

# **EQUIP. MANUAL**

**VME/10  
Microcomputer System  
Equipment Manual**



**MICROSYSTEMS**

**QUALITY • PEOPLE • PERFORMANCE**

VME/10  
MICROCOMPUTER SYSTEM  
EQUIPMENT MANUAL

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WARNING

THIS EQUIPMENT GENERATES, USES, AND CAN RADIATE RADIO FREQUENCY ENERGY. THIS EQUIPMENT HAS BEEN TESTED AS A CLASS A COMPUTING DEVICE AND HAS BEEN FOUND TO COMPLY WITH PART 15 OF FCC RULES. HOWEVER, OPERATION OF THIS EQUIPMENT MAY CAUSE INTERFERENCE, IN WHICH CASE THE USER, AT HIS OWN EXPENSE, WILL BE REQUIRED TO TAKE WHATEVER MEASURES MAY BE REQUIRED TO CORRECT THE INTERFERENCE.

First Edition

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## **SAFETY SUMMARY**

### **SAFETY DEPENDS ON YOU**

*The following general safety precautions must be observed during all phases of operation, service, and repair of this equipment. Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of design, manufacture, and intended use of the equipment. Motorola Inc. assumes no liability for the customer's failure to comply with these requirements. The safety precautions listed below represent warnings of certain dangers of which we are aware. You, as the user of the product, should follow these warnings and all other safety precautions necessary for the safe operation of the equipment in your operating environment.*

#### **GROUND THE INSTRUMENT.**

To minimize shock hazard, the equipment chassis and enclosure must be connected to an electrical ground. The equipment is supplied with a three-conductor ac power cable. The power cable must either be plugged into an approved three-contact electrical outlet or used with a three-contact to two-contact adapter, with the grounding wire (green) firmly connected to an electrical ground (safety ground) at the power outlet. The power jack and mating plug of the power cable meet International Electrotechnical Commission (IEC) safety standards.

#### **DO NOT OPERATE IN AN EXPLOSIVE ATMOSPHERE.**

Do not operate the equipment in the presence of flammable gases or fumes. Operation of any electrical equipment in such an environment constitutes a definite safety hazard.

#### **KEEP AWAY FROM LIVE CIRCUITS.**

Operating personnel must not remove equipment covers. Component replacement and internal adjustments must be made by qualified maintenance personnel. Do not replace components with power cable connected. Under certain conditions, dangerous voltages may exist even with the power cable removed. To avoid injuries, always disconnect power and discharge circuits before touching them.

#### **DO NOT SERVICE OR ADJUST ALONE.**

Do not attempt internal service or adjustment unless another person, capable of rendering first aid and resuscitation, is present.

#### **USE CAUTION WHEN EXPOSING OR HANDLING THE CRT.**

Breakage of the Cathode-Ray Tube (CRT) causes a high-velocity scattering of glass fragments (implosion). To prevent CRT implosion, avoid rough handling or jarring of the equipment. Handling of the CRT should be done only by qualified maintenance personnel using approved safety mask and gloves.

#### **DO NOT SUBSTITUTE PARTS OR MODIFY EQUIPMENT.**

Because of the danger of introducing additional hazards, do not install substitute parts or perform any unauthorized modification of the equipment. Contact Motorola Microsystems Warranty and Repair for service and repair to ensure that safety features are maintained.

#### **DANGEROUS PROCEDURE WARNINGS.**

Warnings, such as the example below, precede potentially dangerous procedures throughout this manual. Instructions contained in the warnings must be followed. You should also employ all other safety precautions which you deem necessary for the operation of the equipment in your operating environment.

#### **WARNING**

**Dangerous voltages, capable of causing death, are present in this equipment. Use extreme caution when handling, testing, and adjusting.**

## PREFACE

An asterisk (\*) following the signal name for signals which are level significant denotes that the signal is true or valid when the signal is low.

An asterisk (\*) following the signal name for signals which are edge significant denotes that the actions initiated by that signal occur on a high to low transition.

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**GENERAL  
INFO**



CHAPTER 1  
GENERAL INFORMATION

1.1 INTRODUCTION

This manual provides general information for the VME/10 Microcomputer System (hereafter referred to as VME/10). The VME/10 consists of a keyboard, control unit chassis, and display unit, as shown in Figure 1-1. Also provided are individual chapters containing a general description, removal/replacement procedures, parts lists, and diagrams for each VME/10 assembly.



6-83-1537

FIGURE 1-1. Typical VME/10 Microcomputer System

## 1.2 GENERAL DESCRIPTION

The VME/10 basically consists of a keyboard, control unit chassis, and a display unit. As shown in Figure 1-2, the control unit chassis consists of the following items:

- a. System Control Module (SCM).
- b. Control (operator) panel containing power, reset, abort, and keyboard lock switches.
- c. Mass storage assembly consisting of a Winchester Disk Controller (WDC) module, Winchester drive, and a floppy drive.
- d. Expansion card cage assembly.
- e. Power supply assembly.

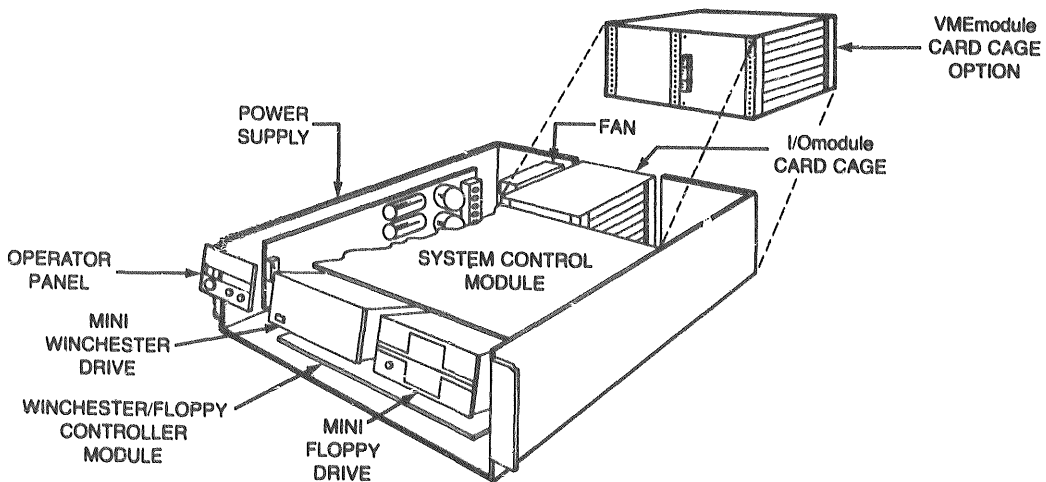


FIGURE 1-2. Control Unit Chassis

There are four VME/10 configurations. Table 1-1 lists the part number and description of each configuration.

TABLE 1-1. VME/10 Configurations

PART NUMBER	DESCRIPTION
M68K101-1	Basic 115 Vac system equipment with 5M-byte (formatted) Winchester drive and 5-slot I/Omodule expansion card cage assembly.
M68K102B1	Basic 115 Vac system equipment with 15M-byte (formatted) Winchester drive and 5-slot VMEmodule plus 4-slot I/Omodule (VME+I/Omodule) expansion card cage assembly.
M68K101-2	Same as M68K101-1, except 230 Vac operation.
M68K102B2	Same as M68K102B1, except 230 Vac operation.

### 1.3 SPECIFICATIONS

Table 1-2 lists the VME/10 specifications.

TABLE 1-2. VME/10 Specifications

CHARACTERISTIC	SPECIFICATION	
Temperature		
Operating	10° to 40° C	
Storage	-40° to 60° C	
Relative humidity	10% to 80% (noncondensing)	
Physical dimensions	<u>Chassis and Monitor</u>	<u>Keyboard</u>
Length	22.8 in. (57.9 cm)	8.3 in. (21.1 cm)
Width	19.0 in. (48.3 cm)	19.0 in. (48.3 cm)
Height	20.0 in. (50.8 cm)	2.0 in. (5.1 cm)
Weight	50 lbs. (23 kg)	5 lbs. (2.3 kg)
Power requirements	90-132 Vac, 47-63 Hz, 500 W	
	180-264 Vac, 47-63 Hz, 500 W	

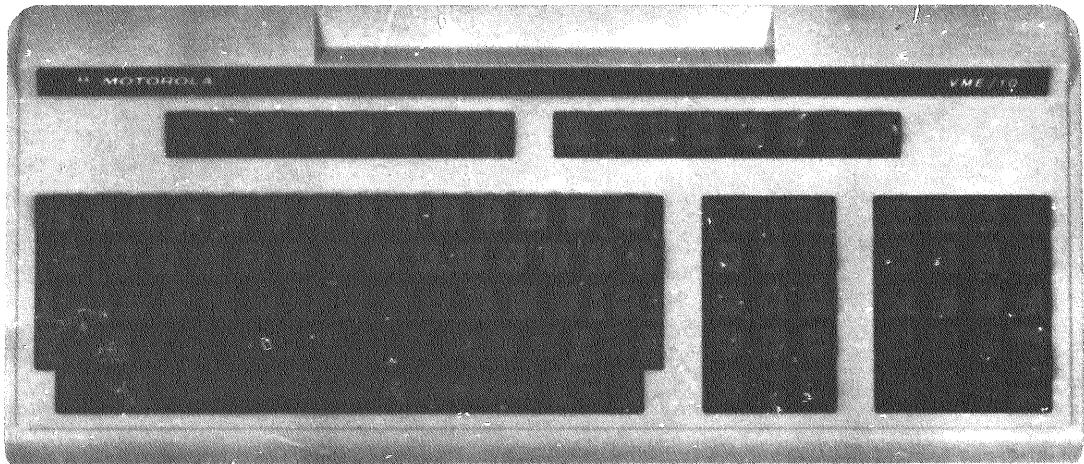
**KEYBOARD**

## CHAPTER 2

### KEYBOARD

#### 2.1 INTRODUCTION

This chapter provides a general description, removal/replacement procedures, parts lists, and diagrams for the keyboard as shown in Figure 2-1.



10-83-1798

FIGURE 2-1. Keyboard

## 2.2 GENERAL DESCRIPTION

The VME/10 keyboard is connected to the control unit chassis via a serial link using a coiled cable assembly with quick disconnect (modular RJ type) connectors. The keyboard consists of a full American Standard Code for Information Interchange (ASCII) character set, 16 function keys, and cursor/tab control and numeric keypads.

The keyboard utilizes an MPU that scans the keyswitch array and reports changes to the control unit chassis System Control Module (SCM). The keyboard also responds to commands from the SCM. This communication interface between the keyboard and SCM is accomplished via a half duplex Universal Asynchronous Receiver/Transmitter (UART) operating at 512 or 600 baud with eight serial data bits, odd parity, one start bit, and one stop bit.

### 2.2.1 Switch Array

The keyboard MPU performs the UART function on an interrupt basis and scans the entire switch array (16 columns x 8 rows) at a minimum of 500 times per second. When a keyboard switch closure is detected, the array scan code is sent to the SCM via the communications interface.

If more than one closure is detected simultaneously, both scan codes are stored in the keyboard MPU First In/First Out (FIFO) memory. A bit map of the switch array is kept in MPU RAM and is used to detect a change in the array state.

A closure is reported only once unless held for more than a half-second; then the report is repeated (placed in FIFO at a rate of 40 + 10 per second, non-overrunnable). Openings are detected by a change in the bit map state.

Keyboard configuration jumper straps are also reported as closures and openings. These jumper straps are labeled E8 through E13 and are defined in Table 2-1.


TABLE 2-1. Keyboard Jumper Straps

JUMPER NUMBER	JUMPER POSITION	SCAN CODE	DESCRIPTION		
E8	Removed (1)	\$01	512 baud rate operation		
	Inserted	\$20	600 baud rate operation		
E9	Removed (1)	\$02	<u>E9</u>	<u>E10</u>	<u>KEYBOARD ADDRESS</u>
	Inserted	\$30			
E10	Removed (1)	\$03	0	0	0000
	Inserted	\$40	1	0	0010
				0	1
			1	1	0011
E11	Removed (1)	\$04			
	Inserted	\$4E			
E12	Removed (1)	\$05	User defined.		
	Inserted	\$50			
E13	Removed (1)	\$06			
	Inserted	\$70			

NOTES:

- (1) As shipped -- factory-installed jumper position.
2. Removed jumper = 0
3. Installed jumper = 1

2.2.2 Scan Codes

Figure 2-2 illustrates the keyboard scan code assignments. There are eight key switches that are assigned two scan codes. As an example, when the CAPS LOCK (  ) key is depressed (in the locked position), scan code \$07 is generated. When this key is released (from the locked position) scan code \$0F is generated. Scan codes are sent to the SCM only if the keyboard MPU FIFO is empty and a read operation is pending; otherwise, the scan code is stored in the FIFO.

There are 128 accessible locations in the keyboard switch 16x8 array. Several locations are reserved:

<u>SCAN CODE</u>	<u>DESCRIPTION</u>
\$00	FIFO empty flag
\$7F	FIFO overflow flag
\$10	Error condition





### 2.2.3 Interconnection

The communications interface between the keyboard and SCM is illustrated in Figure 2-3. As shown, the communications interface wiring consists of six lines:

- a. +12VDC
- b. GND (ground)
- c. +D (+ data)
- d. -D (- data)
- e. RST+ (+ reset)
- f. RST- (- reset)

Signal lines are RS-422 differential driven and terminated at 100 ohms. Table 2-2 describes the interface wiring.

TABLE 2-2. Communications Interface Wiring

PIN NUMBER	SIGNAL MNEMONIC	DESCRIPTION
1	GND	Ground
6	+12VDC	+12 Vdc, 10%, 1 A
3	D-	RS-422 bidirectional data differential lines, terminated at 100 ohms.
4	D+	
2	RST+	RS-422 unidirectional reset differential lines, terminated at 100 ohms.
5	RST-	

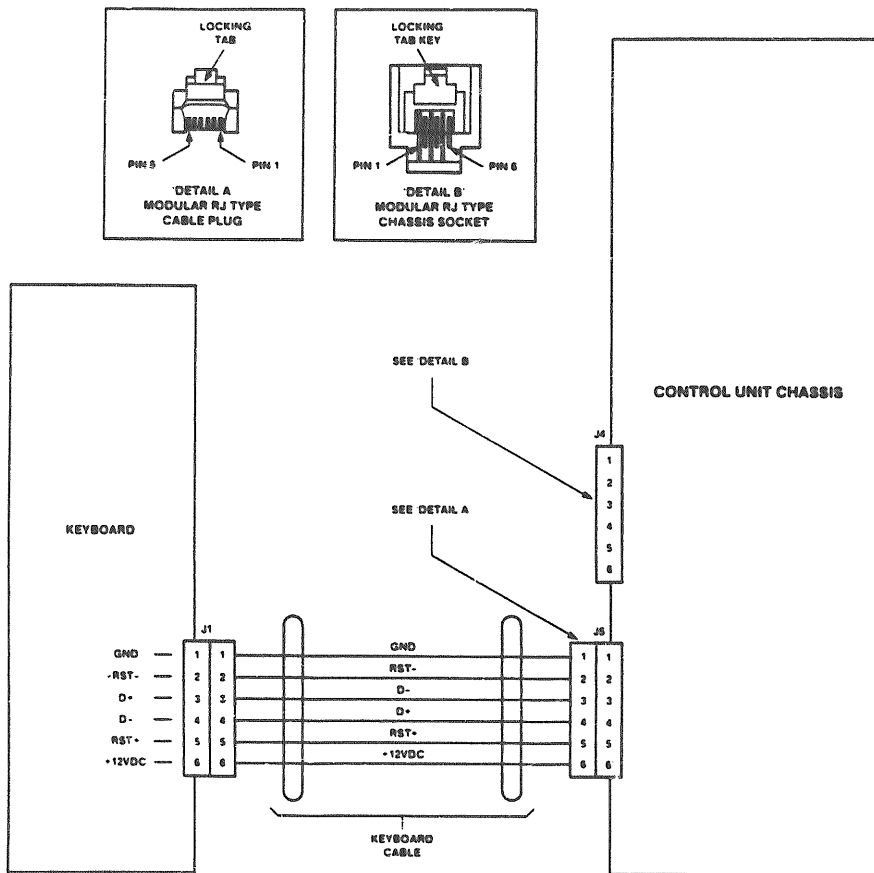


FIGURE 2-3. Communications Interface Wiring Diagram

### 2.3 REMOVAL/REPLACEMENT PROCEDURE

This section provides the removal/replacement procedures for the keyboard. Before performing these procedures, ensure that VME/10 ac power is disconnected.

#### WARNING

AC POWER MUST BE REMOVED TO AVOID ELECTRICAL SHOCKS TO MAINTENANCE PERSONNEL.

The keyboard is removed from the keyboard assembly as follows:

- a. Disconnect system ac power.
- b. Disconnect keyboard cable assembly from the control unit chassis front panel modular RJ type connector. Disconnect the other end of the cable assembly from the keyboard connector (J1).
- c. Remove keyboard assembly bottom panel by removing three pan-head and four flat-head screws.
- d. Remove keyboard from keyboard assembly (housing) by removing four pan-head screws with insulating washers per side.

The keyboard is reinstalled into the keyboard assembly by performing the removal procedure instructions in reverse and opposite order.

### 2.4 PARTS LIST

This section provides the Illustrated Parts List (IPL) for the keyboard. Tables 2-3 and 2-4 list the components of the keyboard by item number, Motorola part number, and description. The parts list item number is used to identify the particular part on the IPL diagram (Figure 2-4) that is associated with the parts list table.

The parts lists reflect the latest issue of hardware at time of printing.

TABLE 2-3. Keyboard Parts List

ITEM NUMBER	MOTOROLA PART NUMBER	DESCRIPTION
1	01-W2190B01	Keyboard assembly
2	15-W4405B01	Housing
3	64-W4480B01	Panel, bottom
4,5	-	N/A
6	03SW993D306	Screw, phillips, M3 x 0.5 x 6
7	04NW9005A43	Washer, nylon shoulder #4
8	-	N/A
9	03SW998C606	Screw, phillips, #6-20 x 3/8
10	03NW9C04B52	Screw, phillips, #6-20 x 3/8
11	75NW9402A21	Foot, rubber, 3/8"D x 1/8"H
12	75NW9402A22	Foot, rubber, 7/16"D x 3/16"H
13	33-W4545B01	Plate, identification
14	33-W4082B03	Label, product ID
15	11NW9203A19	Adhesive

TABLE 2-4. Keyboard Miscellaneous Parts List

ITEM NUMBER	MOTOROLA PART NUMBER	DESCRIPTION
4	30-W2294B01	Cable assembly, external, coiled, 6-conductor

NOTES:

▲ INSTALL PRODUCT LABEL, FIND NO. 14, APPROX WHERE SHOWN.

△ INSTALL RUBBER FEET, FIND NOS. 11 & 12, USING ADHESIVE, FIND NO. 15.

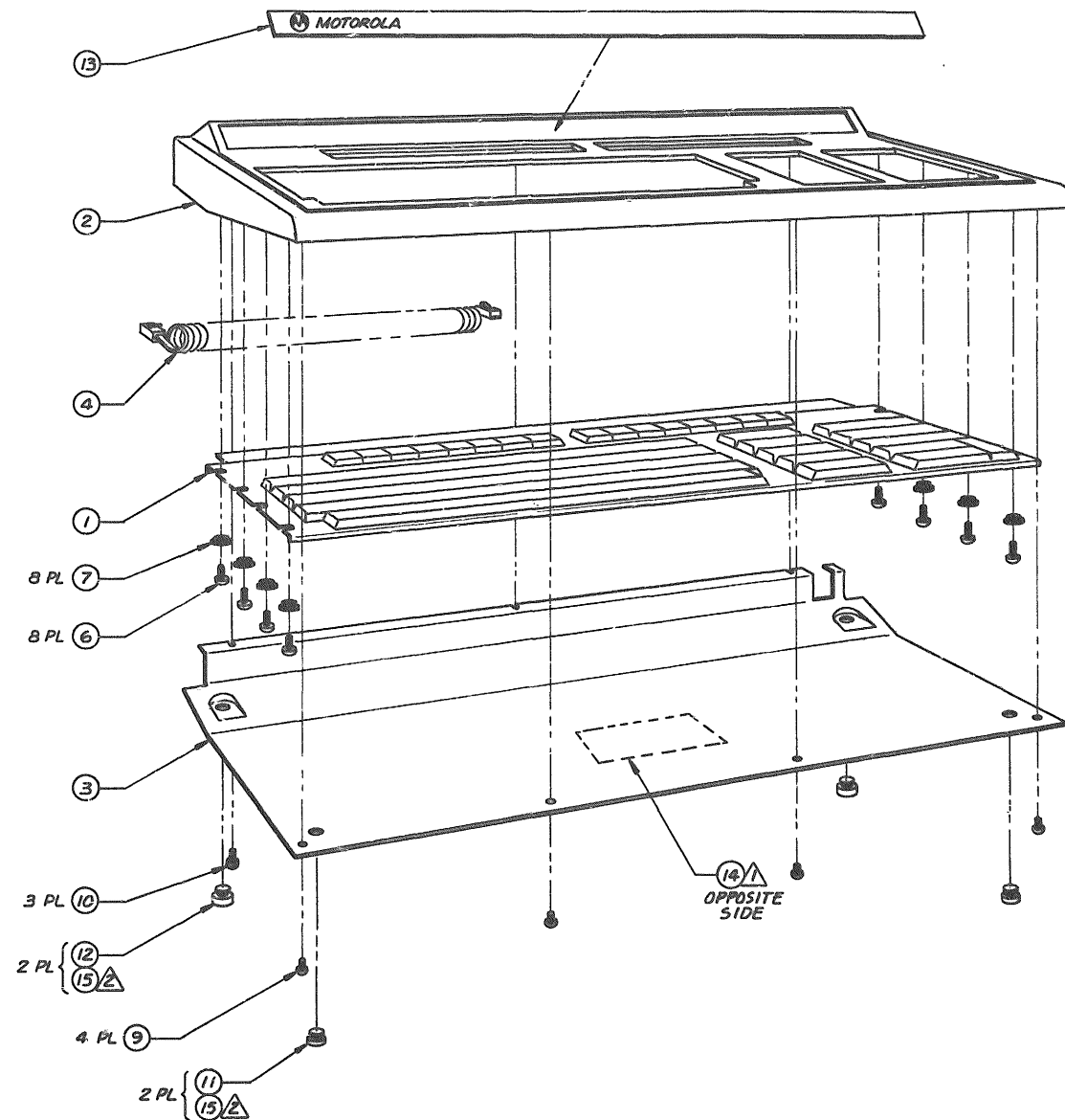


FIGURE 2-4. Keyboard Parts Location Diagram

## 2.5 DIAGRAMS

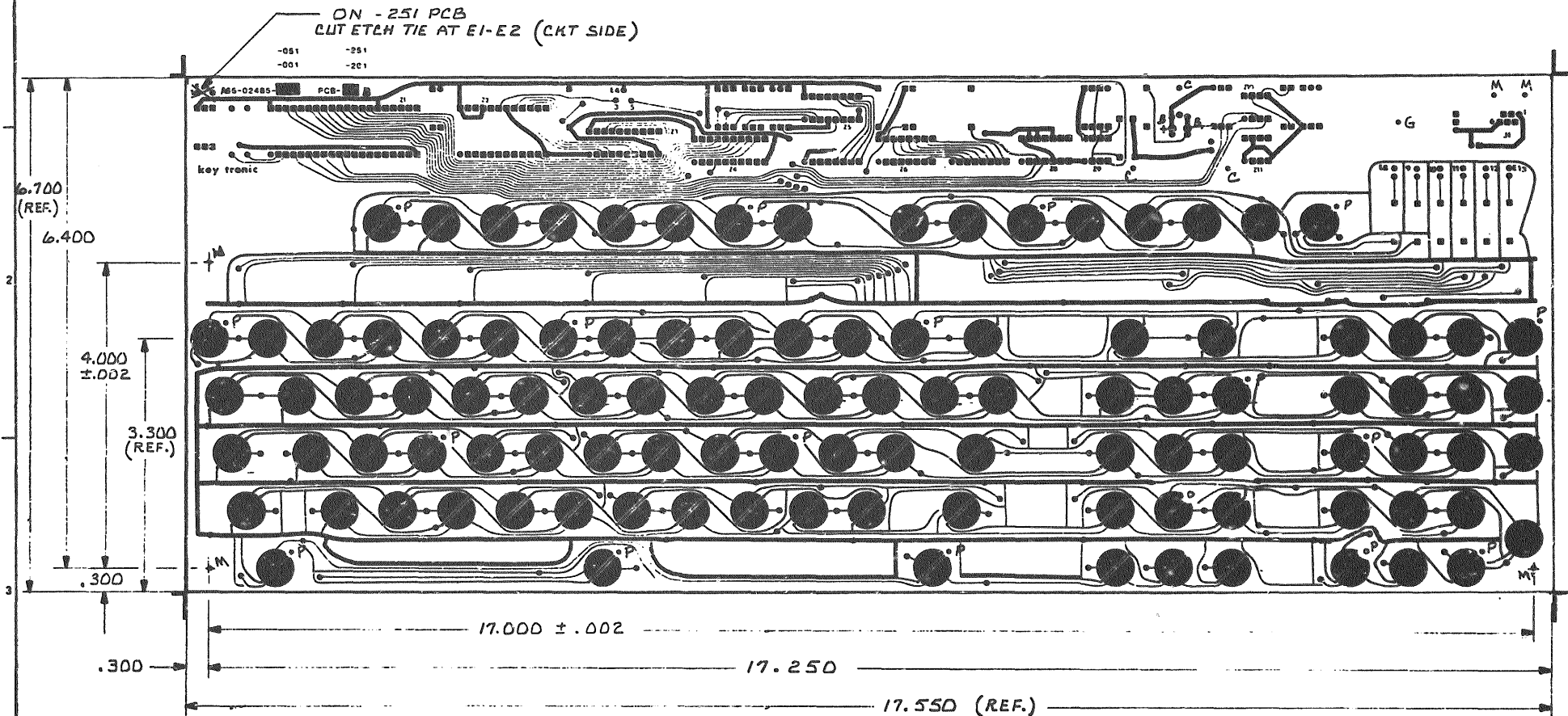
This section provides keyboard assembly and schematic diagrams. Diagrams are organized as follows:

<u>FIGURE NUMBER</u>	<u>FIGURE TITLE</u>
2-5	Keyboard Assembly Diagram
2-6	Keyboard Schematic Diagram

Permission to reprint both assembly and schematic diagrams has been granted by Keytronic Corporation.



EFF.	REV.	ECO.	BY	DESCRIPTION	APP.	DATE
	A		BB	FIRST ARTICLE		10/2/65
	B	16559	BB	MFG REL.		12/21/65



HOLE SIZE AFTER PLATING	CODE
.037	UN-MARKED
.042 ± .002	A
.052	B
.089	C
.128	D
.156	E
.187	F
.191 ± .002	G
.201	H
.234	J
.250	K
.156	L
.125	M
.122	N
.120	P
.130	R
	S
TAG HOLE	T
	U
	V

5. APPLY APPROPRIATE DASH NUMBER AFTER KTC PART NUMBER; PER MFR.
4. SOLDER MASK CKT SIDE OF PCB USING 65-12485-XXX B IN CONJUNCTION WITH ARTWORK 98
3. BREAK ALL SHARP EDGES.
2. PLATE THROUGH ALL UNMARKED, B HOLES
1. USE 1/2 OZ. DOUBLE-CLAD G10-FR4 OR CEM 3 (1/16") THK FABRICATE USING KTC UL APPROVED PROCESS "A".

251 B PCB  
- 201 B PCB  
(COMPONENT SIDE)

.261	
.250	G
.201	B, C, M, P
.089	UNMARKED
SOLDER MASK HOLE CODE	

NOTES:

UNLESS OTHERWISE NOTED ALL DIMENSIONS ARE IN INCHES

XXX DIMENSION NOT TO SCALE

MANUFACTURE PARTS AND/OR ASSY'S PER KTC DOCUMENT

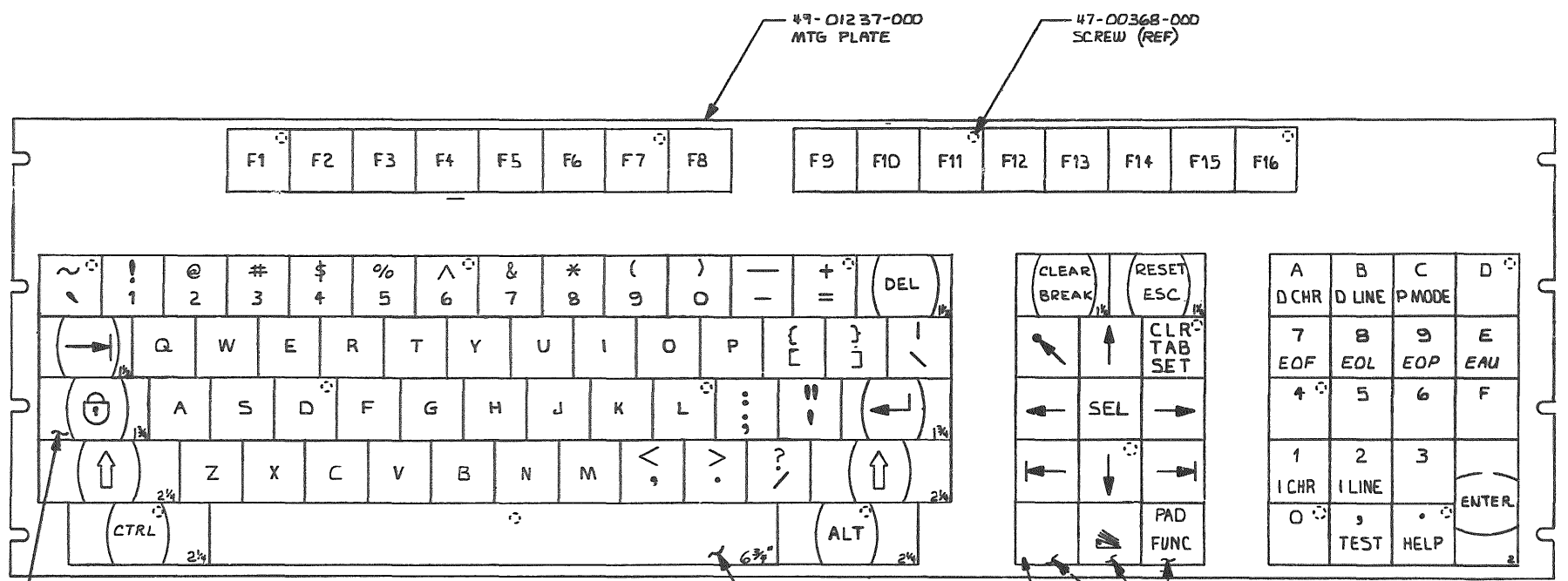
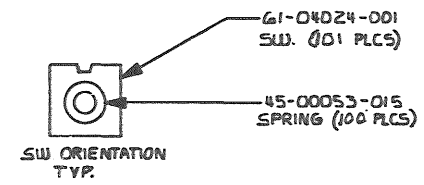
MO15

ITEM	SCALE	PART NO.	DESCRIPTION	QTY.
MOLE 003 DIA. FRACT ± .004	NONE		KEYBOARD ASSY. (PCB HOLE CODE)	
APP				
CH				
DR BB	2/1/63			
			DWG NO. 65-02485	
SPOKANE, WASH., U.S.A.			SHEET 2 OF 3	

FIGURE 2-5. Keyboard Assembly Diagram (Sheet 2 of 3)

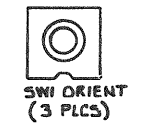


REV.	ECO	BY	DESCRIPTION	APP.	DATE
~	~	BH	PROTO RELEASE	hsl202	5-29-82
A	~	BB	FIRST ARTICLE	hsl202	6-2-82
B	16559	BB	MFG REL	hsl202	6-27-82
C	1701A	RJE	LEGEND CHANGE	hsl202	10-20-82



- 61-04025-001 A/A SW. (3 PLCS)
- 45-00053-030 SPRING
- 48-00174-000 LEG (2 PLCS)
- 44-00173-000 BAR
- 44-00102-000 MNT (2 PLCS)
- 45-00053-030 SPRING
- HC HC 201Z-010900000
- 61-04025-001 A/A SW. (3 PLCS)
- 45-00053-030 SPRING 3 PLCS

-001 & -051 ASSY  
USE 66-02485-001 KEYTOP ASSY.

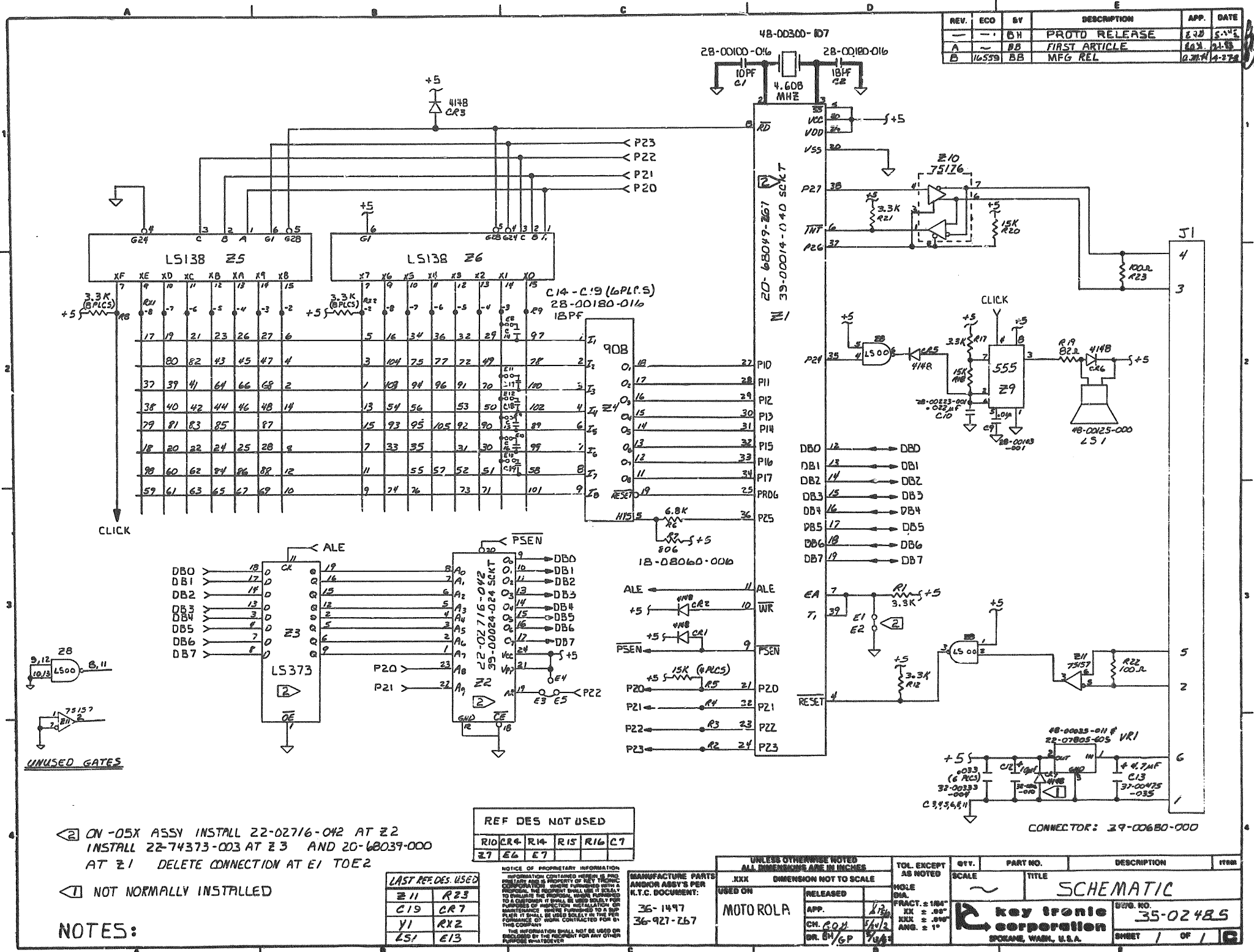


- NOTES:
1. ALL PLUNGERS ARE CENTERED.
  2. KEYBOARD IS 19 MM.
  3. APPLY DATE/SERIAL PRESSURE ADHESIVE TAG TO CKT SIDE OF PCB.

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UNLESS OTHERWISE NOTED ALL DIMENSIONS ARE IN INCHES		TOL. EXCEPT AS NOTED	QTY.	PART NO.	DESCRIPTION	ITEM
XXX	DIMENSION NOT TO SCALE	HOLE DIA.	SCALE	TITLE	KEYBOARD ASSY KEYTOP & MECH	
USED ON	RELEASED	FRACT. ± 1/8"				
MOTOROLA	APP.	XX ± .00"				
	CH. 201	XXX ± .00"				
	DR. BH	ANG. ± 1°				
MANUFACTURE PARTS AND/OR ASSY'S PER K.T.C. DOCUMENT:	QA 51					
	QA 56					
				keytronic corporation	DWG. NO.	
				SPRING, WASH. U.S.A.	65-02485	
					SHEET 3 OF 3	

FIGURE 2-5. Keyboard Assembly Diagram (Sheet 3 of 3)



REV.	ECO	BY	DESCRIPTION	APP.	DATE
-	-	BB	PROTD RELEASE	EJD	5-1-78
A	-	BB	FIRST ARTICLE	60A	2-1-78
B	16539	BB	MFG REL	2.2M	4-2-78

② ON -05X ASSY INSTALL 22-02716-042 AT Z2  
 INSTALL 22-74373-003 AT Z3 AND 20-60039-000  
 AT Z1 DELETE CONNECTION AT E1 TO E2

Ⓛ NOT NORMALLY INSTALLED

NOTES:

REF DES NOT USED					
R10	CR4	R14	R15	R16	C7
Z7	E6	E7			

LAST REF DES USED	
Z11	R23
C19	CR7
Y1	RX2
LS1	E13

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 INCLUDING PHOTOCOPYING, RECORDING,  
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 RETRIEVAL SYSTEM, WITHOUT THE  
 WRITTEN PERMISSION OF KEYTRONIC  
 CORPORATION.

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 AND/OR ASSY'S PER  
 K.T.C. DOCUMENT:  
 36-1497  
 36-927-267

UNLESS OTHERWISE NOTED  
 ALL DIMENSIONS ARE IN INCHES  
 DIMENSION NOT TO SCALE  
 USED ON  
 RELEASED  
 APP. CPM  
 DR. 6/16P

QTY.	PART NO.	DESCRIPTION	ITER
SCALE	TITLE	SCHEMATIC	
FRAC. ± 1/64"		DWG. NO. 35-02485	
HOLE DIA. XX ± .00"		SHEET 1 OF 1	
ANG. ± 1°		keytronic corporation SPRING VALLEY, U.S.A.	

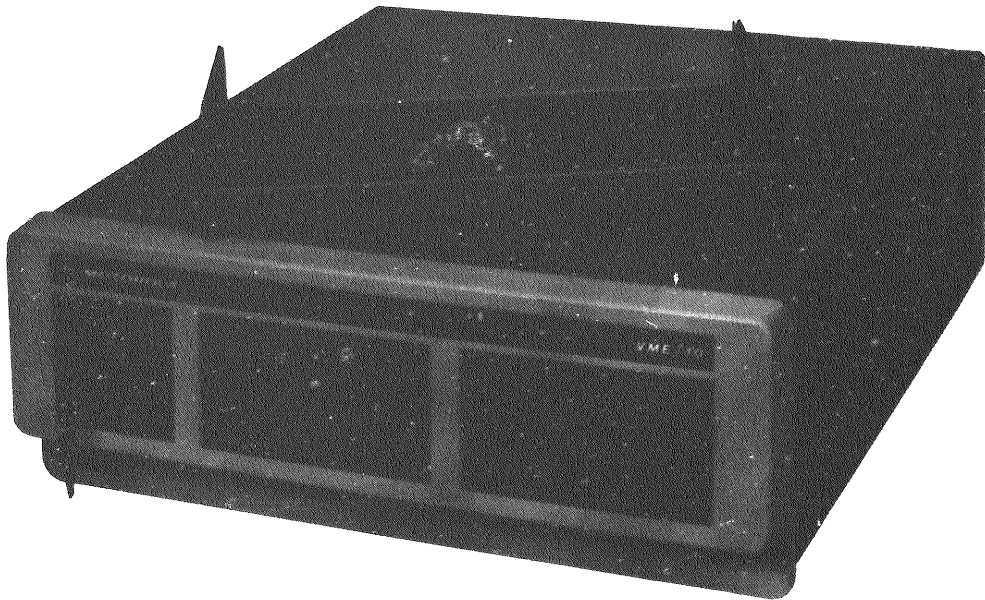
FIGURE 2-6. Keyboard Schematic Diagram

**CONTROL  
UNIT**

CHAPTER 3  
CONTROL UNIT CHASSIS

3.1 INTRODUCTION

This chapter provides a general description, removal/replacement procedures, parts lists, and diagrams for the VME/10 control unit chassis as shown in Figure 3-1.



10-83-1799

FIGURE 3-1. Typical Control Unit Chassis with Tilt/Swivel Assembly

### 3.2 GENERAL DESCRIPTION

The VME/10 control unit chassis forms the mechanical foundation of the VME/10 Microcomputer System. This chassis (as illustrated in Figure 3-2) houses, provides power, and facilitates interconnection of the following components:

- a. System Control Module (SCM)
- b. Mass storage assembly
- c. Expansion card cage assembly
- d. Power supply assembly

The chassis also provides an operator control panel containing power, reset, abort, and keyboard lock switches. Chassis cooling is accomplished by an internal mounted blower fan.

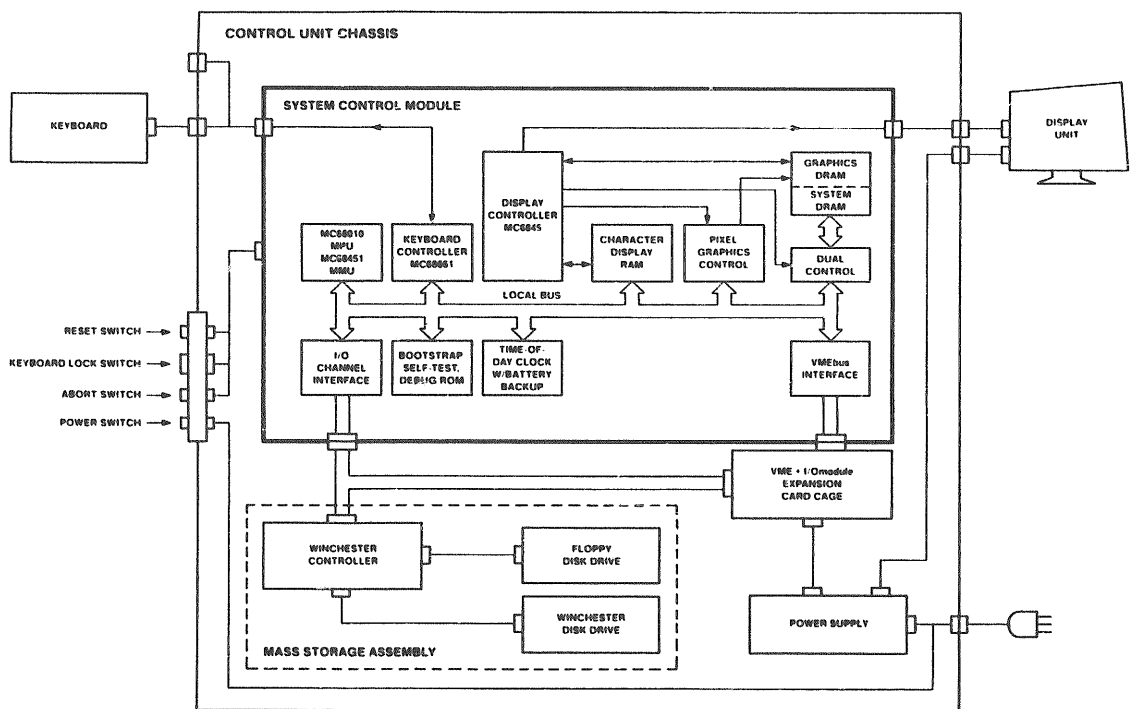
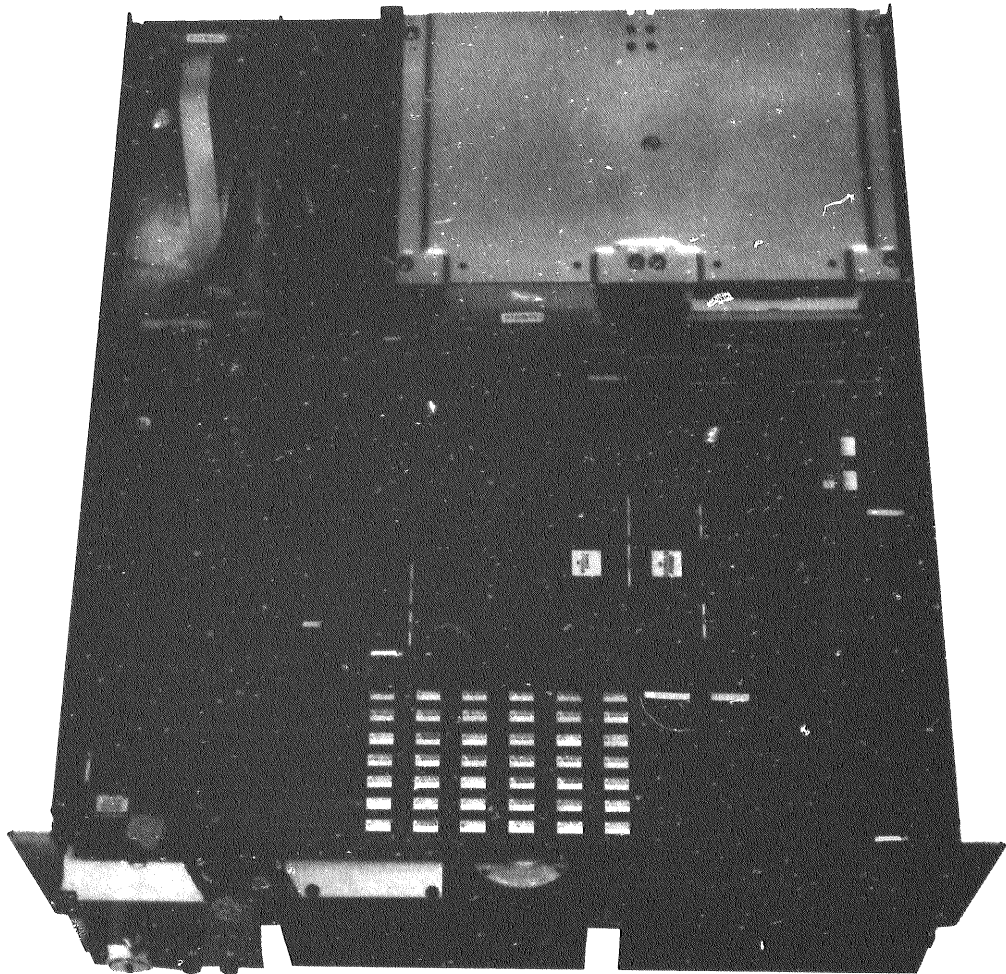


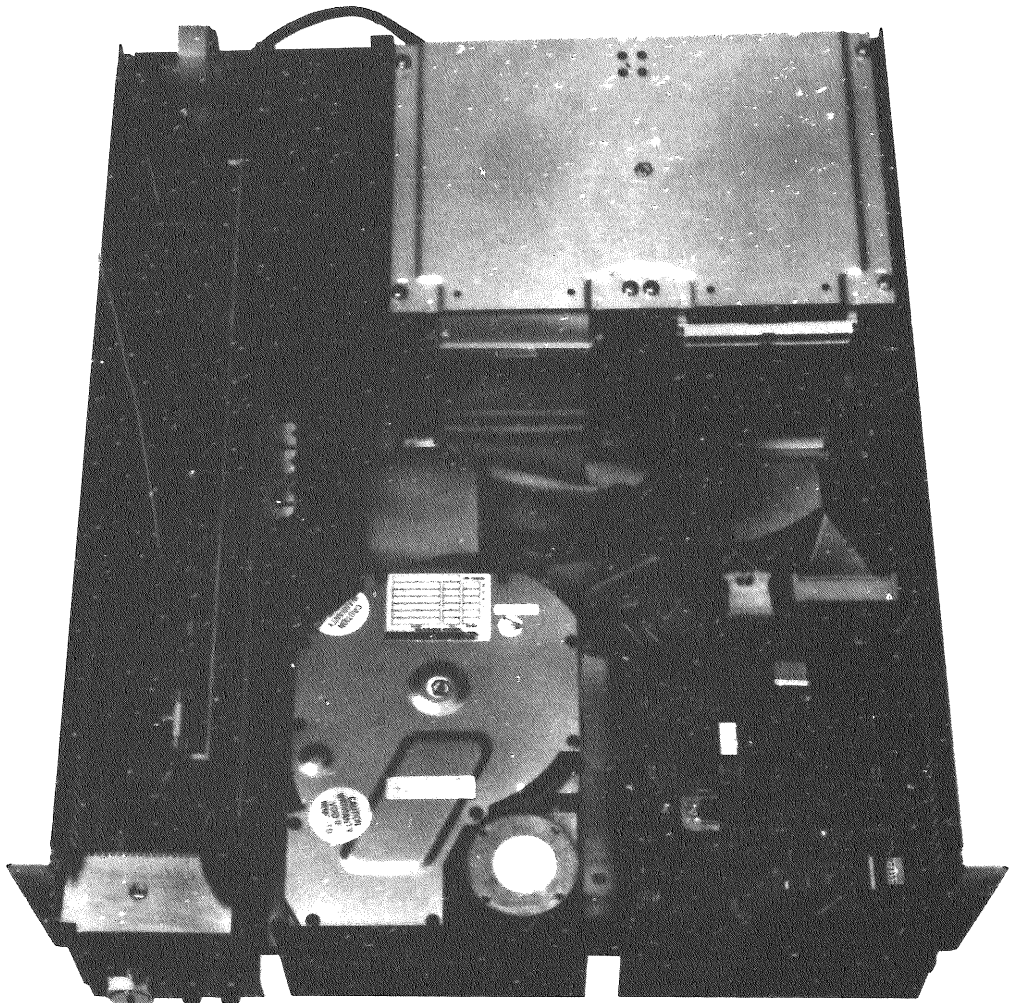
FIGURE 3-2. Control Unit Chassis Overall Block Diagram

Figure 3-3 shows the control unit chassis with cover and side panels removed, thereby exposing the SCM, blow fan, and expansion card cage assembly. Figure 3-4 shows the chassis with the SCM removed, thereby exposing the mass storage and power supply assemblies.



10-83-1805

FIGURE 3-3. Chassis with Cover and Side Panels Removed



10-83-1806

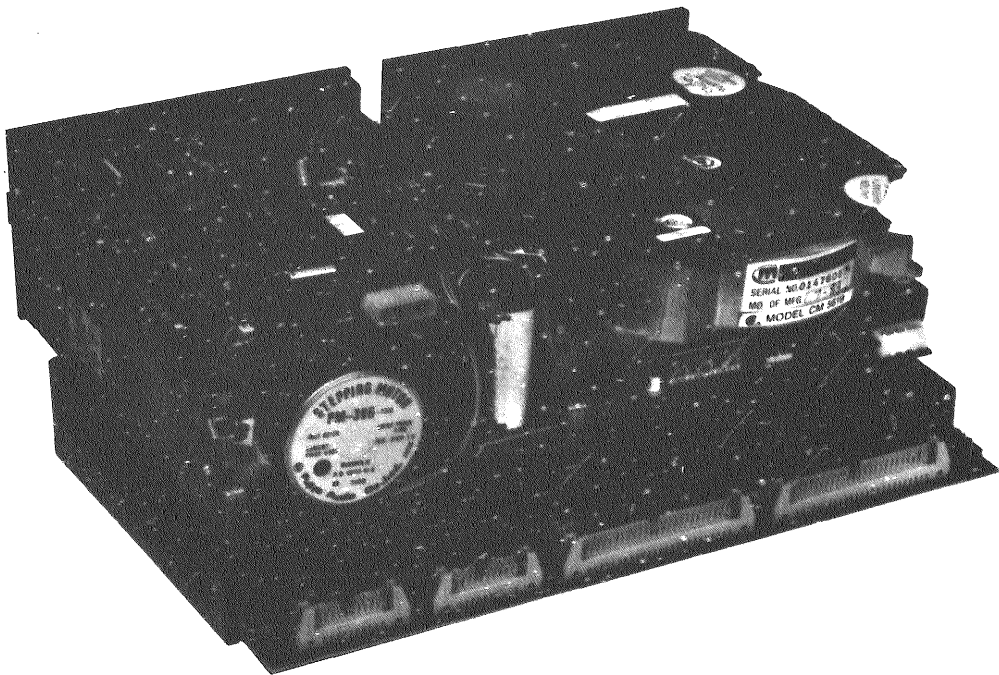
FIGURE 3-4. Chassis with SCM Removed

### 3.2.1 System Control Module

The System Control Module (SCM), shown in Figure 3-3, contains the central intelligence of the VME/10 Microcomputer System. SCM major components are illustrated in Figure 3-2. For detailed information describing these components, refer to the VME/10 Microcomputer System, System Control Module User's Manual, Motorola publication number M68KVSSCM.

### 3.2.2 Mass Storage Assembly

The mass storage assembly (Figure 3-5) consists of a Winchester Disk Controller (WDC) module which is mounted under a 5-1/4 inch Winchester and floppy drives.



10-83-1804

FIGURE 3-5. Mass Storage Assembly



A standard floppy disk drive -- 655K-byte (formatted) capacity (1M-byte unformatted) -- is installed in the mass storage assembly. For additional information on the floppy disk drive, refer to the VME/10 Microcomputer System Floppy Disk Drive User's Manual, Motorola publication number M68KVSFD1.

The WDC module controls both Winchester and floppy drives. For additional information on the WDC, refer to the VME/10 Microcomputer System Winchester Disk Controller User's Manual, Motorola publication number M68KVSWIN.

Depending on the specific VME/10 Microcomputer System model, either one of two Winchester drives is installed in the mass storage assembly as follows:

- a. 5M-byte (formatted) capacity (6.38M-byte unformatted)
- b. 15M-byte (formatted) capacity (19.1M-byte unformatted)

For additional information on the Winchester drive, refer to the VME/10 Microcomputer System Winchester Disk Drive User's Manual, Motorola publication number M68KVSWD1.

### 3.2.3 Expansion Card Cage Assembly

Depending on the specific VME/10 Microcomputer System model, either one of two expansion card cage assemblies is installed in the control unit chassis. These card cage assemblies are identified as follows:

- a. I/Omodule expansion card cage
- b. VME+I/Omodule expansion card cage

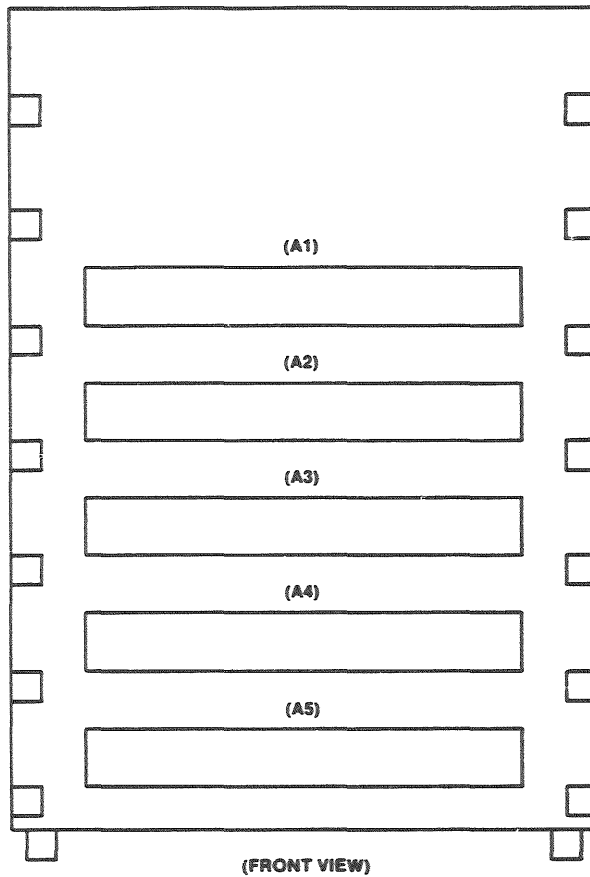
These card cages facilitate system expansion through the addition of I/Omodules and VMEmodules via the I/O Channel and VMEbus, respectively.

3.2.3.1 I/Omodule Expansion Card Cage. Figure 3-6 illustrates the I/Omodule expansion card cage installed in the VME/10. This card cage is designed to accept up to five "single-wide" I/Omodules. J1 connectors installed at card slot locations (A1) through (A5) form the I/O Channel via ribbon cable connections. For additional information on the I/Omodule expansion card cage, refer to the VME/10 Microcomputer System Installation Guide, Motorola publication number M68KVSIG.

3.2.3.2 VME+I/Omodule Expansion Card Cage. Figure 3-7 illustrates the VME+I/Omodule expansion card cage installed in the VME/10. This card cage facilitates the installation of up to five "double-wide" VMEmodules and up to four "single-wide" I/Omodules. The card cage houses the MVME923 Backplane which contains five connectors (J1 through J5) that mate to VMEmodule P1 connectors, and two connectors (J14 and J15) that mate to I/Omodule P1 connectors. Connectors J1 through J5 form the VMEbus, and connectors J14 and J15 form the I/O Channel. The I/O Channel is extended from the backplane by the addition of two connectors (card slot locations A8 and A9) via ribbon cable connection.

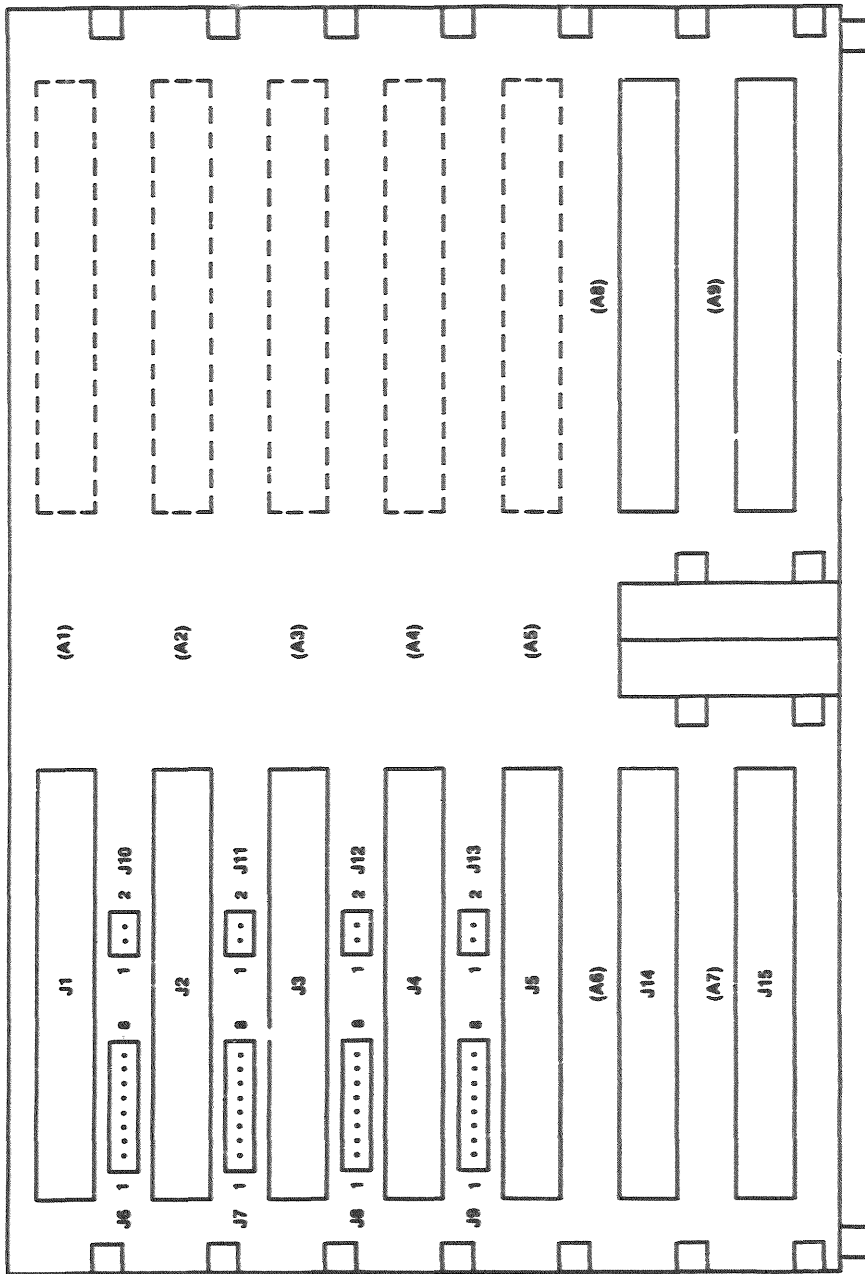
The card cage also provides a connector mounting area. See Figure 3-7. Up to five connectors can be installed by the user to facilitate VMEmodule P2 I/O cabling.

Vacant card slots should not exist between inserted VMEmodules requiring Interrupt Acknowledge (IACK) and Bus Grant (BG) signals in the card cage unless the vacant slots have been daisy-chain jumpered on the MVME923 backplane. Daisy-chain jumpering permits the IACK and BG signals to propagate from card slot (A1) to the last card slot (A5). Remaining vacant slots following the last active card slot (Ax) are not required to be daisy-chain jumpered. Jumper headers J6 through J13 on the backplane facilitate the daisy-chain jumpering technique. Figure 3-7 illustrates the backplane daisy-chain jumper header locations. Card slot (A1) is not assigned a jumper header. Headers J6 and J10 are assigned to slot (A2), headers J7 and J11 to slot (A3), headers J8 and J12 to slot (A4), and headers J9 and J13 to slot (A5). For additional information on the VME+I/Omodule expansion card cage, refer to the VME/10 Microcomputer System Installation Guide, Motorola publication number M68KVSIG.



NOTE: (A1) THRU (A5) DENOTE CARD SLOT LOCATIONS.

FIGURE 3-6. I/O module Expansion Card Cage



(FRONT VIEW)

NOTE: (A1) THRU (A9) DENOTE CARD SLOT LOCATIONS.

FIGURE 3-7. VME+I/Module Expansion Card Cage

Table 3-1 lists the I/O Channel J1/P1 connector pin assignments. For additional information on the I/O Channel, refer to the Input/Output Channel Specification Manual, Motorola publication number M68RI0CS.

TABLE 3-1. I/O Channel Connector Pin Assignments

DIN CONNECTOR PIN	3M CONNECTOR PIN	MNEMONIC	DIN CONNECTOR PIN	3M CONNECTOR PIN	MNEMONIC
C1	1	INT4*	A1	2	GROUND
C2	3	INT3*	A2	4	GROUND
C3	5	INT2*	A3	6	GROUND
C4	7	INT1*	A4	8	GROUND
C5	9	IORES*	A5	10	GROUND
C6	11	XACK*	A6	12	GROUND
C7	13	CLK	A7	14	GROUND
C8	15	(Reserved)	A8	16	GROUND
C9	17	(Reserved)	A9	18	GROUND
C10	19	(Reserved)	A10	20	GROUND
C11	21	GROUND	A11	22	A11
C12	23	A9	A12	24	A10
C13	25	A7	A13	26	A8
C14	27	A5	A14	28	A6
C15	29	A3	A15	30	A4
C16	31	A1	A16	32	A2
C17	33	A0	A17	34	GROUND
C18	35	STB*	A18	36	GROUND
C19	37	WT*	A19	38	GROUND
C20	39	GROUND	A20	40	D7
C21	41	D5	A21	42	D6
C22	43	D3	A22	44	D4
C23	45	D1	A23	46	D2
C24	47	D0	A24	48	GROUND
C25	49	GROUND	A25	50	GROUND
C26		-12 Volts	A26		-12 Volts
C27		(Reserved)	A27		(Reserved)
C28		+12 Volts	A28		+12 Volts
C29		+5 Volts	A29		+5 Volts
C30		+5 Volts	A30		+5 Volts
C31		GROUND	A31		GROUND
C32		GROUND	A32		GROUND

NOTE: Where 50-pin ribbon cable is used, the 14 power/ground lines shown at the bottom of this table are not connected by the cable.

Table 3-2 lists the VMEbus backplane J1/P1 connector pin assignments. For additional information on the VMEbus, refer to the VMEbus Specification Manual, Motorola publication number MVMEBS.

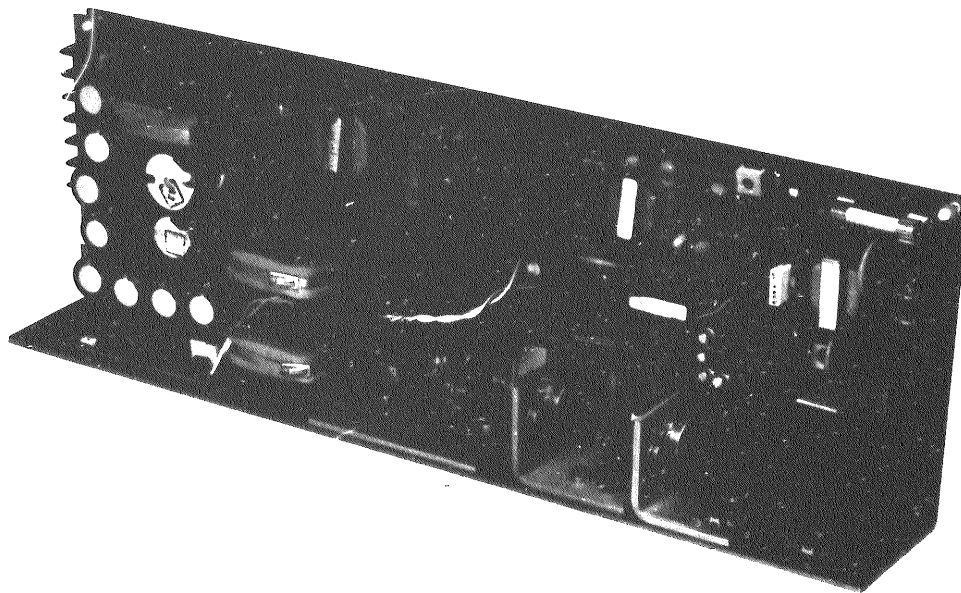
TABLE 3-2. VMEbus Connector Pin Assignments

PIN NUMBER	ROW A SIGNAL MNEMONIC	ROW B SIGNAL MNEMONIC	ROW C SIGNAL MNEMONIC
1	D00	BBSY*	D08
2	D01	BCLR*	D09
3	D02	ACFAIL*	D10
4	D03	BG0IN*	D11
5	D04	BG0OUT*	D12
6	D05	BG1IN*	D13
7	D06	BG1OUT*	D14
8	D07	BG2IN*	D15
9	GND	BG2OUT*	GND
10	SYSCLK	BG3IN*	SYSFAIL*
11	GND	BG3OUT*	BERR*
12	DS1*	BR0*	SYSRESET*
13	DS0*	BR1*	LWORD*
14	WRITE*	BR2*	AM5
15	GND	BR3*	A23
16	DTACK*	AM0	A22
17	GND	AM1	A21
18	AS*	AM2	A20
19	GND	AM3	A19
20	IACK*	GND	A18
21	IACKIN*	SERCLK (NOTE)	A17
22	IACKOUT*	SERDAT (NOTE)	A16
23	AM4	GND	A15
24	A07	IRQ7*	A14
25	A06	IRQ6*	A13
26	A05	IRQ5*	A12
27	A04	IRQ4*	A11
28	A03	IRQ3*	A10
29	A02	IRQ2*	A09
30	A01	IRQ1*	A08
31	-12V	+5V STDBY	+12V
32	+5V	+5V	+5V

NOTE: SERCLK and SERDAT represent provision for a special serial communication bus protocol still being finalized.

### 3.2.4 Power Supply Assembly

The power supply assembly (Figure 3-8) provides the +5, +12, -12, and +24 Vdc voltages for the VME/10 Microcomputer System equipment. This power supply operates on 110/220 Vac input. Over-voltage protection, voltage regulation, and ac power fail circuits are implemented in this power supply. For additional information on the power supply assembly, refer to the VME/10 Microcomputer System Power: Supply Assembly User's Manual, Motorola publication number K68KVSPS1.



10-83-1807

FIGURE 3-8. Power Supply Assembly

### 3.3 REMOVAL/REPLACEMENT PROCEDURES

This section provides the removal/replacement procedures for the control unit chassis. These procedures will enable the user to remove and replace chassis assemblies/subassemblies (components). Procedures must be followed as specified to avoid unnecessary disassembly. Chassis covers must first be removed to gain access to specific components. After the chassis covers are removed, procedures are given for specific chassis components. These specific components and associate removal procedure paragraph numbers are as follows:

- a. SCM (3.3.2)
- b. Mass storage assembly (3.3.3)
- c. Expansion card cage (3.3.4)
- d. Control panel (3.3.5)
- e. Rear I/O panel (3.3.6)
- f. Power supply assembly (3.3.7)
- g. Backup batteries (3.3.8)
- h. Blower fan (3.3.9)
- i. EMI filter (3.3.10)
- j. Fuse holder (3.3.11)
- k. AC power receptacle (3.3.12)

#### NOTE

All replacement procedures are to perform the removal procedure instructions in reverse and opposite order. Ensure that all cabling is properly routed and free from obstructions.

Before performing any procedures, ensure that VME/10 ac power is disconnected.

#### WARNING

AC POWER MUST BE REMOVED TO AVOID ELECTRICAL SHOCKS TO MAINTENANCE PERSONNEL.

#### 3.3.1 Chassis Cover Removal

The chassis covers are removed as follows:

- a. Disconnect system ac power.
- b. Remove all external cables from control unit chassis.
- c. Remove display unit from control unit chassis.
- d. Remove control unit chassis side covers by removing two pan-head screws per side.
- e. Remove control unit chassis top cover by removing seven pan-head screws.



### 3.3.2 SCM Removal

The SCM is removed from the chassis as follows:

Prerequisite -- remove chassis covers.

- a. Remove control unit chassis front panel by removing two flat-head screws per side.

#### CAUTION

TWO MODULAR RJ TYPE CONNECTORS SHOULD BE REMOVED FROM FRONT PANEL TO AVOID CONNECTOR WIRING DAMAGE.

- b. Remove connector bracket and both modular RJ type connectors from front panel by removing two pan-head screws.
- c. Disconnect cable assembly connectors at following SCM connector locations: J1, P2, J12, J13, and J14.

#### NOTE

Observe orientation of connectors J12 and P12.  
P12 red wire must mate with J12 pin 1.

- d. Remove SCM (including bracket assembly) from chassis by removing three flat-head screws per side.
- e. SCM (with bracket assembly) is removed from the chassis by pulling forward on the SCM.

### 3.3.3 Mass Storage Assembly Removal

The mass storage assembly is removed from the chassis as follows:

Prerequisite -- remove SCM from chassis.

- a. Disconnect cable assembly connector P3 at Winchester drive connector location J3.
- b. Disconnect cable assembly connector P2 at floppy drive connector location J2.
- c. Disconnect cable assembly connectors P1 and P2 at WDC connector locations J1 and J2, respectively.
- d. Remove mass storage assembly from chassis by removing four pan-head screws from bottom of chassis, and slide assembly out of chassis.

3.3.3.1 WDC Removal. The WDC is removed from the mass storage assembly as follows:

Prerequisites -- remove SCM and mass storage assembly from chassis.

- a. Disconnect cable assembly connectors P3, P4, and P6 at WDC connector locations J3, J4, and J6, respectively.
- b. Remove six pan-head screws and associated insulating washers from bottom of WDC module.
- c. Remove center rear standoff with associated pan-head screw, lock and flat washers.

#### CAUTION

WDC COMPONENTS MAY HIT ASSEMBLY STANDOFFS.  
DAMAGE TO COMPONENTS MAY RESULT IF CARE IS  
NOT TAKEN DURING WDC REMOVAL.

- d. Remove WDC from assembly by sliding WDC out from front of assembly.

3.3.3.2 Drive Removal. Either drive is removed from the mass storage assembly as follows:

Prerequisites -- remove SCM, mass storage assembly from chassis. WDC must be removed from mass storage assembly.

- a. Either drive (Winchester or floppy) is removed from the mass storage assembly by the removal of four applicable pan-head screws and lockwashers from bottom of assembly.
- b. Refer to applicable user's manual for further disassembly procedures if required.

### 3.3.4 Expansion Card Cage Removal

Following are the removal procedures for the I/Omodule and VME+I/Omodule expansion card cages.

3.3.4.1 I/Omodule Expansion Card Cage. This card cage is removed from the chassis as follows:

Prerequisite -- remove SCM from chassis.

- a. Disconnect cable assembly connector P2 at WDC connector location J2.
- b. Remove four pan-head screws and associated lock-washers from bottom of chassis.
- c. Lift card cage out of chassis.

3.3.4.2 VME+I/Omodule Expansion Card Cage. This card cage is removed from the chassis as follows:

Prerequisite -- remove SCM from chassis.

- a. Disconnect cable assembly connector P2 at WDC connection location J2.
- b. Disconnect following power wiring connectors from card cage:
  - P16-1, -2, -3
  - P17-1, -2, -3
  - P18-1, -2, -3
- c. Disconnect any P2 I/O cabling installed by user if required.
- d. Remove four pan-head screws and associated lock washers from bottom of chassis.
- e. Lift card cage out of chassis.

### 3.3.5 Control Panel Removal

The control panel is removed from the chassis as follows:

Prerequisite -- remove SCM from chassis.

- a. Remove one pan-head screw and associated lock and flat washers from control panel top bracket.
- b. Remove two flat-head screws from chassis side panel.
- c. Remove five wires from control panel power switch. (Refer to Figure 3-13 for power switch wiring information.)
- d. Lift control panel out of chassis.

### 3.3.6 Rear I/O Panel Removal

The rear I/O panel is removed from the chassis as follows:

Prerequisite -- none.

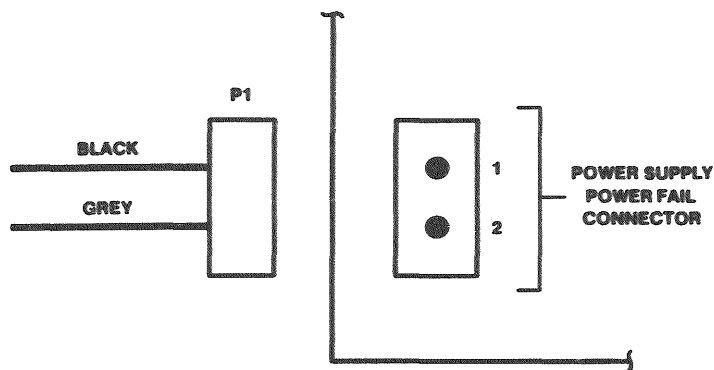
- a. Remove four pan-head screws and associated lock and flat washers, and nuts.
- b. Remove J3 connector from chassis I/O panel by removing connector mounting hardware.
- c. Remove 24VDC connector from chassis I/O panel by squeezing both upper and lower connector locking tabs and pushing in on the connector.
- d. Remove I/O panel from chassis.

### 3.3.7 Power Supply Assembly Removal

The power supply assembly is removed from the chassis as follows:

Prerequisites -- remove SCM and rear I/O panel.

- a. Remove power supply top bracket cover by removing bracket mounting hardware.
- b. Remove power supply assembly mounting hardware (two pan-head screws and associated lock washers) from under chassis.
- c. Unbolt control panel from chassis (do not disconnect any wiring).
- d. Lift up and prop right side (closest to control panel) of power supply assembly.
- e. Remove following wires from right side of power supply:
  - Brown wire - ACHI
  - Blue wires - ACLO
  - Green wire with yellow trace - GND
- f. Control panel with attached power wiring is moved away from power supply assembly (place on top of card cage).
- g. Remove battery backup wiring from power supply. (Remove cable assembly connector P1 from power supply connector shown below.)



#### NOTE

Cable assembly in some models  
have black wire removed.

h. Swing power supply out from chassis and remove following wires from left side of power supply:

<u>TB2</u> <u>PIN NUMBER</u>	<u>WIRE</u>	
1	Blue	} Power wiring harness
2	Black	
3	Orange	
4	Red	} I/O panel 24VDC connector wiring
5	Black	
6	---	
-S	White with black trace	
+S	White with red trace	
COM	Black (3 wires)	
+5V	Red (3 wires)	

i. Lift power supply assembly out of chassis.

NOTE

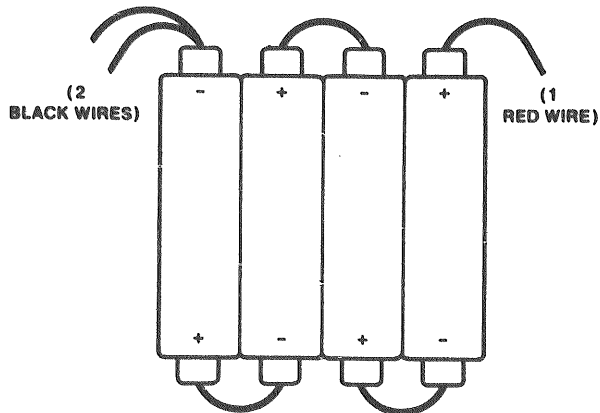
Refer to Figure 3-13 for power supply wiring information.

### 3.3.8 Backup Battery Removal

The backup batteries are removed from the chassis as follows:

Prerequisite -- remove SCM.

- a. Remove batteries from battery holder.
- b. Install batteries in battery holder as shown below.



### 3.3.9 Blower Fan Removal

The blower fan is removed from the chassis as follows:

Prerequisite -- remove SCM and power supply assembly.

- a. Remove both ac power wires from blower fan.
- b. Remove four pan-head screws that secure blower fan to chassis.
- c. Lift blower fan out of chassis.

#### NOTE

Refer to Figure 3-13 for blower fan wiring information.

### 3.3.10 EMI Filter Removal

The EMI filter is removed from the chassis as follows:

Prerequisite -- remove SCM.

- a. Remove two pan-head screws with associated lockwashers and locknuts.
- b. Remove filter wiring (4 wires).
- c. Lift EMI filter out of chassis.

#### NOTE

Refer to Figure 3-13 for EMI filter wiring information.

### 3.3.11 Fuse Holder Removal

The ac fuse holder is removed from the chassis as follows:

Prerequisite -- remove power supply top bracket cover and rear I/O panel.

- a. Remove two wires from fuse holder.
- b. Remove fuse holder nut and remove holder from chassis.

#### NOTE

Refer to Figure 3-13 for fuse holder wiring information.

### 3.3.12 AC Power Receptacle Removal

The ac power receptacle is removed from the chassis as follows:

Prerequisite -- remove power supply assembly.

- a. Remove receptacle mounting hardware (two flat-head screws, lockwashers, and nuts).
- b. Lift receptacle out of chassis. Unsolder receptacle wiring or replace entire power wiring harness.

#### NOTE

Refer to Figure 3-13 for ac power receptacle wiring information.



### 3.4 PARTS LISTS

This section provides the Illustrated Parts Lists (IPL) for the control unit chassis. Tables 3-3 through 3-6 list the components of the control unit chassis by item number, Motorola part number, and description. The parts list item number is used to identify the particular part on the IPL diagram (Figures 3-9 through 3-12) that is associated with the parts list table. The parts lists are organized as follows:

<u>TABLE NUMBER</u>	<u>TABLE NAME</u>
3-3	Control Unit Chassis
3-4	Control Unit Chassis Miscellaneous
3-5	I/Omodule Expansion Card Cage
3-6	VME+I/Omodule Expansion Card Cage

The parts lists reflect the latest issue of hardware at time of printing. For the SCM, WDC, Winchester/floppy disk drive, and power supply assembly parts lists, refer to applicable user's manual.

TABLE 3-3. Control Unit Chassis Parts List

ITEM NUMBER	MOTOROLA PART NUMBER	DESCRIPTION
1	27-W4475B01	Base, chassis, enclosure
2	15-W4474B01	Cover, top, enclosure
3	64-W4476B01	Panel, control, enclosure
4	07-W4477B01	Bracket, mass storage mounting
5	64-W4478B01	Panel, rear, I/O, enclosure
6	64-W4516B01	Panel, air baffle
7	01NW9804C64	Power supply assembly, 400W, 5 outputs
8	07-W4515B01	Bracket, board mounting
9	13-W4528B01	Bezel, front, enclosure
10	07-W4437B01	Bracket, keyboard connectors
11	40NW9801B51	Switch, rocker, DPDT, 125V, neon
	40NW9801B52	Switch, rocker, DPDT, 250V, neon
12	01-W0306B03	Winchester drive, 15MB, CM5619
	01-W0306B01	Winchester drive, 5MB, CM5609
13	40NW9801B22	Switch, key, SPDT
14	64-W4444B02	Plate, cover, bottom, floppy disk drive
15	64-W4444B01	Plate, cover, top, floppy disk drive
16	64-W4443B01	Plate, cover, blank, Winchester drive
17	01-W0304B01	Floppy disk drive, 5-1/4 inch
18	01-W3145B01	PCB assembly, System Controller Module (SCM)
19	01-W3130B01	PCB assembly, Winchester Disk Controller (WDC)
20	30-W2401B01	Cable assembly, internal, Winchester drive data
21	-	N/A
22	30-W2303B01	Cable assembly, internal, ac wiring harness
23	30-W2301B01	Cable assembly, internal, 24 Vdc
24	30-W2302B01	Cable assembly, internal, battery backup

TABLE 3-3. Control Unit Chassis Parts List (cont'd)

ITEM NUMBER	MOTOROLA PART NUMBER	DESCRIPTION
25	30-W2300B01	Cable assembly, internal, control (keyboard, abort, reset, and keyboard lock)
26	30-W2305B01	Cable assembly, internal, video data
27	30-W2402B01	Cable assembly, internal, Wichester drive control
28	30-W2306B01	Cable assembly, internal, Floppy drive data/control
29	03SW992D06	Screw, phillips, M3.5 x 0.6 x 6
30	03NW9004B51	Screw, phillips, pan head, self tapping #4-24 x 1/4
31	03SW992D306	Screw, phillips, M3 x 0.5 x 6
32	03SW993D306	Screw, phillips, M3 x 0.5 x 6
33	04SW997D005	Washer, spade lock, M3 x 0.8
34	04SW999D007	Washer, flat, M3.2 x 0.5
35	03SW993C605	Screw, phillips, #6-32 x 5/16
36,37	-	N/A
38	03SW993C806	Screw, phillips, #8-32 x 3/8
39	11NW9201A04	Tape, adhesive
40	42NW9401A49	Mounting cradle, adhesive back
41	30-W2415B01	Cable assembly, internal, ac input
42	30-W2416B01	Cable assembly, internal, ac line
43-46	-	N/A
47	03SW995D310	Screw, phillips, M3 x 0.5 x 10
48	02SW991D001	Nut, hex, M3 x 0.5 x 5.5 x 3.2
49	47NW9405A32	Jacksocket assembly
50	60NW9701A10	Battery, 1.2V, nickel-cadmium, AA
51	30-W2308B01	Cable assembly, internal, dc power
52	03SW992D308	Screw, phillips, M3 x 0.5 x 8
53	59NW9807A25	Fan, low noise, 115 Vac, 50/60 Hz
	59NW9807A27	Fan, standard, 220 Vac, 50/60 Hz

TABLE 3-3. Control Unit Chassis Parts List (cont'd)

ITEM NUMBER	MOTOROLA PART NUMBER	DESCRIPTION
54	09NW9803A20	Fuseholder, space saver
55	65NW9622A22	Fuse, slow blow, 250V, 7A (1)
	65NW9622A02	Fuse, slow blow, 125V, 4A, 3AG (2)
56	75NW9402A03	Foot, rubber, round top
57	03SW993D410	Screw, phillips, M4 x 0.7 x 10
58	-	N/A
59	64-W4546B01	Plate, cover, power supply
60	15-W4547B01	Cover, side, right hand, enclosure
61	15-W4547B02	Cover, side, left hand, enclosure
62	02NW9006A24	Clip, fastening, fan
63	03SW993A610	Screw, phillips, #6-32 x 5/8
64	03SW995D306	Screw, phillips, M3 x 0.5 x 6
65	03SW993D525	Screw, phillips, M5 x 0.8 x 25
66	01-W3262B01	PCB assembly, Memory Management Unit (MMU), 451 daughter board
67	43SW940A312	Spacer, threaded, round, M3 x 0.5 x 12
68	33-W4564B01	Plate, identification
69	38NW9404B97	Cap, large, snap-on, black
70	02NW9006A53	Nut,
71	43SW940A320	Spacer, threaded, round, M3 x 0.5 x 20
72	33-W4076C16	Label, rating, universal, M68K101-1
	33-W4076C17	Label, rating, universal, M68K101-2
	33-W4076C19	Label, rating, universal, M68K102B1
	33-W4076C20	Label, rating, universal, M68K102B2
73	33CW4075B05	Label, rating, fuse (1)
	33CW4075B01	Label, rating, fuse (2)

TABLE 3-3. Control Unit Chassis Parts List (cont'd)

ITEM NUMBER	MOTOROLA PART NUMBER	DESCRIPTION
74	03SW994D306	Screw, phillips, M3 x 0.5 x 6
75	33-W4214B01	Label, FCC, caution
76	02SW990D003	Nut, hex, M3.5 x 0.6 x 2.8
77	04SW995A006	Washer, lock, #6
78	-	N/A
79	01-W2354B01	Card cage assembly, VME+I/Omodule expansion
	01-W2353B01	Card cage assembly, I/Omodule expansion
80	03SW993D406	Screw, phillips, M4.0 x 0.7 x 6
81	04SW998D005	Washer, lock, M4 x 0.5
82	75NW9408A04	Grommet, plastic edge
83	91NW9705A10	EMI filter, ac line, 5A
84	29NW9805A83	Lug, quick connect
85	42NW9401A63	Clip, self adhesive
86	03SW9930D408	Screw, phillips, M4.0 x 0.7 x 8
87	02SW991D002	Nut, hex, M4 x 0.7 x 7 x 4
88	-	N/A
89	04NW9005A05	Washer, flat, insulating, nylon, #6
90	42NW9401A16	Tie-wrap, nylon
91	11NW9203A19	Adhesive
92-94	-	N/A
95	64-W4211B01	Plate, cover, card cage, double wide
96	64-W4210B01	Plate, cover, card cage, single wide
97	03SW993D208	Screw, phillips, M2.5 x 0.45 x 8
98	64-W4539B01	Panel, rear, filler

## NOTES:

(1) Applicable for 115 Vac system.

(2) Applicable for 230 Vac system.

TABLE 3-4. Control Unit Chassis Miscellaneous Parts List

ITEM NUMBER	MOTOROLA PART NUMBER	DESCRIPTION
(see NOTE)	07-W4472B01	Tilt/swivel assembly
(see NOTE)	03SW994D904	Screw, phillips, M5 x 0.8 x 10 (use with 07-W4472B01 tilt/swivel assembly only)
21	30NW9301A06	Cable assembly, external, ac power

NOTE: User-installed tilt/swivel assembly on first-production VME/10 control unit chassis. Refer to VME/10 Microcomputer System Installation Guide, Motorola publication number M68KVSIG, for additional tilt/swivel information.

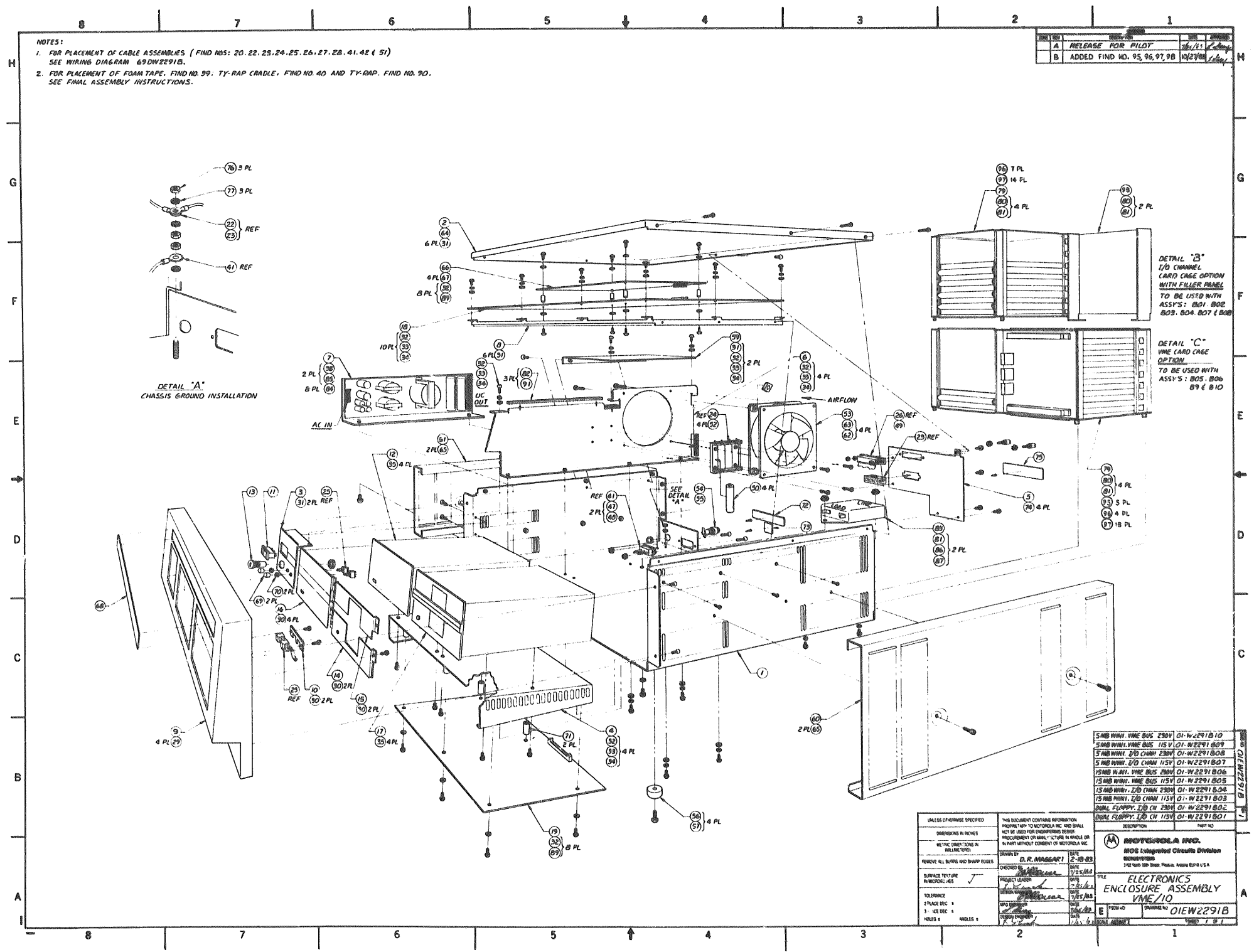


FIGURE 3-9. Control Unit Chassis Assembly Diagram

TABLE 3-5. I/Omodule Expansion Card Cage Parts List

ITEM NUMBER	MOTOROLA PART NUMBER	DESCRIPTION
1	07NW9502A56	Rail, front bottom, 28E long
2	07NW9502A57	Rail, front top, 28E long
3	07NW9502A59	Backplane, 28E long
4	07NW9502A58	Strip, tapped, M2.5, 28E long
5	07NW9502A60	Adapter, backplane to connector
6	-	N/A
7	64NW9414A21	Plate, end, KM6 3U x 182MM
8	07NW9502A38	Guide, card, KM6
9	03NW9004B31	Screw, M4 x 16
10	03SW993D206	Screw, phillips, M2.5 x 0.45 x 6
11	30-W2304B02	Cable assembly
12,13	-	N/A
14	43NW9002B32	Standoff, hex, M4 x 6 x 8
15	03SW993D204	Screw, phillips, M2.5 x 0.45 x 4



**NOTE:**

- ⚠️ **INSTALL CARD GUIDES, ITEM 8, WITH TABS ORIENTED UP SO THAT THE GROOVES ALIGN WITH THE FOLLOWING HASH MARKS AS SILKSCREENED ON TOP AND BOTTOM RAILS, ITEMS 2 & 1: 01, 05, 09, 13, 17, 21 & 25.**
- ⚠️ **INSTALL CONNECTORS OF CABLE ASSY, ITEM 11, USING SCREWS AT THE FOLLOWING RAIL LOCATIONS: 2, 6, 10, 14 & 18.**

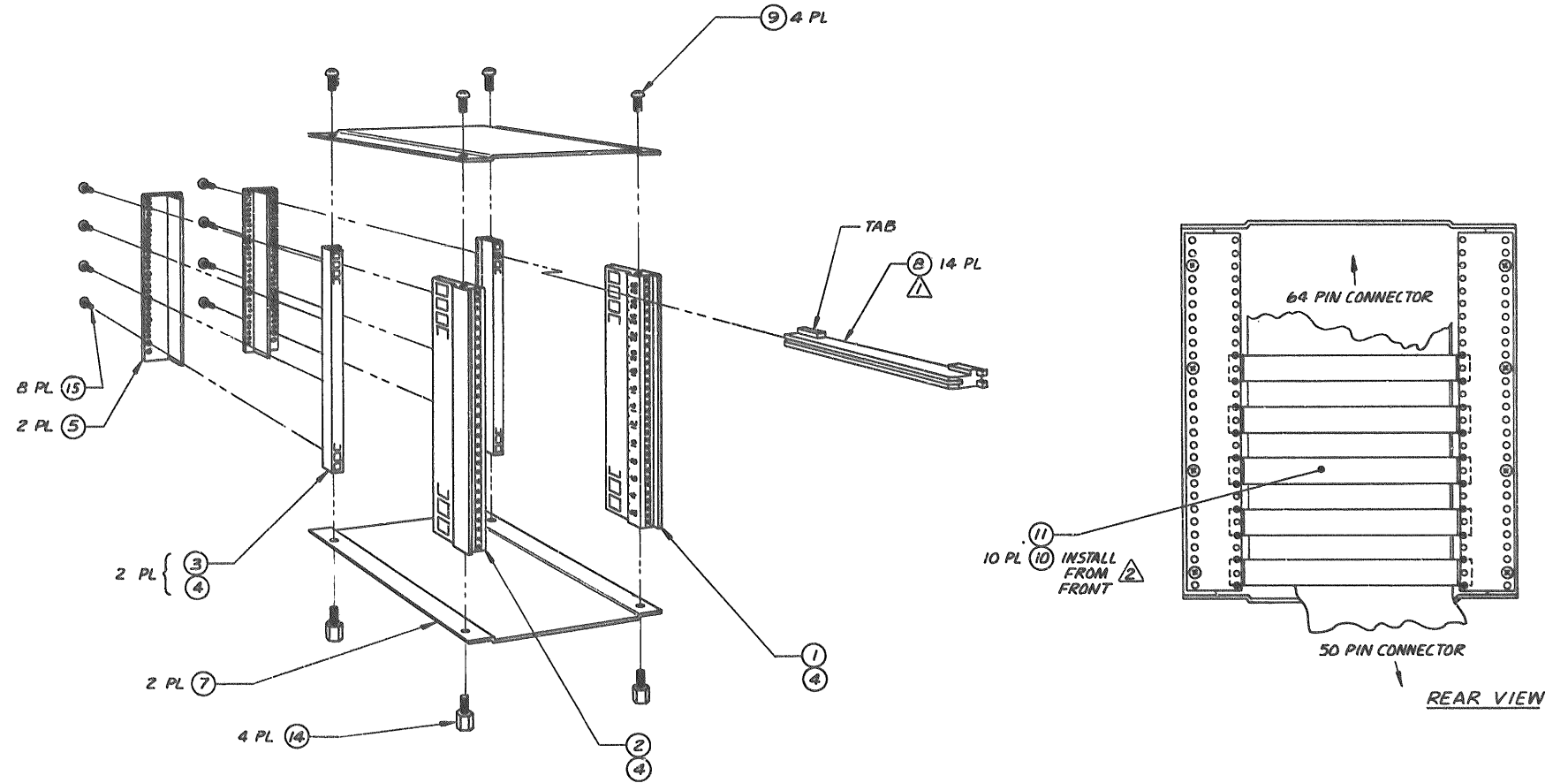
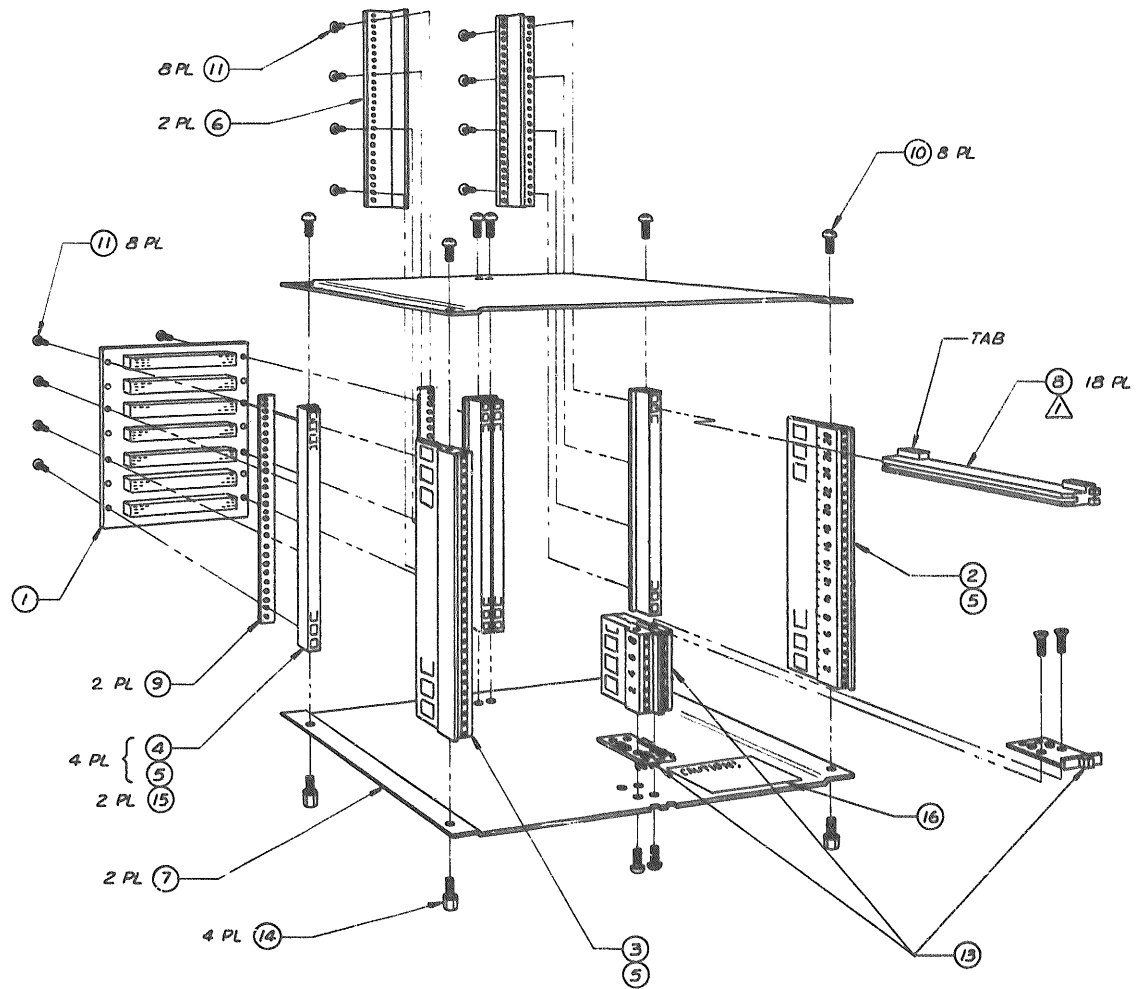


FIGURE 3-10. I/O module Expansion Card Cage Assembly Diagram

TABLE 3-6. VME+I/Omodule Expansion Card Cage Parts List

ITEM NUMBER	MOTOROLA PART NUMBER	DESCRIPTION
1	01-W3168B01	Printed wiring board, backplane, 7-slot (see Figure 3-12)
2	07NW9502A56	Rail, front/bottom, 28E long
3	07NW9502A57	Rail, front top, 28E long
4	07NW9502A59	Backplane, 28E long
5	07NW9502A58	Strip, tapped, M2.5, 28E long
6	07NW9502A60	Adapter, backplane to connector
7	64NW9414A14	Plate, end, KM6
8	07NW9502A38	Guide, card, KM6
9	14NW9416A09	Strip, insulation, 28E long
10	03NW9004B31	Screw, M4 x 16
11	03SW993D206	Screw, phillips, M2.5 x 0.45 x 6
12	30-W2304B01	Cable assembly with backplane
13	07NW9502A61	Kit, divider, 6U to 3U
14	43NW9002B32	Standoff, hex, M4 x 6 x 8
15	11NW9201A40	Tape, electrical
16	33-W4638B01	Label, CAUTION
17	03SW993D204	Screw, phillips, M2.5 x 0.45 x 4



NOTE:  
 ▲ INSTALL CARD GUIDES, ITEM 8, WITH TABS ORIENTED UP SO THAT THE GROOVES ALIGN WITH THE FOLLOWING HASH MARKS AS SILKSCREENED ON TOP & BOTTOM RAILS, ITEMS 3 & 2: 01, 05, 09, 13, 17, 21 & 25.

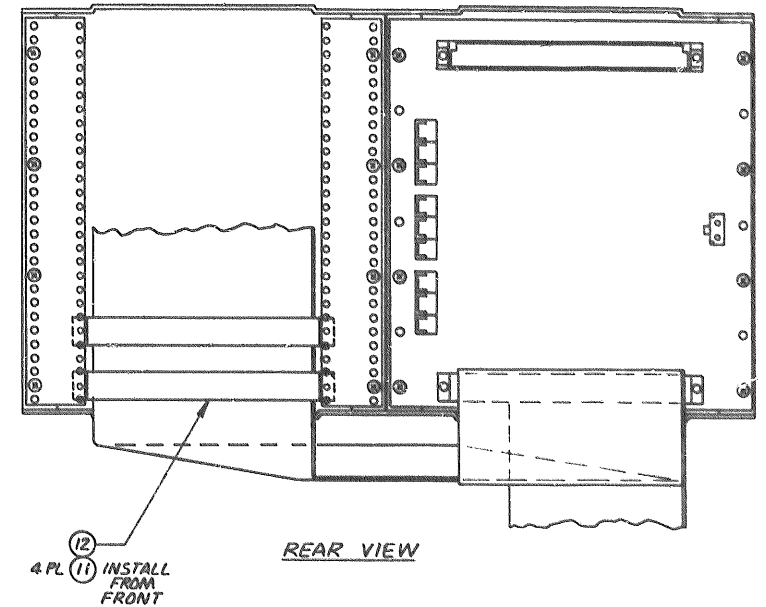


FIGURE 3-11. VME+I/O module Expansion Card Cage Assembly Diagram

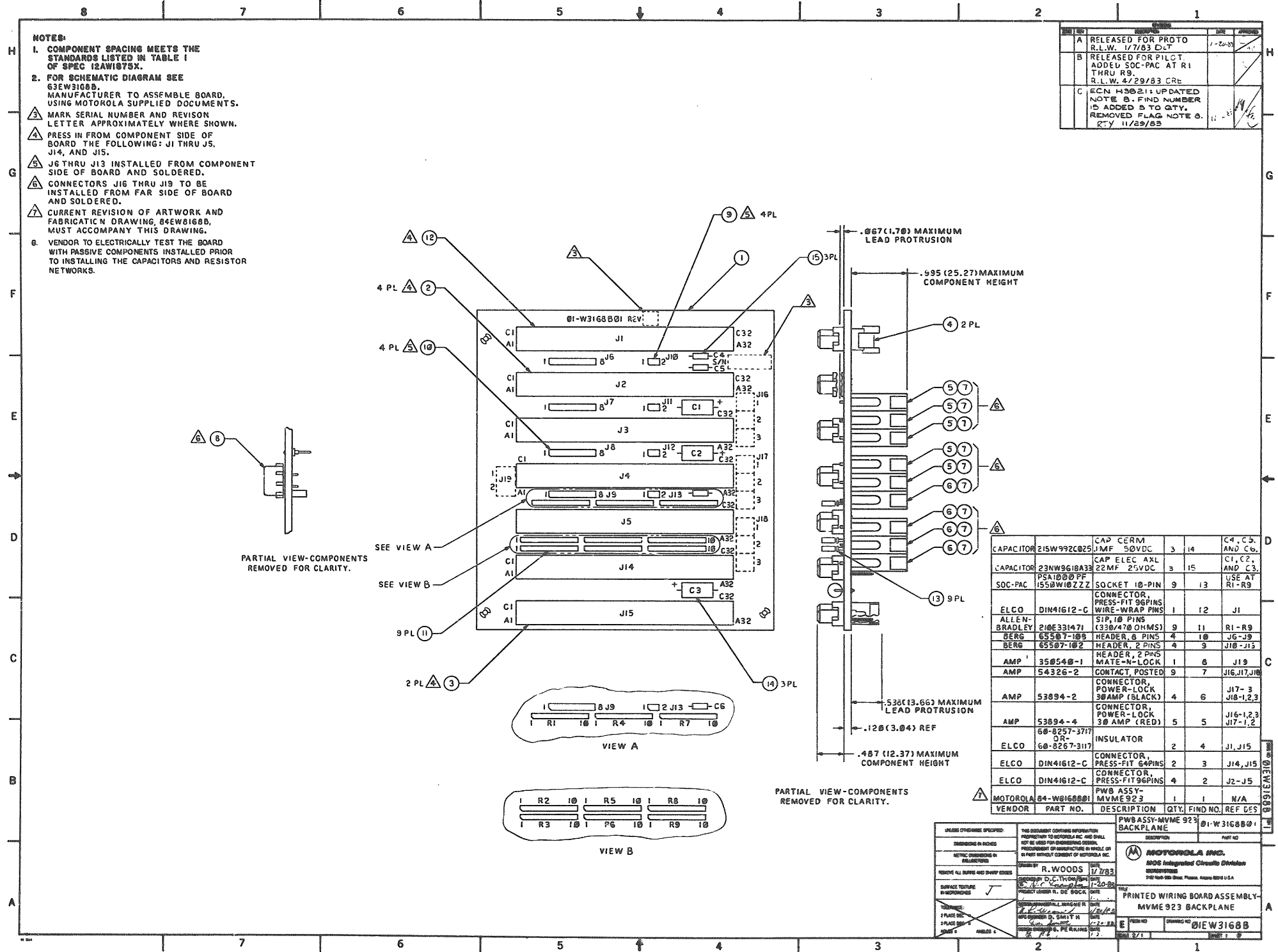


FIGURE 3-12. MVME923 Backplane Printed Wiring Board Assembly Diagram

### 3.5 DIAGRAMS

This section provides the control unit chassis wiring and schematic diagrams. Diagrams are organized as follows:

<u>FIGURE NUMBER</u>	<u>FIGURE TITLE</u>
3-13	Control Unit Chassis Overall Wiring
3-14	Keyboard and Front Panel Interconnect Wiring
3-15	SCM Interconnect Wiring
3-16	Mass Storage Interconnect Wiring
3-17	I/Omodule Expansion Card Cage Schematic
3-18	VME+I/Omodule Expansion Card Cage Schematic

The control unit chassis overall wiring diagram (Figure 3-13) is used primarily to illustrate the ac and dc power wiring. Interconnect wiring diagrams (Figures 3-14 through 3-16) illustrate the data and control cable assemblies shown in Figure 3-13. Schematic diagrams (Figures 3-17 and 3-18) illustrate the electrical wiring of the I/O Channel, VMEbus, and power supply assembly as shown in Figure 3-13.

For the SCM, WDC, Winchester/floppy disk drive, and power supply assembly diagrams, refer to the applicable user's manual.

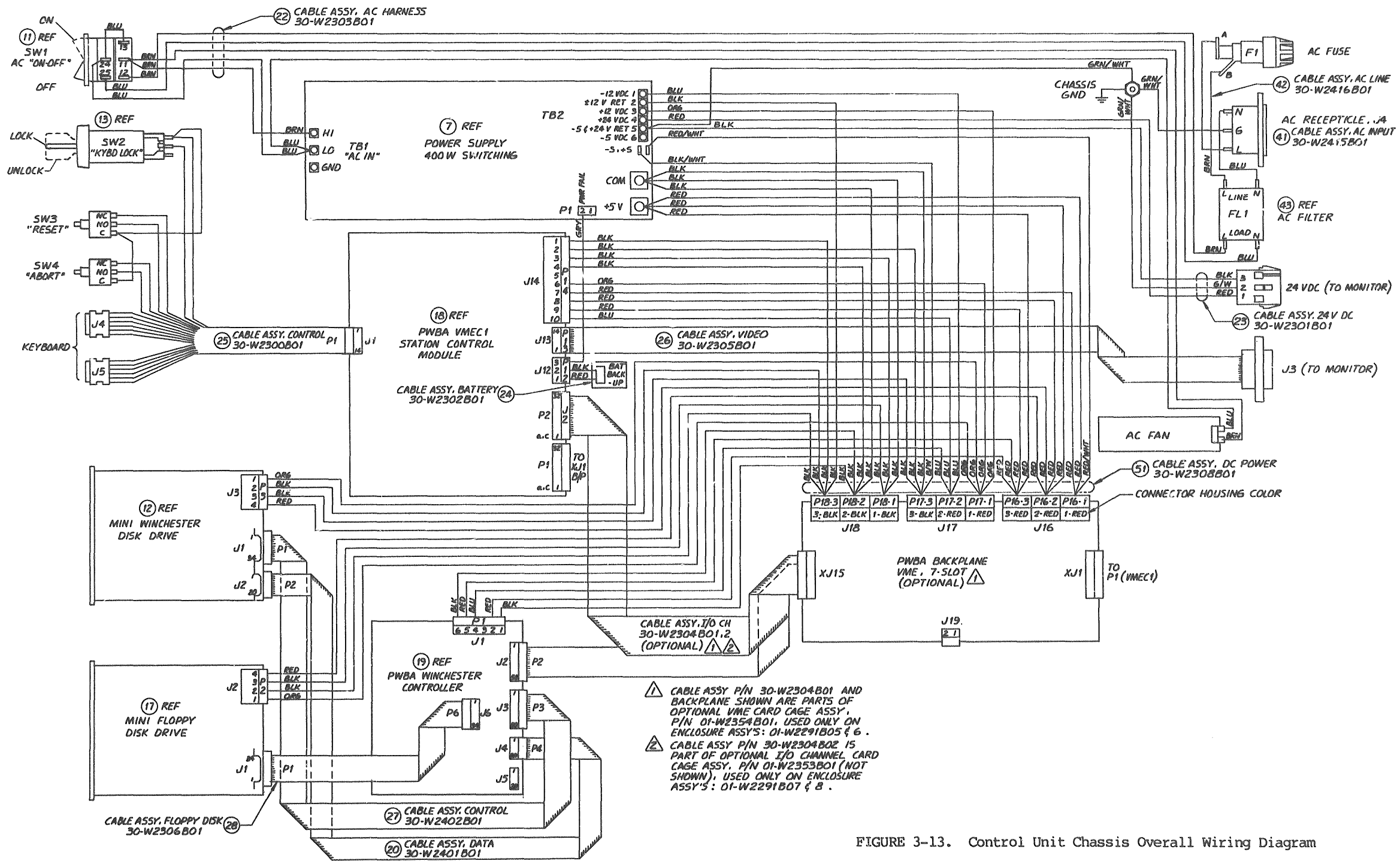


FIGURE 3-13. Control Unit Chassis Overall Wiring Diagram

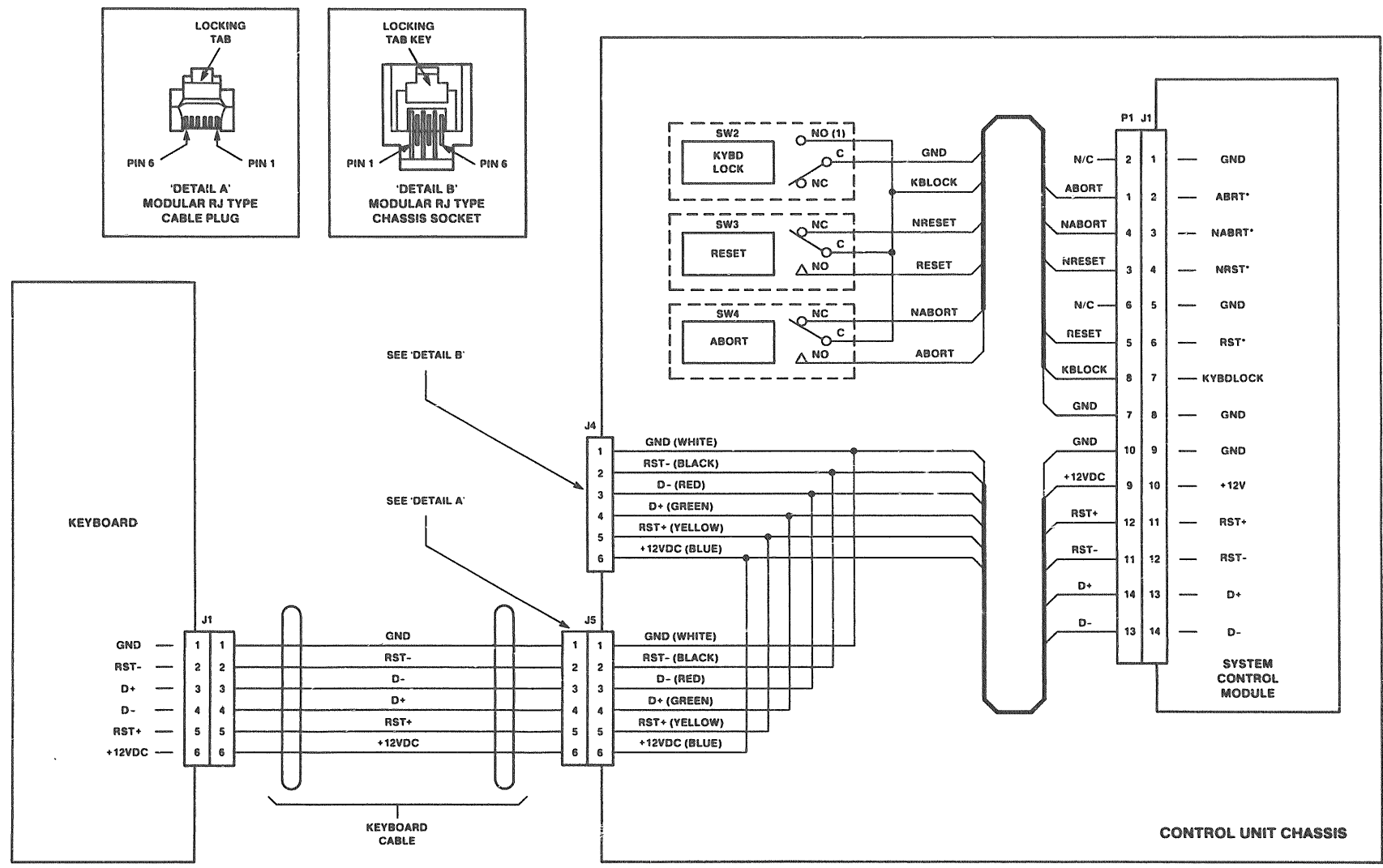


FIGURE 3-14. Keyboard and Front Panel Interconnect Wiring Diagram

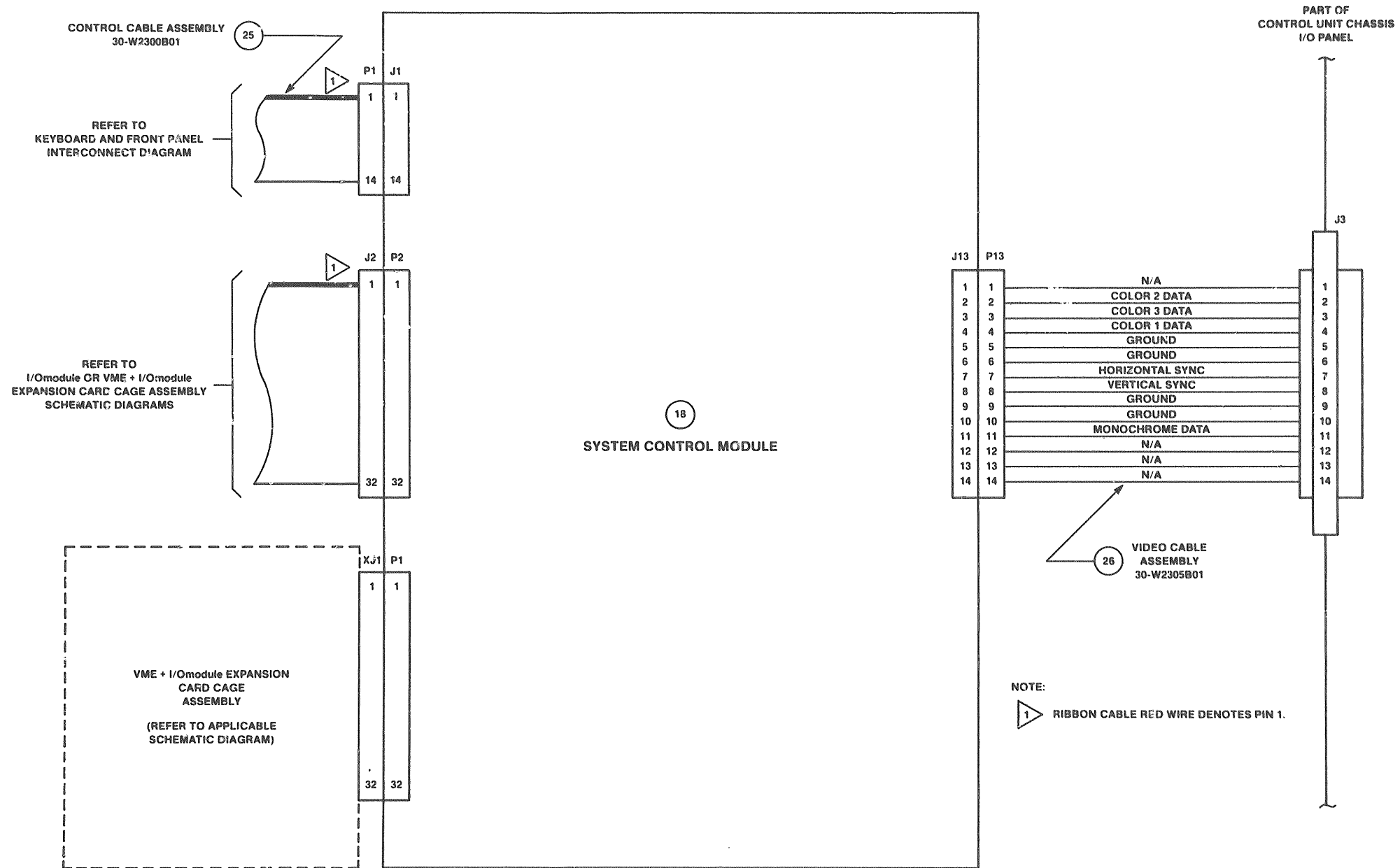


FIGURE 3-15. SCM Interconnect Wiring Diagram



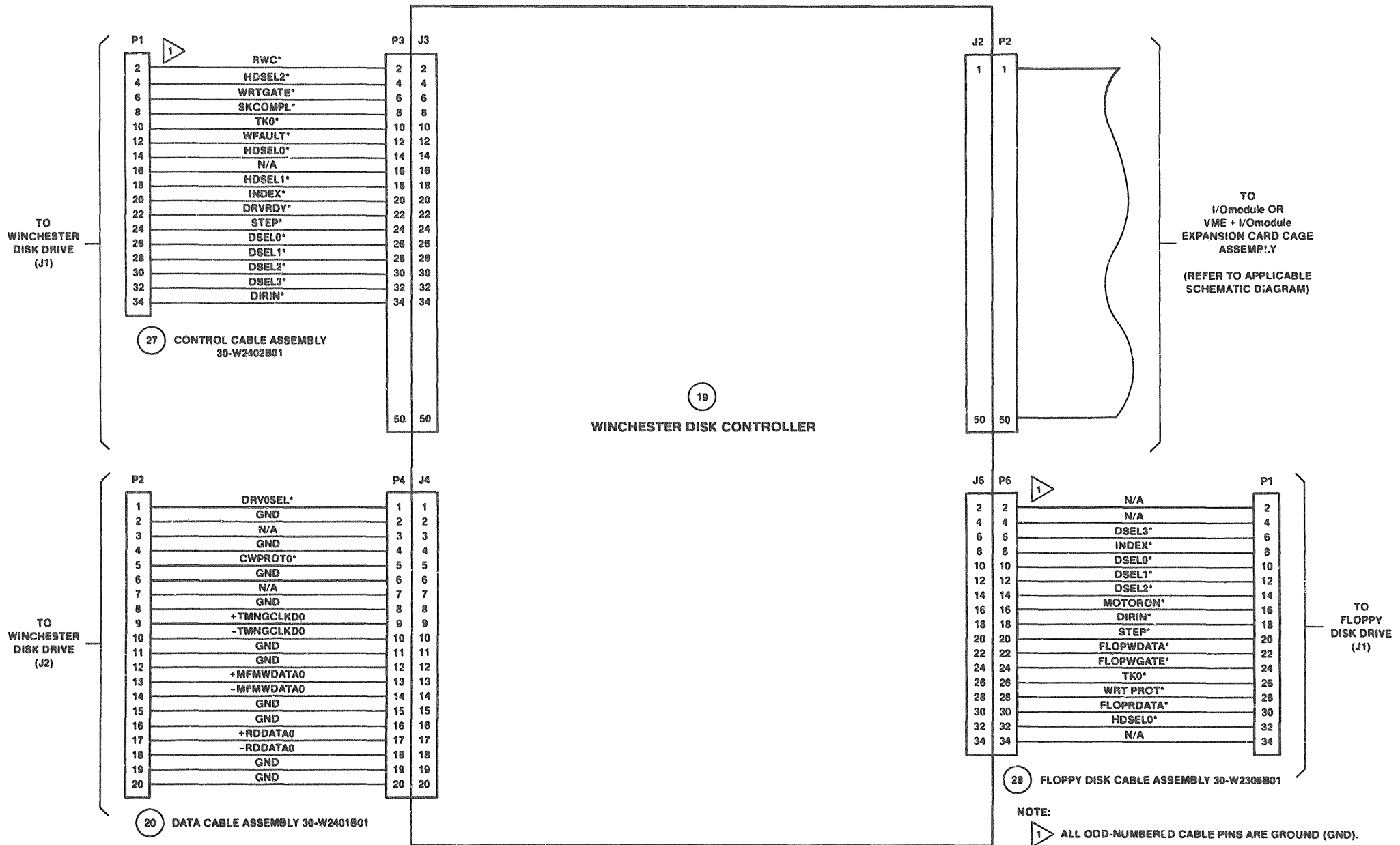


FIGURE 3-16. Mass Storage Interconnect Wiring Diagram

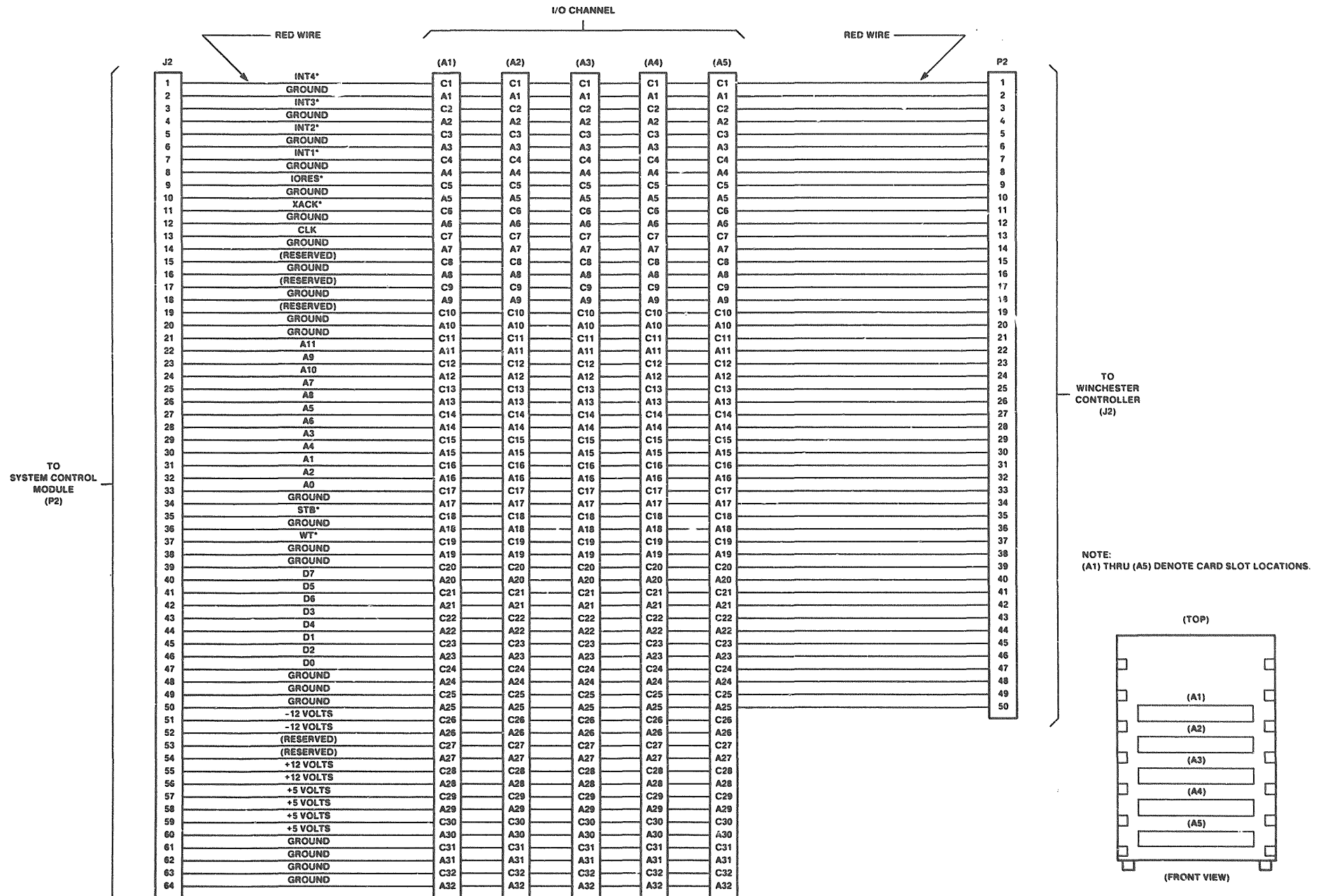


FIGURE 3-17. I/O module Expansion Card Cage, Schematic Diagram

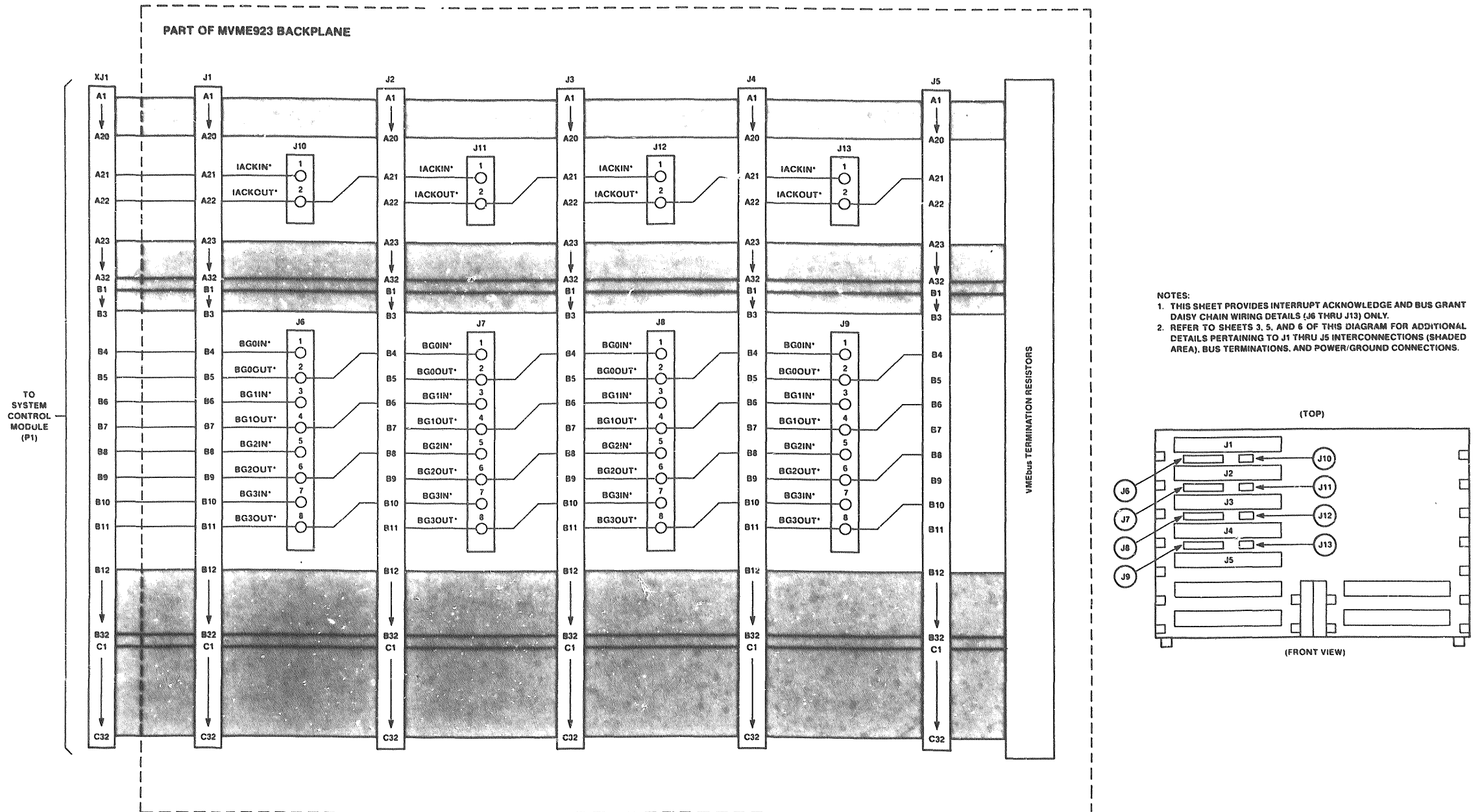


FIGURE 3-18. VME+I/O module Expansion Card Cage, Schematic Diagram (Sheet 1 of 6)

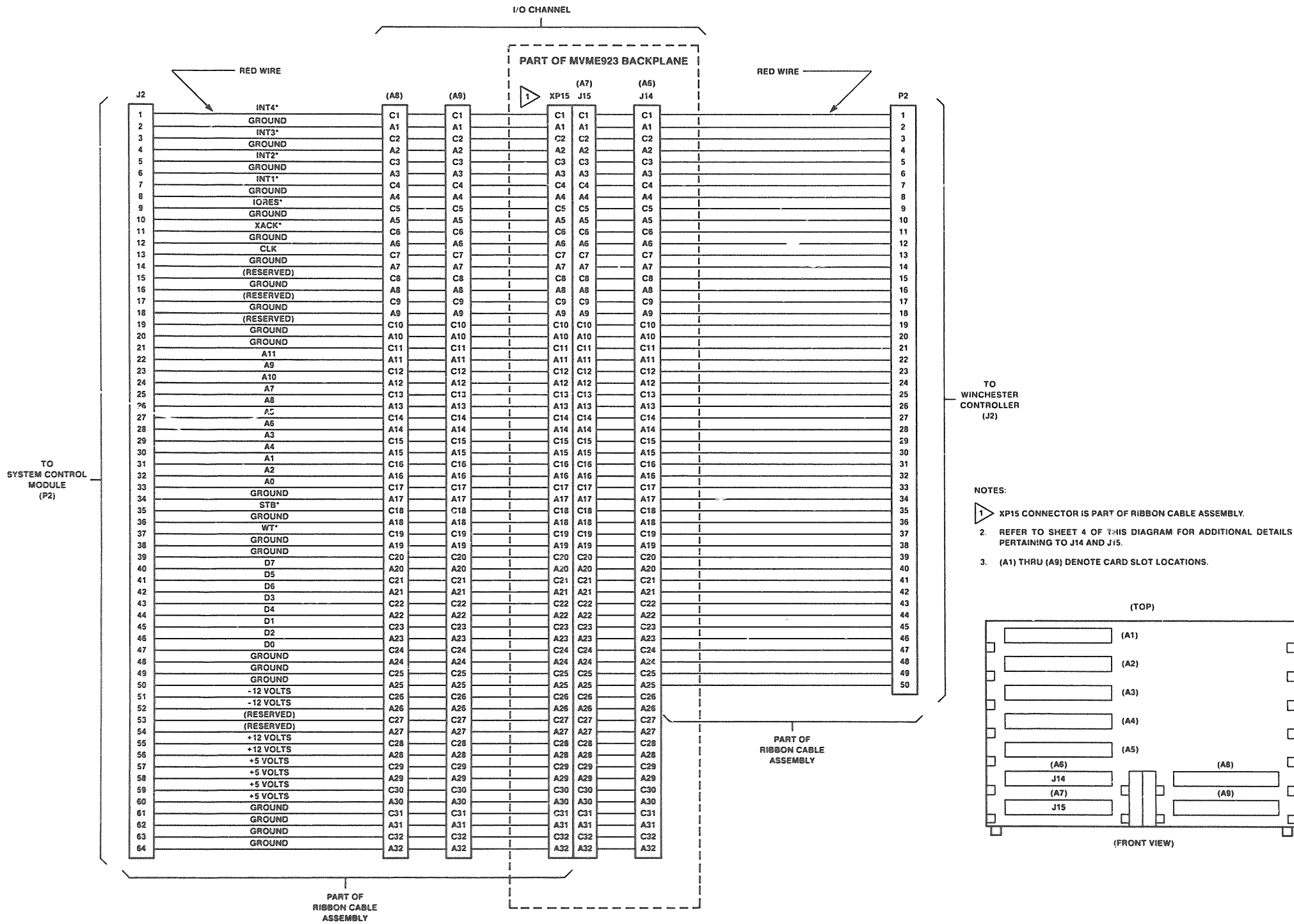
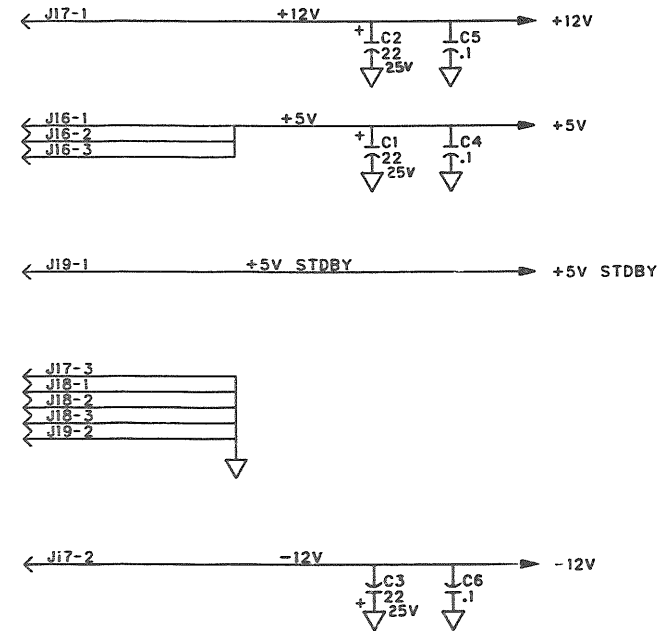


FIGURE 3-18. VME+I/O module Expansion Card Cage, Schematic Diagram (Sheet 2 of 6)

- NOTES:
1. FOR REFERENCE DRAWINGS REFER TO BILL(S) OF MATERIAL @IEW3168B
  2. UNLESS OTHERWISE SPECIFIED:  
ALL RESISTORS ARE IN OHMS,  $\pm 5\text{PCT}$ ,  
1/4 WATT.  
ALL CAPACITORS ARE IN UF.  
ALL VOLTAGES ARE DC.
  3. INTERRUPTED LINES CODED WITH THE SAME LETTER OR LETTER COMBINATIONS ARE ELECTRICALLY CONNECTED.
  4. INTERPRET DIAGRAM IN ACCORDANCE WITH AMERICAN NATIONAL STANDARDS INSTITUTE SPECIFICATIONS, CURRENT REVISION.



XJ1	
R9	
J19	
C6	
HIGHEST NUMBER USED	NOT USED
REFERENCE DESIGNATIONS	

63EW3168B REV B SH 1 OF 4

FIGURE 3-18. VME+1/Omodule Expansion Card Cage, Schematic Diagram (Sheet 3 of 6)

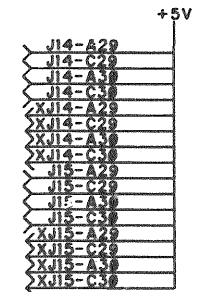
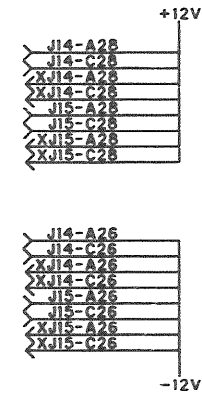
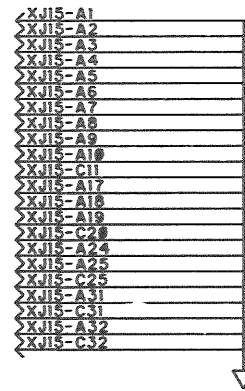
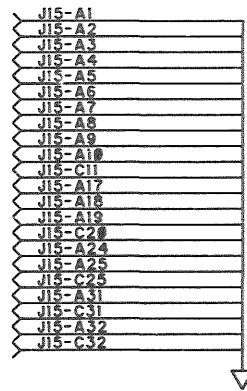
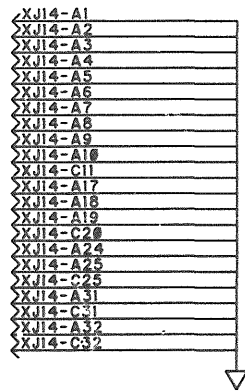
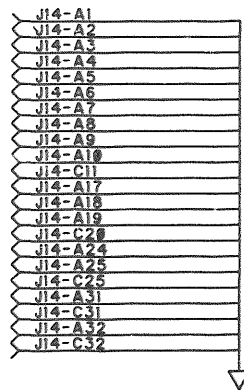
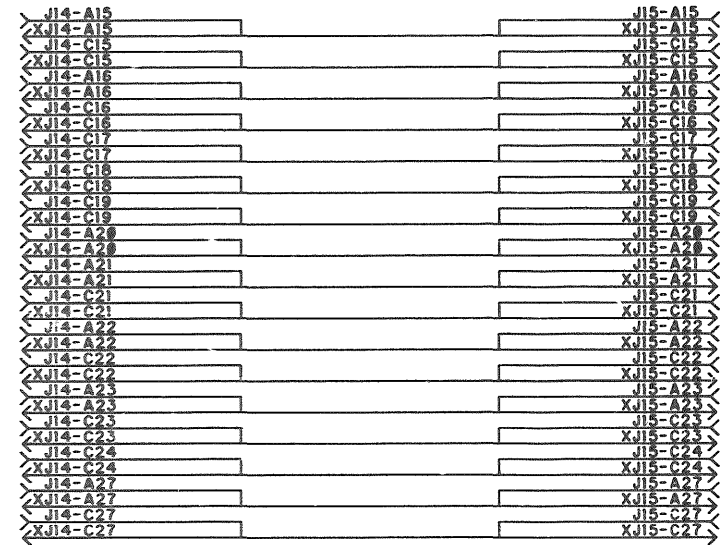
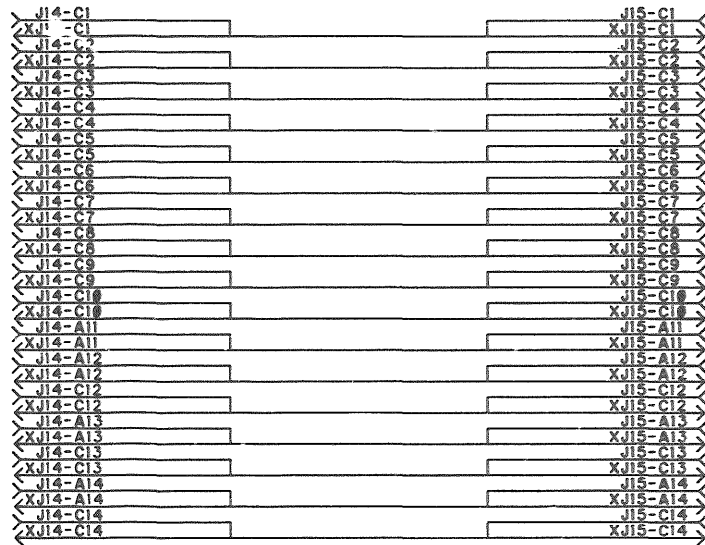


FIGURE 3-18. VME+I/Omodule Expansion Card Cage, Schematic Diagram (Sheet 4 of 6)

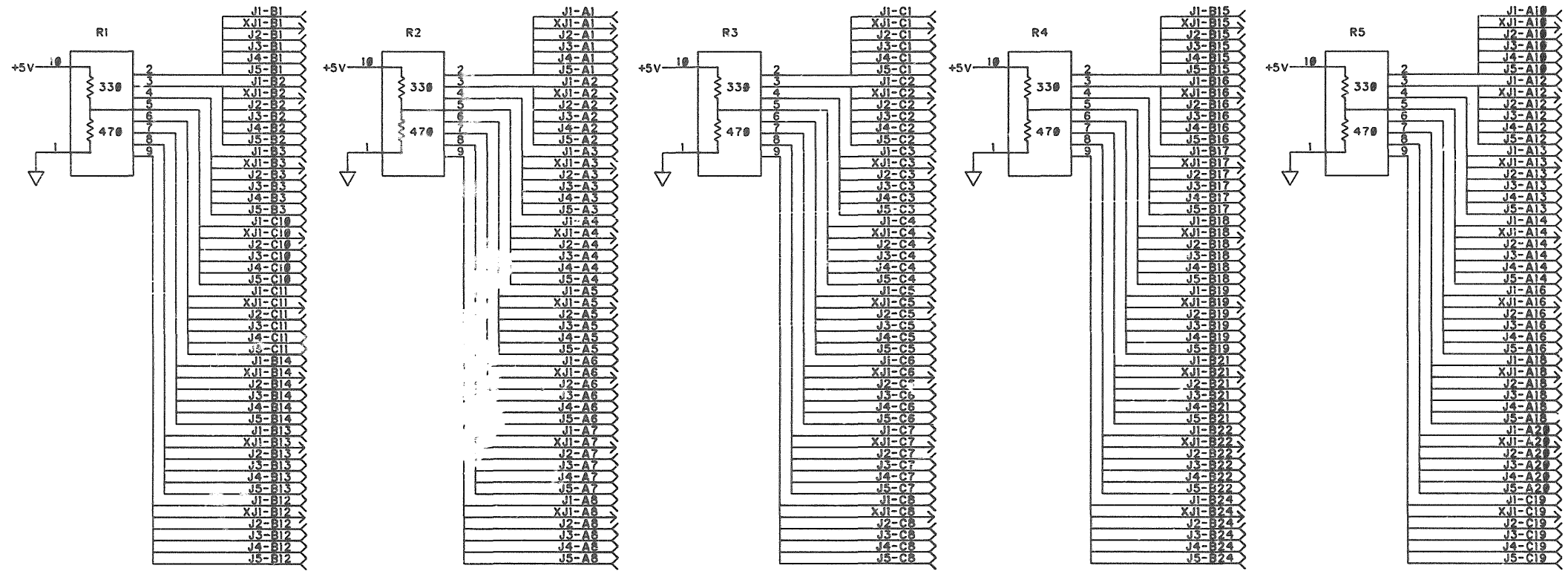


FIGURE 3-18. VME+I/O module Expansion Card Cage, Schematic Diagram (Sheet 5 of 6)

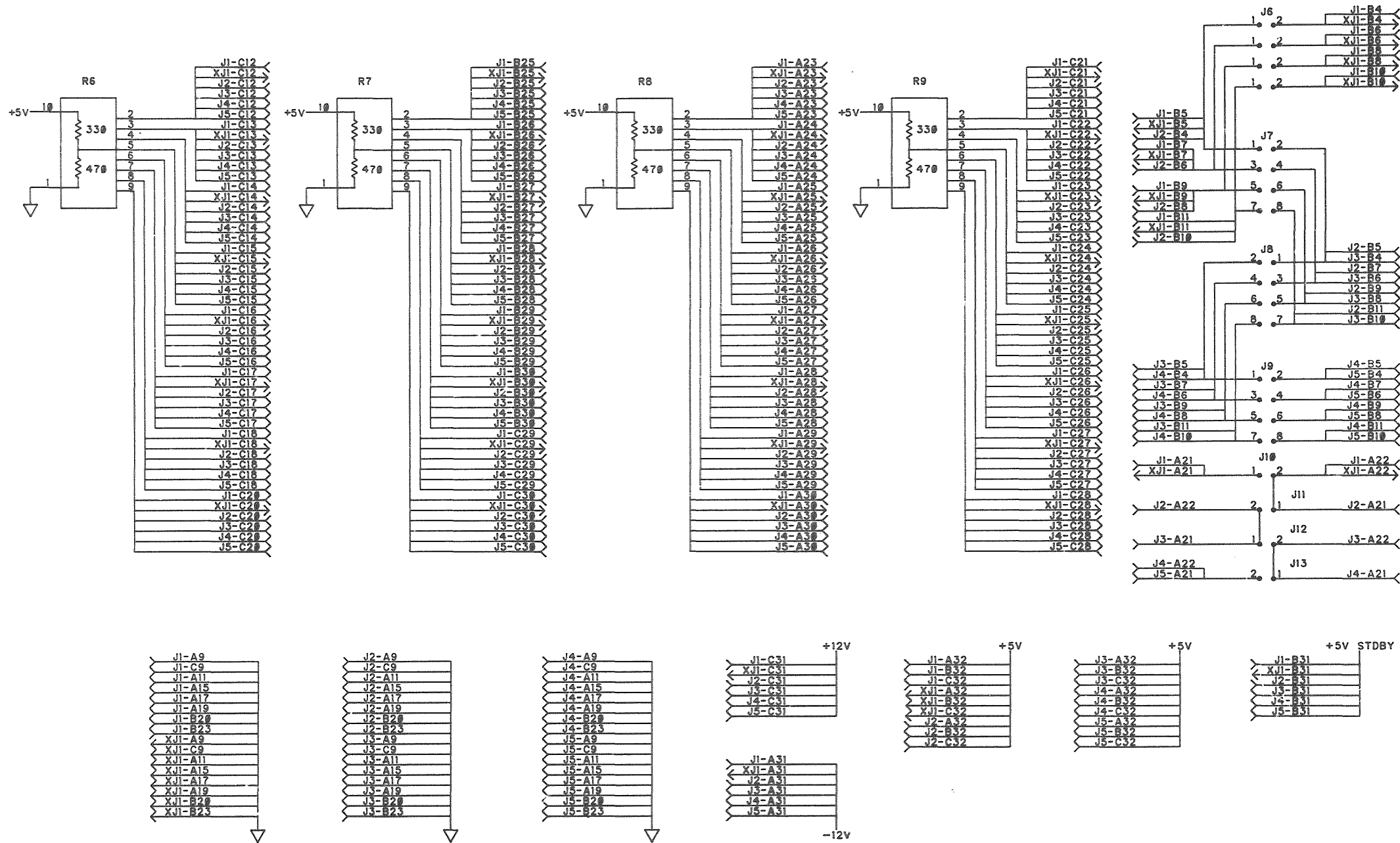


FIGURE 3-18. VME+I/O module Expansion Card Cage, Schematic Diagram (Sheet 6 of 6)

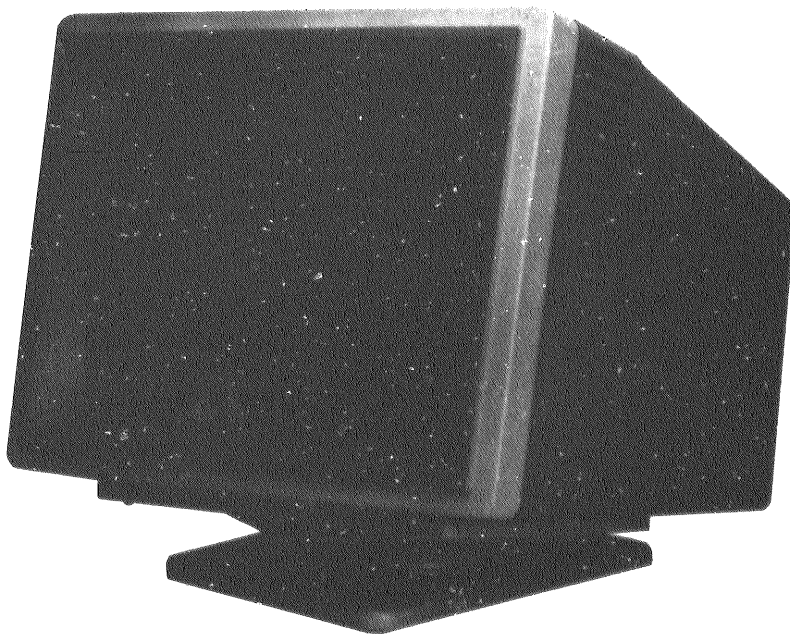


# **DISPLAY UNIT**

CHAPTER 4  
DISPLAY UNIT

4.1 INTRODUCTION

This chapter provides a general description, removal/replacement procedures, parts lists, and diagrams for the display unit as shown in Figure 4-1.



10-83-1800

FIGURE 4-1. Typical Display Unit with Tilt/Swivel Mechanism

## 4.2 GENERAL DESCRIPTION

The VME/10 display unit is a 15-inch (diagonal) monochrome Cathode Ray Tube (CRT) monitor with an anti-glare, P39 (green) phosphor screen. For additional information on the monochrome monitor installed in the display unit assembly, refer to the VME/10 Microcomputer System Monochrome Monitor User's Manual, Motorola publication number M68KVSMM1.

The display unit is accommodated by a tilt/swivel stand (mechanism). Two types of tilt/swivel mechanisms are utilized in the production of the VME/10. One type is mounted on the display unit by the factory (see Figure 4-1). The other type (first production units) is provided in a kit form which is mounted on the control unit chassis by the user (see Figure 3-1). For additional information on both types of tilt/swivel mechanisms, refer to the VME/10 Microcomputer System Installation Guide, Motorola publication number M68KVSIG.

## 4.3 REMOVAL/REPLACEMENT PROCEDURES

This section provides the removal/replacement procedures for the display unit. Before performing these procedures, ensure that VME/10 ac power is disconnected.

### WARNING

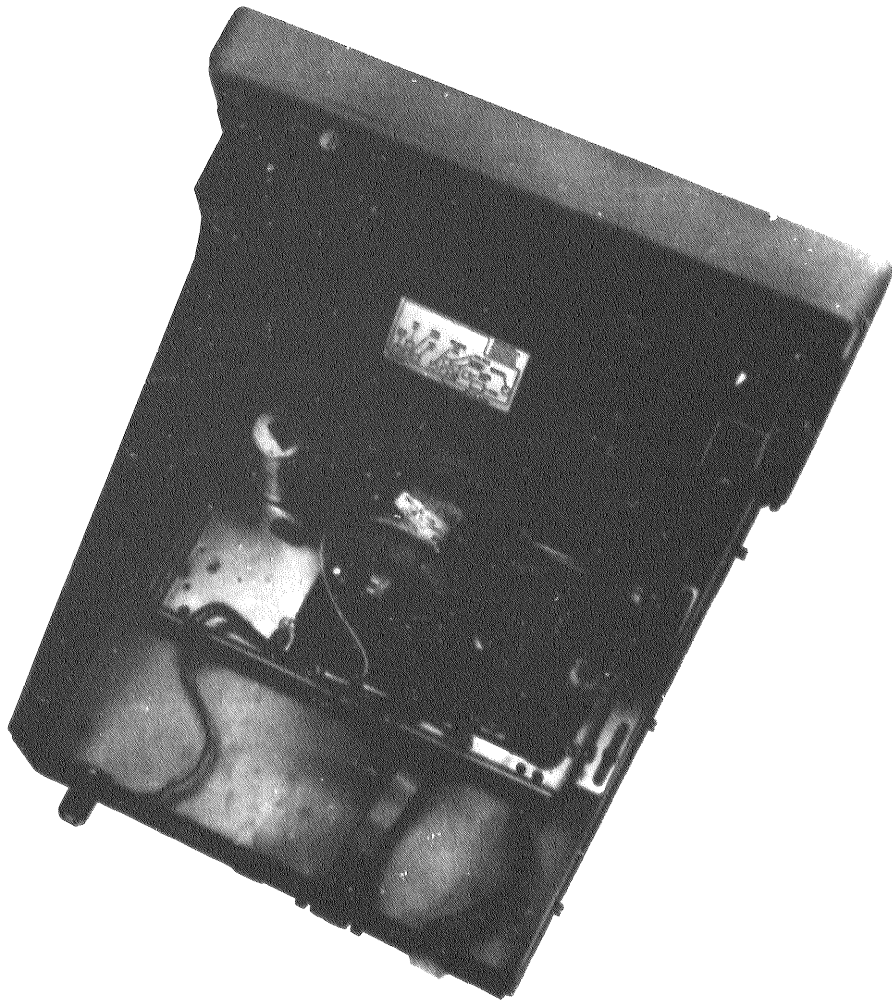
AC POWER MUST BE REMOVED TO AVOID ELECTRICAL SHOCKS TO MAINTENANCE PERSONNEL.

The monitor is removed from the display unit assembly as follows:

- a. Disconnect system ac power.
- b. Remove all external cables from display unit.
- c. Remove display unit from tilt/swivel mechanism.
- d. Remove display unit cover by removing three screws with cup washers per side.
- e. Grasp both sides of cover and pull from the rear. Monochrome monitor is now exposed (shown in Figure 4-2) for further disassembly if required.

### WARNING

USE STANDARD HIGH VOLTAGE CRT DISCHARGING METHODS TO AVOID ELECTRICAL SHOCKS TO MAINTENANCE PERSONNEL.



10-83-1801

FIGURE 4-2. Display Unit with Cover Removed

- f. Remove display unit monitor front bezel by removing two flat-head screws per side.

CAUTION

DAMAGE COULD RESULT TO EXTERNALLY MOUNTED  
MONITOR ANTI-GLARE SCREEN IF PRECAUTION IS  
NOT OBSERVED DURING SCREEN REMOVAL PROCEDURE.

If monitor contains an internal CRT anti-glare screen, proceed to step h.

- g. Remove anti-glare screen ground wire from monitor bracket assembly. Store anti-glare screen in a safe area to avoid screen damage (tearing/puncturing).
- h. Remove 24VDC monitor dc power connector from display unit rear panel by squeezing both upper and lower connector locking tabs and pushing in on the connector.
- i. Disconnect monitor data interconnect cable assembly from the monitor circuit card edge connector Pl.
- j. Remove monitor brightness control from display unit rear panel. (Control knob is removed by grasping knob and a gentle pull.)
- k. Remove monitor from display unit by removing two pan-head screws and associated lockwashers and flatwashers per side.

The monitor replacement procedure is to perform the removal procedure instructions in reverse and opposite order. Ensure that all cabling is properly routed and free from obstructions. Externally mounted anti-glare screen can be cleaned by alcohol and a lint free cloth.

NOTE

Observe connector keying when installing  
monitor data interconnect cable assembly  
to monitor circuit card edge connector Pl.

#### 4.4 PARTS LISTS

This section provides the Illustrated Parts List (IPL) for the display unit. Tables 4-1 and 4-2 list the components of the display unit by item number, Motorola part number, and description. The parts list item number is used to identify the particular part on the IPL diagram (Figure 4-3) that is associated with the parts list table.

The parts lists reflect the latest issue of hardware at time of printing. For the monochrome monitor parts list, refer to the VME/10 Microcomputer System Monochrome Monitor User's Manual, publication number M68KVSMM1.

TABLE 4-1. Display Unit Parts List

ITEM NUMBER	MOTOROLA PART NUMBER	DESCRIPTION
1	13-W4436B01	Bezel, monitor
2	15-W4440B01	Cover, monitor
3	27-W4446B01	Base, monitor
4	01-W0305B01	Monitor, 15" CRT display
	01NW9804C69	Monitor, 15" CRT display (1)
	35NW9303A02	Screen, anti-glare (1)
5	30-W2298B01	Cable assembly, data, internal
6	-	N/A
7	36NW9506A11	Knob, round, black
8	64-W4479B01	Plate, cover
9	03SW992D908	Screw, phillips, M3 x 0.5 x 0.8
10	03SW993D408	Screw, phillips, M4.0 x 0.7 x 8
11	04SW997D007	Washer, spade lock, M4.0 x 0.9
12	04SW999D009	Washer, flat, M4.3 x 0.8 x 9
13	03SW997C412	Screw, phillips, M4 x 0.7 x 12
14	04NW9005A10	Washer, #6, nylon
15	03SW995D108	Screw, phillips, M2 x 0.4 x 0.8
16	04SW997D001	Washer, spade lock, M2 x 0.5
17	04SW999D003	Washer, flat, M2.2 x 0.3
18	02SW990D007	Nut, hex, M2 x 0.4 x 1.6

TABLE 4-1. Display Unit Parts List (cont'd)

ITEM NUMBER	MOTOROLA PART NUMBER	DESCRIPTION
19	47NW9405A32	Jacksocket assembly
20-21	-	N/A
22	33-W4082B04	Label
23	02NW9006A38	Nut ring, 3/8-32 x 1/2
24	75NW9402A24	Foot, rubber, 3.4D x 3/8H (2)
25	03SW993D408	Screw, phillips, M4.0 x 0.7 x 8 (2)

## NOTES:

- (1) Part number 01NW9804C69 is an alternate monitor. Anti-glare screen 35NW9303A02 is used with 01NW9804C69 monitor only.
- (2) Applicable to first production VME/10 units containing 07-W4472B01 tilt/swivel assembly mounted on control unit chassis. (Display unit contained rubber feet and mounted on control unit chassis via tilt/swivel mechanism.)

TABLE 4-2. Display Unit Miscellaneous Parts List

ITEM NUMBER	MOTOROLA PART NUMBER	DESCRIPTION
6	30-W2299B01	Cable assembly, external, dc power
20	30-W2307B01	Cable assembly, external, data
	03SW993D910	Screw, phillips, M3.5 x 0.6 x 10 (use with 30-W2307B01 data cable assembly only)
24	07-W4646B01	Pedestal, tilt/swivel (see NOTE)
25	03SW993D320	Screw, phillips, M3 x 0.5 x 20 (use with 07-W4646B01 tilt/swivel pedestal mechanism only)

NOTE: Tilt/swivel pedestal is installed on display unit by the factory. Refer to the VME/10 Microcomputer System Installation Guide, Motorola publication number M68KVSIG, for additional tilt/swivel information.

NOTE:

1. FIND NOS. 6 & 20 TO BE BAGGED AND ADDED TO SHIPPING CONTAINER.

2. INSTALL PRODUCT LABEL, FIND NO 22, APPROX WHERE SHOWN.

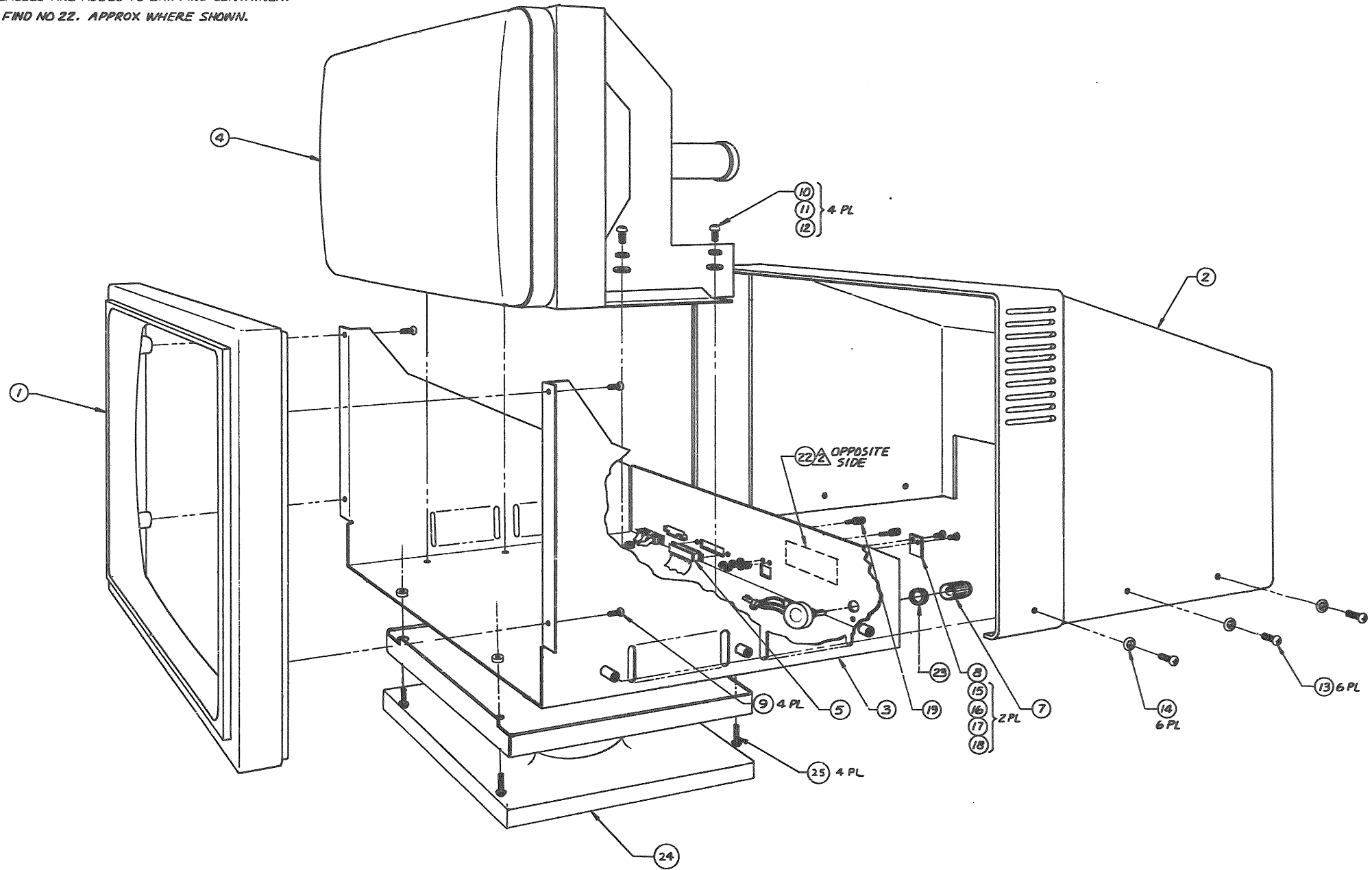
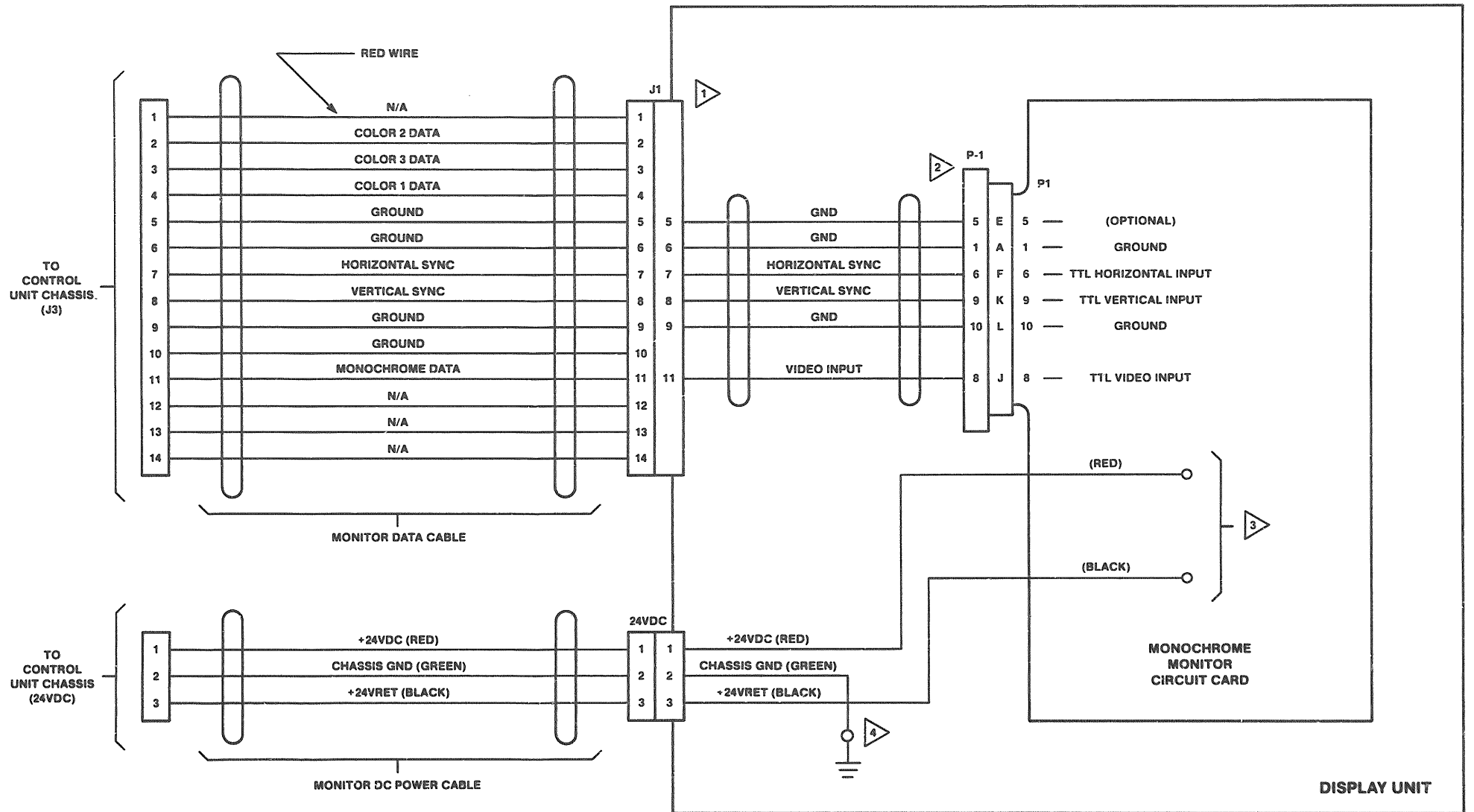


FIGURE 4-3. Display Unit Parts Location Diagram



#### 4.5 DIAGRAMS

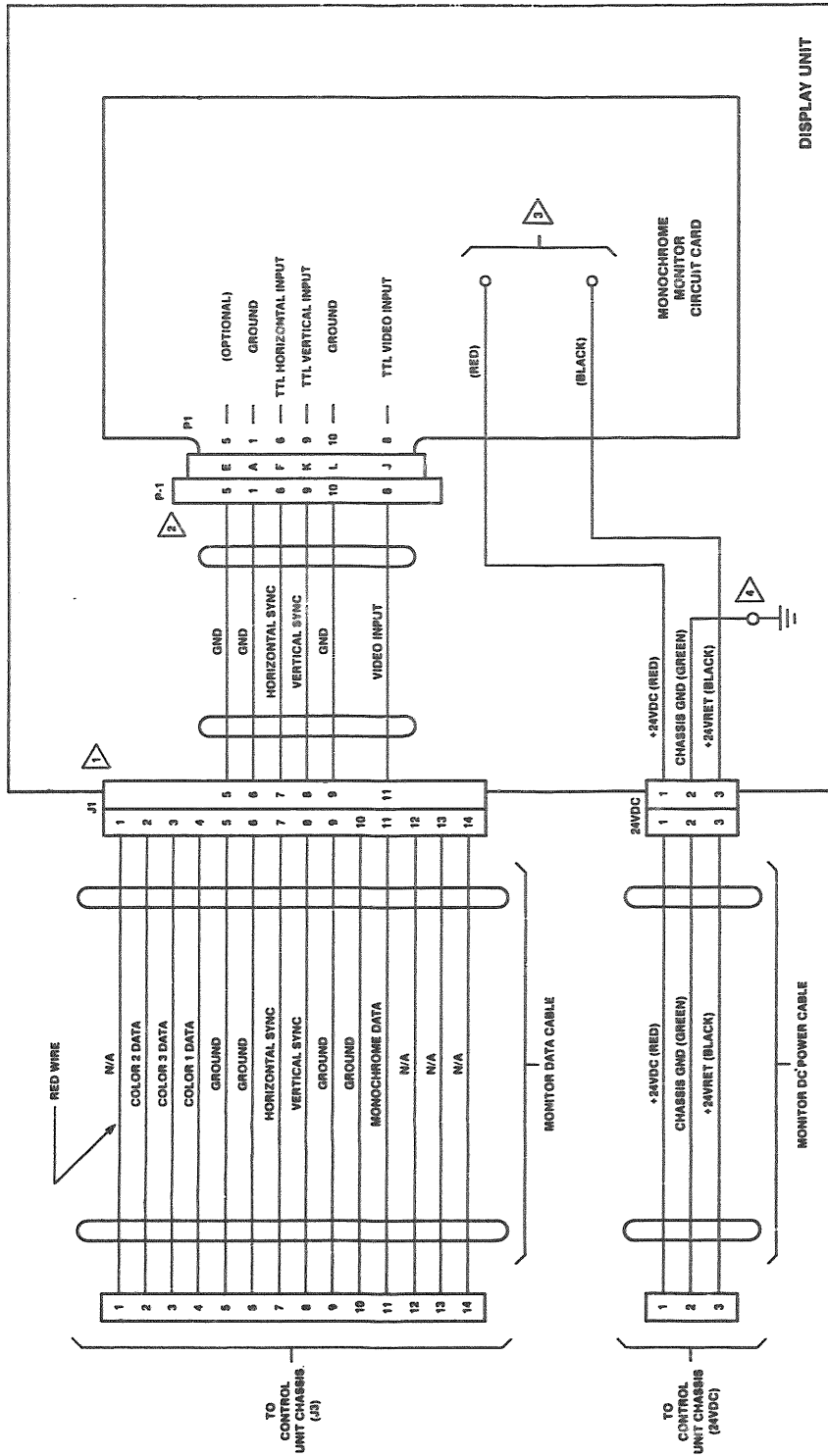
This section provides the display unit interconnect wiring diagram. For the monochrome monitor diagrams, refer to the VME/10 Microcomputer System Monochrome Monitor User's Manual, Motorola publication number M68KVSMM1.



NOTES:

- 1 CONNECTOR J1 PINS 1-4, 10, AND 12-14 NOT CONNECTED.
- 2 CONNECTOR P-1 PINS 2-4 AND 7 NOT CONNECTED.  
OBSERVE CONNECTOR KEYING WHEN CONNECTOR P-1 IS INSERTED ON MONITOR CIRCUIT CARD EDGE CONNECTOR P1.
- 3 AC TO DC CONVERSION CIRCUITRY MODIFIED TO ACCEPT EXTERNAL +24VDC POWER SOURCE.
- 4 GREEN WIRE NOT CONNECTED TO MONITOR CHASSIS GROUND IN EARLY MODELS.

FIGURE 4-4. Display Unit Interconnect Wiring Diagram



NOTES:

- 1 CONNECTOR J1 PINS 1-4, 10, AND 12-14 NOT CONNECTED.
- 2 CONNECTOR P-1 PINS 2-4 AND 7 NOT CONNECTED. OBSERVE CONNECTOR KEYING WHEN CONNECTOR P-1 IS INSERTED ON MONITOR CIRCUIT CARD EDGE CONNECTOR P1.
- 3 AC TO DC CONVERSION CIRCUITRY MODIFIED TO ACCEPT EXTERNAL +24VDC POWER SOURCE.
- 4 GREEN WIRE NOT CONNECTED TO MONITOR CHASSIS GROUND IN EARLY MODELS.

FIGURE 4-4. Display Unit Interconnect Wiring Diagram

NOTE:  
 1. FIND NOS. 6 & 20 TO BE BAGGED AND ADDED TO SHIPPING CONTAINER.  
 2. INSTALL PRODUCT LABEL. FIND NO. 22. APPROX. WHERE SHOWN.

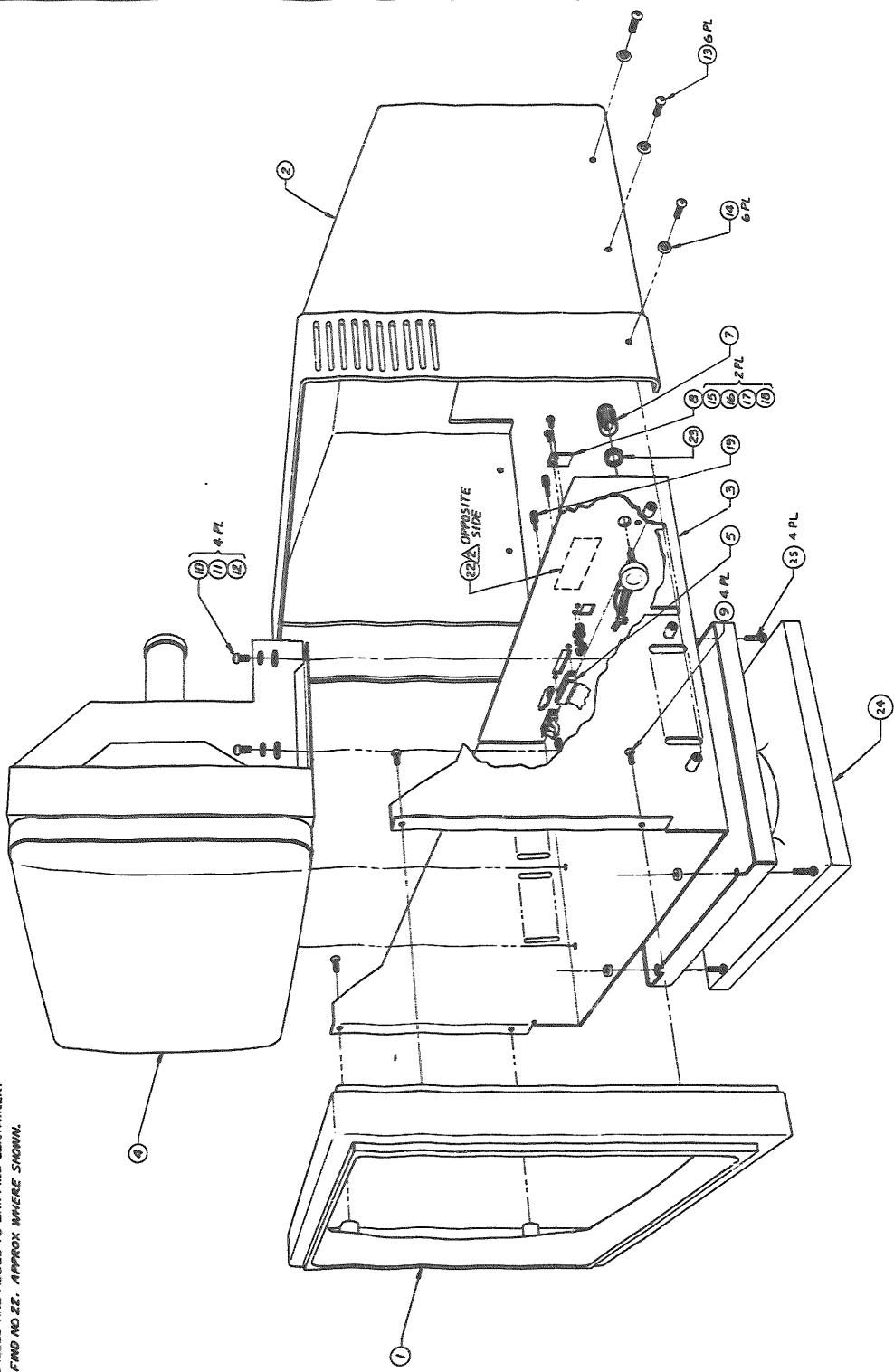


FIGURE 4-3. Display Unit Parts Location Diagram

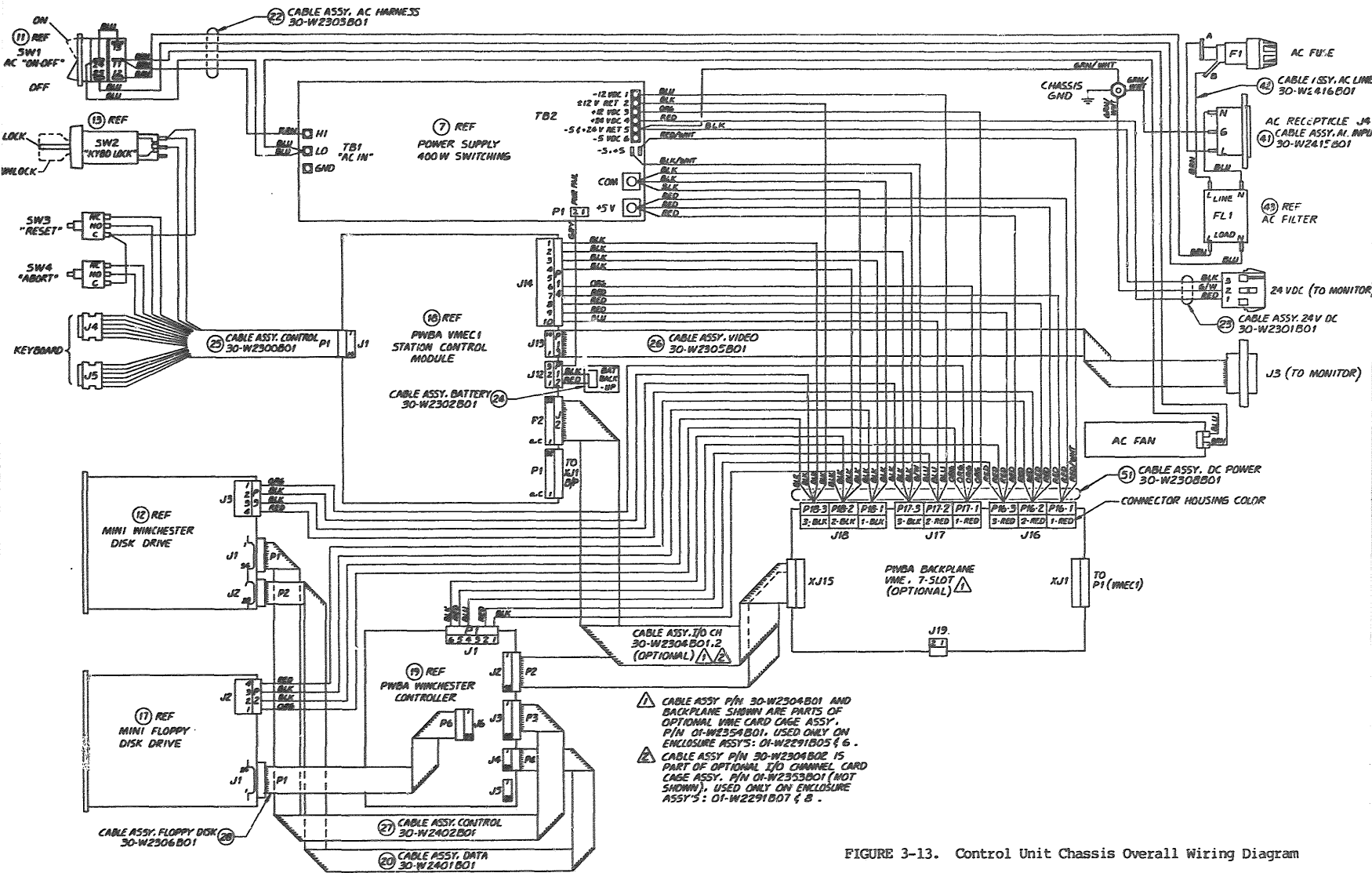


FIGURE 3-13. Control Unit Chassis Overall Wiring Diagram

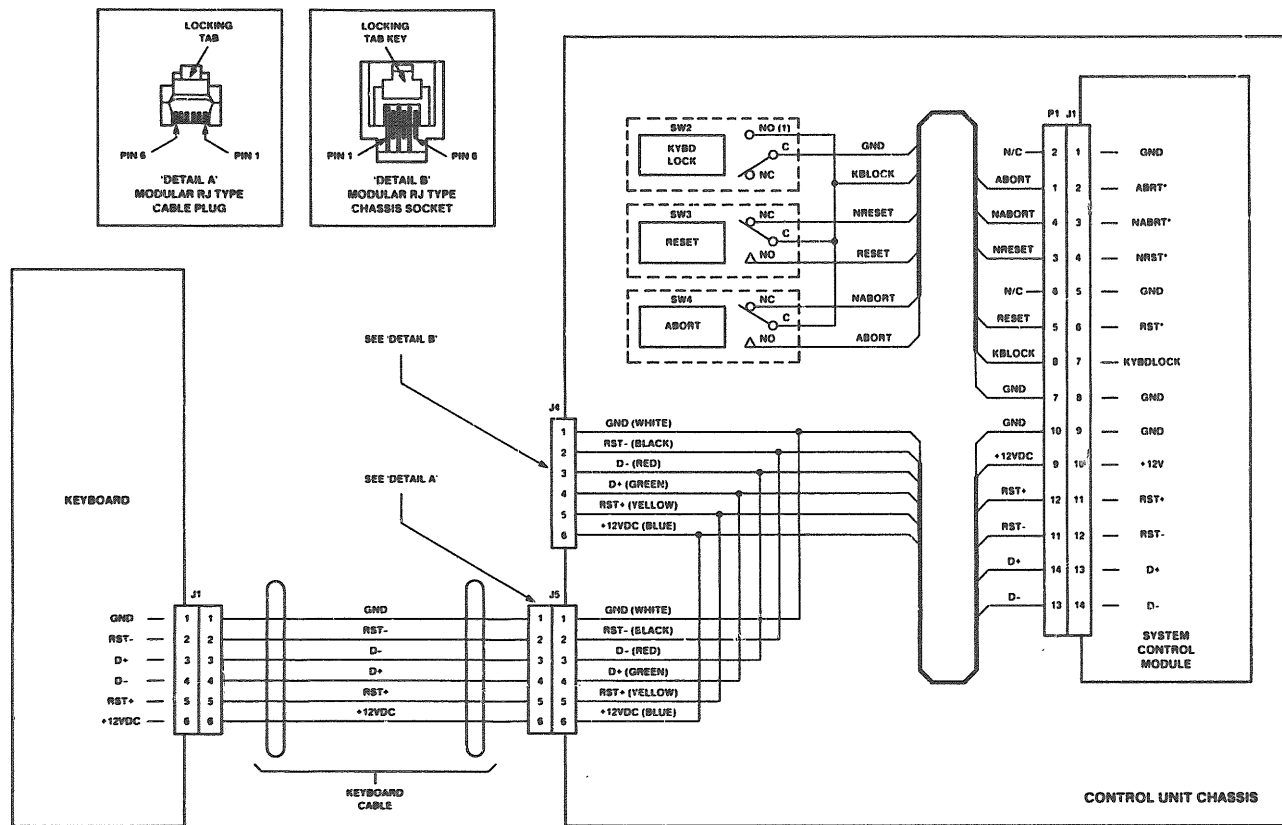


FIGURE 3-14. Keyboard and Front Panel Interconnect Wiring Diagram

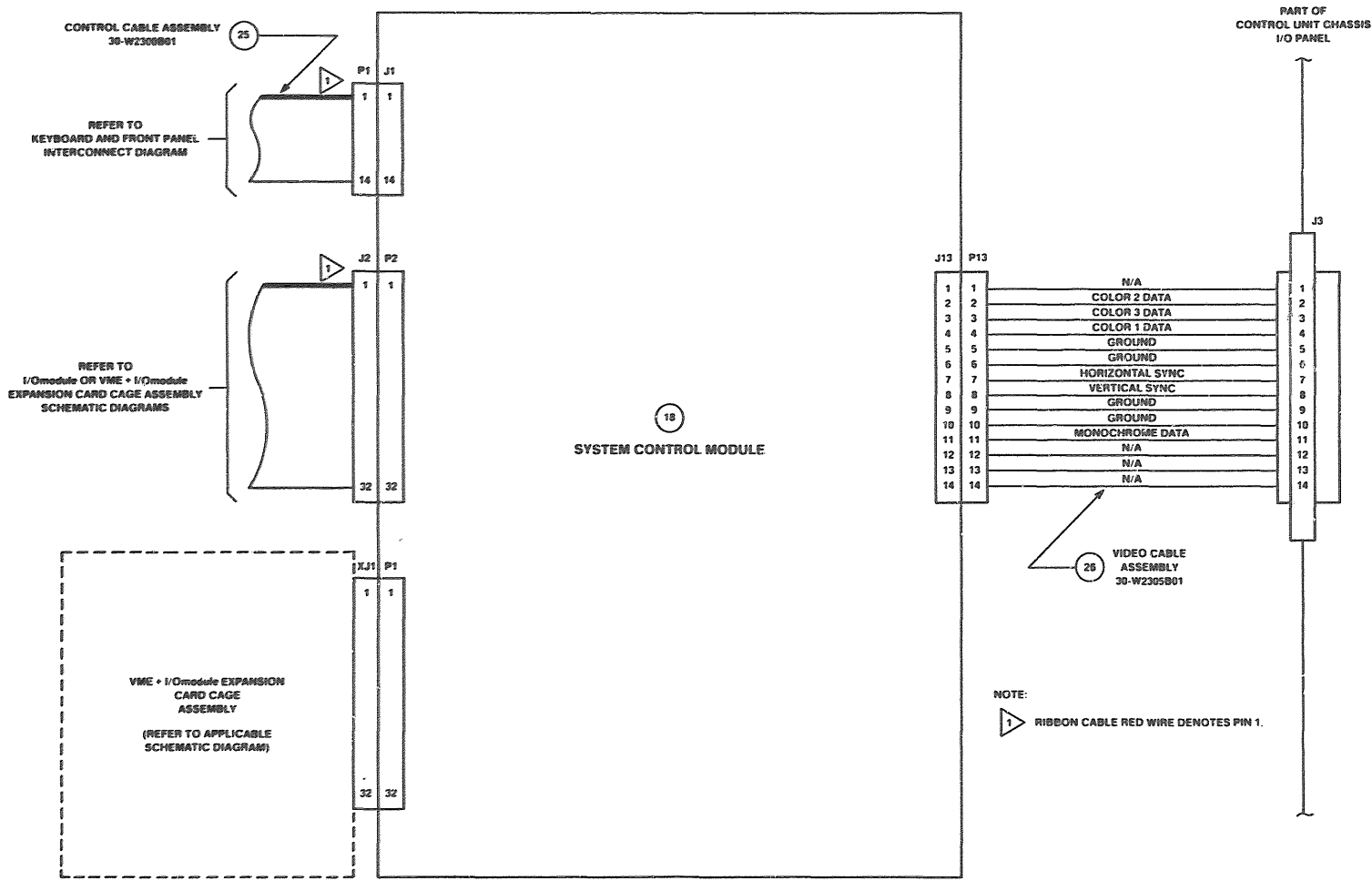


FIGURE 3-15. SCM Interconnect Wiring Diagram

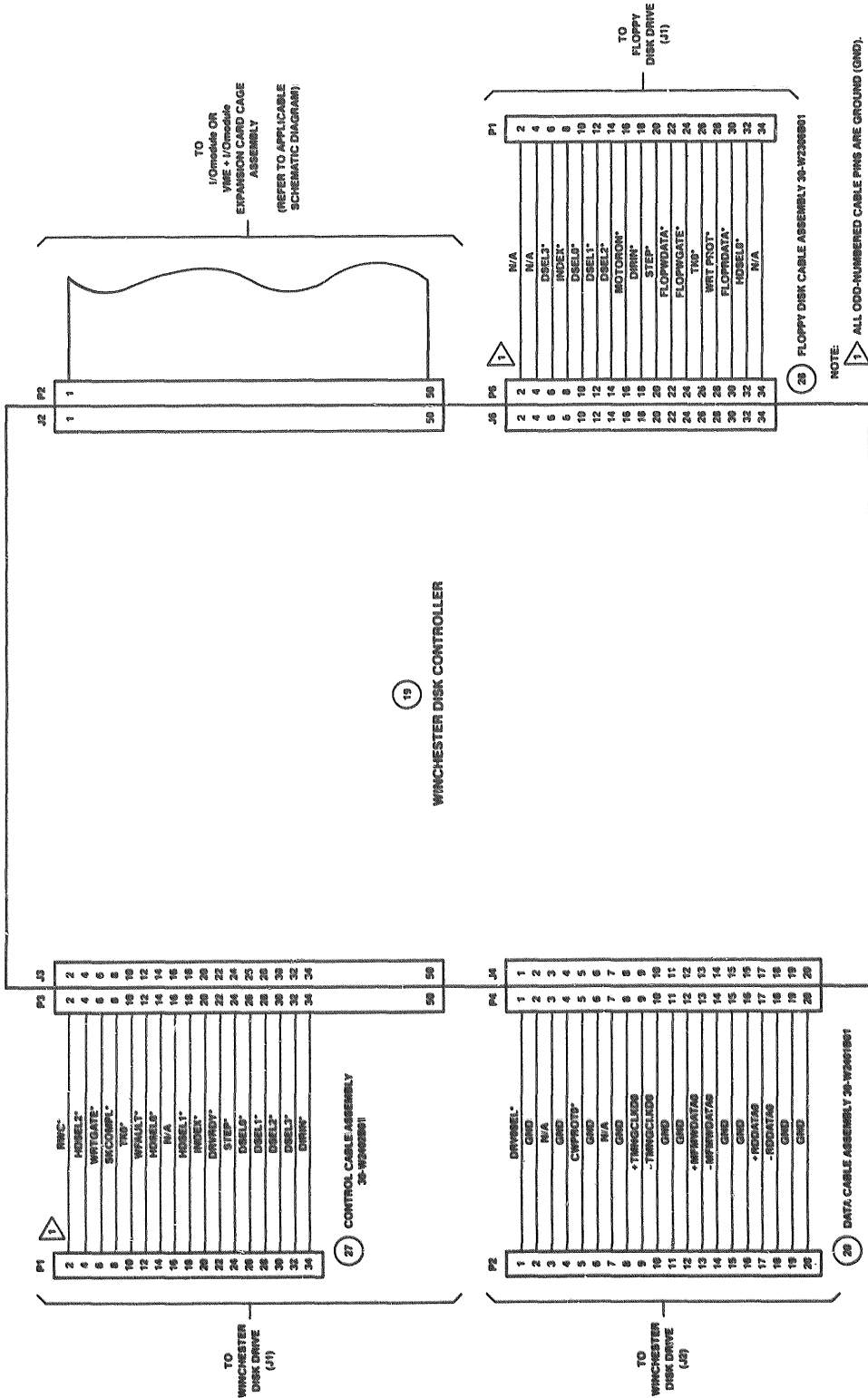
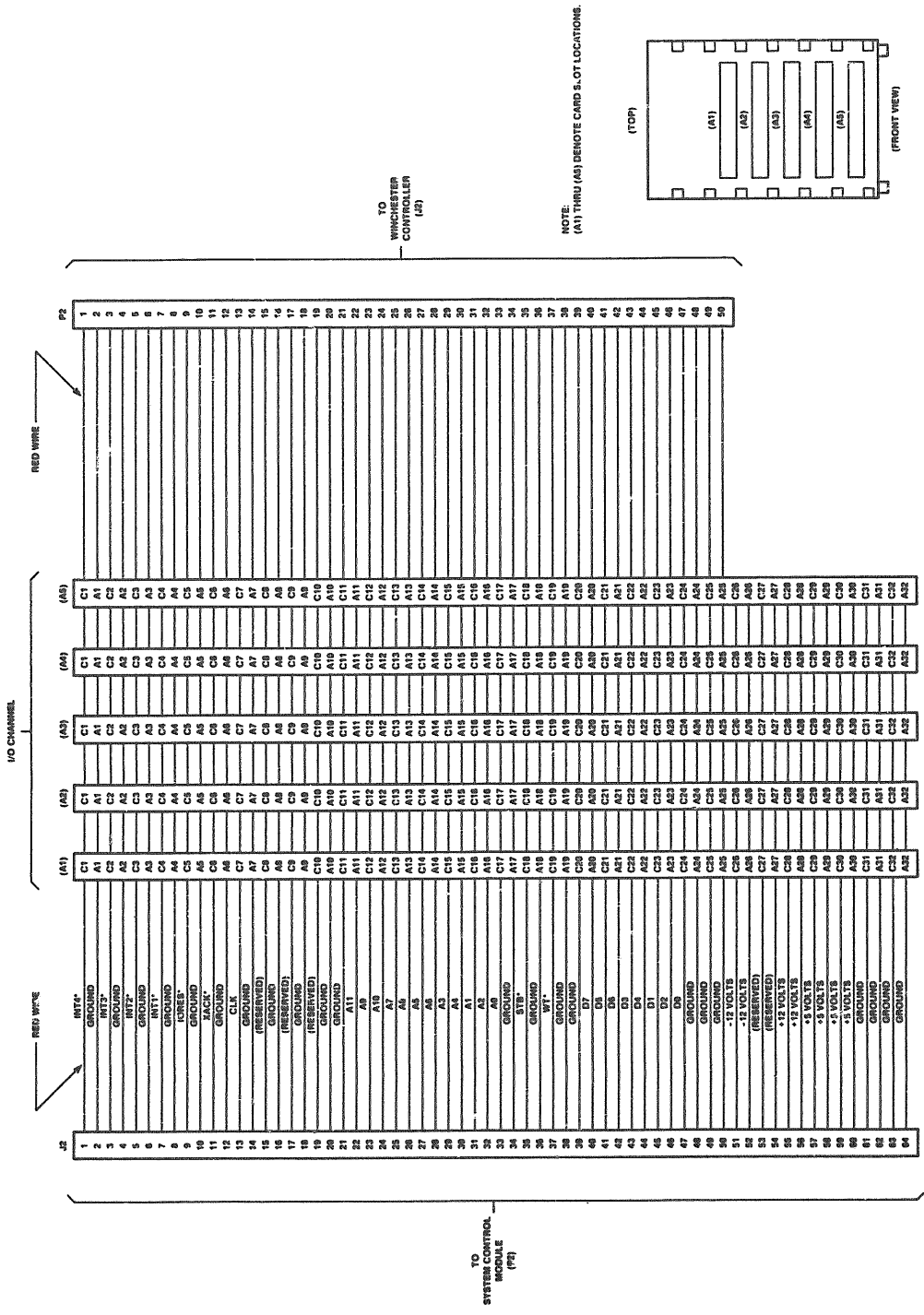
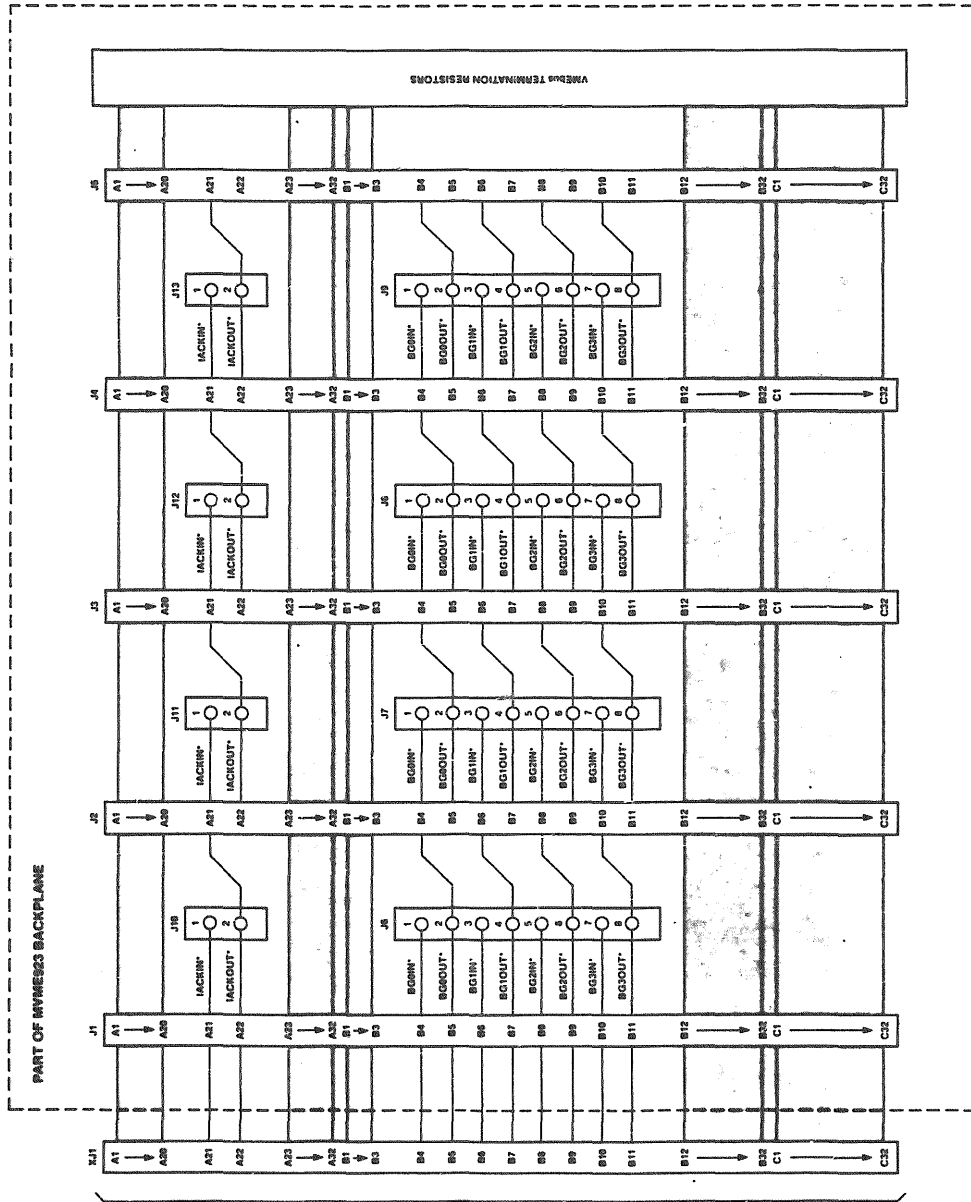


FIGURE 3-16. Mass Storage Interconnect Wiring Diagram







NOTES:  
 1. THIS SHEET PROVIDES INTERRUPT ACKNOWLEDGE AND BUS GRANT DASHY CHAIN WIRING DETAILS (AS THRU J13) ONLY. REFER TO SHEETS 3, 5, AND 6 OF THIS DIAGRAM FOR ADDITIONAL DETAILS OF INTERRUPT ACKNOWLEDGE AND BUS GRANT AREA, BUS TERMINATIONS, AND POWER/GROUND CONNECTIONS.

TO SYSTEM CONTROL WIRE (P1)

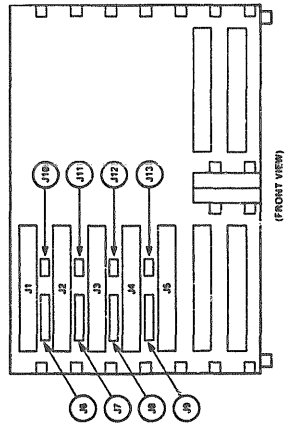


FIGURE 3-18. VME+1/Module Expansion Card Cage, Schematic Diagram (Sheet 1 of 6)

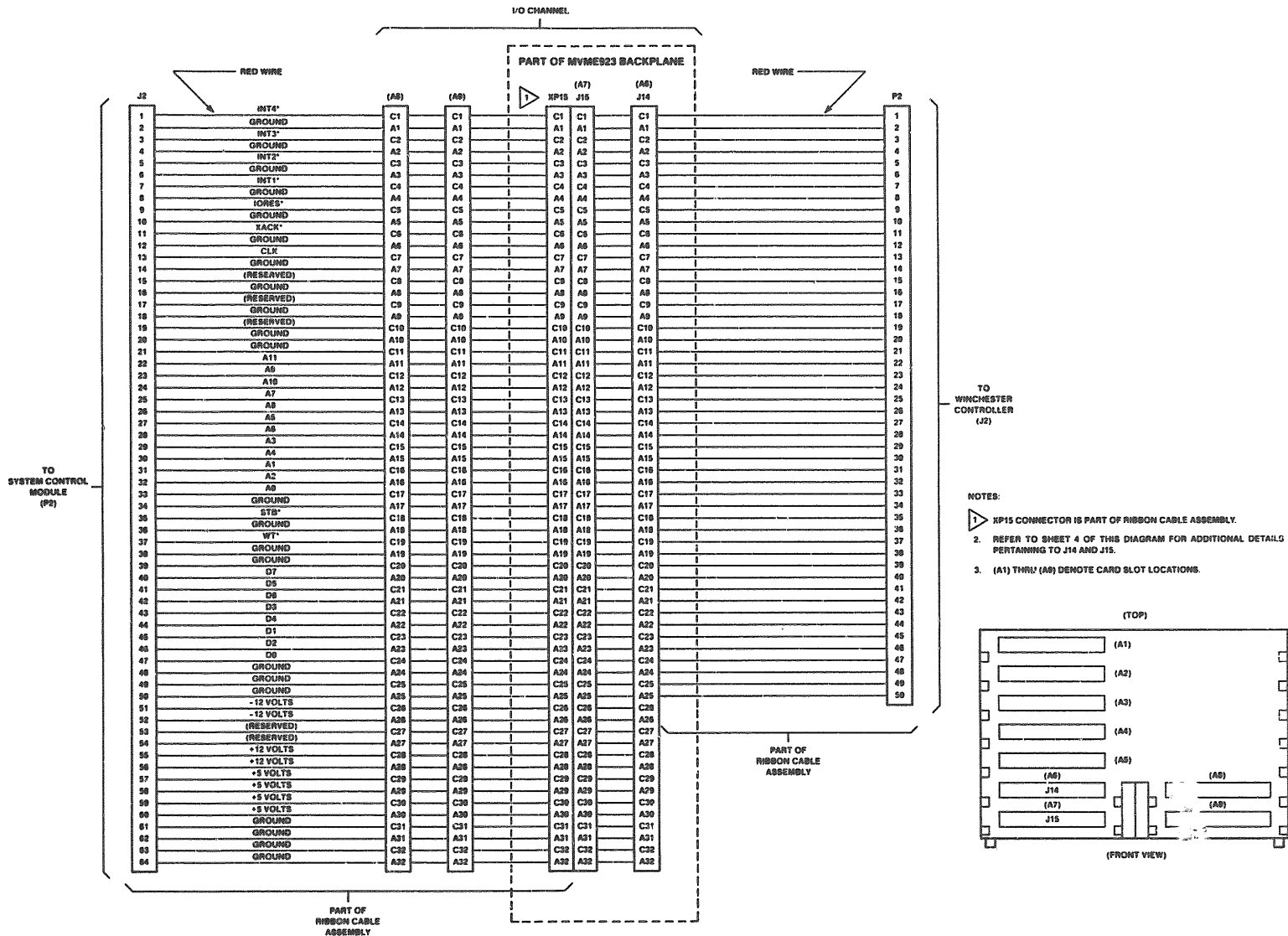
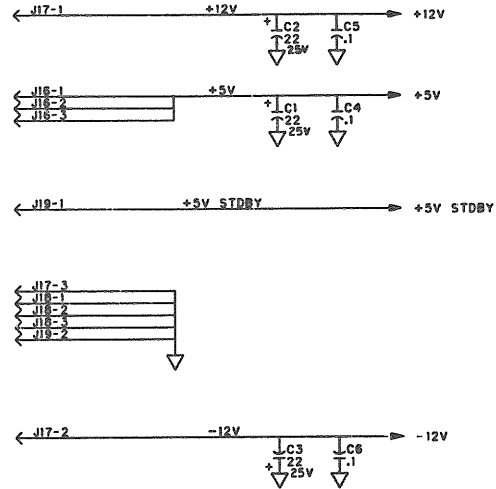


FIGURE 3-18. VME+I/O module Expansion Card Cage, Schematic Diagram (Sheet 2 of 6)

NOTES:

1. FOR REFERENCE DRAWINGS REFER TO BILL(S) OF MATERIAL 61EW3168B
2. UNLESS OTHERWISE SPECIFIED:  
ALL RESISTORS ARE IN OHMS,  $\pm 5\text{PCT.}$   
1/4 WATT.  
ALL CAPACITORS ARE IN UF.  
ALL VOLTAGES ARE DC.
3. INTERRUPTED LINES CODED WITH THE SAME LETTER OR LETTER COMBINATIONS ARE ELECTRICALLY CONNECTED.
4. INTERPRET DIAGRAM IN ACCORDANCE WITH AMERICAN NATIONAL STANDARDS INSTITUTE SPECIFICATIONS, CURRENT REVISION.



XJ1	
R9	
J19	
C6	
HIGHEST NUMBER USED	NOT USED
REFERENCE DESIGNATIONS	

63EW3168B REV B SH 1 OF 4

FIGURE 3-18. VME+I/O module Expansion Card Cage, Schematic Diagram (Sheet 3 of 6)

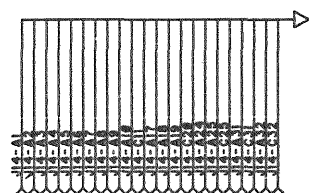
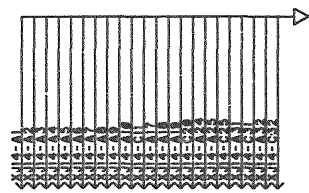
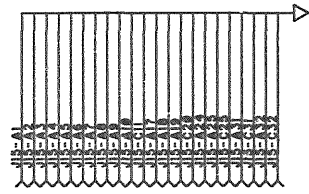
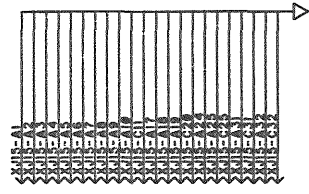
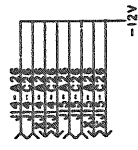
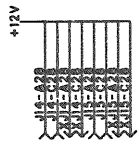
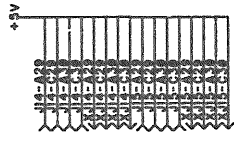
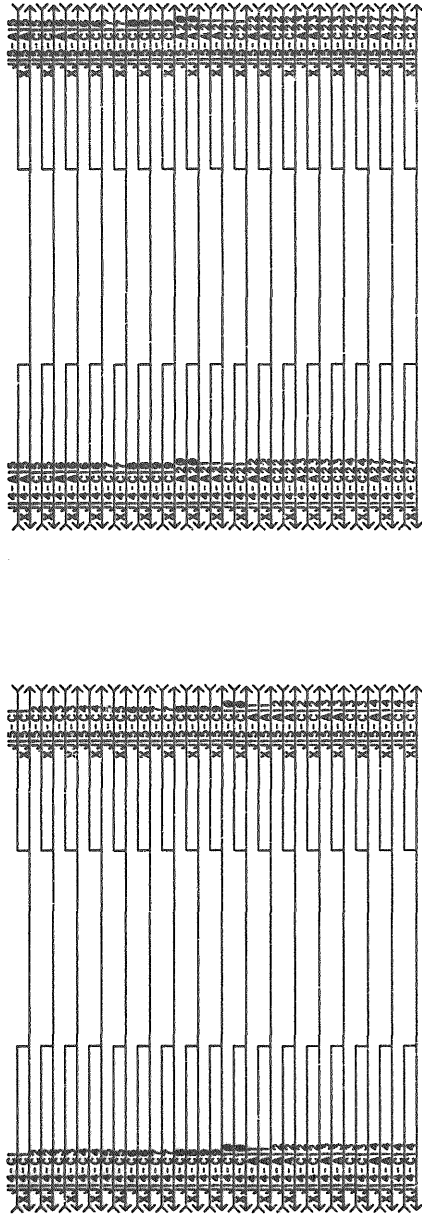


FIGURE 3-18. VME+1/Omodule Expansion Card Cage, Schematic Diagram (Sheet 4 of 6)

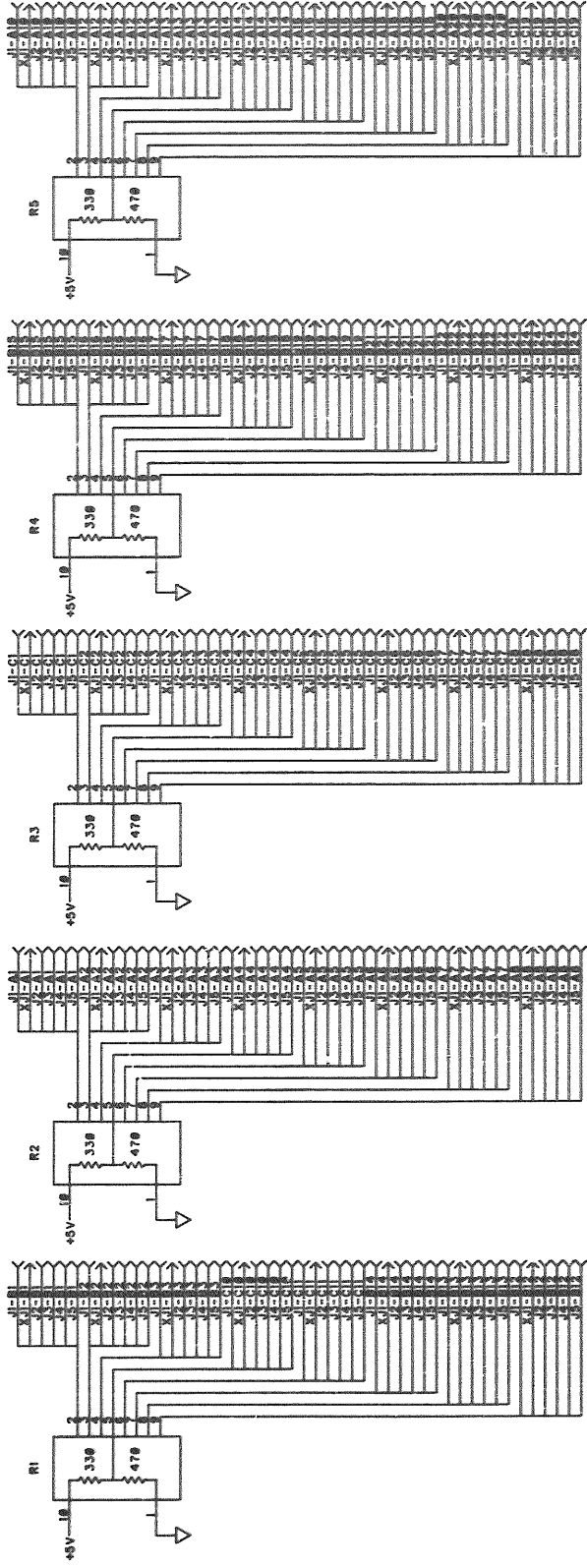


FIGURE 3-18. VME+1/Module Expansion Card Cage, Schematic Diagram (Sheet 5 of 6)

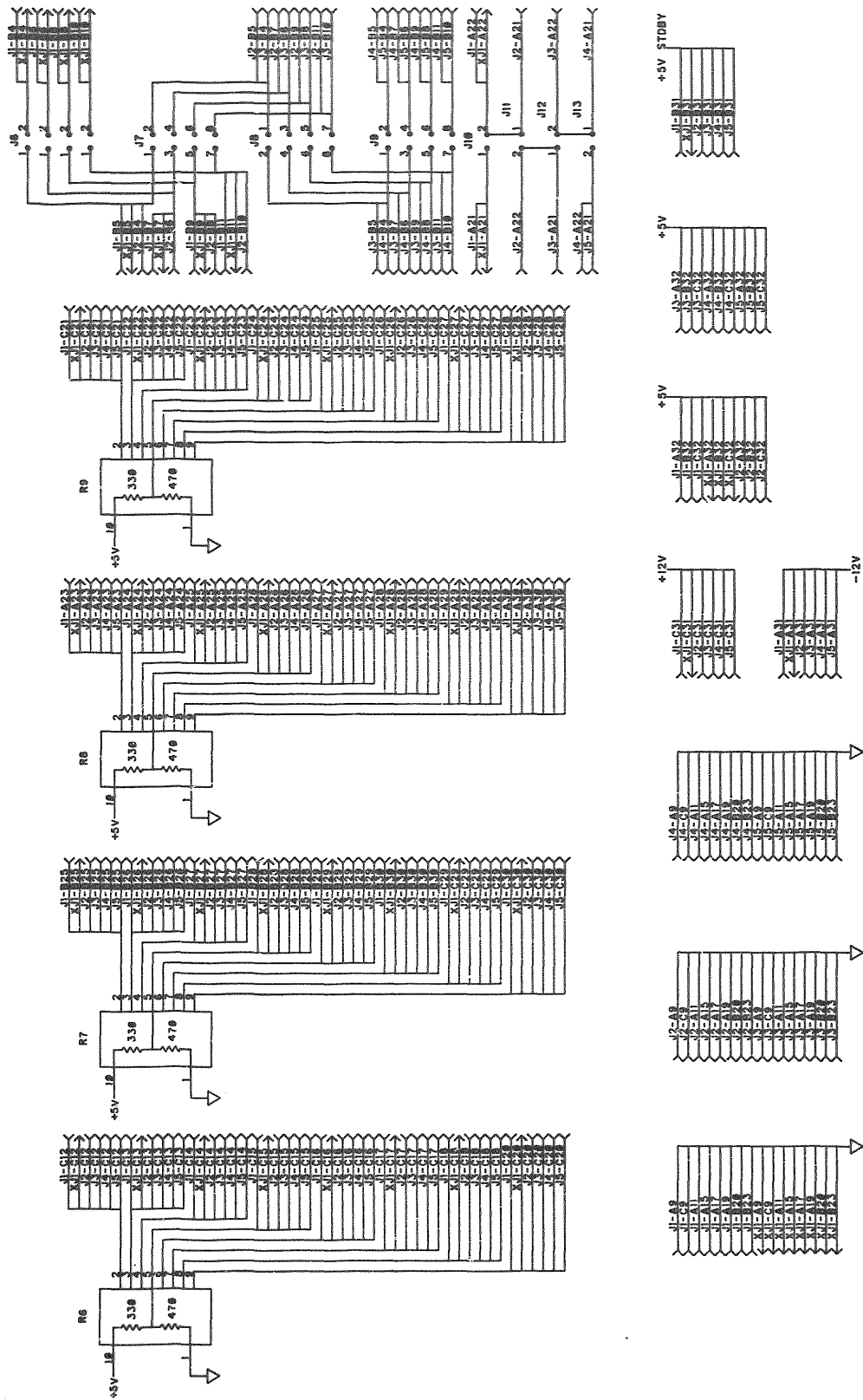
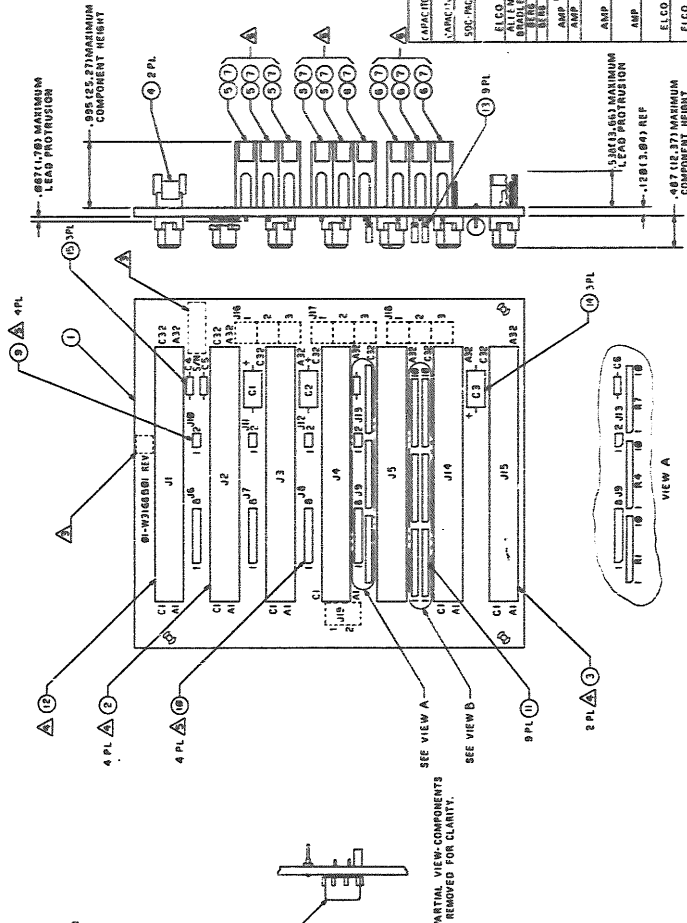


FIGURE 3-18. VME+I/Module Expansion Card Cage, Schematic Diagram (Sheet 6 of 6)

- NOTES:**
1. COMPONENT SPACING MEETS THE STANDARDS LISTED IN TABLE 1 OF SPEC. DRAWING.
  2. EXCEPT AS NOTED OTHERWISE, MANUFACTURER TO ASSEMBLE BOARD.
  3. MARK SERIAL NUMBER AND REVISION LETTER APPROXIMATELY WHERE SHOWN. PRESS IN FROM COMPONENT SIDE OF BOARD AND SOLDERED.
  4. J4, AND J5.
  5. J4, AND J5. FOLLOWING: 01 THRU J5.
  6. J4 THRU J13 INSTALLED FROM COMPONENT SIDE OF BOARD AND SOLDERED.
  7. INSTALLED FROM FAR SIDE OF BOARD AND SOLDERED.
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  100. NETWORKS.



PARTIAL VIEW-COMPONENTS REMOVED FOR CLARITY.



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B	RELEASED FOR PRODUCTION	1/20/73
C	DATE OF REVISION	1/20/73
D	BY	WJG
E	CHECKED BY	WJG
F	APPROVED BY	WJG
G	DATE OF APPROVAL	1/20/73

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**NOTE:**

▲ INSTALL CARD GUIDES, ITEM 8, WITH TABS ORIENTED UP SO THAT THE GROOVES ALIGN WITH THE FOLLOWING HASH MARKS AS SILKSCREENED ON TOP AND BOTTOM RAILS, ITEMS 2 & 1: 01, 05, 09, 13, 17, 21 & 25.

▲ INSTALL CONNECTORS OF CABLE ASSY, ITEM 11, USING SCREWS AT THE FOLLOWING RAIL LOCATIONS: 2, 6, 10, 14 & 18.

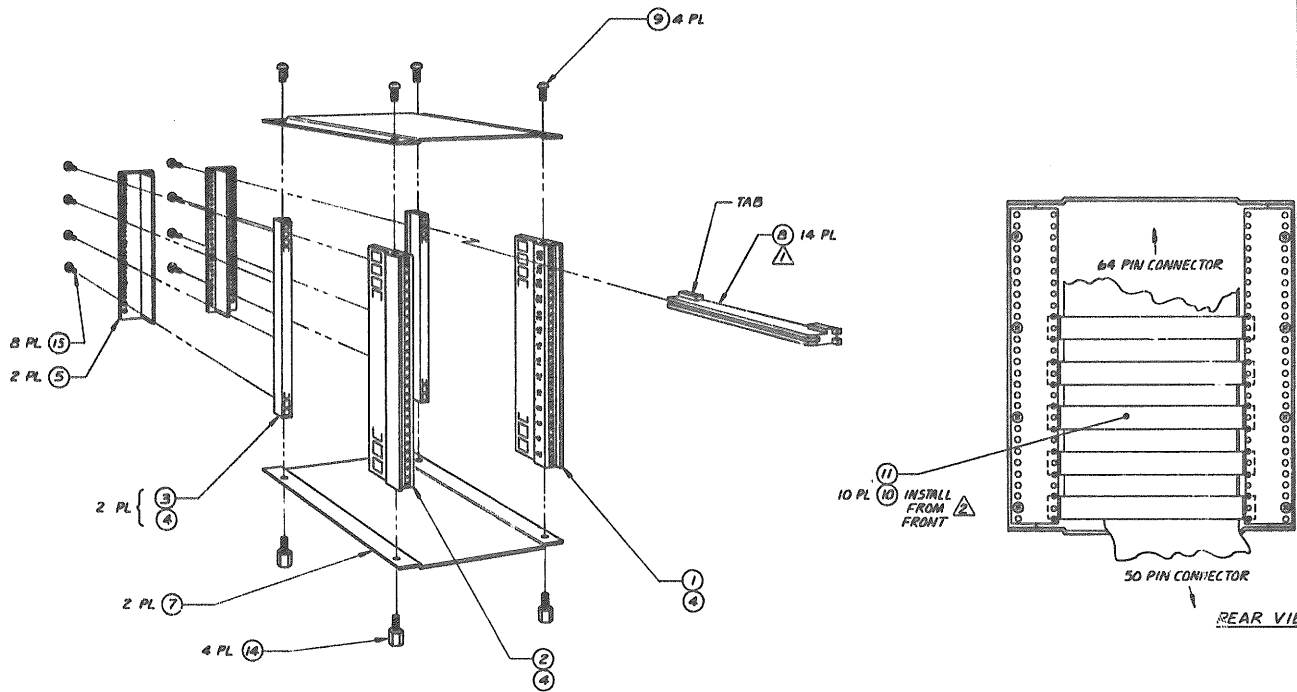
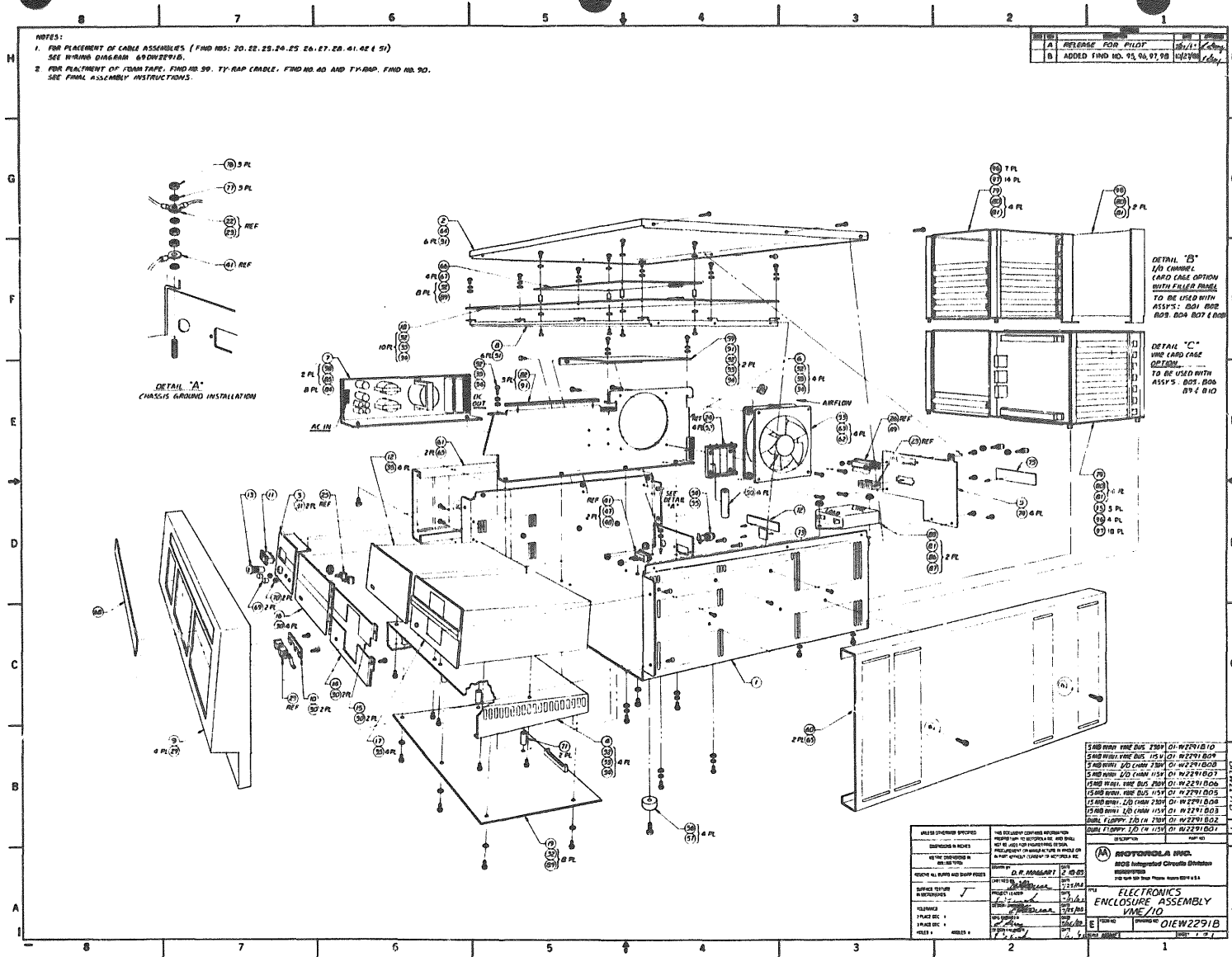
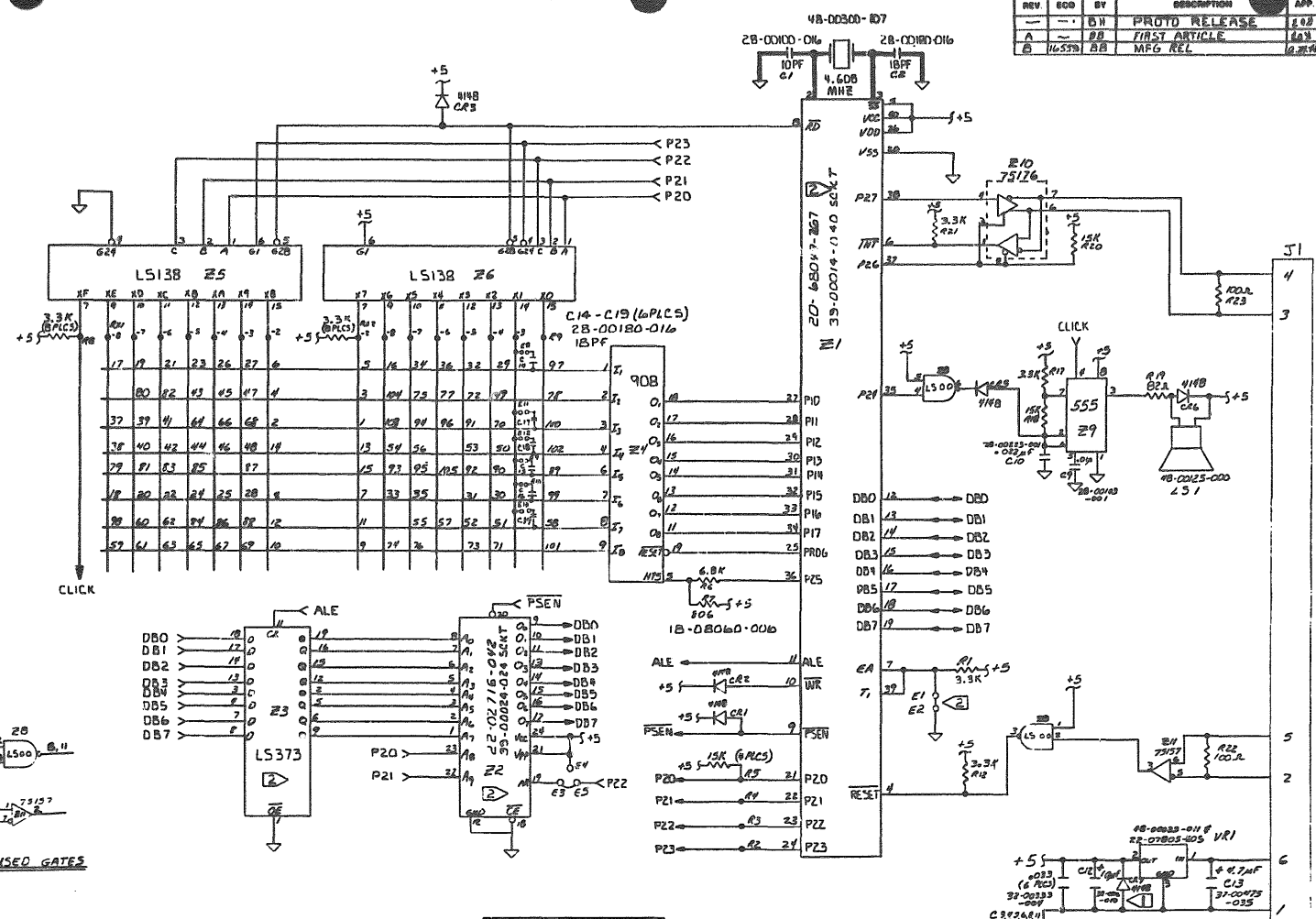


FIGURE 3-10. I/O module Expansion Card Cage Assembly Diagram



REV	ECO	BY	DESCRIPTION	APP.	DATE
---	---	BN	PROTO RELEASE	202	5-14
A	---	BB	FIRST ARTICLE	602	5-14
B	16539	BB	MFG REL.	602	4-25-68



ⓐ ON -05X ASSY INSTALL 22-02716-012 AT Z2  
 INSTALL 22-74373-003 AT Z3 AND 20-68039-000  
 AT Z1 DELETE CONNECTION AT E1 TO E2

ⓑ NOT NORMALLY INSTALLED

NOTES:

REF DES NOT USED						
R16	R14	R15	R16	C7		
Z7	E6	E7				

LAST REVDES USED	
Z11	R23
C19	C47
Y1	R12
E57	E13

UNLESS OTHERWISE NOTED  
 ALL DIMENSIONS ARE IN INCHES  
 TOL EXCEPT AS NOTED  
 DIMENSIONS NOT TO SCALE  
 UNLESS OTHERWISE NOTED  
 ALL DIMENSIONS ARE IN INCHES  
 TOL EXCEPT AS NOTED  
 DIMENSIONS NOT TO SCALE

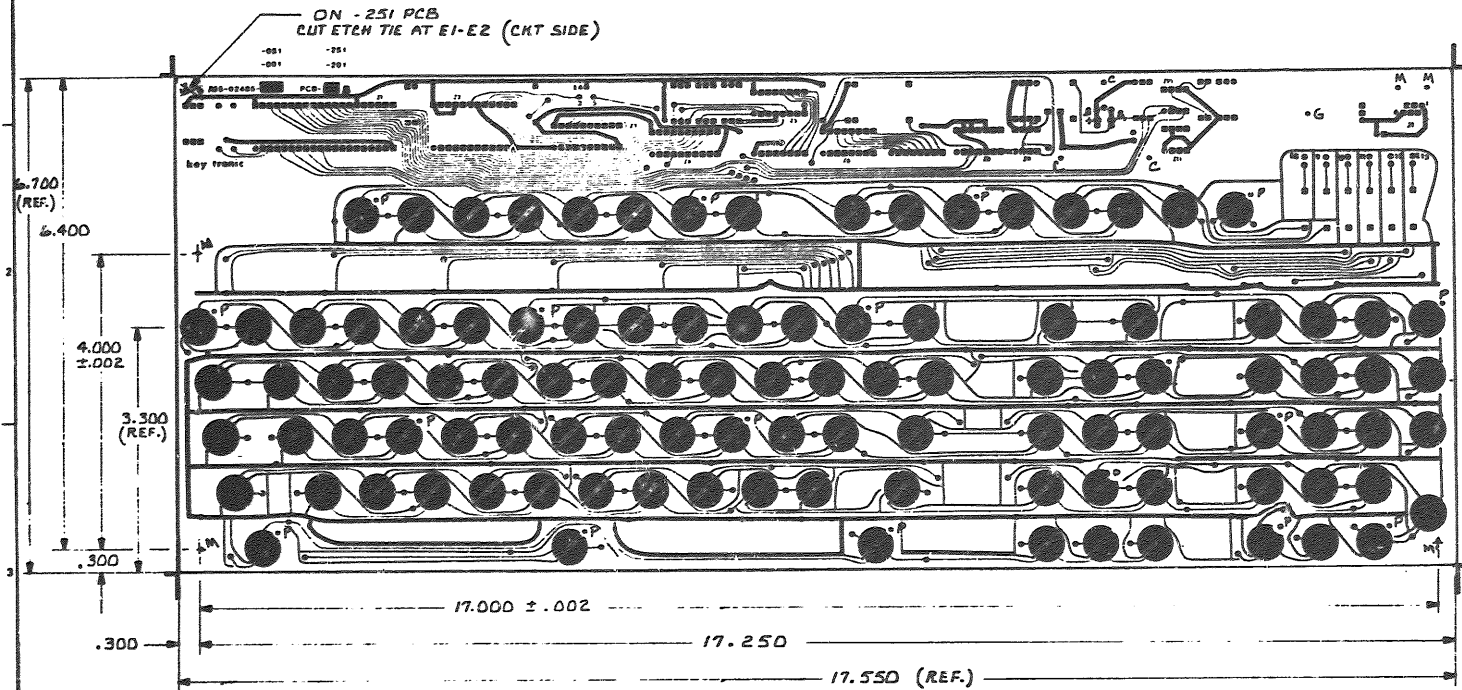
UNLESS OTHERWISE NOTED ALL DIMENSIONS ARE IN INCHES TOL EXCEPT AS NOTED DIMENSIONS NOT TO SCALE	REV. PART NO. DESCRIPTION ITEM
USED ON: MOTOROLA RELEASED: 35-11497 APP: 36-421-267 CR: RCH DR: W/GP	TITLE: SCHEMATIC DWG NO: 35-02485 SHEET: 1 OF 1

keytronic corporation  
 SPokane, WASH., U.S.A.

FIGURE 2-6. Keyboard Schematic Diagram



EFF.	REV.	ECO.	BY	DESCRIPTION	APP.	DATE
	A		BB	FIRST ARTICLE	BB	2/15/63
	A	4-153	BB	MFG REL.		2/15/63



HOLE SIZE AFTER PLATING	CODE
.037	UN-MARKED
.042 ± .002	A
.052	B
.063	C
.073	D
.083	E
.093	F
.103 ± .002	G
.201	H
.234	J
.250	K
.250	L
.250	M
.250	N
.250	P
.250	R
.250	S
.250	T
TAG HOLE	U
	V

5. APPLY APPROPRIATE DASH NUMBER AFTER KTC PART NUMBER; PER MFR.
4. SOLDER MASK CHT SIDE OF PCB USING 65--2485-XXX B RE-CONNECTION WITH SRT-1000-99
3. BREAK ALL SHARP EDGES.
2. PLATE THROUGH ALL UNMARKED, B HOLES
1. USE 90Z DOUBLE-CLAD G10-FR-OR CEM3 (1/16) THK FABRICATE USING KTC UL APPROVED PROCESS "A".
- NOTES:

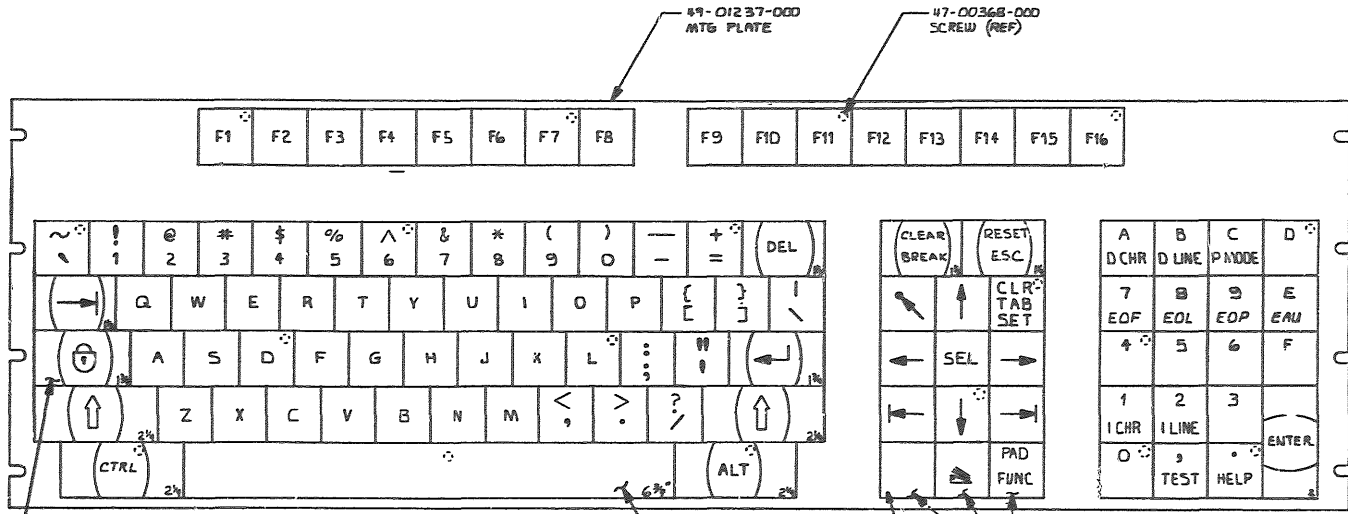
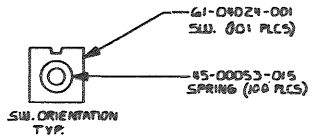
251 B PCB  
-201 B PCB  
(COMPONENT SIDE)

261	G
290	
201	B, C, M, P
000	UNMARKED
SOLDER MASK HOLE CODE	

MANUFACTURE PART AND/OR ASSY S PER KTC DOCUMENT	UNLESS OTHERWISE NOTED ALL DIMENSIONS ARE IN INCHES	TOL EXCEPT AS NOTED	ITEM	PART NO	DESCRIPTION	QTY
	SEE DIMENSION NOT TO SCALE	HOLE .003 SHA .014 FRCT : .104 EX : .03" EE : .015" ANG : 1°	SCALE	TITLE	KEYBOARD ASSY. (PCB HOLE CODE)	
MO15	USED ON	RELEASED	APP	CH	DR BB 2/15/63	
					DRAW NO <b>65-02485</b>	SHEET 2 OF 6
SPOKANE, WASH., U.S.A.						

FIGURE 2-5. Keyboard Assembly Diagram (Sheet 2 of 3)  
2-15/2-16

REV	ECO	BY	DESCRIPTION	APP.	DATE
~	~	ESH	PROVD RELEASE	ESH	5-27-73
A	~	BB	HAST ARTICLE 201-2-93	BB	6-2-73
B	~	BB	RFG REL	BB	6-2-73
C	~	BB	LEGEND CHANGE	BB	6-2-73



61-04025-001 A/A SW.  
45-00053-030 SPRING

48-00174-000 LEG (2PLCS)  
44-00173-000 BAR  
44-00102-000 MNT (2PLCS)  
45-00053-040 SPRING

HC HC 2012-010900000  
61-04025-001 A/A SW. (3PLCS)  
45-00053-030 SPRING 3 PLCS



-001 & -051 ASSY  
USE 66-02485-001 KEYTOP ASSY.

- 3 APPLY DATE/SERIAL PRESSURE ADHESIVE TAG TO CRT SIDE OF PCB
2. KEYBOARD IS 19 MM.
1. ALL PLUNGERS ARE CENTERED.

NOTES:

COPIES OF INFORMATION CONTAINED HEREIN ARE UNCLASSIFIED EXCEPT WHERE SHOWN OTHERWISE. DATE 08-01-2001 BY 60322 UCBAW/STP

MANUFACTURE PARTS LIST DOCUMENT:  
GA 51  
QA 56

UNLESS OTHERWISE NOTED		DIMENSIONS ARE IN INCHES		DIMENSIONS NOT TO SCALE		PART NO.		DESCRIPTION		FORM
ISS	RELEASED	DATE	BY	SCALE	TITLE	KEYBOARD ASSY	KEYTOP & MECH	DRG NO.	65-02485	SHEET 3 OF 6
GA 51	QA 56	MOTOROLA	APP.	SCALE	KEY	KEY	KEY	KEY	KEY	KEY
keytronic corporation						SPokane, Wash., U.S.A.				

FIGURE 2-5. Keyboard Assembly Diagram (Sheet 3 of 3)

NOTES:  
 ▲ INSTALL PRODUCT LABEL, FIND NO. 14. APPROX WHERE SHOWN.  
 ▲ INSTALL RUBBER FEET, FIND NOS. 11 & 12, USING ADHESIVE, FIND NO. 15.

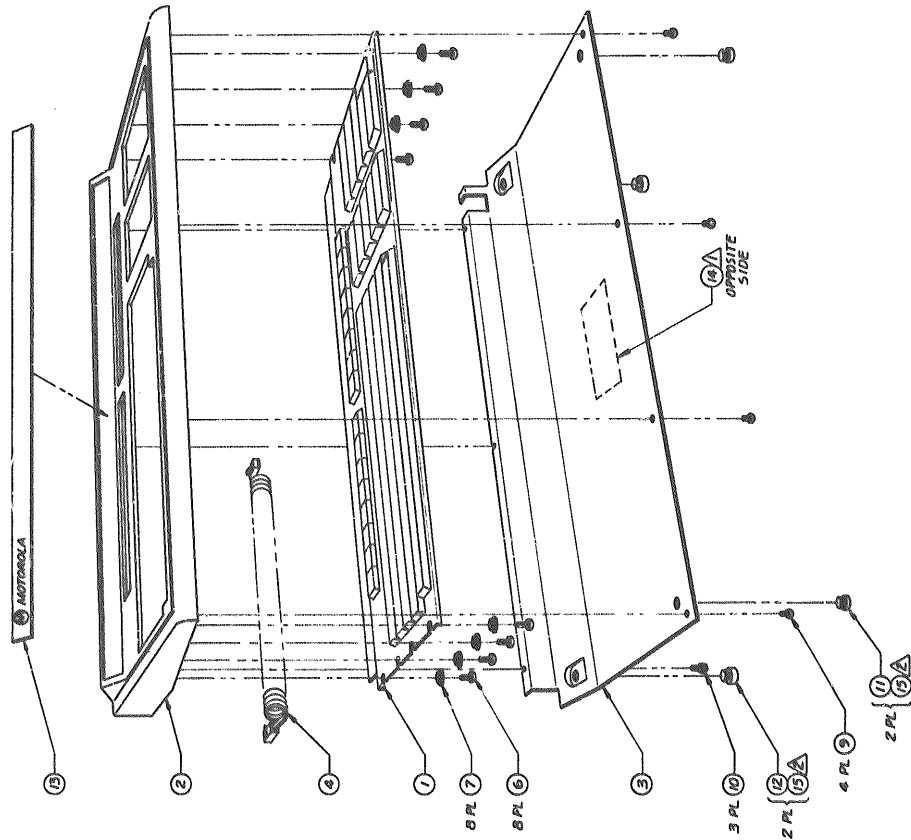


FIGURE 2-4. Keyboard Parts Location Diagram