89672200

CONTROL DATA CORPORATION

CYBERDATA™

970-8
KEY ENTRY STATION

DISTRIBUTION UNIT AND CONTROLLER

GN109-A
FC106-A

CUSTOMER ENGINEERING MANUAL

REVISION RECORD

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or use Comment Sheet in the back of this manual.

MANUAL TO EQUIPMENT LEVEL CORRELATION SHEET

SHEET 1 OF 1

EQUIPMENTS							
MANUAL REV	FCO ECO	SERIES FC106-A	SERIAL	LOGIC DIAGRAM 89656100	PRINTED WIRING ASSEMBLY		
03	CK193	A02	51	REV 05	89655900 -06		
04	CK424	A02	55	REV 06	89655900 -10		
A	CK1215	A03	375, 377	REV A/B	89940400 -01		

MANUAL REV	FCO ECO	SERIES GN109-A	SERIAL	WIRING DIAGRAM 89770100	SCHEMATIC DIAGRAM 89664000	PRINTED WIRING ASSEMBLY	
	CK193	A02	51	REV 01/02	REV 02/03		
	CK488	A02	56				
03	CK517	A03	101	REV 02	REV 02/03	89663800	
04	CK691	A04	121	REV 02	REV 04	89805500 -01/02	
A	CK1110	A05	501	REV 02	REV 05	89920000 -01/02/03	
A	CK1471	A05	605	REV 02	REV 06	89920600 -04/05	

PREFACE

The CDC® CYBERDATA™ System 970-8 Key Entry Station Distribution Unit and Controller Customer Engineering Manual supplies customer engineering information for the Control Data 970-8, FC106-A Key Entry Station Controller and GN109-A Key Entry Station Distribution Unit. This equipment is used with the AB107-A/AB108-A Computer System to control the 970-480, CC108 (A through D) or 970-32, CD126 (A through D) Key Entry Stations. A knowledge of the computer and the key entry stations is required before using this controller.

The following Control Data publications may be useful as references:

Publication	Number
CDC® CYBERDATA™ System 970-8 Key Entry Station Controller and Distribution Unit Reference Manual	89672100
CDC® CYBERDATA™ System 970-32, CD126-A through D Key Entry Station Customer Engineering Manual	89672400
CDC® CYBERDATA™ System 970-480, CC108-A through D Key Entry Station Customer Engineering Manual	89664800
1784 Customer Reference Manual	88830300
AB107-A/AB108-A Computer Customer Engineering Manual	89633300
I/O Specification Manual	89673100

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SECTION 1

GENERAL DESCRIPTION

INTRODUCTION

Section 1 contains the functional and operational description of the Control Data 970-8, FC106-A Key Entry Station Controller and 970-8, GN109-A Distribution Unit.

The 970-8 Key Entry Station Controller logic circuitry is mounted on a single 50-PAK printed wiring board (PWB). The controller interfaces with the A/Q channel of the AB107-A or AB108-A Computer to control key entry station operations. Each controller handles up to and including eight Control Data 970-480, CC108-A through D or 970-32, CD126-A through D Key Entry Stations. The controller contains the logic that interprets AB107-A/AB108-A function codes, transfers data to and from the key entry stations, and provides key entry station status information to the central processing unit (CPU). The key entry station controller may be accommodated in any of the available A/Q slots of the AB107-A/AB108-A enclosure. The following paragraphs supply a list of environmental specifications for the controller.

ENVIRONMENT

Environmental specifications include temperature and humidity ratings:

Temperature

Shipping	-40 to 158 degrees F (-40 to 70 degrees C)
Storage	14 to 122 degrees F (-10 to 50 degrees C)
Operating	40 to 120 degrees F (5 to 50 degrees C)

Humidity

Shipping	0 to 100 percent RH noncondensing
Storage	10 to 90 percent RH noncondensing
Operating	10 to 90 percent noncondensing

POWER

Requirements for power for the 970-8 Controller are:

Input requirements	+5 volts dc
	-12 volts dc

Signal level

Low state (0)	0.4 volt dc or less
High state (1)	2.4 volts dc or more

Ground	Logic ground is connected to computer logic ground

The 970-8, GN109-A Key Entry Station Distribution Unit (DU) is enclosed in a 16-1/2 by 11-3/4 by 5 inch utility box and may be located at a distance up to 800 feet away from the controller. The distribution unit provides signal distribution between the controller and up to eight key entry stations. It also furnishes the operational power necessary for the 32-character key entry station and key entry station controller. The following paragraphs list the environmental specifications for the distribution unit.

ENVIRONMENT

Environmental conditions which must be met for the 970-8 Distribution Unit are:

Temperature	
Shipping	-40 to 158 degrees F (-40 to 70 degrees C)
Storage	14 to 122 degrees F (-10 to 50 degrees C)
Operating	40 to 120 degrees F (5 to 50 degrees C)
Humidity	
Shipping	0 to 100 percent RH noncondensing
Storage	10 to 90 percent RH noncondensing
Operating	10 to 90 percent RH noncondensing

POWER

Input requirements	115 or 230 vac, 60 or 50 Hertz
Output	+6 to +10 vdc (adjustable)
	-14 vdc (floating)
	+240 vdc
	12 vdc

INTERFACE CONNECTORS AND CABLES

The cables required for the operation of the controller and the distribution unit are listed in section 8, parts data. A wire list and a pin list for each is included in section 9.

SECTION 2

OPERATION AND PROGRAMMING

SECTION 2

OPERATION AND PROGRAMMING

INTRODUCTION

Section 2 supplies the programming instructions for the key entry station controller and operating instructions for the key entry station distribution unit.

PROGRAMMING

Programming information for the 970-8 Controller is discussed in the following paragraphs.

Q REGISTER FORMAT

Instructions to the station controller are determined by a 16-bit word which is contained in the computer Q register (figure 2-1).

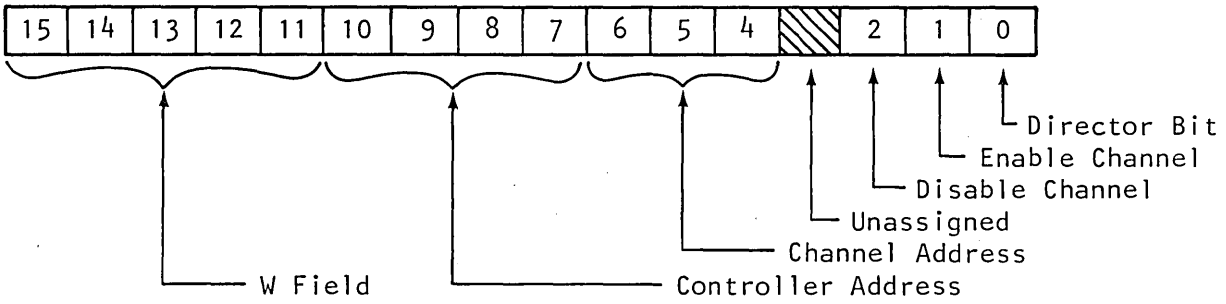


Figure 2-1. Computer Q Register Word Format

The controller is connected to the computer when the following conditions are met:

1. There is a suitable equipment code on Q07 through Q10.
2. The W = 0 line is active.
3. The read or write lines are active.

The controller ignores all the unassigned Q register bits.

A REGISTER FORMAT

After it receives the instruction word, the station controller communicates with the computer or a key entry station depending on the condition of director bit Q00. When Q00 is set, status or function commands refer to the general function of the controller. When Q00 is cleared, status commands, function commands, or data refer to the addressed data channel (A register) shown in figures 2-2 through 2-5.

When the read line is active, the controller performs an input operation to the computer. When the write line is active, it performs an output operation from the computer.

The controller ignores all the unassigned A register bits.

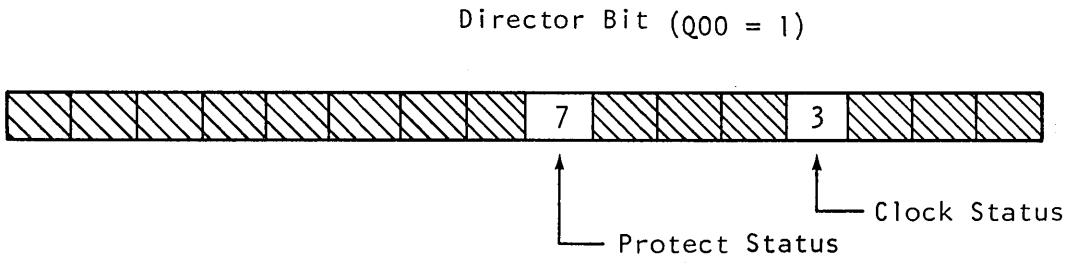


Figure 2-2. A Register Input Word Format, Controller to Computer

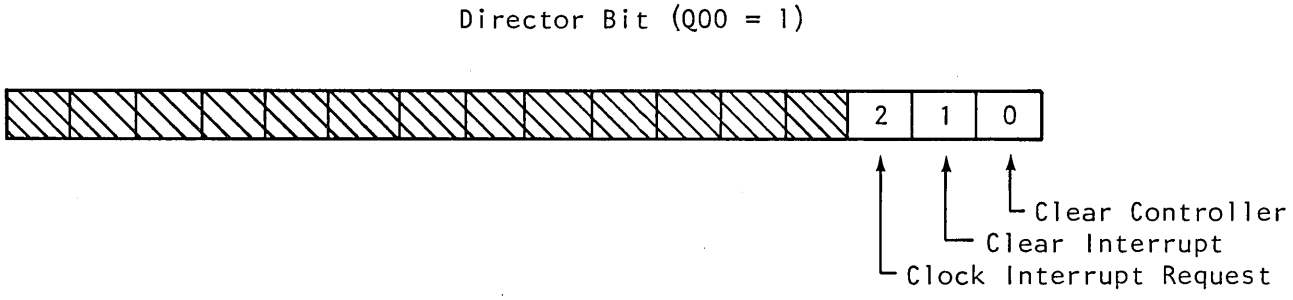


Figure 2-3. A Register Output Word Format, Computer to Controller

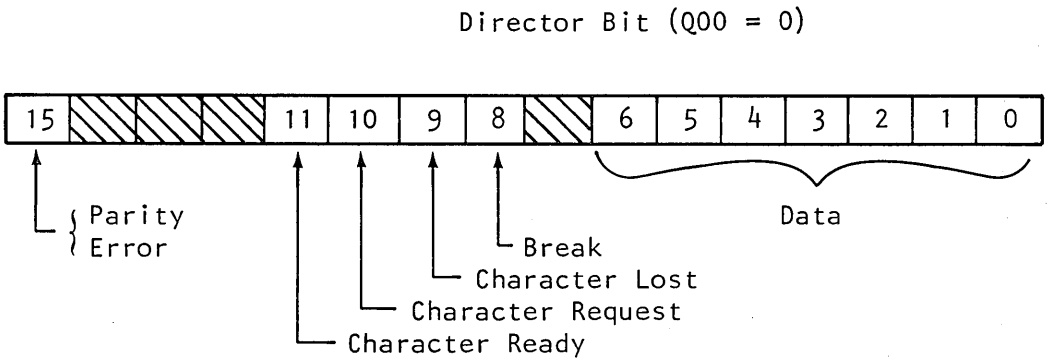


Figure 2-4. A Register Input Word Format, Controller to Computer

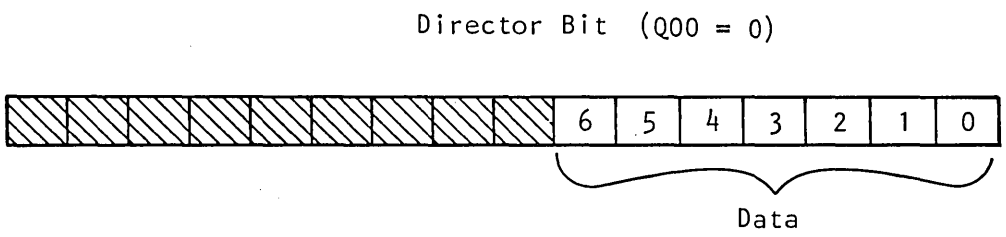


Figure 2-5. A Register Output Word Format, Computer to Controller

STATUS

When director bit Q00 is set and the read line is active, station controller status information is sent to the computer via the A register. Bit A03 of the A register is a logical 1 ("1") if the interrupt clock has completed a cycle since the last status check. It is independent of the clock interrupt request function and is cleared by the clear interrupt function. The Master Clear signal or the clear controller function will also clear status bit A03. A status bit is sent to the computer as a "1" via A07 of the A register if the protect jumper plug is in.

FUNCTION COMMANDS

Station Controller Function commands are issued when the write line is active and director bit Q00 is set. The functions performed are:

Clear Controller (A00)

When bit A00 is set, it clears the interrupt request circuit and the interrupt clock status bit. It also causes a Master Clear signal.

Clear Interrupt (A01)

When bit A01 is set, it clears the interrupt circuit, the interrupt request circuit, and the interrupt clock status bit.

Clock Interrupt Request (A02)

When bit A02 is set, it enables an interrupt to be sent to the computer on the next clock pulse. The first interrupt may occur any time up to one full interrupt clock cycle after the interrupt request function is issued. Bit A02 takes precedence over both bits A00 and A01 with regard to the interrupt request function.

DATA AND STATUS TO COMPUTER

An input to the computer results when the read line is active and Q00 equals a "0". The addressed channel then places 12 bits on the A bus as follows:

- Bits 0 through 6 - data
- Bit 8 - break

- Bit 9 - character lost
- Bit 10 - character request
- Bit 11 - character ready
- Bit 15 - parity error

Data - Bits 0 Through 6

These 7 bits contain a data word from the communication facility.

Break - Bit 8

When this bit is set, it indicates either a break in the line current or an interruption from the remote station. The Break signal is denoted by a space at the end of the character where a marking stop pulse normally occurs.

Character Lost - Bit 9

When it is set, bit 9 indicates that the servicing program did not receive the current data character before a new character was shifted into the holding register of the receive section. Consequently, the data represented by the current character was lost.

Character Request - Bit 10

The setting of bit 10 indicates that the send section is in the proper condition to receive data from the computer. Bit 10 is set only after the Enable Character Request signal from the computer is present in the send section.

Character Ready - Bit 11

Bit 11 sets when the holding register in the receive section contains a valid data character which is ready for transfer to the computer.

Parity Error - Bit 15

Bit 15 sets when the received character parity does not agree with the selected type of parity.

During an input operation, the enable/disable character lines are sampled. If Q02 is set, the addressed channel is disabled; and if Q02 is cleared and Q01 is set, the addressed channel is enabled.

DATA FROM COMPUTER

When the Write signal is active and Q00 is a "0", and where a character request has occurred, the computer places 7 data bits on the A register for the addressed channel.

REPLY/REJECT

The station controller sends a Reply or Reject signal to the computer in response to all instructions it receives. The station controller sends a Reject signal in response to a data output instruction when bit 10 of the addressed data channel is not set or when the protect switch is set and the instruction (except a station controller status) is not protected. A Reply signal is sent to the computer in response to station controller status request or when there is no protect violation (protect jumper plug is cleared or protect jumper plug is set and the instruction is protected) and the instruction is a station controller function command, data to the computer or data from the computer, and the character request bit is set.

The Reply or Reject signals are sent within 1.2 microseconds from the rising edge of the Read or Write signals.

INTERRUPT

A clocked interrupt is provided to the computer. The clock period may be selected out of 0.57, 2.3, 9.16, or 18.3 milliseconds (see internal select in section 3).

MASTER CLEAR

The Master Clear signal from the computer clears the interrupt circuits, the disable character request, and the holding registers input and output of all the channels.

OPERATION

CONTROLLER

Place jumper plugs as described in section 3.

DISTRIBUTION UNIT

For operation of the distribution unit, the ON-OFF switch (S9) must be in the up position. For operation of a selected channel, the associated switch (S1 to S8) must be in the up position. All channels may be selected and used simultaneously.

SECTION 3

INSTALLATION AND CHECKOUT

SECTION 3

INSTALLATION AND CHECKOUT

INSTALLATION

To properly install the 970-8 Distribution Unit and Controller, certain procedures should be followed carefully.

UNPACKING

To unpack the unit and controller:

1. Carefully remove the wrapping from the controller printed wiring assembly (PWA) and the distribution unit. Check for physical damage to each piece of equipment, and record damage on the packing list. Check that the part numbers agree with the packing list.

2. Remove the wrapping from the cables, and check for physical damage. Record damage on the packing list. Check that the part numbers agree with the packing list.

3. Report all damage to both the shipping company and to the CDC division that shipped the equipment.

PHYSICAL LIMITATIONS

Care must be taken to prevent damage to the controller card. The card must not be flexed, bent or dropped, or exposed to extremes of temperature or humidity in excess of those described in section 1. The distribution unit must not be dropped or exposed to extremes of temperature or humidity exceeding those described in section 1.

POWER REQUIREMENTS

The controller card requires +5 vdc derived from the power supply of the computer and -12 vdc from the distribution unit.

The distribution unit requires 115 vac, 60 Hertz or 230 vac, 50 Hertz. Care should be taken to place the voltage selector switch, which is located on the back of the unit, in the proper position.

CABLING AND CONNECTORS

An external interconnecting cable is available for use between the controller and the distribution unit. The external cable may be selected from any of the following:

Part Number	Length
89663300	10 feet
89663301	15 feet
89663302	50 feet
89663303	100 feet
89663304	200 feet
89663305	400 feet
89663306	800 feet

The internal cable (part number 89641800), which is used between the back of the computer and the connector pins on the back plane, is 15.5 inches long.

COOLING REQUIREMENTS

The controller card is cooled by the forced air system of the computer. No further cooling is required. Refer to the computer customer engineering manual (89633300) for further information concerning the cooling capabilities of the computer.

The distribution unit is cooled by the natural convection of air. Adequate ventilation is required.

ENVIRONMENTAL CONSIDERATIONS

The environmental considerations necessary for shipping, operation, or storage of the controller PWB are listed in section 1. The environmental considerations for the distribution unit are also discussed in section 1.

PREPARATION AND INSTALLATION OF THE CONTROLLER

To install the controller, perform the following steps with the computer power switched off:

1. Remove the air-flow block from the lower slide of the card slot that is to be used. Refer to figure 3-1 for selection of the location for the printed wiring board in the A/Q bus (slots 1, 2, 6, or 7).

2. Inspect the enclosure, card slot, PWB slides, and connector pins for physical damage.

3. Place the internal select jumpers in the positions on the card as described in tables 3-1 through 3-3. Table 3-4 lists the settings for the equipment number selection jumper plugs. Location of the internal select positions are shown in figure 3-2.

CAUTION

Do not install or remove cables or controller cards in the computer or expansion enclosure with power on.

4. Install the controller internal cable on the back plane at P2 in the position which is assigned to the controller card and the output connector at the output location provided. The card location will be selected from slot 1, 2, 6, or 7.

5. Install the external cable at the location provided for it on the back of the computer enclosure and P9 of the distribution unit.

6. Carefully install the controller card in the assigned card slot (1, 2, 6, or 7). The card must slide in smoothly.

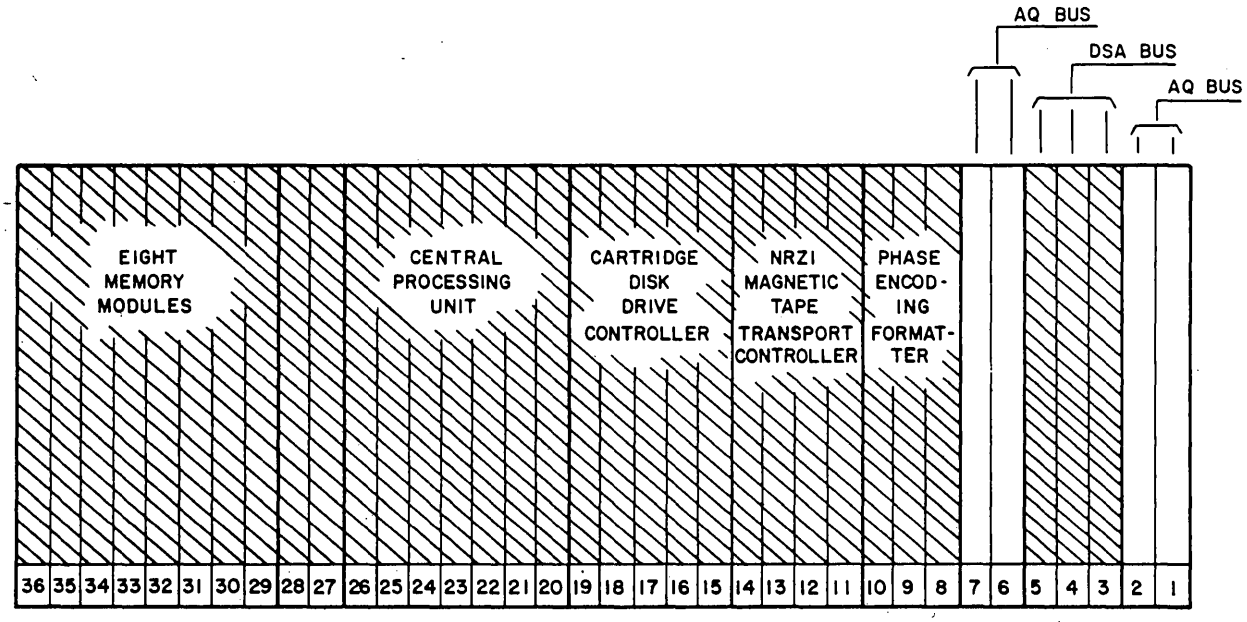


Figure 3-1. Installation Location of Controller PW Assembly (A/Q Bus)

TABLE 3-1. INTERNAL SELECT FOR STATIONS 1 THROUGH 4

To Select	At Location	Between Pins	Jumper Plug
Baud Rate			
9,600	U5*	1 and 20	Install jumper plug
4,800	U5	2 and 19	Install jumper plug
2,400	U5	3 and 18	Install jumper plug
1,200	U5	4 and 17	Install jumper plug
600	U5	10 and 11	Install jumper plug
300	U5	5 and 16	Install jumper plug
110	U5	6 and 15	Install jumper plug
Parity			
Odd	U5	7 and 14	Install jumper plug
Even	U5	7 and 14	Remove jumper plug
Stop Bits			
1	U5	8 and 13	Install jumper plug
2	U5	8 and 13	Remove jumper plug
Data Bits			
5	U5	9 and 12	Install jumper plug
7	U5	9 and 12	Remove jumper plug

*See figure 3-2.

TABLE 3-2. INTERNAL SELECT FOR STATIONS 5 THROUGH 8

To Select	At Location	Between Pins	Jumper Plug
Baud Rate			
9,600	U6*	1 and 20	Install jumper plug
4,800	U6	2 and 19	Install jumper plug
2,400	U6	3 and 18	Install jumper plug
1,200	U6	4 and 17	Install jumper plug
600	U6	10 and 11	Install jumper plug
300	U6	5 and 16	Install jumper plug
110	U6	6 and 15	Install jumper plug
Parity			
Odd	U6	7 and 14	Install jumper plug
Even	U6	7 and 14	Remove jumper plug
Stop Bits			
1	U6	8 and 13	Install jumper plug
2	U6	8 and 13	Remove jumper plug
Data Bits			
5	U6	9 and 12	Install jumper plug
7	U6	9 and 12	Remove jumper plug

*See figure 3-2.

TABLE 3-3. INTERNAL SELECT FOR EQUIPMENT NUMBER, PROTECT, AND INTERRUPT CYCLE TIME

To Select	At Location	Between Pins	Jumper Plug
Equipment Number**			
Q Register = "1"			
Q07	U40*	6 and 13	Install jumper plug
Q08	U40	7 and 12	Install jumper plug
Q09	U40	8 and 11	Install jumper plug
Q10	U40	9 and 10	Install jumper plug
Q Register = "0"			
Q07	U40	6 and 13	Remove jumper plug
Q08	U40	7 and 12	Remove jumper plug
Q09	U40	8 and 11	Remove jumper plug
Q10	U40	9 and 10	Remove jumper plug
Protect			
Set	U40	1 and 18	Remove jumper plug
Cleared	U40	1 and 18	Install jumper plug
Interrupt Cycle Time			
0.57 millisecond	U40	5 and 14	Install jumper plug
2.3 milliseconds	U40	4 and 15	Install jumper plug
9.16 milliseconds	U40	3 and 16	Install jumper plug
18.3 milliseconds	U40	2 and 17	Install jumper plug

*See figure 3-2.
**See table 3-4.

TABLE 3-4. EQUIPMENT NUMBER SELECTION

Jumper Plugs at U40	Q10	Q09	Q08	Q07
Hexadecimal Code				
0	0*	0	0	0
1	0	0	0	1
2	0	0	1	0
3	0	0	1	1
4	0	1	0	0
5	0	1	0	1
6	0	1	1	0
7	0	1	1	1
8	1	0	0	0
9	1	0	0	1
A	1	0	1	0
B	1	0	1	1
C	1	1	0	0
D	1	1	0	1
E	1	1	1	0
F	1	1	1	1

* A binary "0" indicates jumper plug out.
A binary "1" indicates jumper plug in.

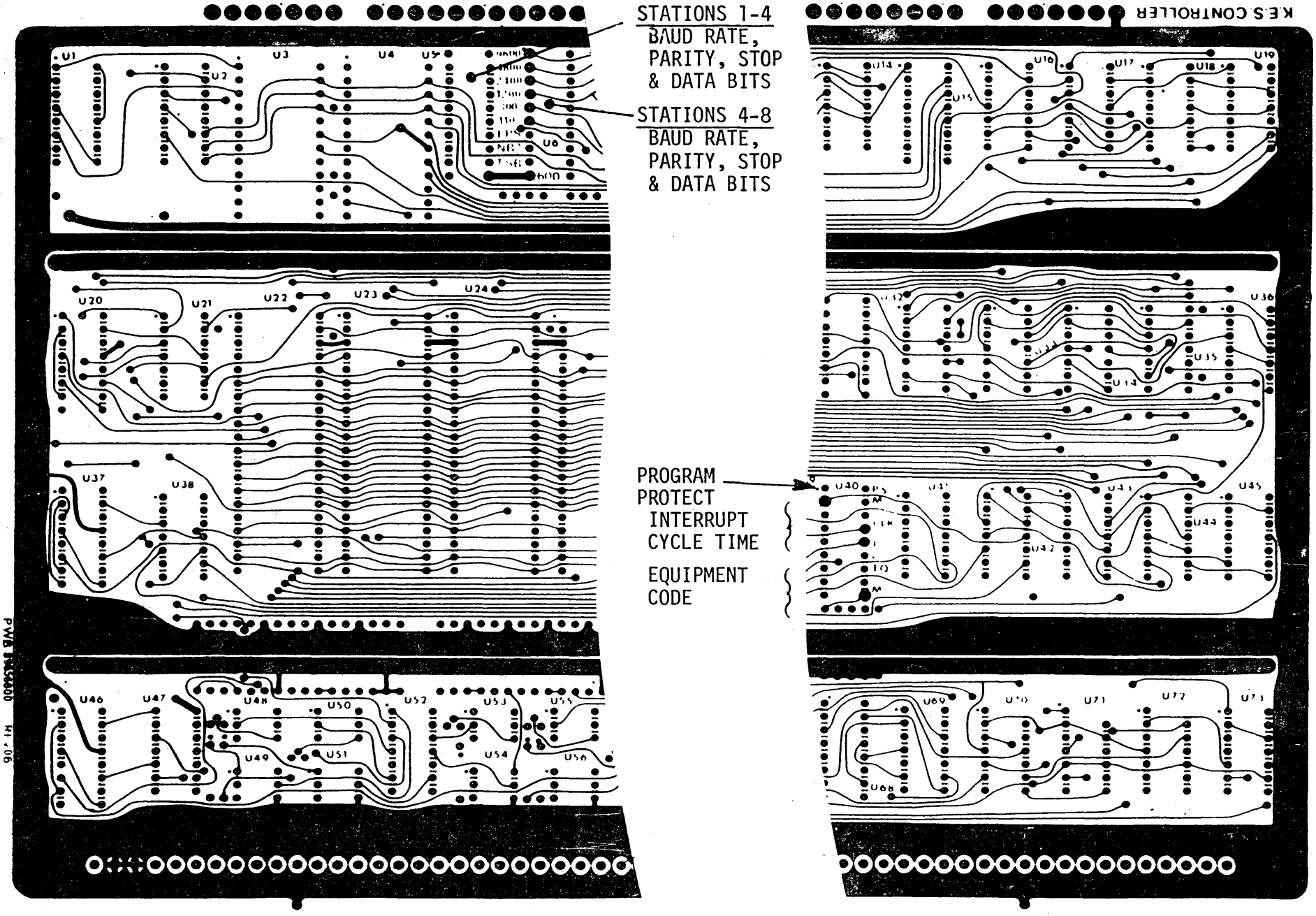


Figure 3-2. Locations for Internal Select Jumper Plugs on PWB

PREPARATION AND INSTALLATION OF THE DISTRIBUTION UNIT

The 970-8 Distribution Unit should be installed by the following procedure:

1. Attach the distribution unit by the mounting brackets provided to the location that is assigned to it in the cabinet. The distribution unit may be located at a distance of up to 800 feet from the controller and 200 feet from the key entry stations.

2. Connect the cables from the controller to P9 and to P1 through P8 as required for the key entry stations which are assigned. P1 represents channel 1 and may be used for key entry station number 1; P2 represents channel 2 and may be used for the second key entry station; etc.

3. Place the voltage selector switch, which is mounted on back panel of distribution unit, in the 115-vac or 230-vac position to match the input voltage which is supplied.

4. Plug the distribution unit ac power plug into the ac outlet assigned to it.

CHECKOUT

For proper checkout of the 970-8 Distribution Unit:

1. Refer to the CPU/computer reference manual, publication number 88830300 and to section 2 of this manual for operation of the controller and distribution unit.

2. Check the voltages at the distribution unit as follows:

   a. Remove the four screws that hold the front cover of distribution unit.

   b. Turn the front cover face down to expose TB1 and TB2.

   c. With power on, measure the voltages at the terminal boards as described in section 6.

   d. If necessary, adjust these voltages to the limits as described in section 6.

NOTE

It may be necessary to readjust the +6 to +10 vdc to match the length of the key entry station cable. Refer to section 6 for the adjustment.

3. Perform a diagnostics check as described in the System Maintenance Monitor (SMM17) Manual, publication 60182000.

SECTION 4

THEORY OF OPERATION

SECTION 4

THEORY OF OPERATION

INTRODUCTION

Section 4 presents general and detailed functional descriptions of the equipment, using such aids as overall and detailed block diagrams. Descriptions are keyed to the detailed logic diagrams in the diagram section (section 5) and afford a basis in understanding the detailed description of the specific circuit in that section.

NOTE

It is assumed that the reader is familiar with Control Data equipment and with the programming characteristics of the computer as described in the 1784 Computer System Reference Manual, publication 88830300.

CONTROLLER - FUNCTIONAL DESCRIPTION

The 970-8 Key Entry Station Controller performs communication with up to eight key entry stations and the computer. This is done in asynchronous mode via the A/Q channel of the computer, which means that each character can be received by the receiving station without further synchronizing bits. Figure 4-1 shows the block diagram of the system.

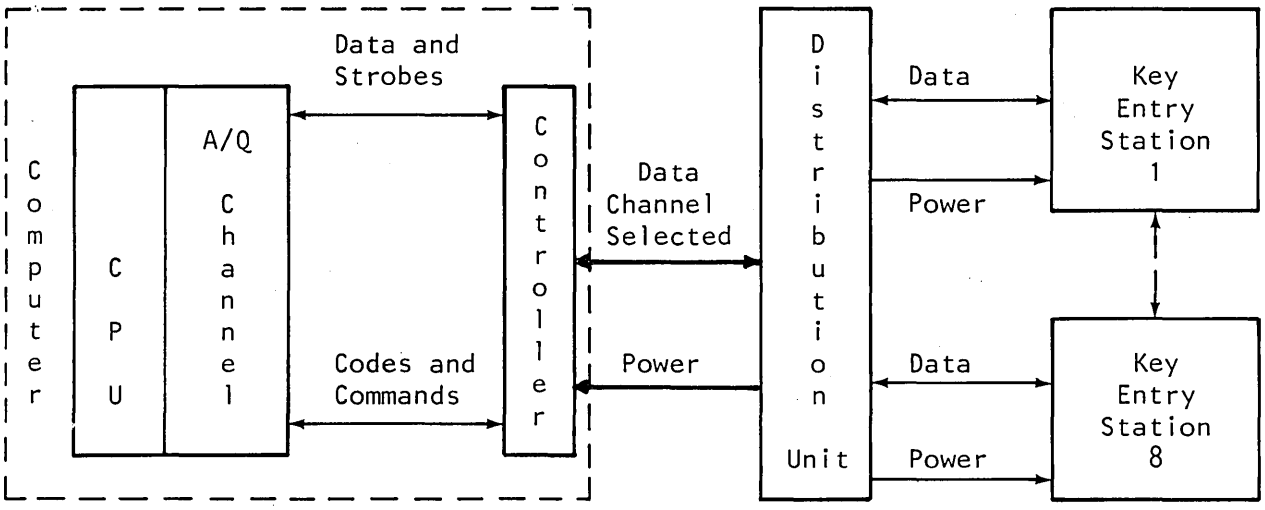


Figure 4-1. System Block Diagram

The Q register of the computer provides the device code, the station code, and other commands to the controller.

Data is transferred from or to the computer via the A register. The train is 12 bits long and is composed of 7 data bits and 5 status bits.

For a clearer understanding of the asynchronous transmit/receive techniques, a brief description of a system is given in the following paragraphs.

A character which is sent to the line contains a start bit, data bits, and stop bit(s) (figure 4-2).

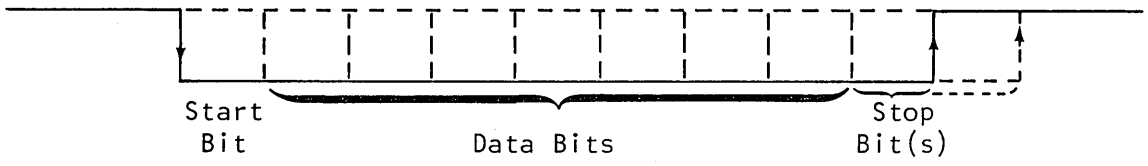


Figure 4-2. Data Character

Each time a character is transferred, a start bit causes the receive section to synchronize sampling of the bit stream in the middle of each bit as shown in figure 4-3.

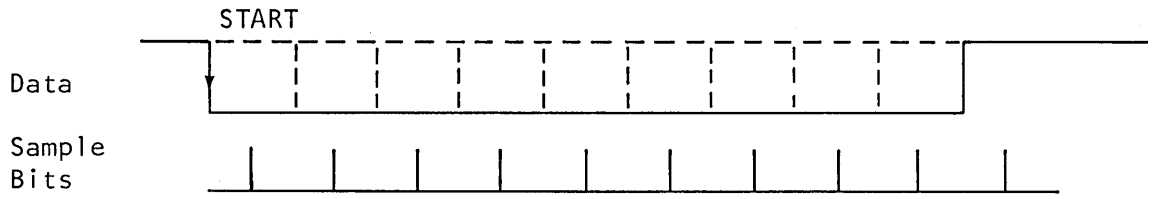


Figure 4-3. Bit Stream Sampling

The circuit of figure 4-4 performs this operation.

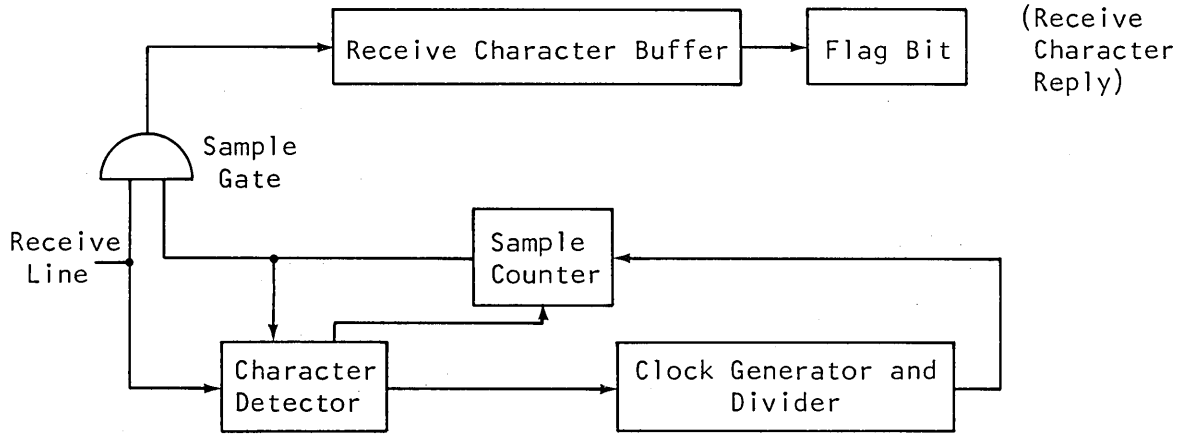


Figure 4-4. Bit Sampling Circuit

When a start bit is present on the receive line, the character detector circuit enables the clock generator and divider to deliver clock pulses to the sample counter each time the sample counter reaches an overflow (this is designed to sample at the middle of the bits). A sample pulse is delivered to the sample gate, and data enters into the receive character buffer. The indication that the whole character has been received is made by the presence of the stop bit, which is usually wider than the other bits.

When the whole character has been received, a flag bit is set which indicates the data is ready in the receive character buffer.

The controller transfers or receives data from a station through a 20-milliampere current loop. The current loop technique is required to overcome drive and noise problems in long distance data transmission. A functional current loop circuit is shown in figure 4-5.

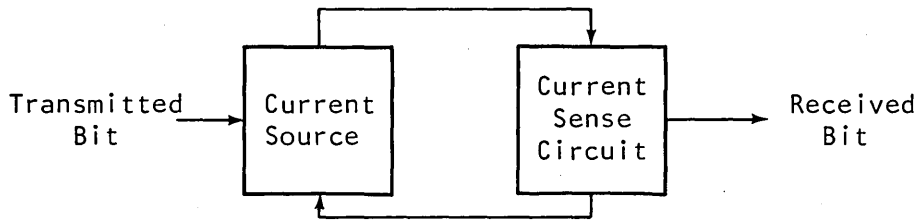


Figure 4-5. Current Loop

If the transmitted bit is a "1", the current source is enabled and a flow of current exists in the loop. In the receive section, a current sense circuit converts the current flow into a "1" TTL level.

If the transmitted bit is a "0", no current flow exists and the received bit will be a "0".

Only one of the channels can send or receive data to and from the computer at a time.

The selection of the channel is made by the computer via the Q register. The Q register provides the device code and the station code. The select channel circuit determines which channel is to be selected according to the station code. Operation mode is determined by the Read/Write signal presented by the computer. If the write mode is selected, the computer places 7 data bits on the A register. The data control circuit strobes this data into the selected channel, allowing it to be transferred.

CONTROLLER OPERATIONS

There are four possible operations that the 970-8 Key Entry Station Controller may handle.

Write

The director bit (Q00) is a "0". The computer performs an output operation, sending data to the controller, which in turn, is sent to the key entry station through the selected channel.

Read

The director bit (Q00) is a "0". The computer performs an input operation, causing the controller to send data received from the key entry station and the controller status section.

Write

The director bit (Q00) is a "1". The computer sends commands to the controller.

Read

The director bit (Q00) is a "1". The controller sends status information to the computer.

DISTRIBUTION UNIT - FUNCTIONAL DESCRIPTION

The 970-8 Key Entry Station Distribution Unit can be divided into two parts: 1) a power supply unit and 2) a signal and a power distribution panel.

The power supply is based on a main transformer and four voltage regulators. The voltage regulators are described as follows:

1. A +5 to 10 volt, 10-ampere switching series transistor regulator provides current limitation and an over-voltage protection.

2. A +240 volt, 1/4-ampere series transistor regulator provides current limitation and over-voltage protection.

3. A -14 volt, 1.3-ampere series transistor regulator provides current limitation.

4. A 12 volt, 1/4-ampere floating power supply provides remote sense and current limitation.

The signal and power distribution panel acts as a junction box for the signals from the controller to the terminals and distributes power from the power supply to the terminals. The power supply also furnished -14 vdc in series to the 20-milliampere data current loop.

SECTION 5

LOGIC DIAGRAMS

SECTION 5

LOGIC DIAGRAMS

KEY TO LOGIC SYMBOLS

Publication 89723700 (Key to Logic Symbols) or an equivalent CDC manual lists the symbols used in the logic diagrams in this manual and gives a short description of the functions they represent. The symbols conform generally to Control Data usage (Microcircuit Handbook, publication 15006100), using the polarity logic convention.

The following paragraphs describe the signal flow conventions that are used in the logic diagrams for the 970-8 Distribution Unit and Controller.

SIGNAL FLOW

Input signals are drawn coming from the left or above; output signals are drawn going to the right or down.

The signal lines are sometimes interrupted to allow a logical grouping of components. At each such interruption, either an on-sheet or off-sheet indicator is used.

ON-SHEET CONTINUATION REFERENCE SYMBOLS

When used with the logic symbols in the following logic diagrams, these symbols indicate that a connection exists between two points on a sheet (figure 5-1). The arrows attached to each circle point from signal origin to signal destination. The letters, C, H, I, O, and P are not used inside the circles since they have a special significance in logic diagrams.

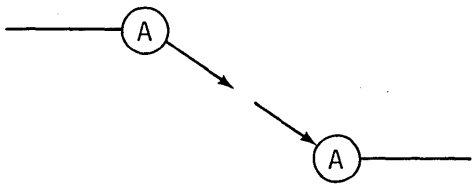


Figure 5-1. On-Sheet Continuation Symbol

OFF-SHEET CONTINUATION REFERENCE SYMBOLS

When used with the logic symbols in the following logic diagrams, these symbols (figure 5-2) indicate that a common signal point exists between two sheets in a series of related drawings. These symbols point from output to direction of input as shown in figure 5-2. The letters C, H, I, O, and P are not used in the hexagons, since they have a special significance in logic diagrams. The number(s) next to each hexagon indicate the sheet(s) that the signal is continued from or to. The numbers 3.6, for instance, refer to sheets 3 and 6, while 2.3 refers to

sheets 2 and 3. It should be noted that the referenced sheet number(s) is always placed opposite the line extending from the hexagon.

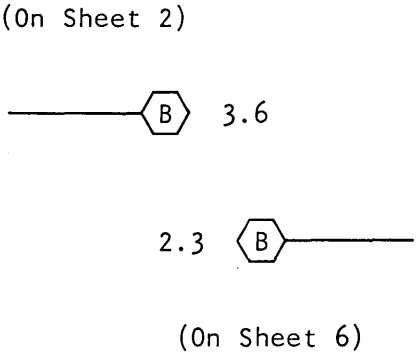


Figure 5-2. Off-Sheet Continuation Symbol

TEST POINTS

The test point symbol (figure 5-3) on a logic diagram shows the connection of a test point on the printed wiring board (PWB). The number adjacent to the symbol refers to the test point position on the PWB at the edge opposite the connectors. Only test point 1 is labeled on the edge of the PWB.

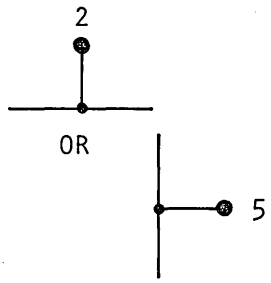


Figure 5-3. Test Point Symbol

CONNECTING AND NONCONNECTING LINES

Lines connected to a common point or at a junction point are shown in the upper part of figure 5-4. No more than four lines are connected to a common point in the diagrams.

Lines which cross but which are not connected are shown in the lower part of figure 5-4.

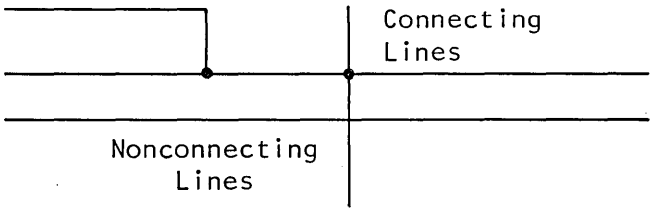


Figure 5-4. Connecting and Nonconnecting Lines

CONNECTORS

Connectors for both input and output signals are represented on the logic diagrams by the symbol for a female connector. The name of the signal is placed in the open end of the connector symbol (figure 5-5), using the full name of the signal or the common abbreviation applicable to logic diagrams. The connector number, pin row, and pin number are located above the line extending from the connector symbol.

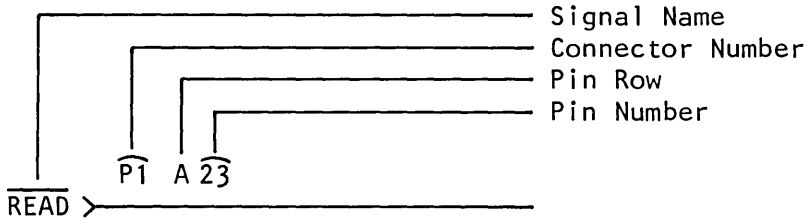


Figure 5-5. Connectors

CONTROLLER

Refer to figures 5-6 through 5-9 for logic diagram 89656100 for the 970-8 Key Entry Station Controller.

WRITE AND READ CONTROL CIRCUITS

See sheet 2 of the logic diagram for the write and read control circuits (figure 5-7).

WRITE = "1", Q00 = "0" Mode

After a character request has been sent to computer, the computer places 7 data bits on the A register for the addressed channel provided the Write signal is active.

When the write mode is selected ($\overline{W}$ = "0", $\overline{WRITE}$ = "0", $\overline{READ}$ = "1") and the equipment code that is being sent (Q07 - Q10) equals the equipment selection set by the jumpers at U40, U68-6 goes high. At U32-8, a low is generated by the first derivative of U68-6, which clears U31, U14 and sets U36-9.

When the Program Protect signal matches the setting of the protect jumper, U19-8 goes low which causes U36-1 to go high, and U36-5 can be set.

U36-5 controls the data strobe for the selected channel. The channel selected is determined by the station code (Q04, Q05, and Q06). U15 performs a batch function so that each time U68-6 goes high, the station code is strobed into U15.

The station code is delivered to U4, which is working as a one-of-sixteen decoder. U2 performs a selector function, which puts one of its inputs (D00 - D07) into the output $\overline{W}$ according to the station code. If the station code is 000, Channel 0 is selected (U22). When U2-6 is in the high state, it indicates a character request (transmitter buffer empty). After 0.8 microsecond, U31-14 goes high, and U36-5 causes the data strobe (DS) at U35-3 to generate a reply at U70-11. An active low is sent when U31-13 goes high (1.2 microseconds after the write request).

When the computer receives a Reply it drops the Write, U36-5 goes low, DS goes high, and the clock output transfers the data out of the UAR/T (U22, sheet 3 in figure 5-8) to the key entry station. If U2-6 is low, the transmitter buffer is full, and acceptance of new data is now impossible. U36-5 then goes low, and the DS is inhibited. A Reject is then transferred to the computer by U67-8. The acceptance of Reject drops the Write command.

READ = "1", Q00 = "0" Mode

If the controller has received data (with the station code 000), U30-2 (DA of UAR/T) goes high. When the read mode is selected, U68-6 goes high. After 0.8 microsecond, the leading edge of the positive pulse at U68-6 causes U31-14 to go high, setting U30-5 to a high. The output from U30-5 is a status command that the computer accepts, indicating a character ready (A11-00). U67-6 sends a Reply. The computer accepts the data available at the output of gates U70, U71, U72, and U73 (bus lines) and drops the read command. The drop of the Read resets U31, and U34-1 goes high. U30-5 is high, so U34-3 goes low, generating the RDA pulse at U4-9.

WRITE = "1", Q00 = "1" Mode

When this mode is selected, the computer sends function commands to the controller. When the director bit (Q00) is high and a Write is present, U18-12 goes high. If the program protect is present, a Reply will be sent by U67-11; if not, a Reject will be sent by U70-6.

When bit A00 is set (U44-2 high), U44-3 goes low, causing the following to occur:

1. U45-12 goes high, sending a reset to all UAR/T's.
2. U45-10 goes low, setting U20-11 and 15, U1-11 and 15, U37-11 and 15 to a high (clear to send).
3. U42-9 is cleared (interrupt clock status bit).
4. U42-5 is cleared (interrupt request circuit).

When bit A1 is set (U45-9 high), U42-9 and U42-5 are set (clear interrupt). When bit A2 is set (U44-5 high), U42-5 goes high (clock interrupt request).

READ = "1", Q00 = "1" Mode

When this mode is selected, the computer accepts status when the Read is active, and a Reply is sent from U67-11. At U70-8 ($\overline{A03}$), the status of the interrupt clock is seen, causing the status of the protect program jumper to be noted at U72-11 ($\overline{A7}$).

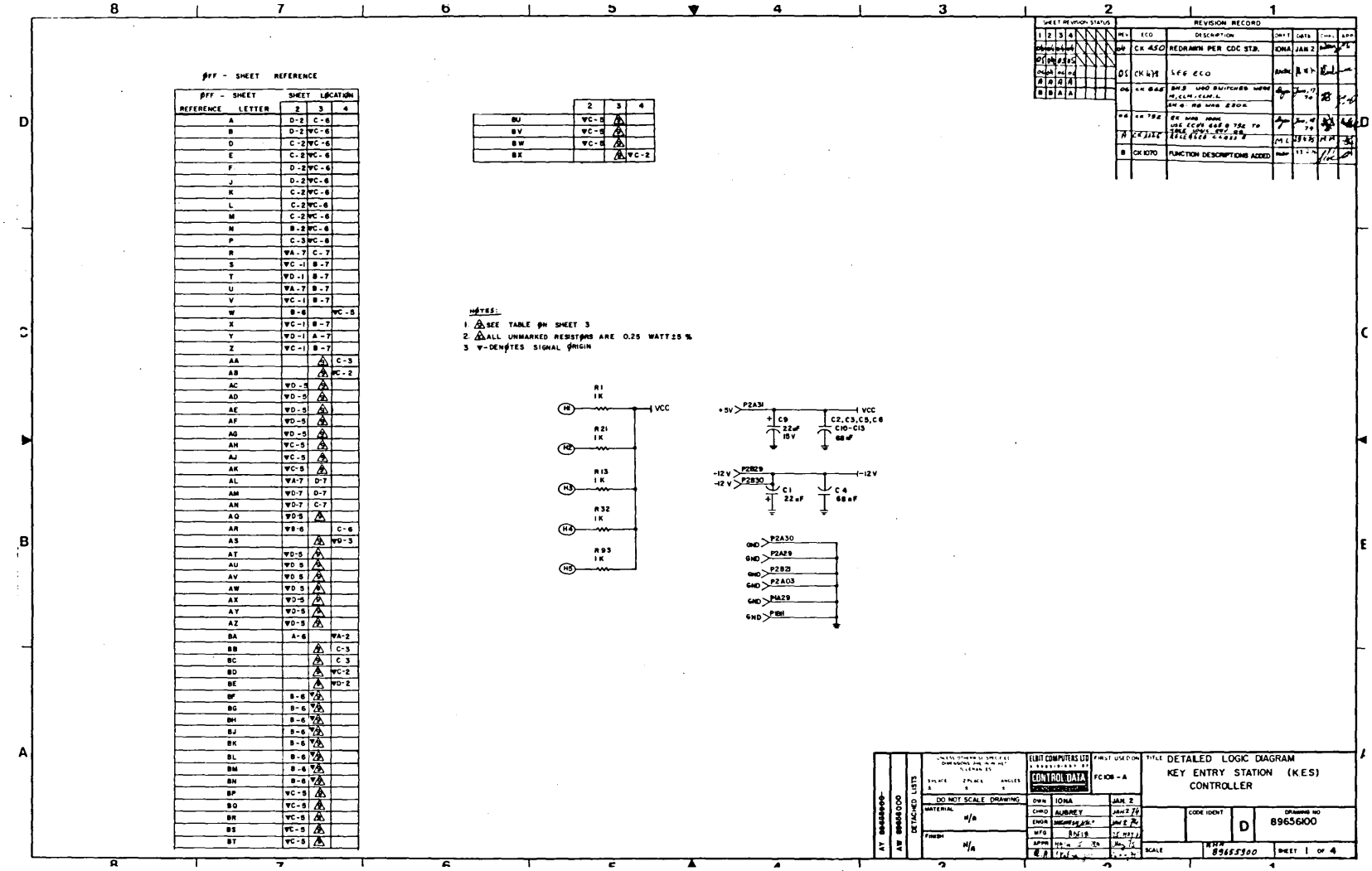


Figure 5-6. 970-8 Key Entry Station Controller Logic Diagram Sheet 1

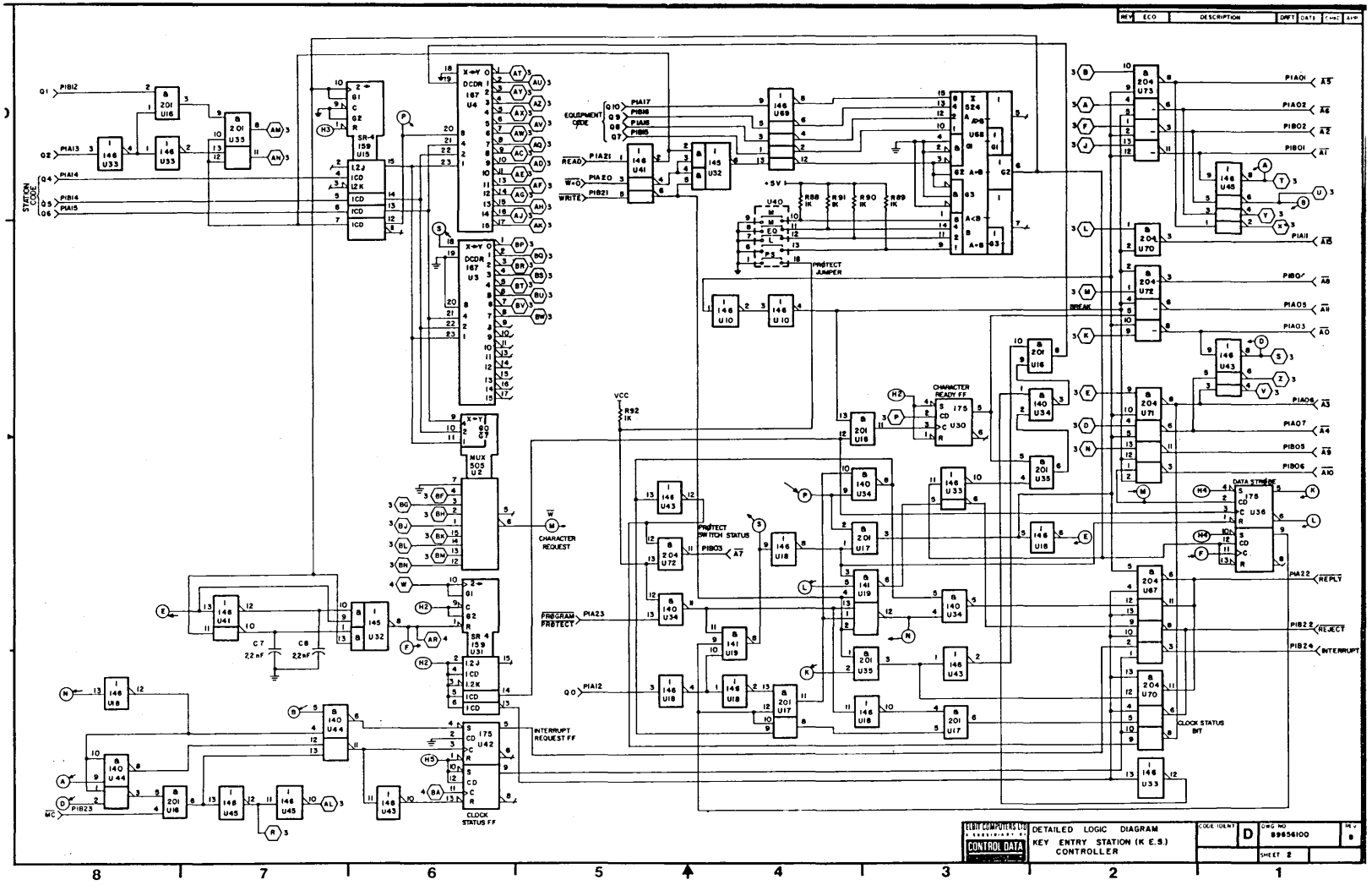


Figure 5-7. 970-8 Key Entry Station Controller Logic Diagram, Sheet 2

RECEIVE/TRANSMIT CIRCUITS

Refer to figure 5-8 which is sheet 3 of logic diagram 89656100.

Eight UAR/T's in the controller perform communications between the key entry stations and the computer. These eight UAR/T's are divided into two groups which have different properties (baud rate, stop bits, etc.). These properties may be selected by placing jumper plugs in the locations designated in tables 3-1 through 3-3. These selections for baud rate, parity, stop bits, and number of data bits may be made at package U5 for data channels 1 through 4 and at package U6 for channels 5 through 8.

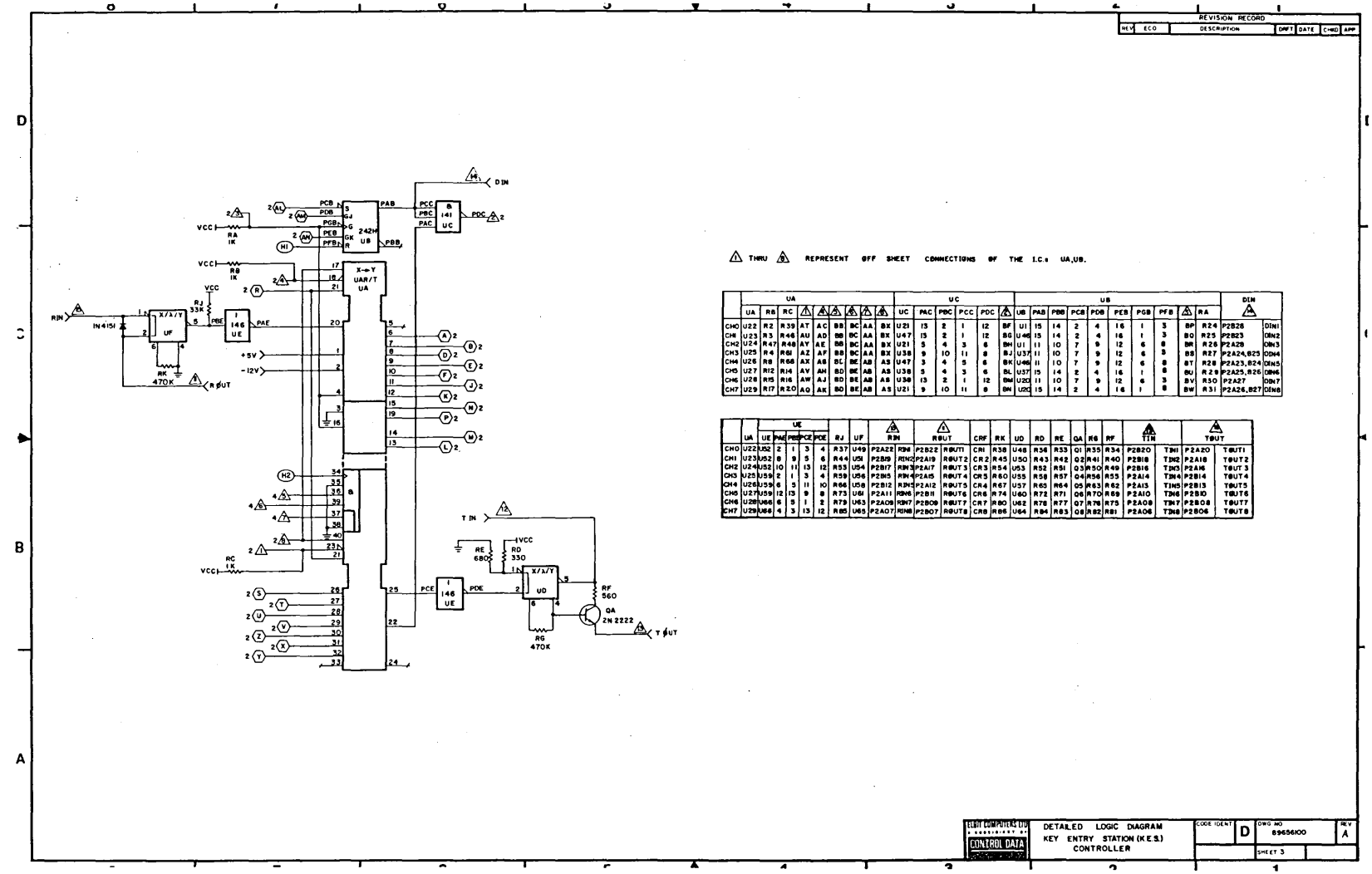
All receive data lines at the UAR/T's are connected together (such as RD1 of channel 1 is connected to RD1 of channels 2 through 8, etc.). All data input lines are also connected together through U43 and U45. Control for the UAR/T was discussed with the logic for sheet 2.

CLOCK CIRCUITS

Sheet 4 of the 970-8 Controller logic diagram 89656100 is given in figure 5-9.

NAND gate U12 and the crystal comprise an oscillator which generates a frequency of 9.83 megahertz. This frequency is divided by 8 through U11. U8, U7, and U9 are counters from which the baud rate may be selected by placing jumper plugs at locations U5 and U6 as necessary. The frequencies at U7, U8, and U9 are 16 times the indicated baud rate. U14 divides the clock rate by 4, delivering it to U31. U30 and U39 are counters for the interrupt periods.

The interrupt cycle time may be selected as necessary by placing jumper plugs in the specified sockets at U40.



	UA									UC						UB									DIN
	UA	RB	RC	1	2	3	4	5	6	UC	PAC	PBC	PCC	PDC	7	UB	PAB	PBB	PCB	PDB	PEB	PFB	8	RA	
CH0	U22	R2	R39	AT	AC	BB	BC	AA	BX	U21	13	2	1	12	BF	U1	15	14	2	4	16	1	3	8P	R24	P2B28	DIN1
CH1	U23	R3	R46	AU	AD	BB	BC	AA	BX	U47	13	2	1	12	BG	U46	15	14	2	4	16	1	3	8Q	R25	P2B23	DIN2
CH2	U24	R47	R48	AY	AE	BB	BC	AA	BX	U21	5	4	3	6	BH	U1	11	10	7	9	12	6	8	8R	R26	P2A29	DIN3
CH3	U25	R4	R6	AZ	AF	BB	BC	AA	BX	U38	9	10	11	8	BJ	U37	11	10	7	9	12	6	8	8S	R27	P2A24,825	DIN4
CH4	U26	R8	R68	AX	AB	BC	BE	AB	AS	U47	3	4	5	6	BK	U46	11	10	7	9	12	6	8	8T	R28	P2A23,824	DIN5
CH5	U27	R12	R14	AV	AH	BD	BE	AB	AS	U38	5	4	3	6	BL	U37	15	14	2	4	16	1	8	8U	R29	P2A25,826	DIN6
CH6	U28	R15	R16	AW	AJ	BD	BE	AB	AS	U38	13	2	1	12	BM	U20	11	10	7	9	12	6	8	8V	R30	P2A27	DIN7
CH7	U29	R17	R20	AQ	AK	BD	BE	AB	AS	U21	9	10	11	8	BN	U20	15	14	2	4	16	1	8	8W	R31	P2A26,827	DIN8

	UA	UE	UE PAC	UE PBC	UE PCC	UE PDE	RJ	UF	3 RIN	4 RBUT	CRF	RK	UD	RD	RE	QA	RG	RF	5 TIN	6 TBUT	
CH0	U22	U52	2	1	3	4	R37	U49	P2A22	RN4	P2B22	RBUT1	CR1	R38	U48	R38	R33	Q1	R35	R34	P2B20	T1N1	P2A20	TBUT1
CH1	U23	U52	8	9	5	6	R44	U51	P2B9	RN2	P2A19	RBUT2	CR2	R45	U50	R43	R42	Q2	R41	R40	P2B18	T1N2	P2A18	TBUT2
CH2	U24	U52	10	11	13	12	R53	U54	P2B17	RN3	P2A17	RBUT3	CR3	R54	U53	R52	R51	Q3	R50	R49	P2B16	T1N3	P2A16	TBUT3
CH3	U25	U59	2	1	3	4	R59	U56	P2B5	RN4	P2A15	RBUT4	CR5	R60	U55	R58	R57	Q4	R56	R55	P2A14	T1N4	P2B14	TBUT4
CH4	U26	U59	6	5	11	10	R66	U58	P2B12	RN5	P2A12	RBUT5	CR4	R67	U57	R65	R64	Q5	R63	R62	P2A13	T1N5	P2B13	TBUT5
CH5	U27	U59	12	13	9	8	R73	U61	P2A11	RN6	P2B11	RBUT6	CR6	R74	U60	R72	R71	Q6	R70	R69	P2A10	T1N6	P2B10	TBUT6
CH6	U28	U66	6	5	1	2	R79	U63	P2A08	RN7	P2B09	RBUT7	CR7	R80	U62	R78	R77	Q7	R76	R75	P2A08	T1N7	P2B08	TBUT7
CH7	U29	U66	4	3	13	12	R85	U65	P2A07	RN8	P2B07	RBUT8	CR8	R86	U64	R84	R83	Q8	R82	R81	P2A06	T1N8	P2B06	TBUT8

Figure 5-8. 970-8 Key Entry Station Controller Logic Diagram, Sheet 3

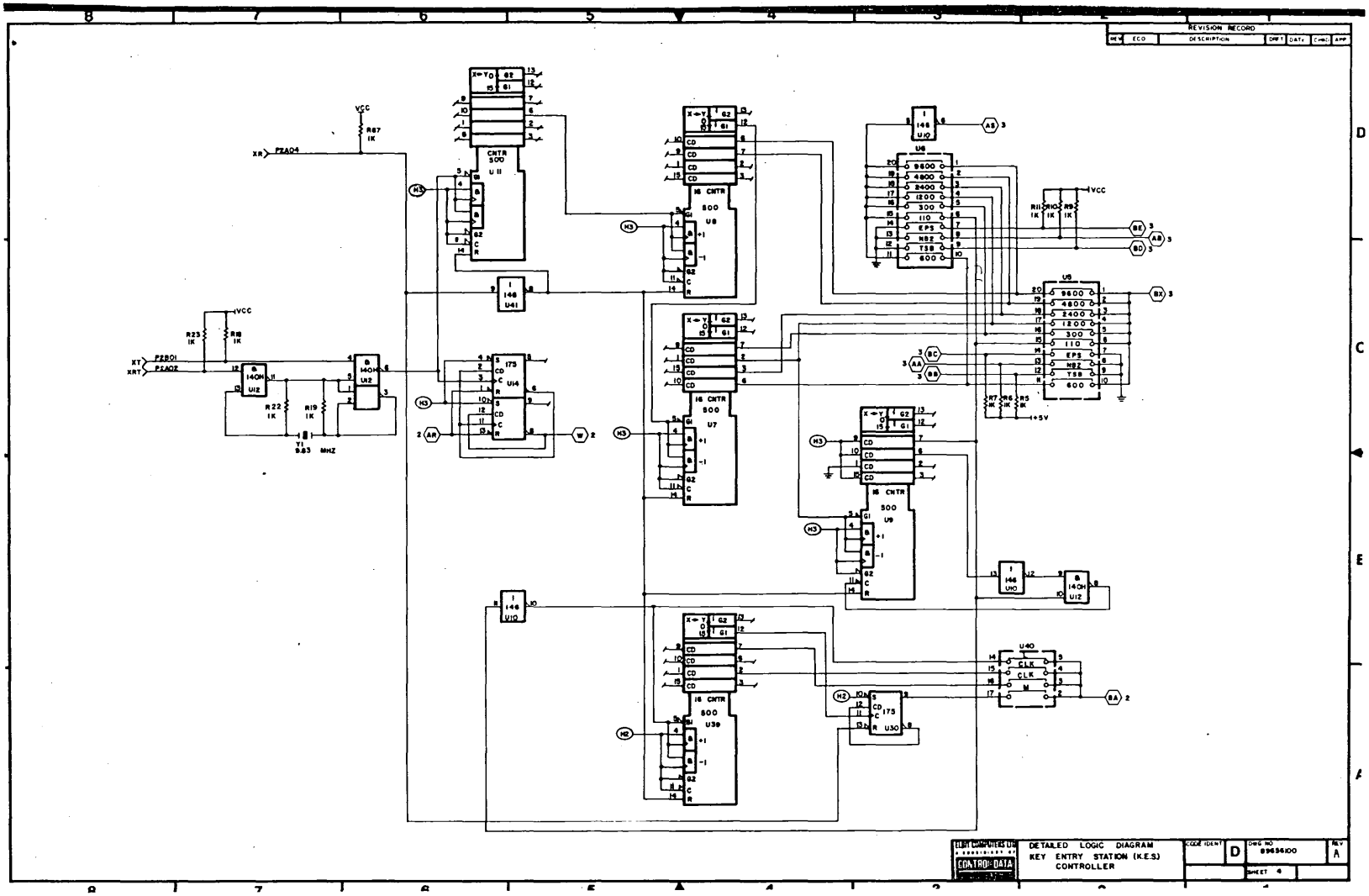


Figure 5-9. 970-8 Key Entry Station Controller Logic Diagram, Sheet 4

DISTRIBUTION UNIT

The following paragraphs discuss the 970-8 Key Entry Station Distribution Unit logic.

POWER SUPPLY

Figures 5-10 and 5-11 are sheets 1 and 2 of logic diagram 89664000 for the distribution unit power supply.

Power Input

Input power is furnished to the distribution circuit power supply through TB1, terminals 8, 9, and 10. Terminal TB1-8 serves as the neutral contact, TB1-9 serves as power, and TB1-10 is ground. TB1-9 is connected to the ON-OFF switch (S9) through fuse F3 (3 ampere, slow-blow) and then to TB1-7. Neutral from TB1-8 is connected to TB1-6 through another set of terminals on the ON-OFF switch. Selector switch S10 places the primary of the power transformer in either series or parallel with TB1-6 and TB1-7. This allows the power supply to be used with 115 vac or 230 vac as the input voltage. The ON/OFF lamp (DS1) is connected across pins 3 and 4 of T1 and glows when either 115 vac or 230 vac is applied to the distribution unit and switched on.

+6 VDC to +10 VDC Supply

The 25 vac derived from T1, pins 6 and 7, is rectified through the full-wave bridge rectifier SCBA-1 and is filtered by a 5,000-millifarad capacitor (C16) mounted on the frame of the power supply.

The filtered voltage is regulated by a series switching transistor regulator (2N3055).

The Q2 and Q4 act as a switching oscillator for which reference (+6 to +10 vdc) is adjusted by RV1. The voltage across R7 and RV1 is maintained by VR1. R3 and C1 act as a filter for the reference voltage. C3 and C4 determine the frequency. Q3 is the preamp for Q1, which acts as a clamping amplifier. The pulsed output of the oscillator at Q1 is placed on the base of Q10 with Q10 and Q5 acting as drivers for the 2N3055. In turn, 2N3055 acts as a switching transistor. In full conduction, the +30 volts flows through 2N3055 and through L1 to the output. In cut off, it disconnects L1 from the input voltage. The purpost of 1N3889 is to shorten the discharge time of L1. C14 and C5 filter the output. The output voltage is returned to Q4 through R6 to balance the oscillator. Current limitation protection is through Q8 and Q9 which are usually in the cut-off state. When output is over 12 amperes, R26, R27, R29, and R30 drop enough voltage to cause Q8 to conduct.

Q9 then starts to conduct, holding both transistors on for full conduction. At that time, the voltage across CR4 allows conduction, thereby holding the collector of Q2 at a high level and stopping the oscillator. This causes the switching transistor 2N3055 to be cut off, which reduces the power supply output. Q8-Q9 returns to the cut-off state only after the power supply is switched off for a period of time (approximately 30 seconds). Output is from point T of the PWB.

Overvoltage protection (Crowbar) is provided. Q7 is normally cut off. When the voltage across VR2 is over 12 volts, the SCR starts to conduct heavily, causing fuse F2 to blow.

-14 VDC Supply

Input voltage (16.5 vac) is received from T1, pins 12 and 13. The input voltage is rectified through the full-wave bridge rectifier (CR9-CR12) and is filtered by C15-C18. Regulation is through the series-pass transistor (2N3055) and U3 (μA273 - the precision voltage regulator). The reference output at pin 6 is fed to pin 5 (noninverting input). The inverting input receives reference from the output through the voltage divider R13, RV3 (output adjust), and R14. The output current flows through R15, which is the current limit resistor (2.2 amperes). The positive output of the regulator is tied to ground with the -14 vdc output at point E.

12 VDC Supply (Floating)

The 12-vdc rectification and regulation is identical to that of the -14 vdc regulator. 15 vac is derived from T1, pins 14 and 15, and is rectified across CR5 through CR8 with C19 filtering the dc. Q6 acts as a series-pass transistor with U2 as a series regulator. Output voltage is selected through divider R9, R10, and RV2. R10 (+ Sense) is connected externally to TB2-7 and R9 to the -12 volts. The input voltage level for U2-4 is selected by the position of RV2 at the inverting input. Reference is supplied to the noninverting input of U2 as reference voltage. Resistors R11 and R12 act to limit the current through Q6 to 300 milliamperes. The output *floats* between pins X and Y of the PWB. Points X and V are jumpered together at TB2-5 and 7 for the +12 vdc output. Pins Y and Z are jumpered at TB2-6 and 8 for the -12 vdc output.

+240 VDC Supply

The input voltage (220 vac) from T1, pins 8 and 9, is rectified by the full-wave bridge rectifier (CR14 through CR17) and is filtered by a 100-millifarad capacitor mounted on the power supply chassis.

The 2N6308 acts as a serial-pass transistor, and U1 acts as a floating series regulator. Supply current for U1 is received from T1, pins 10 and 11 (14 vac). The current is rectified by CR13 and is filtered by C11. The V- (pin 7) of U1 is connected to the negative output of the -14 volt supply and to the output of the supply. The 14-vdc supply floats free on the output of the power supply. Reference voltage for U1 is applied at the noninverting input. Pin 5 is received through voltage divider R20 and R23. CR18 maintains a negative bias on U1-5. The divider network (R21, R22, and RV4) sets the +240 vdc output voltage through the inverting input at U1-4. The type of current limiting used is known as fold-back current limiting. The fold-back current limit starts from 300 milliamperes and continues through 30 milliamperes. Current limitation begins with the voltage across R17 over 6.6 vdc when the output current is over 300 milliamperes and the voltage divider (R18, R19) of the current limiting input to U1-2 at 5.9 vdc in comparison with the emitter of 2N6308. At the start of current limitation, the voltage between U1-3 (current limit) and U1-2 (current sense) will be 0.7 vdc. This is comparable to the action that occurs also at U2 and U3.

Overvoltage protection begins when ignition occurs across SCR Q11. When the voltage across VR3-VR6 exceeds 276 vdc, they begin to conduct, and Q11 shorts the input voltage. This short causes F1 to blow. CR20 protects the 2N6308 from high inverse voltages that may occur at the beginning of conduction through Q11. Output of the +240 vdc regulator is from point P of the PW board and uses the board common as ground.

DISTRIBUTION PANEL

The logic diagram (89770100) for the 970-8 Distribution Unit Panel is given in figure 5-12.

The distribution panel (DP) acts as a junction box between the controller and up to eight key entry stations through P1 to P9. The voltages necessary for control and transfer of data to and from the key entry stations are paralleled to each of the stations via switches S1 through S8. Each switch controls one data set, and therefore, one channel of data through the distribution unit. S1 supplies station 1 (and channel 1), S2 supplies station 2 (and channel 2), ect. While the -14 vdc and +6 to +10 vdc is supplied for both the 32-character and 480-character key entry stations, the +240 vdc output is supplied only for the 32-character stations for operation of the display tube.

The data and control lines between the controller and each station pass through the DP without being affected. These lines are distributed to and from each of eight connectors (P1 to P8) to and from a single connector (P9).

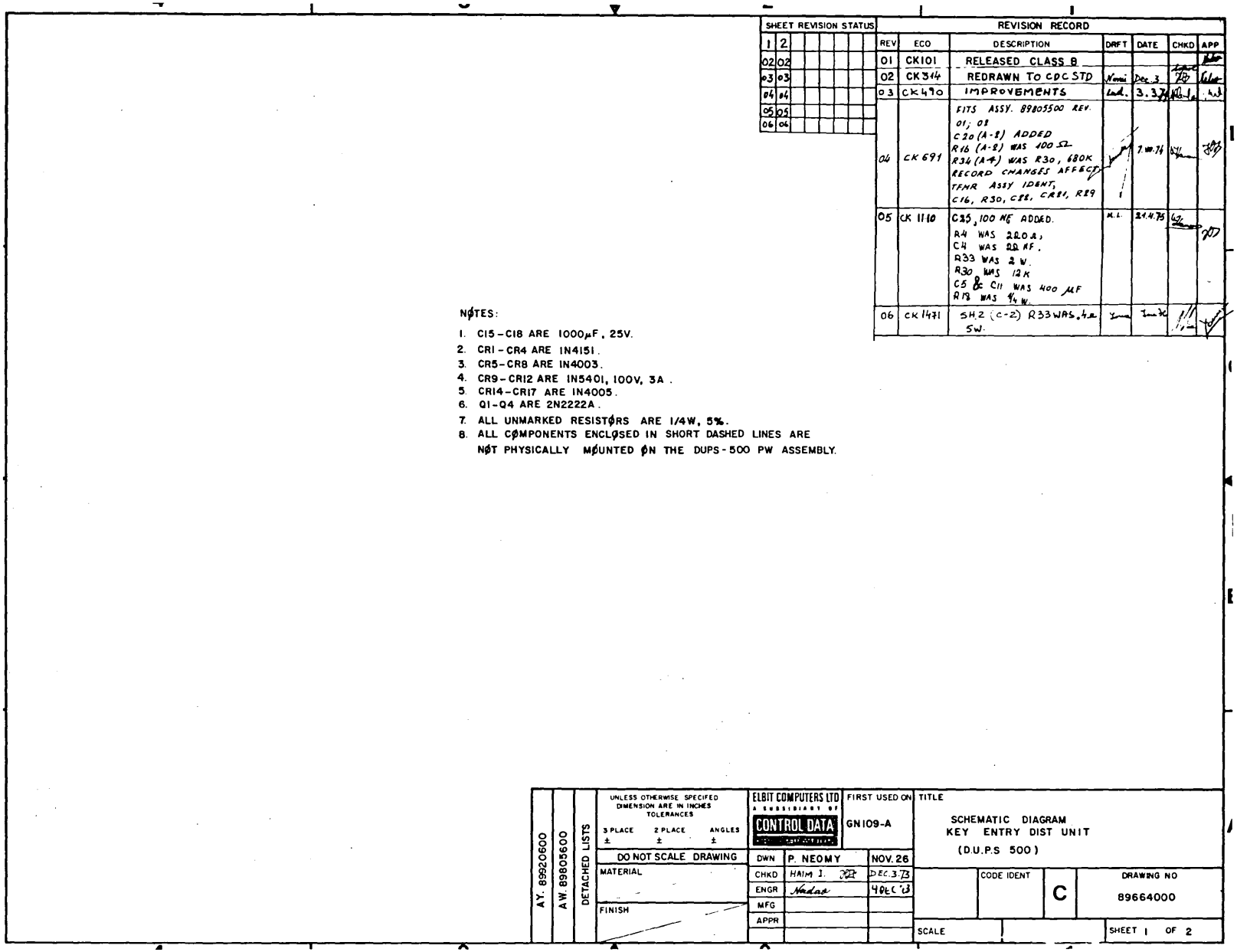


Figure 5-10. 970-8 Key Entry Station Distribution Unit Power Supply Logic Diagram, Sheet 1

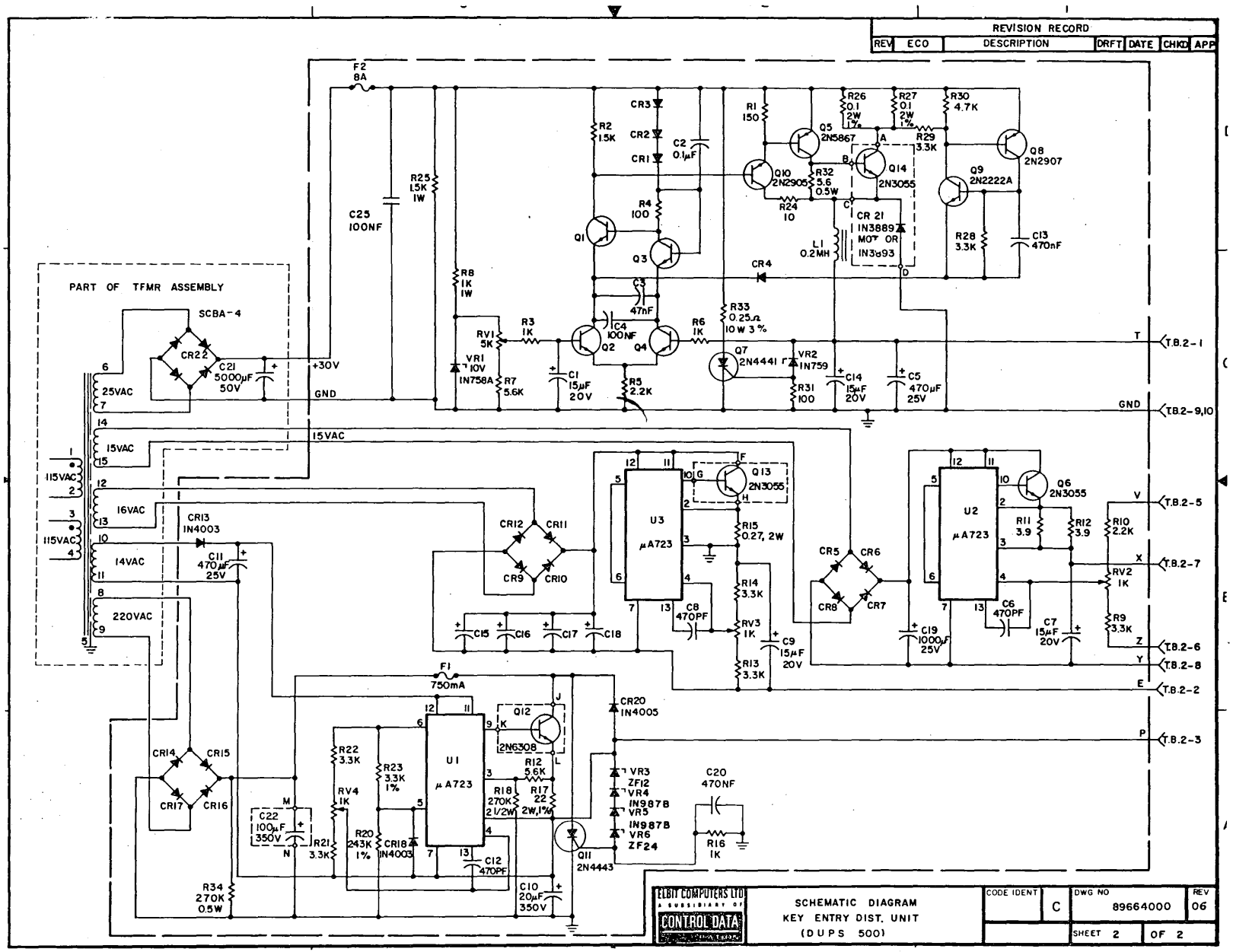


Figure 5-11. 970-8 Key Entry Station Distribution Unit Power Supply Logic Diagram, Sheet 2

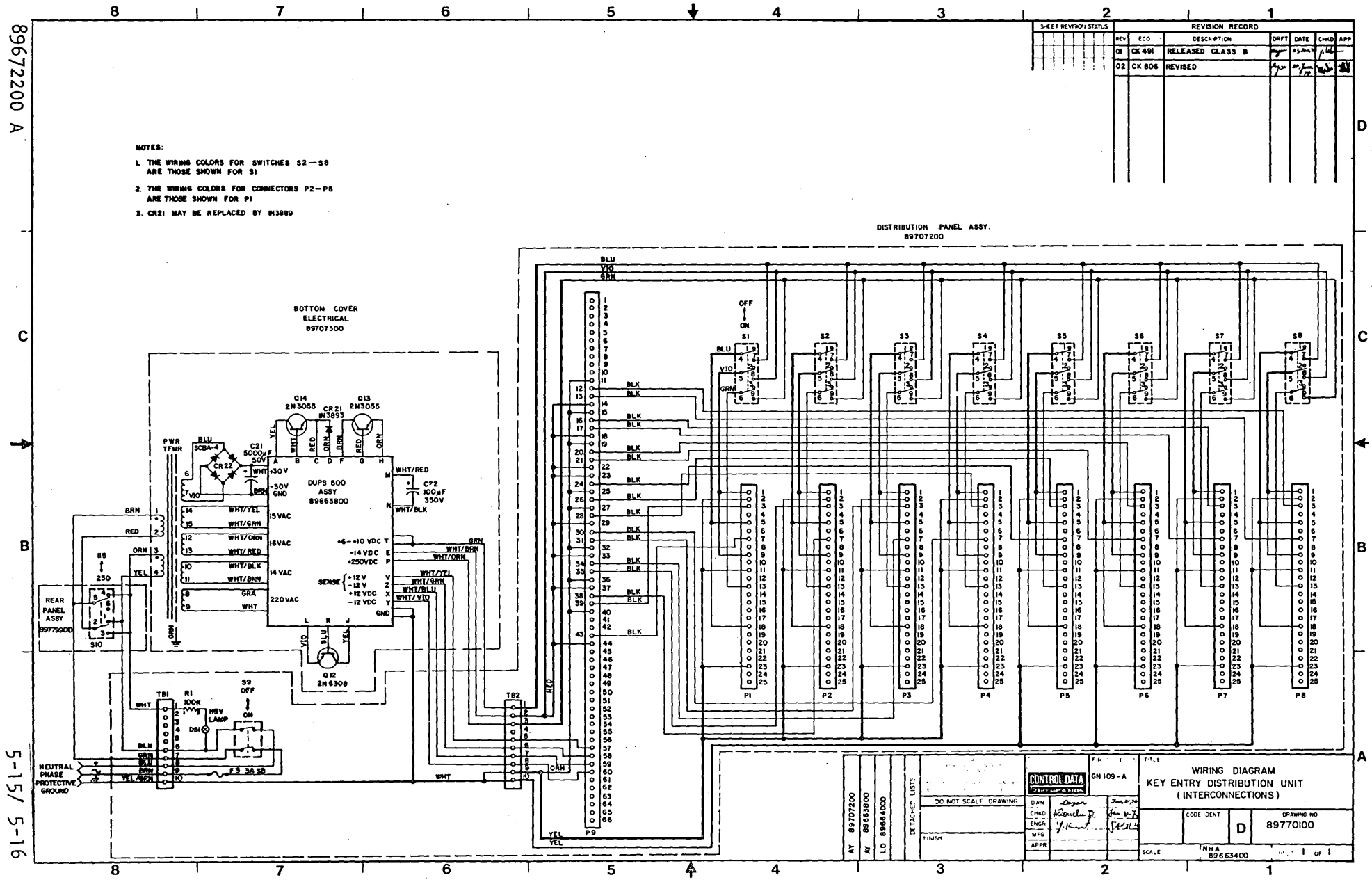


Figure 5-12. 970-8 Key Entry Station Distribution Unit Panel Wiring Diagram

SECTION 6

MAINTENANCE

SECTION 6

MAINTENANCE

INTRODUCTION

Section 6 supplies maintenance references and procedures for the equipment listed in section 1 of this manual.

The following CDC publications are applicable to the equipment:

Publication	Number
1784 Computer Customer Engineering Manual	89633300
1784 Computer Reference Manual	88830300
1784 Site Preparation Manual	60158400
1700 Computer System Codes Manual	60163500
System Maintenance Monitor (SMM 17)	60182000

TOOLS AND SPECIAL EQUIPMENT

Table 6-1 is a list of maintenance tools recommended for this equipment.

TABLE 6-1. TOOL AND EQUIPMENT LIST

Part Number	Part Description	Quantity
89688700	Board, extender	1
89670300	Board, extractor	1
	Oscilloscope, Tektronix 453 or equivalent	1
	Voltmeter, digital	1
	Screwdriver, 6 inch	1
	Screwdriver, miniature	1
	Screwdriver, crosspoint or Phillips	1

PREVENTIVE MAINTENANCE

Proper preventive maintenance procedures for the 970-8 Distribution Unit is outlined in the following paragraphs.

INSPECTION AND CLEANING

Perform preventive maintenance on the distribution unit as required by following steps 1 to 5:

1. Turn the system power off.

NOTE

Make sure the system is not operating before turning off the distribution unit.

2. Remove the top cover of the distribution unit.

3. Clean the inside of the distribution unit and power supply with a vacuum cleaner and a soft brush. Avoid touching the components on the board.

4. Inspect the printed wiring board for any damage (discolored components, loose connections, damaged solder joint). If damage is found, replace the distribution unit.

5. Replace the top cover of the distribution unit and power supply.

MAINTENANCE

Proper maintenance is required for the distribution unit. Maintenance for the controller consists of replacing the unit. The procedure for each is given in the following paragraphs.

CONTROLLER

Preventive maintenance of the controller is not required. After it is determined that the controller has failed, it should be replaced. For removal and replacement of the controller, refer to section 3. After replacement, a diagnostic check should be run as described in SMM17. Consult table 6-3 for troubleshooting or maintenance.

CAUTION

Do not remove or replace printed wiring boards or cables with the power on.

DISTRIBUTION UNIT

Maintenance of the distribution unit is limited to replacement of fuses, voltage adjustments, and replacement of the distribution unit. Consult table 6-3 for troubleshooting or maintenance of the distribution unit.

WARNING

High voltages are present in the distribution unit.

Fuse Replacement

The following fuses are available and may be replaced by removing the top cover of the distribution unit (figures 6-1 and 6-3).

Fuses	Rating	Function
F1 (power supply)	0.75 ampere	+240 vdc supply
F2 (power supply)	8 amperes	+6 to +10 vdc supply
F3 (front panel)	3 amperes	115/230 vac input

Voltage Checks and Adjustments

WARNING

High voltages are present in the distribution unit.

The voltage checks shown in table 6-2 should be made approximately every 3 months or as required by usage of the system. Adjustment must only be made as is absolutely necessary.

TABLE 6-2. DISTRIBUTION UNIT POWER SUPPLY VOLTAGES

Test Points	Voltages (vdc)	Cable Length To Key Entry Station	Adjust
TB2-1(+) and TB2-10(-)	+6.5 ± 0.1	10 feet	RV1
	+7.5 ± 0.1	50 feet	RV1
	+8.0 ± 0.1	100 feet	RV1
	+10.0 ± 0.1	200 feet	RV1
TB2-3(+) and TB2-10(-)	+240.0 ± 2.0	-	RV4
TB2-2(-) and TB2-10(+)	-14.0 ± 0.1	-	RV3
TB2-6(-) and TB2-5(+)	-12.0 ± 0.1	-	RV2

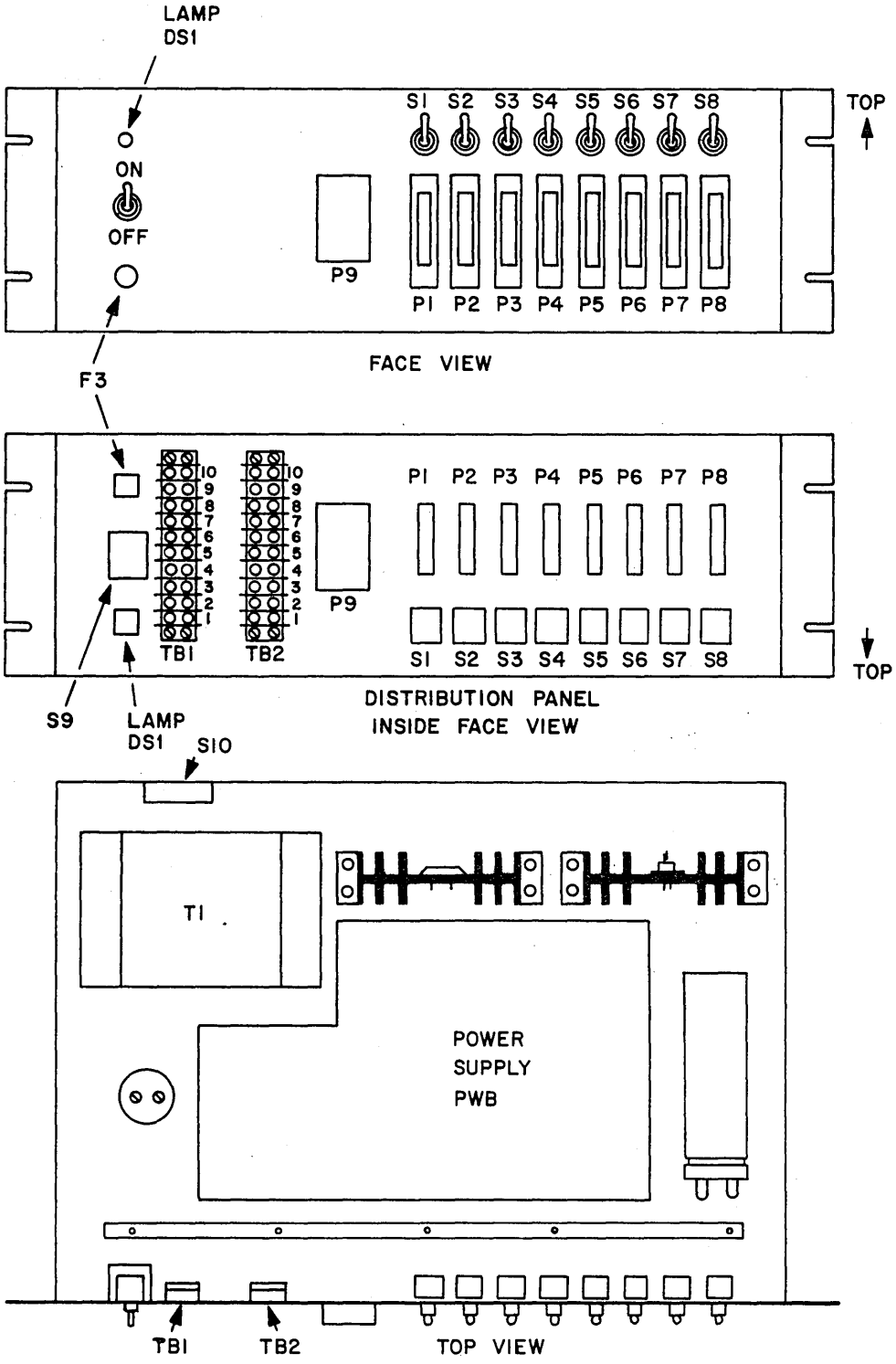


Figure 6-1. Distribution Unit Parts Location

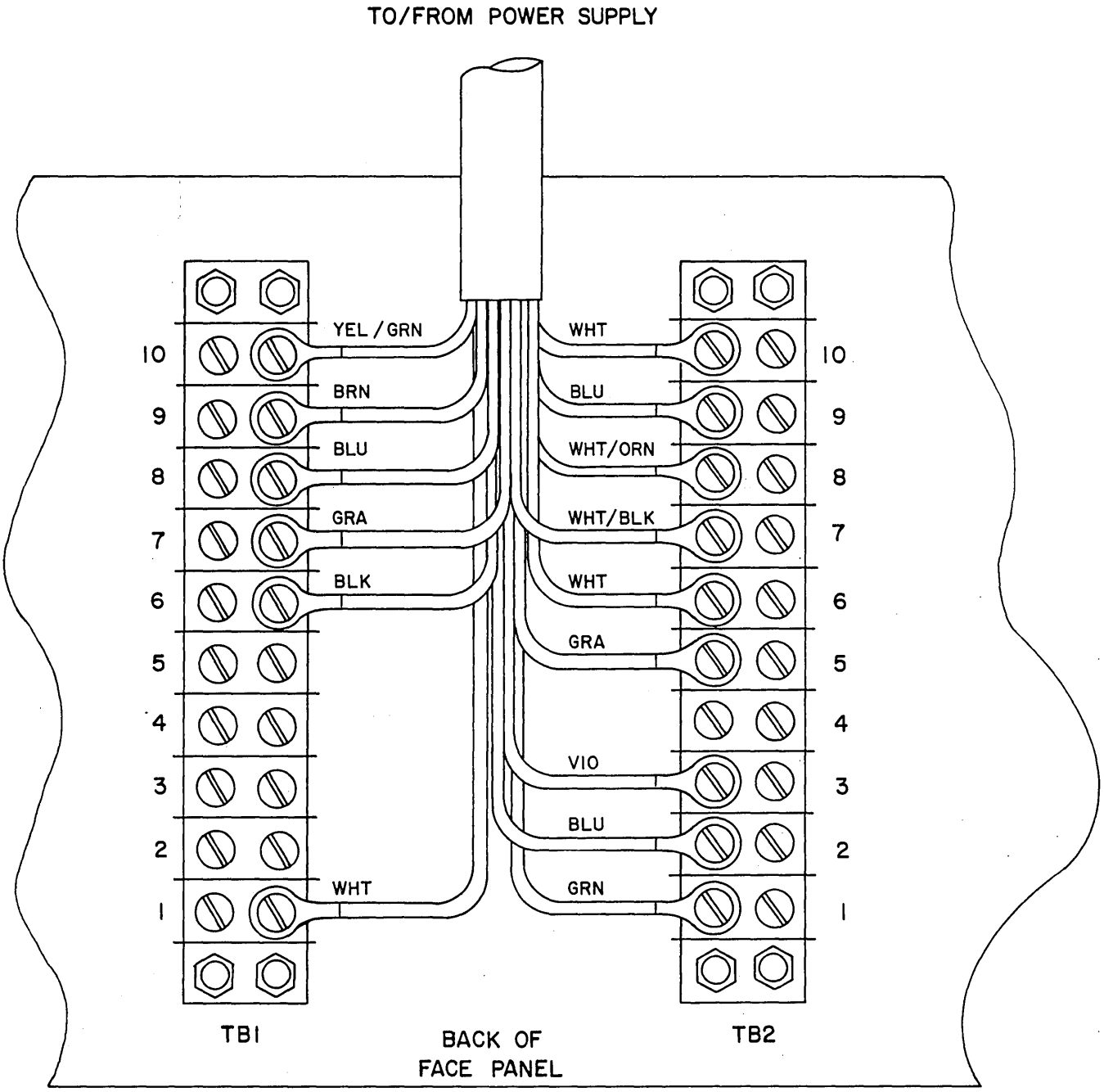
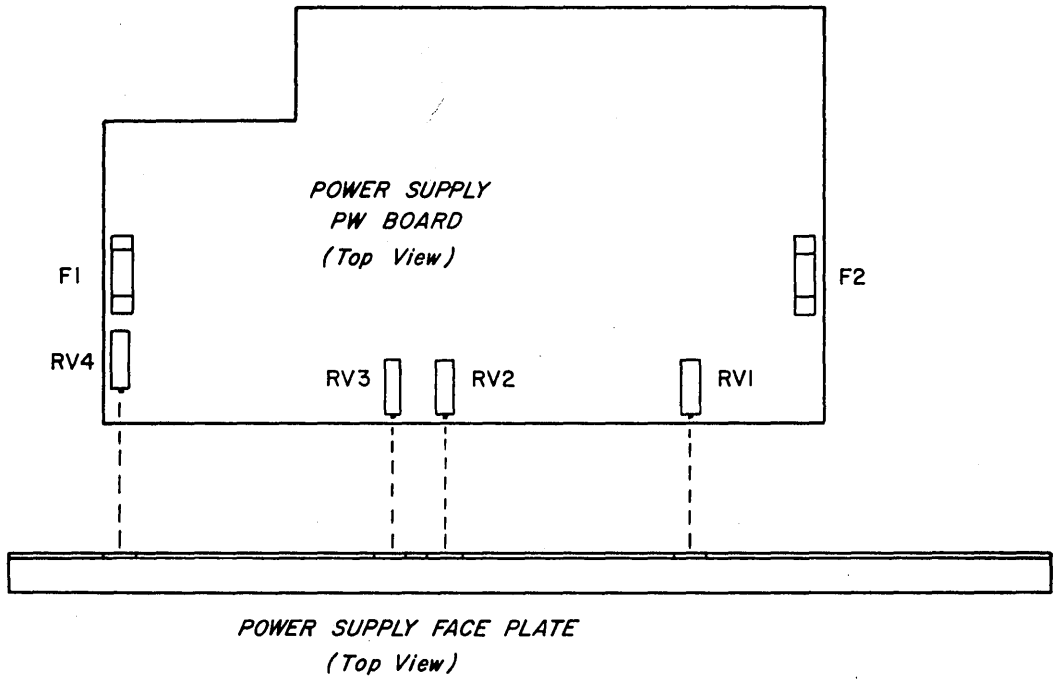


Figure 6-2. Terminal Board Layout



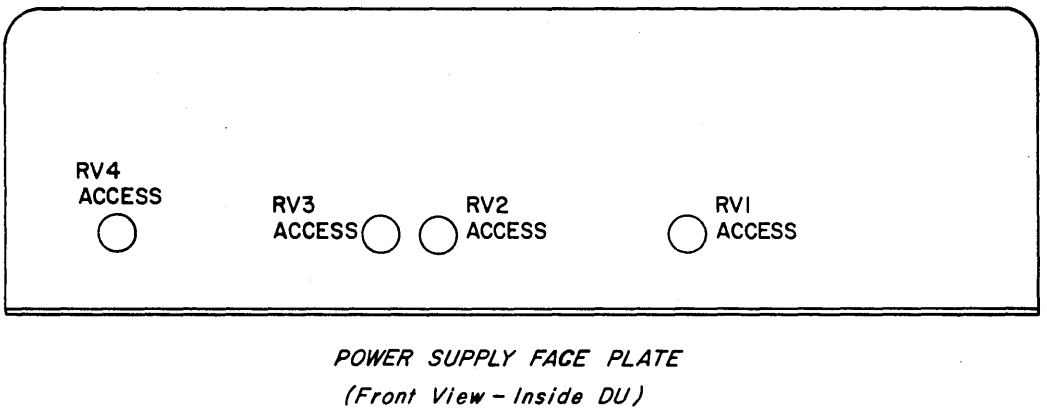


Figure 6-3. Fuse and Power Supply Adjustment Access (Inside Distribution Unit)

TROUBLESHOOTING

For proper operation of the system, the following conditions must be met:

1. All jumper plugs must be in the proper positions on the controller and key entry stations PWB's. Baud rates, interrupt cycle rates, number of start, stop, and data bits, equipment code, parity and protect bits jumper plugs must match on both the controller PWB and the stations PWB's and with that of the incoming signal.

2. The controller must be properly seated in the CPU.

3. Voltage selector switches on the distribution unit (back panel) and the 480-character key entry station (inside, under top cover, on display unit frame) must be set to match the line voltage.

4. The blink refresh rate jumper plug in the 480-character key entry stations must be set to 60-Hertz position for 115 vac use or to the 50-Hertz position for 230 vac use.

5. All cables required for use with this system must be properly connected in their assigned positions, including the power cords into the power receptacle.

6. The CPU, the distribution unit, and the key entry stations must be on.

7. The CPU must be properly programmed.

In the event of failure of the equipment, the procedure for troubleshooting as given in table 6-3 should be followed.

NOTE

Before removing or replacing controller, distribution unit, or cables or removing the cover of the 480-character key entry station, turn the power OFF.

TABLE 6-3. TROUBLESHOOTING GUIDE

Symptom	Cause	Action
1. Lamp DS1 on the distribution unit front panel does not light.	1. Main power switch S9 is in the OFF position.	Place the main power switch in the ON position.
	2. The power plug is not connected to the power source.	Connect the power plug.
	3. Main power (115/230 vac) is not present at power receptacle.	Inform the facilities manager that power is not present at the power receptacle.

TABLE 6-3. TROUBLESHOOTING GUIDE (cont)

Symptom	Cause	Action
	4. Fuse F3 is blown.	a. Turn off the distribution unit main power switch (S9). b. Replace fuse F3. c. Turn the distribution unit main power switch (S9) on. d. If F3 blows again, see symptom 3.
2. Lamp DS1 glows dimly.	1. If using 115 vac, the power selector switch (S10) may be in the 230-vac position.	Place the power selector (S10) on the back panel in the 115-vac position.
	2. Main power has dropped below usable limits.	a. Turn off all key entry stations. b. Turn the distribution unit main power switch (S9) off until main power rises.
3. Main power fuse F3 blows after it is replaced. There is no display at the key entry stations.	1. If using 230 vac, the power selector switch (S10) is in the 115-vac position.	Place the power selector switch (S10) on the back panel in the 230-vac position.
	2. There is a short in the distribution unit.	a. Turn off the unit main power switch. b. Remove cables from P1 through P9 from the unit. c. Replace fuse F3. d. Turn on the unit main power switch. e. If fuse F3 blows, replace the unit.
	3. There is a short in the controller or in the external or internal cables from the distribution unit to the controller.	a. Turn off the unit main power switch. b. Reconnect the cable between the CPU and P9 on the unit.

TABLE 6-3. TROUBLESHOOTING GUIDE (cont)

Symptom	Cause	Action
		c. Replace the controller. d. Replace fuse F3. e. Turn on the unit main power switch. f. If fuse F3 blows, turn off the unit main power switch. g. Install the controller that was removed in step c. h. Replace fuse F3. i. Turn on the distribution unit main power switch. j. If fuse F3 blows, replace the controller internal cable after turning off the unit main power switch. The cable that was removed in step 2.b. must be replaced. k. Reconnect cables P1 through P8.
	4. There is a short in one key entry station or in one cable between a station and the distribution unit.	a. Turn off the unit main power switch. b. Place switches S1 through S8 on the unit in the off (down) position. c. Replace fuse F3. d. Turn on the unit main power switch. e. Turn on S1 through S8 one at a time until fuse F3 blows. f. Turn off the unit main power switch.

TABLE 6-3. TROUBLESHOOTING GUIDE (cont)

Symptom	Cause	Action
		g. Turn the switch (S1 through S8) that is related to the affected key entry station to the off position. h. Disconnect the cable from the back of the affected key entry station. i. Replace fuse F3. j. Turn on the unit main power switch. k. Turn the switch (S1 through S8) on the unit to the affected key entry station on (up). l. If fuse F3 blows, replace the cable. m. If fuse F3 does not blow, replace the key entry station.
4. The +240 volt fuse (F1) on the PWB blows repeatedly after it is replaced.	1. There is a short in the 32-character key entry station (if used).	Replace the 32-character key entry station.
	2. There is a short in the cable between the distribution unit and the key entry station.	Replace the cable.
	3. There is a short in any connector (P1 through P8).	Replace the distribution unit.
	4. There is a short in the distribution unit.	Replace the unit.

TABLE 6-3. TROUBLESHOOTING GUIDE (cont)

Symptom	Cause	Action
5. The +6 vdc to +10 vdc fuse (F2) on the PWB blows repeatedly after it is replaced.	1. There is a short in the key entry station.	Replace the key entry station.
	2. There is a short in the cable between the distribution unit and the key entry station.	Replace the cable.
	3. There is a short in any connector (P1 through P8).	Replace the distribution unit.
6. Characters will not display on any key entry station in the system.	1. A cable is disconnected between the key entry station and the distribution unit or between the unit and the controller.	Reconnect the loose cable, and secure it properly.
	2. The power switch (S9) is off at the distribution unit.	Place the power switch (S9) in the on position.
	3. The distribution unit main power fuse (F3) is blown.	Replace the fuse (F3).
	4. The distribution unit power plug is disconnected.	Connect the power plug.
	5. There is no main power.	Report this failure to the supervisor.
	6. The power selector switch (S10) on the back of the distribution unit is in the wrong position.	Place the power selector switch (S10) in the position which matches power line voltage.
	7. The +250 vdc fuse (F1) is blown in the distribution unit (32-character key entry station only).	Replace the fuse (F1) in the unit.

TABLE 6-3. TROUBLESHOOTING GUIDE (cont)

Symptom	Cause	Action
	8. The +6 vdc to +10 vdc fuse (F2) is blown in the distribution unit.	Replace the fuse (F2) in the unit.
	9. Voltages in the distribution unit are misadjusted.	Readjust the voltages in the unit as required.
	10. There is a broken connector on the distribution unit.	Replace the unit.
	11. The distribution unit is faulty.	Replace the unit.
	12. The controller is faulty.	Replace the controller.
7. Characters are missing, faulty, or erratic on all key entry stations in the system.	1. Voltages in the distribution unit are misadjusted.	Readjust voltages in the unit as required.
	2. The controller is faulty.	Replace the controller.
8. Characters are missing, faulty, or erratic on one key entry station.	1. The key entry station or the controller is faulty.	a. Interchange the key entry station affected with a second key station by moving the key entry station cable from one connector-channel assignment to another. b. If faults remain on the same key entry station after interchange, replace the station. c. If the fault does not remain on the same key entry station, replace the controller.

SECTION 7

MAINTENANCE AIDS

SECTION 7

MAINTENANCE AIDS

Section 7 is not required for maintenance of the 970-8 Key Entry Station Distribution Unit and Controller.

SECTION 8

PARTS DATA

SECTION 8

PARTS DATA

The following parts list in table 8-1 is applicable to the 970-8, FC106-A Key Entry Station Controller and the 970-8, GN109-A Key Entry Station Distribution Unit.

TABLE 8-1. PARTS DATA

Nomenclature	Part Number
Controller PW assembly	89940400
Internal cable assembly	89641800
External cable assembly	
10 feet	89663300
15 feet	89663301
50 feet	89663302
100 feet	89663303
200 feet	89663304
400 feet	89663305
800 feet	89663306
Distribution unit	
Top Assembly	89663403
Fuse-3AG, 250V, 8A (F2)	93418238
Fuse-3AG, 250V, 0.75A (F1)	92371010
Fuse-3AG, 250V, 3A (F3)	92412009
Electrical assembly	89707300
Distribution panel assembly	89707200
Mounting bracket	89695300

SECTION 9

WIRE LIST

SECTION 9

WIRE LIST

The following wire lists are applicable to the 970-8, FC106-A Key Entry Station Controller and the 970-8, GN109-A Key Entry Station Distribution Unit (tables 9-1 through 9-5). Wire size in AWG, wire color, origin and destination, and signal names are included.

TABLE 9-1. WIRING LIST FOR DISTRIBUTION UNIT INTERNAL HARNESS

Conductor Identity	Gauge	Color	Origin	Destination	Remarks
1		Blu	PWR TFMR	CR22; AC	
2		Vio	PWR TFMR	CR22; AC	
3	AWG 18	Brn	Q13; C	Print; F	
4	AWG 22	Red	Q13; B	Print; G	
5	AWG 22	Orn	Q13; E	Print; H	
6	AWG 22	Yel	Q12; C	Print; J	
7	AWG 22	Blu	Q12; B	Print; K	
8	AWG 22	Vio	Q12; E	Print; L	
9	AWG 18	Red	CR21; CATHODE	Q1 ; E; 2	
10	AWG 18	Red	Q14; E;2	Print; C	
11	AWG 18	Yel	Q14; C	Print; A	
12	AWG 22	Wht	Q14; B	Print; B	
13	AWG 18	Orn	CR21; ANODE	Print; D	
14	AWG 18	Wht	CR22; +; 2	Print; +30V	
15	AWG 18	Wht	CR22; +; 2	C21; +	5000MF
16	AWG 18	Brn	CR22; -; 2	C21; -	
17	AWG 18	Brn	CR22; -; 2	Print; -30V	

TABLE 9-1. WIRING LIST FOR DISTRIBUTION UNIT INTERNAL HARNESS (cont)

Conductor Identity	Gauge	Color	Origin	Destination	Remarks
18		Gra	PWR TFMR	Print 220 VAC	
19		Wht	PWR TFMR	Print 220 VAC	
20		Wht/Blk	PWR TFMR	Print 14 VAC	
21		Wht/Brn	PWR TFMR	Print 14 VAC	
22		Wht/Orn	PWR TFMR	Print 16 VAC	
23		Wht/Red	PWR TFMR	Print 16 VAC	
24		Wht/Yel	PWR TFMR	Print 15 VAC	
25		Wht/Grn	PWR TFMR	Print 15 VAC	
26	AWG 22	Wht/Red	C22; +	Print; M	100 MF
27	AWG 22	Wht/Blk	C22; -	Print; N	
28	AWG 18	Grn	Print; T; 2	TB 2; 1; 2	
29	AWG 22	Wht/Brn	Print; E	TB 2; 2	
30	AWG 22	Wht/Orn	Print; P	TB 2; 3	
31	AWG 22	Wht/Yel	Print; V	TB 2; 5	
32	AWG 22	Wht/Grn	Print; Z	TB 2; 6	
33	AWG 22	Wht/Blu	Print; X	TB 2; 7	
34	AWG 22	Wht/Vio	Print; Y	TB 2; 8	
35	AWG 18	Blk	Print; GND; 2	TB 2; 9; 2	
36		Grn	PWR TFMR	PS GND SCREW; 2	
37	AWG 18	Wht	PANEL GND SCR	PS GND SCREW; 2	
38		Brn	PWR TFMR	S 10; 5; 2	
39		Red	PWR TFMR	S 10; 2	
40		Orn	PWR TFMR	S 10; 3; 2	
41		Yel	PWR TFMR	S 10; 1; 2	

TABLE 9-1. WIRING LIST FOR DISTRIBUTION UNIT INTERNAL HARNESS (cont)

Conductor Identity	Gauge	Color	Origin	Destination	Remarks
42	AWG 22	Orn	S 10; 3; 2	S 10; 4; 2	
43	AWG 22	Wht	S 10; 4; 2	TB 1; 1	
44	AWG 22	Grn	S 10; 5; 2	TB 1; 7	
45	AWG 22	Blk	S 10; 1; 2	TB 1; 6	
46		Yel/Grn	Cable	TB 1; 10	
47		Brn	Cable	TB 1; 9	
48		Blu	Mains	TB 1; 8	

TABLE 9-2. WIRING LIST FOR DISTRIBUTION UNIT FRONT PANEL

Conductor Identity	Gauge	Color	Origin	Destination	Remarks
1	AWG 24	Blk	P9; 39	P1; 03	
2	AWG 24	Blk	P9; 35	P2; 03	
3	AWG 24	Blk	P9; 31	P3; 03	
4	AWG 24	Blk	P9; 28	P4; 03	
5	AWG 24	Blk	P9; 26	P5; 03	
6	AWG 24	Blk	P9; 20	P6; 03	
7	AWG 24	Blk	P9; 16	P7; 03	
8	AWG 24	Blk	P9; 12	P8; 03	
9	AWG 24	Blk	P9; 43	P1; 07	
10	AWG 24	Blk	P9; 38	P2; 07	
11	AWG 24	Blk	P9; 34	P3; 07	
12	AWG 24	Blk	P9; 30	P4; 07	
13	AWG 24	Blk	P9; 24	P5; 07	
14	AWG 24	Blk	P9; 21	P6; 07	
15	AWG 24	Blk	P9; 17	P7; 07	
16	AWG 24	Blk	P9; 13	P8; 07	
17	AWG 24	Brn	TB 2; 05	P9; 57	12V S +
18	AWG 24	Brn	TB 2; 06	P9; 58	12V S -
19	AWG 24	Brn	TB 2; 07	P9; 59	12V P +
20	AWG 24	Brn	TB 2; 08	P9; 60	12V P -
21	AWG 24	Red	TB 2; 02; 2	P9; 37; 2	-14V
22	AWG 24	Red	P9; 37; 2	P9; 44; 2	-14V
23	AWG 24	Red	P9; 44; 2	P9; 33; 2	-14V
24	AWG 24	Red	P9; 33; 2	P9; 29; 2	-14V

TABLE 9-2. WIRING LIST FOR DISTRIBUTION UNIT FRONT PANEL (cont)

Conductor Identity	Gauge	Color	Origin	Destination	Remarks
25	AWG 24	Red	P9; 29; 2	P9; 18; 2	-14V
26	AWG 24	Red	P9; 18; 2	P9; 23; 2	-14V
27	AWG 24	Red	P9; 23; 2	P9; 22; 2	-14V
28	AWG 24	Red	P9; 22; 2	P9; 14	-14V
29	AWG 24	Orn	TB 2; 09; 2	P9; 11; 2	GND for P9
30	AWG 24	Orn	P9; 11; 2	P9; 15; 2	GND for P9
31	AWG 24	Orn	P9; 15; 2	P9; 19; 2	GND for P9
32	AWG 24	Orn	P9; 19; 2	P9; 25; 2	GND for P9
33	AWG 24	Orn	P9; 25; 2	P9; 27; 2	GND for P9
34	AWG 24	Orn	P9; 27; 2	P9; 32; 2	GND for P9
35	AWG 24	Orn	P9; 32; 2	P9; 40; 2	GND for P9
36	AWG 24	Orn	P9; 40; 2	P9; 36	GND for P9
37	AWG 24	Yel	P1; 02	TB 2; 9; 12	
38	AWG 24	Yel	P1; 11; 2		
39	AWG 24	Yel	P1; 23; 2		
40	AWG 24	Yel	P2; 02		
41	AWG 24	Yel	P2; 11; 2		
42	AWG 24	Yel	P2; 23; 2		
43	AWG 24	Yel	P3; 02		
44	AWG 24	Yel	P3; 11; 2		
45	AWG 24	Yel	P3; 23; 2		
46	AWG 24	Yel	P4; 02		
47	AWG 24	Yel	P4; 11; 2		
48	AWG 24	Yel	P4; 23; 2		

TABLE 9-2. WIRING LIST FOR DISTRIBUTION UNIT FRONT PANEL (cont)

Conductor Identity	Gauge	Color	Origin	Destination	Remarks
49	AWG 24	Yel	P5; 02	TB 2; 10; 12	
50	AWG 24	Yel	P5; 11;		
51	AWG 24	Yel	P5; 23;		
52	AWG 24	Yel	P6; 02		
53	AWG 24	Yel	P6; 11;		
54	AWG 24	Yel	P6; 23;		
55	AWG 24	Yel	P7; 02		
56	AWG 24	Yel	P7; 11;		
57	AWG 24	Yel	P7; 23;		
58	AWG 24	Yel	P8; 02		
59	AWG 24	Yel	P8; 11;		
60	AWG 24	Yel	P8; 23;		
61	AWG 24	Grn	TB 2; 03	S1; 09; 2	+250V
62	AWG 24	Grn	S1; 09; 2	S2; 09; 2	+250V
63	AWG 24	Grn	S2; 09; 2	S3; 09; 2	+250V
64	AWG 24	Grn	S3; 09; 2	S4; 09; 2	+250V
65	AWG 24	Grn	S4; 09; 2	S5; 09; 2	+250V
66	AWG 24	Grn	S5; 09; 2	S6; 09; 2	+250V
67	AWG 24	Grn	S6; 09; 2	S7; 09; 2	+250V
68	AWG 24	Grn	S7; 09; 2	S8; 09	+250V
69	AWG 24	Grn	S1; 06	P1; 13	+250V
70	AWG 24	Grn	S2; 06	P2; 13	+250V
71	AWG 24	Grn	S3; 06	P3; 13	+250V
72	AWG 24	Grn	S4; 06	P4; 13	+250V

TABLE 9-2. WIRING LIST FOR DISTRIBUTION UNIT FRONT PANEL (cont)

Conductor Identity	Gauge	Color	Origin	Destination	Remarks
73	AWG 24	Grn	S5; 06	P5; 13	+250V
74	AWG 24	Grn	S6; 06	P6; 13	+250V
75	AWG 24	Grn	S7; 06	P7; 13	+250V
76	AWG 24	Grn	S8; 06	P8; 13	+250V
77	AWG 24	Blu	TB 2; 01; 8	S1; 07	+10V
78	AWG 24	Blu	TB 2; 01; 8	S2; 07	+10V
79	AWG 24	Blu	TB 2; 01; 8	S3; 07	+10V
80	AWG 24	Blu	TB 2; 01; 8	S4; 07	+10V
81	AWG 24	Blu	TB 2; 01; 8	S5; 07	+10V
82	AWG 24	Blu	TB 2; 01; 8	S6; 07	+10V
83	AWG 24	Blu	TB 2; 01; 8	S7; 07	+10V
84	AWG 24	Blu	TB 2; 01; 8	S8; 07	+10V
85	AWG 24	Blu	S1; 04; 2	P1; 18;	
86	AWG 24	Blu	S1; 04; 2	P1; 05	
87	AWG 24	Blu	S2; 04; 2	P2; 18;	
88	AWG 24	Blu	S2; 04; 2	P2; 05	
89	AWG 24	Blu	S3; 04; 2	P3; 18;	
90	AWG 24	Blu	S3; 04; 2	P3; 05	
91	AWG 24	Blu	S4; 04; 2	P4; 18;	
92	AWG 24	Blu	S4; 04; 2	P5; 05	
93	AWG 24	Blu	S5; 04; 2	P5; 18;	
94	AWG 24	Blu	S5; 04; 2	P5; 05	
95	AWG 24	Blu	S6; 04; 2	P6; 18;	
96	AWG 24	Blu	S6; 04; 2	P6; 05	

TABLE 9-2. WIRING LIST FOR DISTRIBUTION UNIT FRONT PANEL (cont)

Conductor Identity	Gauge	Color	Origin	Destination	Remarks
97	AWG 24	Blu	S7; 04; 2	P7; 18;	
98	AWG 24	Blu	P7; 18; 2	P7; 05	
99	AWG 24	Blu	S8; 04; 2	P8; 18;	
100	AWG 24	Blu	P8; 18; 2	P8; 05	
101	AWG 24	Vio	TB 2; 02; 2	S1; 08; 2	-14V
102	AWG 24	Vio	S1; 08; 2	S2; 08; 2	-14V
103	AWG 24	Vio	S2; 08; 2	S3; 08; 2	-14V
104	AWG 24	Vio	S3; 08; 2	S4; 08; 2	-14V
105	AWG 24	Vio	S4; 08; 2	S5; 08; 2	-14V
106	AWG 24	Vio	S5; 08; 2	S6; 08; 2	-14V
107	AWG 24	Vio	S6; 08; 2	S7; 08; 2	-14V
108	AWG 24	Vio	S7; 08; 2	S8; 08	-14V
109	AWG 24	Vio	S1; 05; 2	P1; 01;	
110	AWG 24	Vio	S1; 05; 2	P1; 09	
111	AWG 24	Vio	S2; 05; 2	P2; 01;	
112	AWG 24	Vio	S2; 05; 2	P2; 09	
113	AWG 24	Vio	S3; 05; 2	P3; 01;	
114	AWG 24	Vio	S3; 05; 2	P3; 09	
115	AWG 24	Vio	S4; 05; 2	P4; 01;	
116	AWG 24	Vio	S4; 05; 2	P4; 09	
117	AWG 24	Vio	S5; 05; 2	P5; 01;	
118	AWG 24	Vio	S5; 05; 2	P5; 09	
119	AWG 24	Vio	S6; 05; 2	P6; 01	
120	AWG 24	Vio	S6; 05; 2	P6; 09	

TABLE 9-2. WIRING LIST FOR DISTRIBUTION UNIT FRONT PANEL (cont)

Conductor Identity	Gauge	Color	Origin	Destination	Remarks
121	AWG 24	Vio	S7; 05; 2	P7; 01; 2	
122	AWG 24	Vio	S7; 05; 2	P7; 09	
123	AWG 24	Vio	S8; 05; 2	P8; 01; 2	
124	AWG 24	Vio	S8; 05; 2	P8; 09	
125	W-103	Red	TB 1; 09	F1	
126	W-103	Red	F1; side	S9; 04	
127	W-103	Red	S9; 03	TB 1; 07	
128	W-103	Blk	TB 1; 08	S9; 01	
129	W-103	Blk	TB 1; 06	S9; 02; 2	
130	W-103	Blk	S9; 02; 2	To lamp	
131	N/A	N/A	TB 1; 01	R1, 1 (F/N33)	Solder only, no wire.
132	N/A	N/A	R1; 2	DS1 (F/N10)	Solder only, no wire.
133	W-104	Wht	TB 1; 10	GND Pin	
134	W-104	Wht	TB 2; 10	GND Pin	
135	Shorting Jumper		TB 2; 10	TB2; 09	

TABLE 9-3. WIRING LIST FOR CONTROLLER EXTERNAL CABLE

Conductor Identity	Gauge	Color	Origin	Destination	Remarks
1	AWG 24	Brn	P1; 5	P2; 5	
2	AWG 24	Blk	P1; 42	P2; 42	
3	AWG 24	Red	P1; 39	P2; 39	
4	AWG 24	Blk	P1; 40	P2; 40	
5	AWG 24	Orn	P1; 43	P2; 43	
6	AWG 24	Blk	P1; 44	P2; 44	
7	AWG 24	Yel	P1; 57	P2; 57	
8	AWG 24	Blk	P1; 58	P2; 58	
9	AWG 24	Grn	P1; 59	P2; 59	
10	AWG 24	Blk	P1; 60	P2; 60	
11	AWG 24	Blu	P1; 11	P2; 11	
12	AWG 24	Blk	P1; 12	P2; 12	
13	AWG 24	Vio	P1; 13	P2; 13	
14	AWG 24	Blk	P1; 14	P2; 14	
15	AWG 24	Gra	P1; 15	P2; 15	
16	AWG 24	Blk	P1; 16	P2; 16	
17	AWG 24	Wht	P1; 17	P2; 17	
18	AWG 24	Blk	P1; 18	P2; 18	
19	AWG 24	Red	P1; 19	P2; 19	
20	AWG 24	Brn	P1; 20	P2; 20	
21	AWG 24	Orn	P1; 21	P2; 21	
22	AWG 24	Brn	P1; 22	P2; 22	
23	AWG 24	Yel	P1; 23	P2; 23	
24	AWG 24	Brn	P1; 24	P2; 24	

TABLE 9-3. WIRING LIST FOR CONTROLLER EXTERNAL CABLE (cont)

Conductor Identity	Gauge	Color	Origin	Destination	Remarks
25	AWG 24	Grn	P1; 25	P2; 25	
26	AWG 24	Brn	P1; 26	P2; 26	
27	AWG 24	Blu	P1; 27	P2; 27	
28	AWG 24	Brn	P1; 28	P2; 28	
29	AWG 24	Vio	P1; 29	P2; 29	
30	AWG 24	Brn	P1; 30	P2; 30	
31	AWG 24	Gra	P1; 31	P2; 31	
32	AWG 24	Brn	P1; 32	P2; 32	
33	AWG 24	Wht	P1; 33	P2; 33	
34	AWG 24	Brn	P1; 34	P2; 34	
35	AWG 24	Orn	P1; 35	P2; 35	
36	AWG 24	Red	P1; 36	P2; 36	
37	AWG 24	Yel	P1; 37	P2; 37	
38	AWG 24	Red	P1; 38	P2; 38	

TABLE 9-4. WIRING LIST FOR CONTROLLER INTERNAL CABLE

Conductor Identity	Gauge	Color	Origin	Destination	Remarks
1	AWG 28	Wht/Blk	P2; A01	P1; 01	
2	AWG 28	Blk	P2; B01	P1; 02	
3	AWG 28	Wht/Brn	P2; A02	P1; 03	
4	AWG 28	Blk	P2; B02	P1; 04	
5	AWG 28	Wht/Red	P2; A03	P1; 05	
6	AWG 28	Blk	P2; B03	P1; 06	
7	AWG 28	Wht/Orn	P2; A04	P1; 07	
8	AWG 28	Blk	P2; B04	P1; 08	
9	AWG 28	Wht/Yel	P2; A05	P1; 09	
10	AWG 28	Blk	P2; B05	P1; 10	
11	AWG 28	Wht/Grn	P2; A06	P1; 11	
12	AWG 28	Blk	P2; B06	P1; 12	
13	AWG 28	Wht/Blu	P2; A07	P1; 13	
14	AWG 28	Blk	P2; B07	P1; 14	
15	AWG 28	Wht/Vio	P2; A08	P1; 15	
16	AWG 28	Blk	P2; B08	P1; 16	
17	AWG 28	Wht/Gra	P2; A09	P1; 17	
18	AWG 28	Blk	P2; B09	P1; 18	
19	AWG 28	Wht/Blk	P2; A10	P1; 19	
20	AWG 28	Brn	P2; B10	P1; 20	
21	AWG 28	Wht/Brn	P2; A11	P1; 21	
22	AWG 28	Brn	P2; B11	P1; 22	
23	AWG 28	Wht/Red	P2; A12	P1; 23	
24	AWG 28	Brn	P2; B12	P1; 24	

TABLE 9-4. WIRING LIST FOR CONTROLLER INTERNAL CABLE (cont)

Conductor Identity	Gauge	Color	Origin	Destination	Remarks
25	AWG 28	Wht/Orn	P2; A13	P1; 25	
26	AWG 28	Brn	P2; B13	P1; 26	
27	AWG 28	Wht/Yel	P2; A14	P1; 27	
28	AWG 28	Brn	P2; B14	P1; 28	
29	AWG 28	Wht/Grn	P2; A15	P1; 29	
30	AWG 28	Brn	P2; B15	P1; 30	
31	AWG 28	Wht/Blu	P2; A16	P1; 31	
32	AWG 28	Brn	P2; B16	P1; 32	
33	AWG 28	Wht/Vio	P2; A17	P1; 33	
34	AWG 28	Brn	P2; B17	P1; 34	
35	AWG 28	Wht/Gra	P2; A18	P1; 35	
36	AWG 28	Brn	P2; B18	P1; 36	
37	AWG 28	Wht/Blk	P2; A19	P1; 37	
38	AWG 28	Red	P2; B19	P1; 38	
39	AWG 28	Wht/Brn	P2; A20	P1; 39	
40	AWG 28	Red	P2; B20	P1; 40	
41	AWG 28	Wht/Red	P2; A21	P1; 41	
42	AWG 28	Red	P2; B21	P1; 42	
43	AWG 28	Wht/Orn	P2; A22	P1; 43	
44	AWG 28	Red	P2; B22	P1; 44	
45	AWG 28	Wht/Yel	P2; A23	P1; 45	
46	AWG 28	Red	P2; B23	P1; 46	
47	AWG 28	Wht/Grn	P2; A24	P1; 47	
48	AWG 28	Red	P2; B24	P1; 48	

TABLE 9-4. WIRING LIST FOR CONTROLLER INTERNAL CABLE (cont)

Conductor Identity	Gauge	Color	Origin	Destination	Remarks
49	AWG 28	Wht/Blu	P2; A25	P1; 49	
50	AWG 28	Red	P2; B25	P1; 50	
51	AWG 28	Wht/Vio	P2; A26	P1; 51	
52	AWG 28	Red	P2; B26	P1; 52	
53	AWG 28	Wht/Gra	P2; A27	P1; 53	
54	AWG 28	Red	P2; B27	P1; 54	
55	AWG 28	Wht/Blk	P2; A28	P1; 55	
56	AWG 28	Orn	P2; B28	P1; 56	
57	AWG 28	Wht/Brn	P2; A29	P1; 57	
58	AWG 28	Orn	P2; B29	P1; 58	
59	AWG 28	Wht/Red	P2; A30	P1; 59	
60	AWG 28	Orn	P2; B30	P1; 60	

TABLE 9-5. PIN LIST FOR 970-8 CONTROLLER PWB

P1			P2		
A		B	A		B
$\overline{A5}$	01	$\overline{A1}$		01	XT
$\overline{A6}$	02	$\overline{A2}$	XRT	02	
$\overline{A0}$	03	$\overline{A7}$	GND	03	
	04	$\overline{A8}$	XR	04	
$\overline{A11}$	05	$\overline{A9}$		05	
$\overline{A3}$	06	$\overline{A10}$	TIN 8	06	TOUT 8
$\overline{A4}$	07		RIN 8	07	ROUT 8
	08		TIN 7	08	TOUT 7
	09		RIN 7	09	ROUT 7
	10		TIN 6	10	TOUT 6
$\overline{A15}$	11	GND	RIN 6	11	ROUT 6
Q0	12	Q1	ROUT 5	12	RIN 5
Q2	13		TIN 5	13	TOUT 5
Q4	14	Q5	TIN 4	14	TOUT 4
Q6	15	Q7	ROUT 4	15	RIN 4
Q8	16	Q9	TOUT 3	16	TIN 3
Q10	17		ROUT 3	17	RIN 3
	18		TOUT 2	18	TIN 2
	19		ROUT 2	19	RIN 2
$\overline{W=0}$	20		TOUT 1	20	TIN 1
$\overline{READ}$	21	$\overline{WRITE}$		21	GND
$\overline{REPLY}$	22	$\overline{REJECT}$	RIN 1	22	ROUT 1
$\overline{PROGRAM\ PROTECT}$	23	$\overline{MC}$	DIN 5	23	DIN 2
	24	INTERRUPT	DIN 4	24	DIN 5
	25		DIN 6	25	DIN 4
	26		DIN 8	26	DIN 6
	27		DIN 7	27	DIN 8
	28		DIN 3	28	DIN 1
GND	29		GND	29	-12V
	30		GND	30	-12V
	31		+5V	31	

COMMENT SHEET

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Distribution Unit and Controller Customer Engineering Manual

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