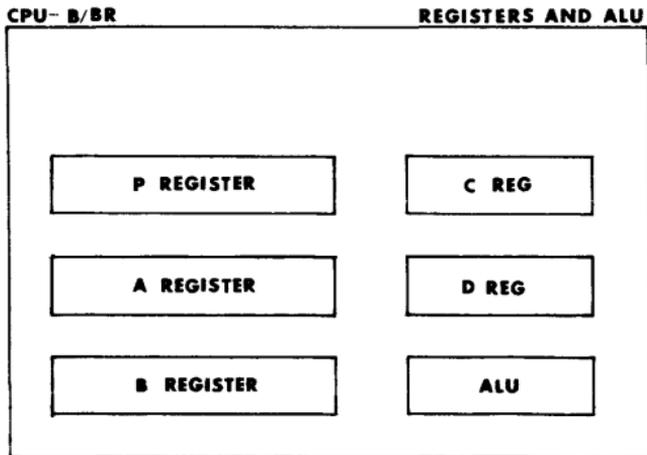
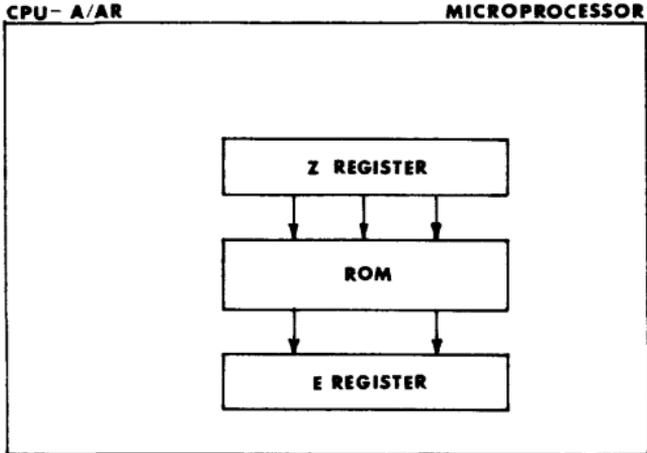
1100
 1200
 1300
 1400



Q7, Q7.5 BACKPLANE

PROCESSOR

CPU BOARD LAYOUT



HARDWARE COMPATIBILITY GUIDE

Rom Level 9 to run Best on system

8-11

Revised 3/10/76

PROCESSOR REVISION LEVEL	2311 DISK	2314 DISK	3+3/6+6 DISK	QCRT	MEM2	MEM3	MEM5	MAX MEMORY	SYSTEM
Q 5 LEVEL 1 BPU - ROM 1 & 2	NO	NO	NO	NO	YES	NO	NO	8K	V
Q 5 LEVEL 2 BPU - ROM 1,2, & 3	YES	NO	NO	NO	YES	NO	NO	8K	V
Q 6 LEVEL 1 CPU A/B ROM 1,2, & 3	YES	NO	NO	NO	NO	YES	YES	32K	VI
Q 6 LEVEL 2 CPU A/B ROM 1,2,FL3	YES	YES	NO	NO	NO	YES	YES	32K	VI
Q 6 LEVEL 3 CPU AR/B ROM 5,6,7	YES	YES	NO	NO	NO	YES	YES	32K	VI
Q 6.5 LEVEL 1 CPU AR/B ROM 5,6,8,9	NO	YES	YES	YES	NO	YES	YES	32K	800 * 900 *
Q 6.5 LEVEL 2 CPU AR/BR ROM 5,6,8,9	NO	YES	YES	YES	NO	YES	YES	48K	950 *
Q 7 LEVEL 1 CPU AR/BR ROM 5,6,8	NO	YES	YES	YES	NO	YES	YES	64K	1100 1200
Q 7 LEVEL 2 CPU AR/BR ROM 5,6,8,9	NO	YES	YES	YES	NO	YES	YES	64K	1100 1200
Q 7.5 LEVEL 1 CPU AS/BS	NO	YES	YES	YES	NO	NO	YES	128K	1300

PROCESSOR

* Selectric cannot be used on these models. *Needs 26V Power supply*

PROCESSOR

MACRO INSTRUCTION SET

BACKPLANE

5 6 7 7.5	6 6.5 7 7.5	INSTRUCTION	MNEMONIC	OP CODE	VAR 1	VAR 2
		* * * INCREMENT BY 3	IN3	8	E	
		* * * DECREMENT BY 3	DC3	8	F	
*	*	* * * AND	AND	9	0	
*	*	* * * OR	OR	9	1	
*	*	* * * EXCLUSIVE OR	XOR	9	2	
*	*	* * * TEST BIT	TBT	9	3	
*	*	* * * MOVE NUMERIC	MN	9	4	
*	*	* * * MOVE ZONE	MZ	9	5	
*	*	* * * COMPARE DECIMAL	CD	9	6	
*	*	* * * SHIFT BIT LEFT	SBL	9	7	
*	*	* * * SHIFT BIT RIGHT	SBR	9	8	
*	*	* * * EDIT	EDT	9	9	
*	*	* * * UNEDIT	UED	9	A	
*	*	* * * PACK	PAK	9	B	
*	*	* * * UNPACK	UPK	9	C	
*	*	* * * I/O EXECUTE	LOX	9	D	0
*	*	* * * DEVICE CONTROL	CTL	9	D	1
*	*	* * * SET READ	SRD	9	D	2
*	*	* * * STATUS-IN	SIN	9	D	4
*	*	* * * RESET I/O	RIO	9	E	
*	*	* * * RETURN FROM INTERRUPT	RTI	9	F	
*	*	* * * NO OPERATION	NOP	A	0	
*	*	* * * BRANCH ON OVERFLOW	BOV	A	1	
*	*	* * * BRANCH ON MINUS	BMI(BGT)	A	2	
*	*	* * * BRANCH ON NON-ZERO	BNZ(BNE)	A	3	
*	*	* * * BRANCH EQUAL	BEQ(BZ)	A	4	
	*	* * * BRANCH NOT MINUS	BNM(BLE)	A	5	
	*	* * * BRANCH NOT OVERFLOW	BNO	A	6	
*	*	* * * UNCONDITIONAL BRANCH	BRU	A	7	
*	*	* * * HALT AND BRANCH	HLT	A	8	
*	*	* * * BRANCH AND LINK	BLI	A	9	
	*	* * * BRANCH PLUS	BPL	A	A	
*	*	* * * MICRO INSTRUCTION MODE	MIM	A	B	
	*	* * * BANK SELECT C	BSC	A	C	
	*	* * * BANK SELECT D	BSD	A	D	
	*	* * * BANK SELECT E	BSE	A	E	
	*	* * * BRANCH NOT PLUS	BNP	A	F	
*	*	* * * WRITE	WR	B	0	
*	*	* * * WRITE HEX	WHX	B	1	
*	*	* * * WRITE AND COUNT	WRC	B	2	
*	*	* * * WRITE HEX AND COUNT	WHC	B	3	
*	*	* * * ADD BINARY	ADB	D		
*	*	* * * SUBTRACT BINARY	SBB	E		
*	*	* * * LOAD ADDRESS	LDA	F		

TEST PANEL OPERATION WITH 1300

The TPA and TPU test panels are compatible with the 1300 (7.5 backplane) but some of the functions display or control different registers. The following is a list and explanation of the test panel functions when used with the 7.5 backplane. Operation of the DMA switch becomes complex with the 7.5, and is explained in text, but is followed by a table. The table summarizes all of the registers that can be selected through the DMA switch.

- FR Creates the 2^{16} bit that is needed for test panel addressing in the 7.5.
- SF When the Single Function is ON, the 7.5 runs at machine speed until it reaches a "bus" cycle, then it halts. A bus cycle is either a memory cycle or an I/O cycle.
- ICSP Stops after each macro instruction.
- IPL General reset of the processor. The processor halts just before executing whatever instruction is at memory location zero. IPL does NOT generate a read hex instruction as it does in the earlier processors.
- MIM Generates the 2^{15} bit for memory addressing from the test panel.
- MASP/
ZSP In the MASP position, causes the processor to halt when the processor is required to access the memory address that is contained in the test panel address register. The contents of the test panel address register is displayed when the DATA/E/ADDR switch is in the ADDR position.
In the OFF position, the MASP/ZSP switch has no effect.
The ZSP position is not used with the 7.5 backplane.
- AMI When in the ON position, inhibits the address advance that is normally automatic when the RD (read) or WR (write) function is used. When the machine is running and AMI is ON, the memory contents from the test panel ADDRESS register is read into the test panel DATA register after every refresh cycle.
- DATA/E/ADDR
The E position has no effect in the 7.5 backplane processor. The DATA and ADDR positions display the contents of the data and address registers within the test panel. These registers can be reset (by pressing the R button) to a zero state, then reloaded by depressing the desired bit switches.
- R Resets the particular register (DATA or ADDR) that is selected by the DATA/E/ADDR switch. The other (unselected) register is not reset.

SWITCH/
LAMPS

Work in conjunction with the register switch to either load or display the contents of the selected register. When the register is selected, the contents are displayed. If the R (reset) button is pressed, the selected register is set to zero, and can then be loaded by pressing the buttons that correspond to the desired bits. All four columns (0-3) of lamps and switches are used for the ADDRESS register, but only the two right hand columns (0 and 1) are used with the DATA register.

- SP Sets the processor program (P) address to the number that is contained in the test panel ADDR register and MIM and FR switches.
- CD Loads the test panel DATA register from the processor MD register. The data can then be displayed by moving the ADDR/E/DATA switch to the DATA position.
- HLT Indicates that the processor is halted, or that a Direct Memory Access (DMA) cycle is in progress.
- ST-SP When the DMA-SEL switch is zero, stops the processor after the current instruction is completed. Processor restarts when the ST-SP button is pressed a second time.
- When the DMA-SEL switch is NOT at zero, allows only one cycle to execute (each time the ST-SP button is pressed). This applies to the processor and all active DMA devices. HLT coming ON when ST/SP is pressed no longer means that the machine is running.

DMA-SEL

The following definitions apply only when the DMA-SEL switch is in the 0 position.

- RD Reads the contents (one byte) of the memory address that is specified by the number in the ADDR register and the MIM and FR bits. The data that is read is placed into the DATA register where it can be displayed by the DATA/E/ADDR switch.
- WR Writes the contents of the test panel DATA register into the address in memory that is specified by the ADDR register and the MIM and FR bits.
- A Loads the contents of the processor A register into the test panel ADDRESS register.
- B Loads the processor B register into the test panel ADDRESS register.
- P Loads the processor P register into the test panel ADDRESS register.
- Z Loads the test panel ADDRESS register from the processor MA register.

DMA-SEL (Continued)

When the DMA-SEL switch is in positions 3 through 9, the A, B, P, and Z registers of the selected DMA device can be loaded into the test panel ADDRESS register for display. Or the contents of the test panel ADDRESS register can be loaded into the register of the selected DMA device.

DMA SET TO 1 OR 2

The following definitions apply only when the DMA-SEL switch is set to 1 or 2.

- RD Reads the contents of the selected processor register into the test panel DATA register.
- WR Loads the contents of the test panel DATA register into the selected processor register.

Processor registers are selected as follows:

Test Panel ADDR reg. (in binary)	DMA-SEL=1	DMA-SEL=2
00	P reg. lower bits	TD reg.
01	P reg. upper bits	XD reg.
02	A reg. lower bits	FC reg.
03	A reg. upper bits	DC reg.
04	B reg. lower bits	CC reg.
05	B reg. upper bits	V2/EC reg.
06	T reg. lower bits	OP/V1 reg.
07	T reg. upper bits	MS reg.
10	Zero reg.	
11	Base reg. 0 lower 8 bits	
12	Base reg. 0 middle 8 bits	
13	Base reg. 0 upper bit	
14	Zero reg.	
15	Base reg. 1 lower 8 bits	
16	Base reg. 1 middle 8 bits	
17	Base reg. 1 upper bit	
18	Zero reg.	
19	Base reg. 2 lower 8 bits	
1A	Base reg. 2 middle 8 bits	
1B	Base reg. 2 upper bit	
1C	Zero reg.	
1D	Base reg. 3 lower 8 bits	
1E	Base reg. 3 middle 8 bits	
1F	Base reg. 3 upper bit	

Q298

CENTRAL PROCESSING UNIT

The Q298 logic assembly serves as the CPU for the QANTEL 970 and 1450 Systems. It is a single board CPU, utilizing bipolar bit slice microprocessing elements, field programmable logic arrays (FPLA), and a pipelined architecture. It contains ROM microcode which interprets the standard QANTEL instruction set. The Q298 is slightly faster than the Q7.5 processor and introduces a main memory capability of one megabyte (1024K).

No Direct-Memory Access (DMA) controllers are supported on the Q298. In particular the controllers and their replacements are:

DMA CONTROLLER	REPLACEMENT
IOU-15 Communications	IOU-40
IOU-28 QCRT	IOU-39T
IOU-32 Memorex Disc	Non-DMA IOU-32

MACHINE LANGUAGE COMPATIBILITY

- All machine instructions available on the Q7.5 processor are implemented on the Q298. The condition switches (NZ, MI, OV) are set as on the Q7.5.
- The Load Decimal instruction sets the Nonzero switch if the field being moved is not equal to decimal zeros.
- There are two new instructions which enable and disable I/O interrupts. Location \$12 (bit 2**7) is no longer used as the interrupt enable switch.
- There are sixteen 20-bit base registers as compared to four 17 bit registers in the Q7.5. This allows a main memory capacity of 1024K. The old Set Bank and Load Base Register instructions are supported in addition to new base register instructions.

Q29B

Q29B IPL FEATURE

- At power-on or when the IPL button is pressed, the CPU performs the following operations:
 - 1) Loads its base registers to point to the first 32K of main memory (banks A/C).
 - 2) Resets all I/O controllers (0-F).
 - 3) Reads from device 0.
 - 4) Branches to fetch the first QANTEL instructions.

- The data entered on device 0 may have many forms. If the operator only presses TRANSMIT, the CPU will bootstrap to disc 00. If the entered data consists of two hexadecimal characters, the CPU bootstraps to the disc with this device number (eg, 1D or 0C).

Otherwise, the data should be hexadecimal QANTEL machine language instructions. The data is packed, two hex digits per byte, and placed starting at location 0 in memory. Non-hex characters (except Q and ') are ignored. Execution of QANTEL code begins at location 0.

- If a Q is encountered, then the next 4 characters form a hexadecimal address. This address is used as the location to place the subsequent data. As a special case, if Q is the first character entered, then the hex address following the Q is used as the execution start address for the QANTEL machine code. The CPU branches to fetch instructions from the address specified after the Q.

- If an apostrophe (') is encountered, then the following data characters are interpreted as ASCII and placed directly into memory (with no packing). No characters are ignored. ASCII mode is terminated by another apostrophe.

Q29B

Q29B MACHINE LANGUAGE INSTRUCTION SET

	OBJECT CODE		INSTRUCTION	MNEMONIC
	xxxxf1	aaaa0d	Read	RD
	ccccf2	aaaa0d	Read Hex	RHX
	ccccf3	aaaa0d	Read With Count	RDC
	ccccf4	aaaa0d	Read Hex With Count	RHC
N	[bbbbfL]	aaaa0x	CRC Calculation	CRC
	[bbbbfL]	aaaa1L	Add Decimal	ADD
	[bbbbfL]	aaaa2L	Subtract Decimal	SBD
	[bbbbfL]	aaaa3L	Multiply Decimal	MPY
	[bbbbfL]	aaaa4L	Divide Decimal	DIV
	[bbbbfL]	aaaa5L	Load Decimal	LD
	bbbb6L		Store Accumulator	STA
	bbbbfL	aaaa6L	Move	MOV
	[bbbbfL]	aaaa7L	Compare	CMP
		aaaa80	Seek	SEK
		aaaa81	Disc Bootstrap	DBS
		aaaa82	Load Base Register	LBR
	bbbbfx	aaaa82	Translate	TRN
	bbbbfL	aaaa83	Search Equal	SEQ
	[bbbbfL]	aaaa84	Compare Numeric	CN
	[bbbbfL]	aaaa85	Compare Zone	CZ
	bbbbf0	xdaa86	Read Status 2	RS2
	bbbbf1	aaaa86	Load Immediate	LDI
	bbbbf2	aaaa86	Add Immediate	ADI
	bbbbf3	aaaa86	Subtract Immediate	SBI
N		aaaa87	Move Immediate	MVI
	ccccf0	bbbb87	Read Base Register	RBR
	ccccf2	bbbb87	Translate Right	TR
	ccccf3	bbbb87	Scan Unequal Right	SNR
	ccccf4	bbbb87	Scan Equal Right	SER
	ccccf5	bbbb87	Fill Right	FR
	ccccf6	bbbb87	Move Right	MR
	ccccf7	bbbb87	Exchange Right	XR
	ccccf8	bbbb87	Compare Right	CR
	ccccf9	bbbb87	Translate Left	TL
N	ccccfA	bbbb87	Hex To Ascii Conversion	HAC
	ccccfB	bbbb87	Scan Unequal Left	SNL
	ccccfC	bbbb87	Scan Equal Left	SEL
	ccccfD	bbbb87	Fill Left	FL
	ccccfE	bbbb87	Move Left	ML
	ccccfF	bbbb87	Exchange Left	XL
		aaaa88	Compare Left	CL
		aaaa88	Scan Interrupt	SCI
	bbbbf0	aaaa88	Load Base Register & Branch	LOB

[] Fields enclosed in parentheses are optional.

N Instructions marked with an N are new.

Q29B

Q29B MACHINE LANGUAGE INSTRUCTION SET Continued

	OBJECT CODE		INSTRUCTION	MNEMONIC
	ssss89		Return From Subroutine	RET
	sssf0	aaaa89	Subroutine Call	SUB
	sssf1	aaaa89	Pull Data	PUL
	sssf2	aaaa89	Push Data	PSH
	sssf3	aaaa89	Pop Data	POP
		aaaa8A	Increment By 1	IN1
N	ttttf0	aaaa8A	Branch On Table	BT
N	bbbbf1	aaaa8A	Loader Relocation	LDR
		aaaa8B	Decrement By 1	DC1
N	ccccf0	ssss8B 1111	Load Base List	LBL
N	ccccf1	ssss8B 1111	Read Base List	RBL
		aaaa8C	Increment By 2	IN2
		aaaa8D	Decrement By 2	DC2
		aaaa8E	Increment By 3	IN3
		aaaa8F	Decrement By 3	DC3
	[bbbbfx]	aaaa90	And	AND
	[bbbbfx]	aaaa91	Or	OR
	[bbbbfx]	aaaa92	Exclusive Or	XOR
	[bbbbfx]	aaaa93	Test Bit	TBT
	[bbbbfx]	aaaa94	Move Numeric	MN
	[bbbbfx]	aaaa95	Move Zone	MZ
	[bbbbfx]	aaaa96	Compare Decimal	CD
		aaaa97	Shift Bit Left	SBL
	ccccfL	aaaa97	Shift Field Left	SHL
		aaaa98	Shift Bit Right	SBR
	ccccfL	aaaa98	Shift Field Right	SHR
	[bbbbfL]	aaaa99	Edit	EDT
	bbbbfL	aaaa9A	Unedit	UED
	[bbbbfL]	aaaa9B	Pack	PAK
	[bbbbfL]	aaaa9C	Unpack	UPK
		0dxx9D	I/O Execute	IOX
		1dss9D	Device Control	CTL
		2dxx9D	Set Read	SRD
		4dss9D	Status In	SIN
		xdxx9E	Reset I/O	RIO
		xxxx9F	Return From Interrupt	RTI
N	xxxxf0	xxxx9F	Disable Interrupts	DI
N	xxxxf1	xxxx9F	Enable Interrupts	EI
		aaaa00	No Operation	NOP
		aaaaA1	Branch On Overflow	BOV
		aaaaA2	Branch On Minus	BMI
		aaaaA3	Branch On Nonzero	BNZ
		aaaaA4	Branch On Zero	BZ
		aaaaA5	Branch On Not Minus	BNH
		aaaaA6	Branch On No Overflow	BNO
		aaaaA7	Branch Unconditional	BRU

Q29B

Q29B MACHINE LANGUAGE INSTRUCTION SET Continued

OBJECT CODE	INSTRUCTION	MNEMONIC	
	aaaaA8	Halt & Branch	HLT
	aaaaA9	Branch & Link	BLI
	aaaaAA	Branch On Plus	BP
	xxxxAC	Set Bank C	BKC
	xxxxAD	Set Bank D	BKD
	xxxxAE	Set Bank E	BKE
	aaaaAF	Branch On Not Plus	BNP
	aaaaBd	Write	WR
xxxxF1	aaaaBd	Write Hex	WHX
ccccF2	aaaaBd	Write With Count	WRC
ccccF3	aaaaBd	Write Hex With Count	WHC
ccccF4	aaaaBd	Read Check	RCH
[bbbbFL]	aaaaCL 02	Load Binary	LDB
[bbbbFL]	aaaaCL 03	Multiply Binary	MPB
[bbbbFL]	aaaaCL 04	Divide Binary	DVB
[bbbbFL]	aaaaCL 05	Binary To Decimal Conversion	BDV
[bbbbFL]	aaaaCL 06	Decimal to Binary Conversion	DBV
[bbbbFL]	aaaaCx 07	Machine Identification	MID
bbbbFm	aaaaCL 07	Key Search	KSR
	cccc ddee		
[bbbbFL]	aaaaDL	Add Binary	ADB
[bbbbFL]	aaaaEL	Subtract Binary	SBB

Q29B MACHINE LANGUAGE - NEW INSTRUCTION SUMMARY

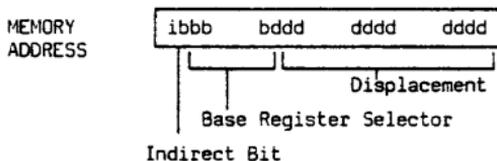
CRC - CRC Calculation
 MVI - Move Immediate
 HAC - Hex-To-ASCII Conversion
 BT - Branch On Table
 LDR - Loader Relocation
 LBL - Load Base List
 RBL - Read Base List
 DI - Disable Interrupts
 EI - Enable Interrupts
 RCH - Read Check
 LDB - Load Binary
 MPB - Multiply Binary
 DVB - Divide Binary
 BDV - Binary To Decimal Conversion
 DBV - Decimal To Binary Conversion
 MID - Machine Identification
 KSR - Key Search

Q29B

BASE REGISTERS AND MEMORY ADDRESSING

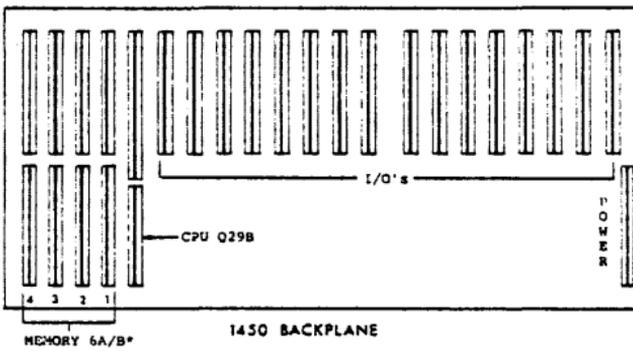
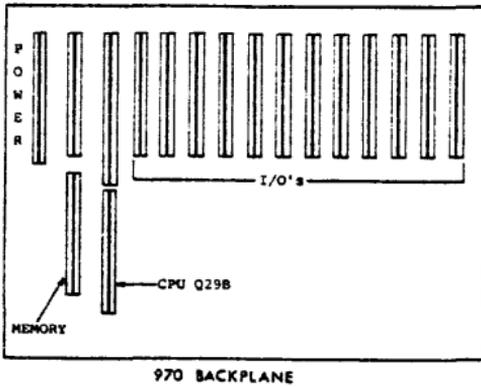
The Q29B system uses base register addressing. There are 16 base registers with 20 bits each for one megabyte of addressing capability. The base registers are numbered 0 - F.

Any memory address referenced in a Qantel machine instruction consists of 16 bits. Bit 15 is the indirect addressing bit which is resolved by the microcode (and is meaningless to the hardware). Bits 11-14 from the memory address are used as the base register selector. Bits 0-10 are used as the displacement added to the base register contents. Displacements are 11 bits in length, giving 2K memory partitioning.



On every memory reference the hardware adds the 11-bit displacement to the 20-bit contents of the base register selected to form the actual 20-bit memory address.

Q29B

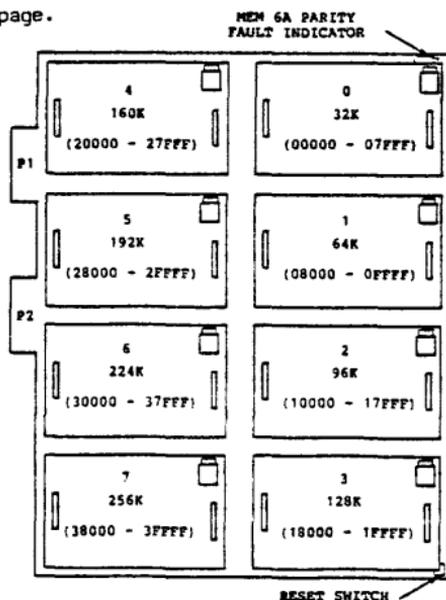


* The first MEM 6A/B module should be placed in slot number one and the following MEM 6A/B's in numerical sequence.

MEM 6A/B

MEM 6A/B

- The MEM 6A/B is used with the Q29B CPU exclusively. It consists of a MEM6A board assembly together with from one to eight MEM6B modules. The MEM6B module is organized in 32K nine-bit words (eight data bits and one parity bit). Each MEM6A assembly can accommodate up to eight 32K MEM6B modules for a maximum of 256K bytes of memory per MEM6A board assembly.
- The Q29B CPU has the capability of addressing up to 1 megabyte of memory. The QANTEL 1450 can accommodate up to four fully loaded MEM6A assemblies, for a maximum of 1 megabyte of memory per system. The QANTEL 970 System has one memory slot (256K).
- The addressing of the MEM6A assemblies is location sensitive to the backplane, which can accommodate from one to four MEM6A board assemblies (refer to backplane illustration on previous page). The addressing of the MEM6B modules (0-7) on each MEM6A board assembly is shown below, and is listed more completely on the following page.



MEM 6A/B

MEMORY MAP

1st MEM 6A

- 0) \$ 00000 - 07FFF
- 1) 08000 - 0FFFF
- 2) 10000 - 17FFF
- 3) 18000 - 1FFFF
- 4) 20000 - 27FFF
- 5) 28000 - 2FFFF
- 6) 30000 - 37FFF
- 7) 38000 - 3FFFF

2nd MEM 6A

- 0) \$ 40000 - 47FFF
- 1) 48000 - 4FFFF
- 2) 50000 - 57FFF
- 3) 58000 - 5FFFF
- 4) 60000 - 67FFF
- 5) 68000 - 6FFFF
- 6) 70000 - 77FFF
- 7) 78000 - 7FFFF

3rd MEM 6A

- 0) \$ 80000 - 87FFF
- 1) 88000 - 8FFFF
- 2) 90000 - 97FFF
- 3) 98000 - 9FFFF
- 4) A0000 - A7FFF
- 5) A8000 - AFFFF
- 6) B0000 - B7FFF
- 7) B8000 - BFFFF

4th MEM 6A

- 0) \$ C0000 - C7FFF
- 1) C8000 - CFFFF
- 2) D0000 - D7FFF
- 3) D8000 - DFFFF
- 4) E0000 - E7FFF
- 5) E8000 - EFFFF
- 6) F0000 - F7FFF
- 7) F8000 - FFFFF

MEM 6A/B

MEM 6A/B CONTINUED

- The Q29B CPU generates a 20-bit memory address. The two high order address bits, AD19-AD18, are decoded to generate one of four, BRD ENA-N, signals used to enable one of the four MEM6A board assemblies per system.
- The four address lines, AD17-AD14, go directly to each of the MEM6A board assemblies. Each MEM6B module consists of two banks of nine 16K dynamic RAMs for a total of eighteen dynamic RAMs and 32K 9-bit words of memory per MEM6B module. The 16K dynamic RAMs employ a seven-bit multiplexed address in which a seven-bit row address and a seven-bit column address are latched into the RAM at different times by the row address strobe, RAS-N, and the column address strobe, CAS-N, respectively. The four non-multiplexed address bits, AD17-AD14, are decoded by the MEM6A board assembly to generate the row address strobe, RAS-N, for one of the sixteen possible 16K banks of RAM per MEM6A board assembly. The row address strobe acts as a chip select enabling the subsequent memory operation in the 16K bank which is selected.
- Fourteen address lines are multiplexed on the backplane in two 7-bit bytes, AD13-AD07 and AD06-AD00, which are latched and buffered on the MEM6A assembly and go directly to the 16K dynamic RAMs on the MEM6B modules.
- The refresh timing is generated by the Q29B processor. A refresh cycle is performed every 16 microseconds maximum. The refresh address counter is provided by the Q29B processor, which generates an 128-cycle refresh every 2 milliseconds.

CONTROLS

- The MEMORY 6 SYSTEM responds to the I/O control signals from the backplane. The device address for selecting the MEMORY 6A board assembly is fixed at 5. If more than one MEM6A board assembly is in the backplane, all MEM 6A/B boards will be selected when the CPU selects device address 5.

MEM 6A/B

CONTROLS CONTINUED

- The MEM6A board assembly responds to Write Control, Read Status 2, and Reset I/O. The write control byte is defined below:

- DA00 - Reset Parity Enable
- DA01 - Set Parity Enable - Enables Parity Check
- DA02 - Reset Indicator Enable
- DA03 - Set Indicator Enable - Enables Parity Fault Indicator
- DA04 - Reset Parity Swap
- DA05 - Set Parity Swap - Exchanges parity RAM with least significant data bit for testing purposes.
- DA06 - Reset Parity Fault - Resets parity flip-flop.

- The Read Status 0 response from the MEM 6A is \$F4.

- The Read Status 2 response from the MEM6A is \$F6.

- The Reset I/O resets 'Parity Enable', 'Indicator Enable', 'Parity Swap', and 'Parity Fault'. Power-On Reset performs the same functions.

PARITY

- The MEM6A/B provides byte parity for the detection of single bit errors in the memory. The parity bit is generated during a write cycle, even parity is always stored. The parity is checked during each read cycle. If parity checking is enabled and a parity is detected, the parity fault signal PAR FLI-N will be outputted on the backplane causing a system interrupt. If the parity indicator is enabled, a permanent magnetic indicator is set on the MEM6A board assembly and on the particular MEM6B module which experienced the error.
- The magnetic indicator on the MEM6B module is a permanent record on the failed module and is not affected by power down or subsequent operation.

MEM 6A/B

PARITY CONTINUED

- The MEM6A board assembly has a momentary switch to reset the magnetic indicator on the MEM6A board when the defective module has been replaced.
- The parity fault signal can be reset by a write control instruction to memory (see control codes given on previous page). The magnetic parity indicators are not affected by the reset of the parity fault. However, to manually reset the magnetic indicator on the MEM6A board assembly, it is necessary that the parity fault be reset.
- A parity swap function is provided for memory testing purposes. The parity RAM is exchanged with the least significant data bit of main memory RAM on the entire MEM6A board assembly. This facilitates the testing of the parity RAM by normal ATP memory programs.

BEST ERROR CODES

ERROR CODES FOR 10x,20x,30x AND 40x OPERATING SYSTEMS
Effective: December 1, 1979

ERROR	DESCRIPTION
E02	END OF FILE
E03	DISC FULL
E04	KEYED FILE WRITE WITHOUT INDEX
E05	CREATE WITHOUT DISC LABEL
E06	DIRECTORY NOT FOUND
E07	FILE UNAVAILABLE--LOCK/UNLOCK ERROR
E08	ATTEMPTED LOCK ON UNOPENED LUN
E09	ATTEMPTED WRITE/DELETE TO DIRECTORY
E10	FILE HEADER UNAVAIL FOR RE-WRITE
E11	FILE NOT FOUND
E12	FILE ALREADY EXISTS
E13	NO FREE DIRECTORY ENTRIES
E14	DIR HEADER UNAVAIL FOR RENAME
E19	SPOOL DIRECTORY HEADER OPEN ERROR
E20	SPOOL JOB FILE OVERFLOW
E21	SPOOL JOB CREATE ERROR
E22	MISSING DEVICE/SPOOL QUE CREATE ERR
E23	WRONG DEVICE TYPE/SPOOL QUE OPEN ERR
E24	CARD READ ERR/SPOOL CONTROL MISSING
E25	CARD READER ERR/SPOOL QUE FULL
E26	EOF/SPOOL QUE JOB RECORD WRITE ERR
E27	TAPE ERROR/SPOOL QUE JOB WRITE ERR
E28	VFU ERROR/SPOOL JOB OPEN ERROR
E29	LOAD READ ERROR/SPOOL BUFFER UNAVAIL
E30	DEVICE INOPERATIVE
E31	DEVICE UNAVAILABLE
E32	KEY NOT FOUND
E33	RECORD UNAVAILABLE--EXTRACT ERROR
E34	LOGICAL UNIT # UNAVAILABLE FOR OPEN
E35	FILE NOT OPEN FOR READ OR WRITE
E36	CANNOT ERASE OPEN FILE
E37	DISC UNAVAILABLE FOR GET OR PUT
E38	DEVICE / FILE CAN'T PERFORM FUNCTION
E39	DISC UNAVAILABLE FOR LOCK OR UNLOCK
E41	EDIT MASK LENGTH INCORRECT
E42	RESERVE AMT GT 30K
E43	OUT OF RESERVABLE MEMORY
E44	I/O BUFFER OVERFLOW
E46	NON-NUMERIC INPUT IN NUMERIC FIELD
E47	PARAMETER TOO LARGE
E48	INVALID KEY OR RECORD SIZE; CREATE
E50	ARRAY SUBSCRIPT OUT OF RANGE
E51	DIVIDE OVERFLOW
E53	INVALID FILE ACCESS
E54	CANNOT DELETE IN NON-KEYED FILE
E60	CANNOT IPL WHILE OTHER USERS ACTIVE

BEST ERROR CODES

ERROR CODES FOR 10x,20x,30x AND 40x OPERATING SYSTEMS
Effective: December 1, 1979

ERROR	DESCRIPTION
E61	PROGRAM NOT FOUND
E62	PROGRAM TOO LARGE FOR PARTITION
E63	CANNOT RUN NON-OBJECT FILE
E64	INVALID PARTITION NAME
E65	PARTITION BUSY-PROGRAM RUNNING
E66	PARTITION NOT BACKGROUND
E67	PARTITION BUSY-NORMAL TERMINATION
E69	PARTITION BUSY-ERROR TERMINATION
E75	AFL LAST REC SECT DOESN'T MATCH FILE
E76	AFL POINTER STACK OVERFLOW
E77	FILE ACCESS ON INOP DISC
E78	DISC DESCRIPTOR UNAVAILABLE
E79	FEATURE UNAVAILABLE ON THIS SYSTEM
E80	MAXIMUM I/O BUFFER SIZE EXCEEDED
E81	SECTOR ALLOCATION ERROR - CREATE
E82	TOP KEY SECTOR NOT IN DELETE STACK
E83	DISC ERROR
E84	KEY SECTOR SEARCH LEVEL IMPOSSIBLE
E85	INVALID REAL PARAMETERS
E86	ACTIVE FILE LIST OVERFLOW
E87	DISC ERROR DURING ERASE OR OPEN
E88	INVALID AFL RECORD SECTOR OFFSET
E89	DIRECTORY INSERT ERROR - CREATE
E90	SYSTEM RETURN STACK OVER/UNDERFLOW
E91	INVALID LOAD ITEM IN OBJECT FILE
E92	GOSUB STACK UNDERFLOW
E93	GOSUB STACK OVERFLOW
E94	DIRECTORY ENTRY UNAVAILABLE / CLOSE
E95	NEXT KEY UNAVAILABLE FOR DELETION
E96	NEW KEY FOUND DURING INSERT
E97	NEW FIRST KEY FOUND DURING INSERT
E98	EXTRACTED RECORD NOT FOUND IN TABLE
E99	GET/RETURN SECTOR OUT OF DISC LIMITS

BEST DISC ORGANIZATION

TO BEST 13/14.9.10

<u>SYSTEM PACK</u>	100 Sectors for operating system.
0-2	System Loader
3-4	Allocation Bit Map
5-9	Beginning of User File Directory
10-299	Core Image Programs
300-999	Operating System
1000-...	User Files

<u>USER PACK</u>	40 Sectors for operating system.
0-2	System Loader
3-4	Allocation Bit Map
5-9	Beginning of User File Directory
10-39	Core Image Programs
40-..	User Files

SIMPLE DFULL USES

SD1D (or OD)	Sets device used by following instructions.
RD 1000,300	Read 300 (hex) bytes from the selected disc to position 1000 in memory.
DP 1000,300	List on (dump to) the printer 300 bytes starting at location 1000 in memory.
SDA xxxxx	Set disc address (enter 5-digit sector address).
EA 1000,7	Exhibit ASCII translation for 7 bytes starting at location 1000 in memory.
EH 1000,7	Exhibit the hexadecimal contents of 7 bytes from location 1000 in memory.

BEST OPERATING SYSTEMS

DISC LAYOUT

SYSTEM 30X

<u>SECTOR</u> <u>NUMBER</u>	<u>SYSTEM PACK</u>	<u>SECTOR</u> <u>NUMBER</u>	<u>DATA PACK</u>
0 - 3	Disc Program Loader	0 - 1	Disc Program Loader
4	CoreImage Directory	-	
5	Disc Description Record	5	Disc Description Record
6	AU Bit Map	5	AU Bit Map
7 - 9	Directory's keys	7 - 9	Directory's keys
10 -14	First Directory's records	2 - 4	First Directory's records
15-499	BEST Coreimages	-	
500-834	BEST files	10-834	BEST files

NEW VERSION:

System 30X

<u>SECTOR</u> <u>NUMBER</u>	<u>SYSTEM PACK</u>	<u>SECTOR</u> <u>NUMBER</u>	<u>DATA PACK</u>
0 - 3	Disc Program Loader	0 - 1	Disc Program Loader
4	CoreImage Directory	-	
5	Disc Description Record	5	Disc Description Record
	Directory Description Record		Directory Description Record
6	AU Bit Map	5	AU Bit Map
7- 9	Directory's keys	7- 9	Directory's keys
10- 14	Directory's records	2- 4	Directory's records
15-499	BEST Coreimages	-	
500-834	BEST files	10-834	BEST files

SYSTEM 40X

<u>SECTOR</u> <u>NUMBER</u>	<u>SYSTEM PACK</u>	<u>SECTOR</u> <u>NUMBER</u>	<u>DATA PACK</u>
0 - 3	Disc Program Loader	0 - 3	Disc Program Loader
4	CoreImage Directory	4	CoreImage Directory
5	Disc Description Record & beginning of multiple directory description records	5	Disc Description Record & beginning of multiple directory description records
6 - 9	Multiple directory Description Records	6 - 9	Multiple Directory Description Records
10 -14	AU Bit Map	10 -14	AU Bit Map
15 -	BEST Coreimages	15 -39	Selected BEST Coreimages
999			
1000+	Multiple directories & all BEST files	40+	Multiple directories & all BEST files

BEST OPERATING SYSTEMS

DISC LAYOUT

The BEST Operating System defines its reserved space on a disc as follows:

SYSTEM 10X

<u>SECTOR NUMBER</u>	<u>SYSTEM BACK</u>	<u>SECTOR NUMBER</u>	<u>DATA BACK</u>
0 - 3	Disc Program Loader	0 - 3	Disc Program Loader
4	CoreImage Directory	4	CoreImage Directory
5	Disc Description Record & one directory description record	5	Disc Description Record & one directory description record
6 - 9	Not used	6 - 9	Not used
10 -14	AU Bit Map	10 -14	AU Bit Map
15 - 999	BEST Coreimages	15 -39	Selected BEST Coreimages
1000+	One directory file all BEST files	40+	One directory file all BEST files

SYSTEM 20X

<u>SECTOR NUMBER</u>	<u>SYSTEM BACK</u>	<u>SECTOR NUMBER</u>	<u>DATA BACK</u>
0 - 3	Disc Program Loader	0 - 3	Disc Program Loader
4	CoreImage Directory	4	CoreImage Directory
5	Disc Description Record & beginning of multiple directory description records	5	Disc Description Record & beginning of multiple directory description records
6 - 9	Multiple directory Description Records	6 - 9	Multiple Directory Description Records
10 -14	AU Bit Map	10 -14	AU Bit Map
15 - 999	BEST Coreimages	15 -39	Selected BEST Coreimages
1000+	Multiple directories & all BEST files	40+	Multiple directories & all BEST files

DIRECTORY FORMAT

10X/20X/30X/40X SERIES OPERATING SYSTEMS

DISC DESCRIPTION RECORD

POSITION	CONTENTS
1 - 8	File Name - \$FF 00 00 00 00 00 00 00
9 - 11	DKIN date
12 - 14	Last BACKUP date
15	File type - \$82
16 - 17	Directory record size - \$003F
18 - 20	First directory of directories sector
21 - 22	Next record offset - \$02F4
23 - 25	Last directory of directories sector
26 - 27	Bad Allocation Unit Count
28 - 39	Unused
40 - 41	Seek/Read errors
42 - 44	First disc sector that can be allocated
45 - 47	Last disc sector that can be allocated
48 - 50	First Allocation Unit Bit Map sector
51 - 53	Last Allocation Unit Bit Map sector
54	Fill character - \$00
55 - 57	Number of records per sector - \$303132
58 - 59	Unused
60	DKIN Version Number
61 - 63	Disc Label

DIRECTORY DESCRIPTION RECORD

POSITION	CONTENTS
1 - 8	File Name - \$FF xx xx xx 00 00 00 00 where xxx is the directory name
9 - 11	Create date
12 - 14	Update date
15	File type = \$84
16 - 17	Record size - \$003F
18 - 20	First record sector
21 - 22	Next record offset
23 - 25	Last record sector
26 - 27	Allocation Unit Count
28 - 45	Unused
46 - 48	Key sector delete chain sector
49 - 50	Record delete chain offset
51 - 53	Record delete chain sector
54	Keysize - \$08
55 - 57	Last key sector
58 - 60	First Key sector
61 - 63	Top key sector

DIRECTORY FORMAT

10X/20X/30X/40X SERIES OPERATING SYSTEMS

CONTIGUOUS FILE

<u>POSITION</u>	<u>CONTENTS</u>
1 - 8	File Name
9 - 11	*Create Date
12 - 14	*Update Date
15	File Type =\$02
16 - 17	Record Size
18 - 20	First Record Sector
21 - 22	Next Record Offset
23 - 25	Last Record Sector
26 - 27	Allocation Unit Count
28 - 53	Unused
54	Fill Character
55 - 57	Number of records/sector
58 - 63	Unused

*New items in the directory format

OBJECT/STANDALONE FILE

<u>POSITION</u>	<u>CONTENTS</u>
1 - 8	File Name
9 - 11	*Create Date
12 - 14	*Update date
15	File type =\$10 - Object File type =\$30 - Standalone
16 - 17	Record Size
18 - 20	First Record Sector
21 - 22	Next Record Offset
23 - 25	Last Record Sector
26 - 27	*Allocation Unit Count
28 - 42	Unused
43	*Version Number
44 - 51	*Source File Name
52 - 53	*Message Address (Standalone only)
54 - 55	Execution Start Address
56 - 57	Common Length
58 - 59	Buffer Length
60 - 61	Local Length
62 - 63	Program Length

*New items in the directory format

DIRECTORY FORMAT

10X/20X/30X/40X SERIES OPERATING SYSTEM

KEYED FILE

<u>POSITION</u>	<u>CONTENTS</u>
1 - 8	File Name
9 - 11	*CREATE date
12 - 14	*Update date
15	File type - \$04
16 - 17	Record Size
18 - 20	1st Record Sector
21 - 22	Next Record Sector Offset
23 - 25	Last Record Sector
26 - 27	Allocation Unit Count
28 - 45	Unused
46 - 48	Key Sector Delete Chain Sector
49 - 50	Record Delete Chain Offset
51 - 53	Record Delete Chain Sector
54	Key Size
55 - 57	Last Key Sector
58 - 60	First Key Sector
61 - 63	Top Key Sector

*New items in the directory format

SEQUENTIAL FILE

<u>POSITION</u>	<u>CONTENTS</u>
1 - 8	File Name
9 - 11	*Create Date
12 - 14	*Update Date
15	File Type = \$01
16 - 17	Record Size
18 - 20	First Record Sector
21 - 22	Next Record Offset
23 - 25	Last Record Sector
26 - 27	Allocation Unit Count
28 - 63	Unused

*New items in the directory format

DIRECTORY ENTRIES

	KEYED	SEQUENTIAL
1-3	TOP KEY SECTOR	1st DATA SECTOR
4	UNUSED	UNUSED
5-12	FILE NAME	FILE NAME
13	FILE TYPE-04	FILE TYPE-01
14-16	LAST DATA SECTOR	LAST DATA SECTOR
17-18	RECORD SIZE	RECORD SIZE
19-20	AU COUNT	AU COUNT
21-23	LAST KEY SECTOR	UNUSED
24	KEY SIZE	X
25-26	DELETE CHAIN OFFSET	X
27-29	DELETE CHAIN SECTOR	X
30-31	NEXT RECORD OFFSET	X
32-34	FIRST DATA SECTOR	X
35-37	FIRST SECTOR OF FIRST KEY AU	X X
34-48	UNUSED	UNUSED

SECTOR CONTROL BYTES

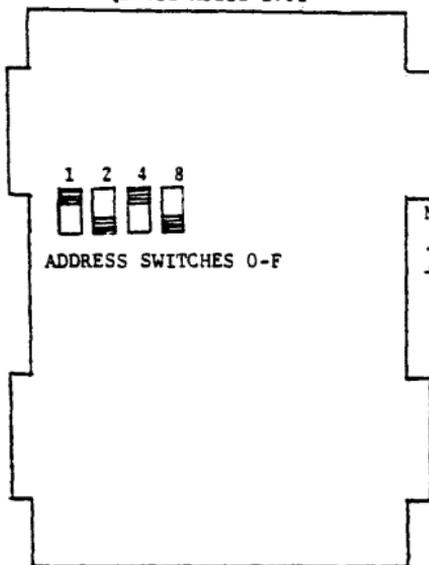
1-756	USER DATA
757-759	DISC NAME-APPEARS IN TOP LEVEL DIRECTORY SECTORS AND ALL TOP LEVEL KEY SECTORS.
760	KEY LEVEL-LEVEL OF SECTOR. FOR KEY AND DIRECTORY SECTORS.
761-763	UNUSED
764-766	FORWARD LINK-EVERY DATA SECTOR LINKS TO THE NEXT DATA SECTOR. IN KEY SECTORS THE 5th KEY SECTOR OF AN A.U. WILL POINT TO THE NEXT KEY A.U.
767-768	OFFSET-GIVES THE NEXT AVAILABLE BYTE IN THE SECTOR FOR DATA ENTRY. ALL INFORMATION IN THE SECTOR BEFORE THE OFFSET ADDRESS IS <u>GOOD DATA</u> .

KEY ENTRY

1-2	DATA OFFSET-STARTING ADDRESS WITHIN A DATA SECTOR FOR THE RECORD ASSOCIATED WITH THIS KEY.
3-5	SECTOR NUMBER OF NEXT SECTOR OR DATA. A LEVEL 0 KEY SECTOR WILL HAVE THE SECTOR NUMBER OF THE DATA SECTOR FOR ITS KEY. ALL KEY LEVELS ABOVE 0 WILL MERELY POINT TO THE NEXT LOWER KEY LEVEL TOWARDS 0.
6	UNUSED
7	KEY

IOU 25 CLOCK

Qantel Model 2901



ADDRESS SWITCHES 0-F

MAX. PWR. REQUIRED

-12v = .01A

+ 5v = .86A

WRITE CONTROL INSTRUCTIONS

1XYY9D X = DEVICE ADDRESS YY = CONTROL BYTE

CONTROL BYTE	FUNCTION
-----------------	----------

02	SET TEST
09	LOAD TIME OF DAY
0C	READ INTERVAL

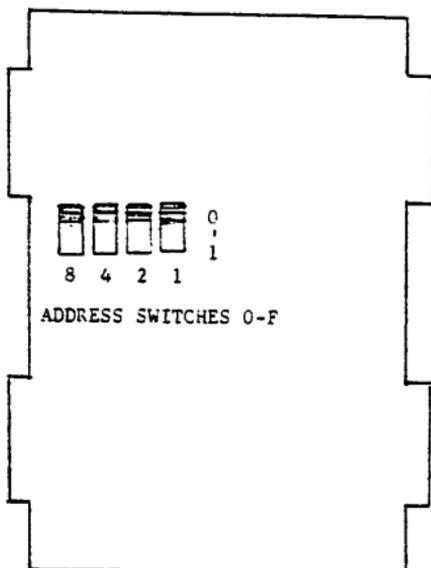
STATUS IN INSTRUCTIONS

4XYY9D X = DEVICE ADDRESS YY = STATUS BYTE

STATUS BYTE	MEANING
----------------	---------

01	READ BUSY
02	WRITE BUSY
04	END
08	SERVICE REQUEST
10	INTERRUPT
20	TIME CORRECT
40	N/A
80	N/A

IOU 9 UNBUFFERED TEN KEY



MAX. PWR. REQUIREMENTS

-12v = .16A
+ 5v = .33A

TEN KEY MODULE UN-BUFFERED

WRITE CONTROL INSTRUCTIONS

1XYY9D X = DEVICE ADDRESS YY = CONTROL BYTE

CONTROL BYTE	FUNCTION
-----------------	----------

00	RESET TONE
01	SET TONE

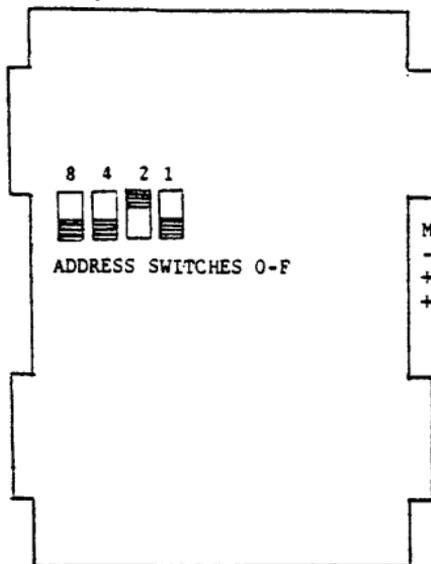
STATUS IN INSTRUCTIONS

4XYY9D X = DEVICE ADDRESS YY = STATUS BYTE

STATUS BYTE	MEANING
00	BUSY
02	N/A
04	END
08	SERVICE REQUEST
10	N/A
20	FLAG TWO
40	FLAG THREE
80	N/A

IOU 18 BUFFERED TEN KEY

Qantel Model 5701



ADDRESS SWITCHES 0-F

MAX. PWR. REQUIRED
 -12v = .16A
 + 5v = .68A
 +26v = .35A

WRITE CONTROL INSTRUCTIONS

1XYY9D X = DEVICE ADDRESS YY = CONTROL BYTE

CONTROL BYTE	FUNCTION
00	RESET SIGNAL
01	SET SIGNAL
04	RESET ALLOW TERMINATION INTERRUPT
05	SET ALLOW TERMINATION INTERRUPT

STATUS IN INSTRUCTIONS

4XYY9D X = DEVICE ADDRESS YY = STATUS BYTE

STATUS BYTE	MEANING
01	READ BUSY
02	N/A
04	END
08	SERVICE REQUEST
10	INTERRUPT
20	FLAG TWO
40	FLAG THREE
80	N/A

FILFIL or BFILFIL EXAMPLES

*I,FD,F=0,C=08000 (RETURN) or (TRANSMIT)
*O,RD,F=0,C=8000 (RETURN) or (TRANSMIT)
Copies everything (8000 sectors) bit-for-bit from the fixed disc to the removable disc. By exchanging the FD and RD copy is from the removable to the fixed. The D is the disc address.

*I,FD,F=00000,C=08000 (RETURN) or (TRANSMIT)
*O,M8,R=768,B=7680 (RETURN) or (TRANSMIT)
From fixed disc (FD) to mag tape (M8) in blocks of ten sectors.

*I,M8,R=768,B=7680
*O,RD,F=0,C=8000
From mag tape to the removable disc.

*I,RD,F=xxxxx,C=yyyyy
*O,LF,R=768
Prints (on device LF) everything from the removable disc (RD) starting at address xxxxx, and continuing for yyyyy number of sectors.

*I,CE,R=80
*O,LF,R=80
Prints from punch cards to device LF.

FORMAT

*I,RD,R=nnn,B=nnnn,S=nnn,F=nnnnn,C=nnnnn

I = Input or FROM; O = output or TO
R = Removable (disc); F = Fixed (disc)
L = Lineprinter; C = Card reader
M = Mag tape
O to F = Device address (2nd digit of 2nd expression)
R = Record length (R= 768 if not specified)
B = Block length
S = Number characters from each record
F = Starting sector (disc only)
C = Number of sectors (disc only); must be 5 digits.

Defaults:

Record length - 80 for Cards; 380 for 111 disc. Output record length can not be shorter than input (S).
Block length - To record length. Can not be more than 380 for 111 or 768 for 6+6,3+3, or 114.
Input length (S) - 1 record length. Used for limited number of sectors.
Number of sectors (C) - Must have 5 digits. C in the output will terminate when reached, regardless of C in the input.

