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VMIVME-2200

32-CHANNEL MERCURY-WETTED/DRY REED RELAY OUTPUT BOARD

INSTRUCTION MANUAL

DOCUMENT NO. 500-002200-000 L

Revised July 31, 1997

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RECORD OF REVISIONS

REVISION LETTER	DATE	PAGES INVOLVED	CHANGE NUMBER
A	11/10/88	Release Entire Manual	88-0196
B	12/16/88	Revise Manual	88-0352
C	01/18/91	Cover, Pages ii, 2-1, and 3-1	90-0016
D	01/18/91	Cover, Page ii, and Appendix A	90-0037
E	01/18/91	Cover, Pages ii, 1-1, 2-4, and 3-2	90-0221
F	04/21/92	Cover, Page ii, Sections 2 and 6, and Appendix A	92-0098
G	07/20/92	Cover, Page ii, Sections 3 and 5	92-0242
H	09/24/92	Reformat Entire Manual	92-0379
J	02/16/94	Cover, Pages ii, 3-1, 3-6, and 5-4	94-0219
K	06/13/97	Cover, Pages ii and 1-1	97-0496
L	07/31/97	Cover, Pages ii and 1-1	97-0551

VMIC
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GROUND THE SYSTEM

To minimize shock hazard, the chassis and system cabinet must be connected to an electrical ground. A three-conductor AC power cable should be used. 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.

DO NOT OPERATE IN AN EXPLOSIVE ATMOSPHERE

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

KEEP AWAY FROM LIVE CIRCUITS

Operating personnel must not remove product 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.

DO NOT SUBSTITUTE PARTS OR MODIFY SYSTEM

Because of the danger of introducing additional hazards, do not install substitute parts or perform any unauthorized modification to the product. Return the product to VME Microsystems International Corporation for service and repair to ensure that safety features are maintained.

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DANGEROUS VOLTAGES, CAPABLE OF CAUSING DEATH, ARE PRESENT IN THIS SYSTEM. USE EXTREME CAUTION WHEN HANDLING, TESTING, AND ADJUSTING.

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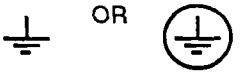
General Definitions of Safety Symbols Used in this Manual.



Instruction manual symbol: the product is marked with this symbol when it is necessary for the user to refer to the instruction manual in order to protect against damage to the system.



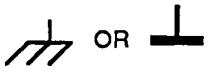
Indicates dangerous voltage (terminals fed from the interior by voltage exceeding 1000 volts are so marked).



Protective conductor terminal. For protection against electrical shock in case of a fault. Used with field wiring terminals to indicate the terminal which must be connected to ground before operating equipment.



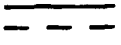
Low-noise or noiseless, clean ground (earth) terminal. Used for a signal common, as well as providing protection against electrical shock in case of a fault. Before operating the equipment, terminal marked with this symbol must be connected to ground in the manner described in the installation (operation) manual.



Frame or chassis terminal. A connection to the frame (chassis) of the equipment which normally includes all exposed metal structures.



Alternating current (power line).



Direct current (power line).



Alternating or direct current (power line).

WARNING

The WARNING sign denotes a hazard. It calls attention to a procedure, practice condition, or the like, which, if not correctly performed or adhered to, could result in injury or death to personnel.

CAUTION

The CAUTION sign denotes a hazard. It calls attention to an operating procedure, practice, condition, or the like, which, if not correctly performed or adhered to, could result in damage to or destruction of part or all of the system.

NOTE:

The NOTE sign denotes important information. It calls attention to procedure, practice, condition or the like, which is essential to highlight.

VMIVME-2200
32-CHANNEL MERCURY-WETTED/DRY REED RELAY OUTPUT BOARD

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A Assembly Drawing, Parts List, and Schematic

SECTION 1

INTRODUCTION

1.1 FEATURES

The VMIVME-2200 is a VMEbus-compatible 32-bit relay output board, shown in Figure 1.1-1. Its features include the following:

a. 8- or 16-bit data transfers
b. 32 mercury wetted or dry reed relays - configured one Form A

Mercury wetted*	Dry reed
Power - 50 VA maximum	Power - 10 VA maximum
Voltage - 350 VDC or peak AC maximum	Voltage - 200 VDC or Peak AC maximum
Current - 0.5 A maximum switched 2 A maximum carry	Current - 0.75 A maximum switched 2 A maximum carry

c. Optional contact protection electronics
d. Double-Wide Eurocard format with front panel
e. Nonprivileged or Supervisory Short I/O access

WARNING

*** MERCURY WETTED RELAYS ARE POSITION SENSITIVE. THEY MUST BE OPERATED IN THE UPRIGHT POSITION.**

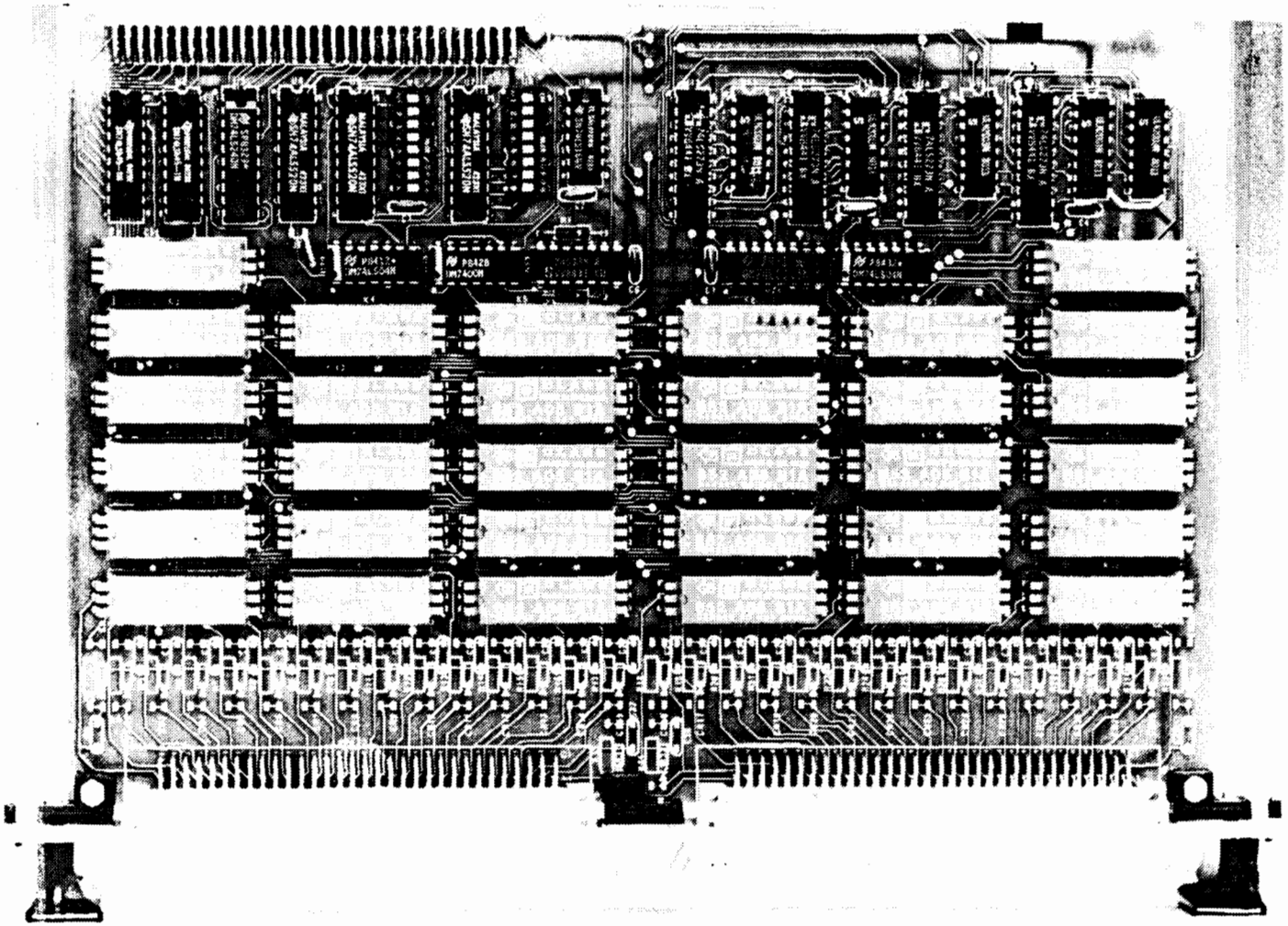
1.2 FUNCTIONAL DESCRIPTION

The Relay Output Board consists of VMEbus foundation logic, data output control logic, four 8-bit Output Registers, and 32 relay outputs. The VMEbus foundation logic contains address decoding logic, and data transfer control logic allowing 8- or 16-bit data transfers. The data output control logic, in conjunction with four 8-bit registers, selects bytes or words for transfer to the 32 output channels. The 32 relay output channels convert TTL voltages into buffered relay outputs.

1.3 REFERENCE MATERIAL

The reader should refer to "The VMEbus Specification" for a detailed explanation of the VMEbus. "The VMEbus Specification" is available from the following source:

VITA
VMEbus International Trade Association
7825 East Gelding Drive, No. 104
Scottsdale, Arizona 85260
(602) 951-8866 FAX: (602) 951-0720
Internet: www.vita.com



M2200/F1.1-1

Figure 1.1-1. VMIVME-2200 32-bit Relay Output Board

The following Application and Configuration Guides are available from VMIC to assist the user in the selection, specification, and implementation of the systems based on VMIC's products.

TITLE	DOCUMENT NO.
Digital Input Board Application Guide	825-000000-000
Change-of-State Board Application Guide	825-000000-002
Connector and I/O Cable Application Guide	825-000000-006
Digital I/O (with Built-in-Test) Product Line Description	825-000000-003

SECTION 2

PHYSICAL DESCRIPTION AND SPECIFICATIONS

REFER TO 800-002200-000 SPECIFICATION

SECTION 3

THEORY OF OPERATION

3.1 INTRODUCTION

The design of the Relay Output Board, as shown in the functional block diagram in Figure 3.1-1, consists primarily of four sections which are:

a. VMEbus foundation logic.
b. Device addressing.
c. Output registers and relay drivers.
d. 32 one Form A relays.

To perform data transfers, data is written to the Output Data Registers. The appropriate outputs are selected via address bit A01, which selects one of the two banks of 16 bits for data outputs. The two data strobes, DS0 and DS1, select word or byte access of the banks. The Data Transfer/Board Select Signal is logically gated with DS0 and DS1 to produce active signals for data transfer. These gated signals activate output latches, which latch the output data for control of the relays.

3.2 DEVICE ADDRESSING

The Relay Output Board is designed to support data transfers in supervisory or nonprivileged short I/O memory space. A jumper is provided, as shown in Figure 3.2-1 (Address Decode Block Diagram), to allow user selection of either I/O access. The jumper (J1) is factory configured (jumper J1 is not installed) to respond to short supervisory I/O access. As shown in Figure 3.2-1, 14 address select switches allow the user to establish a board base address any where in short I/O memory.

3.3 FOUNDATION LOGIC

The VMEbus foundation logic for the Relay Output Board is shown in Figure 3.3-1. This logic consists primarily of data and address buffers and control signal buffers. The DTACK generator is factory preset for maximum data transfer.

3.4 OUTPUT REGISTERS AND RELAY DRIVERS

A functional block diagram of the Output Registers and relay drivers is shown in Figure 3.4-1. Each register/driver function is designed using a 74LS273 8-bit register driving a Sprague:ULN2003A. This functional block diagram depicts the mapping of the 8-bit register outputs into the 7-bit relay driver I.C.s.

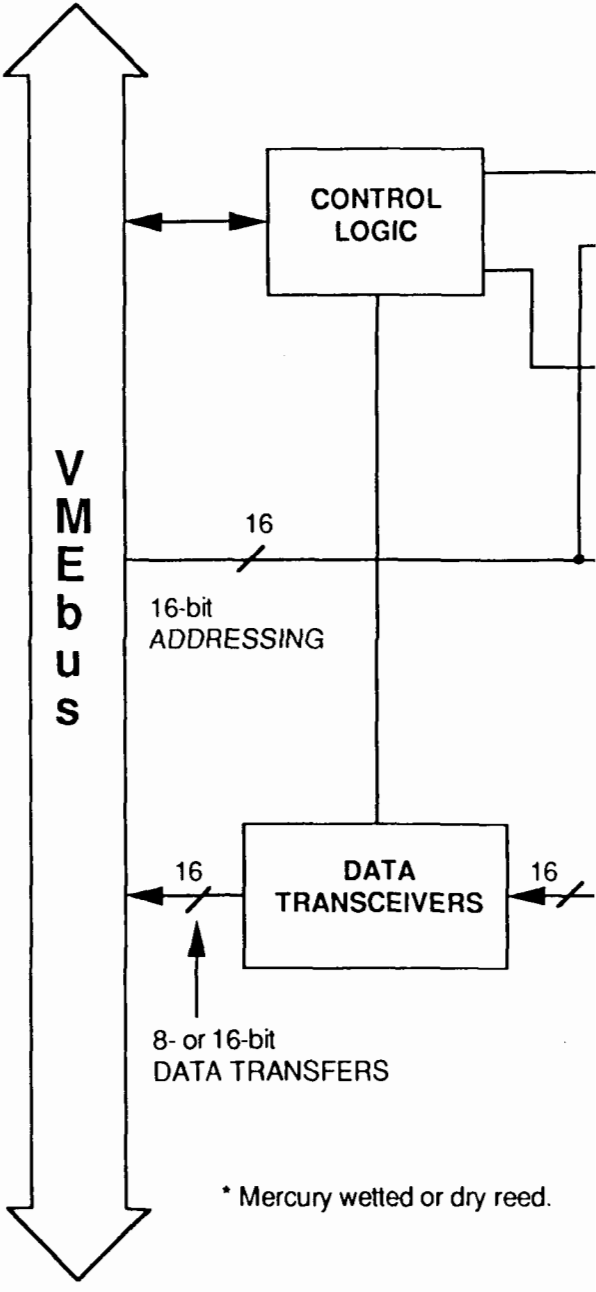
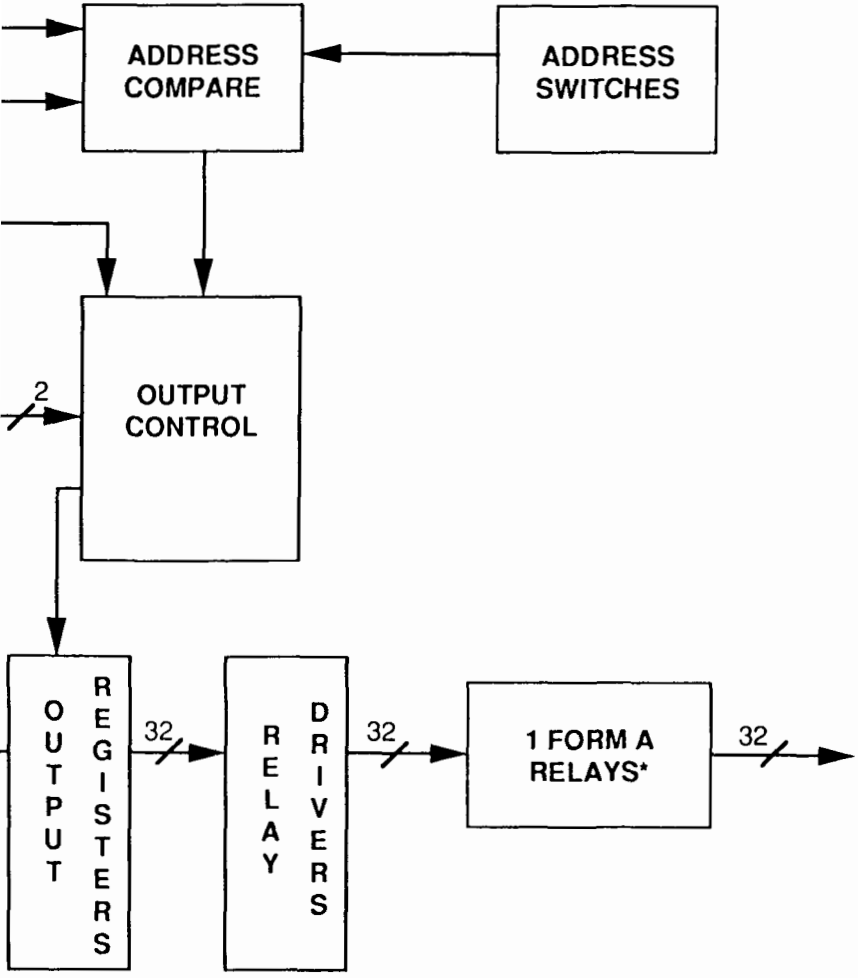

VMEbus
CONTROL LOGIC
16
16-bit
ADDRESSING
16
DATA TRANSCEIVERS
16
8- or 16-bit
DATA TRANSFERS
* Mercury wetted or dry reed.

Figure 3.1



M2200/F3.1-1

500-002200-000

-1. Functional Block Diagram

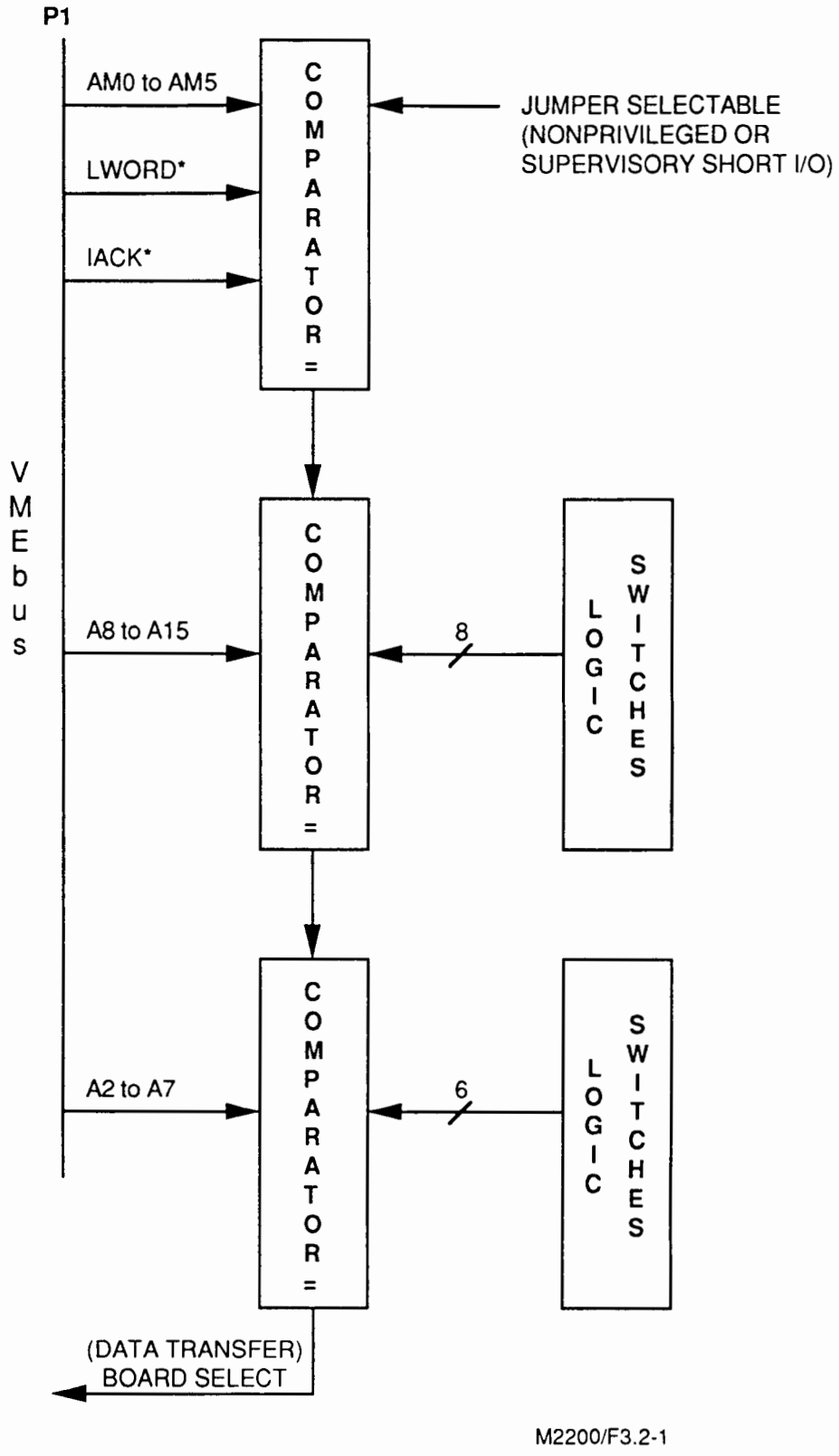


Figure 3.2-1. Address Decode Block Diagram

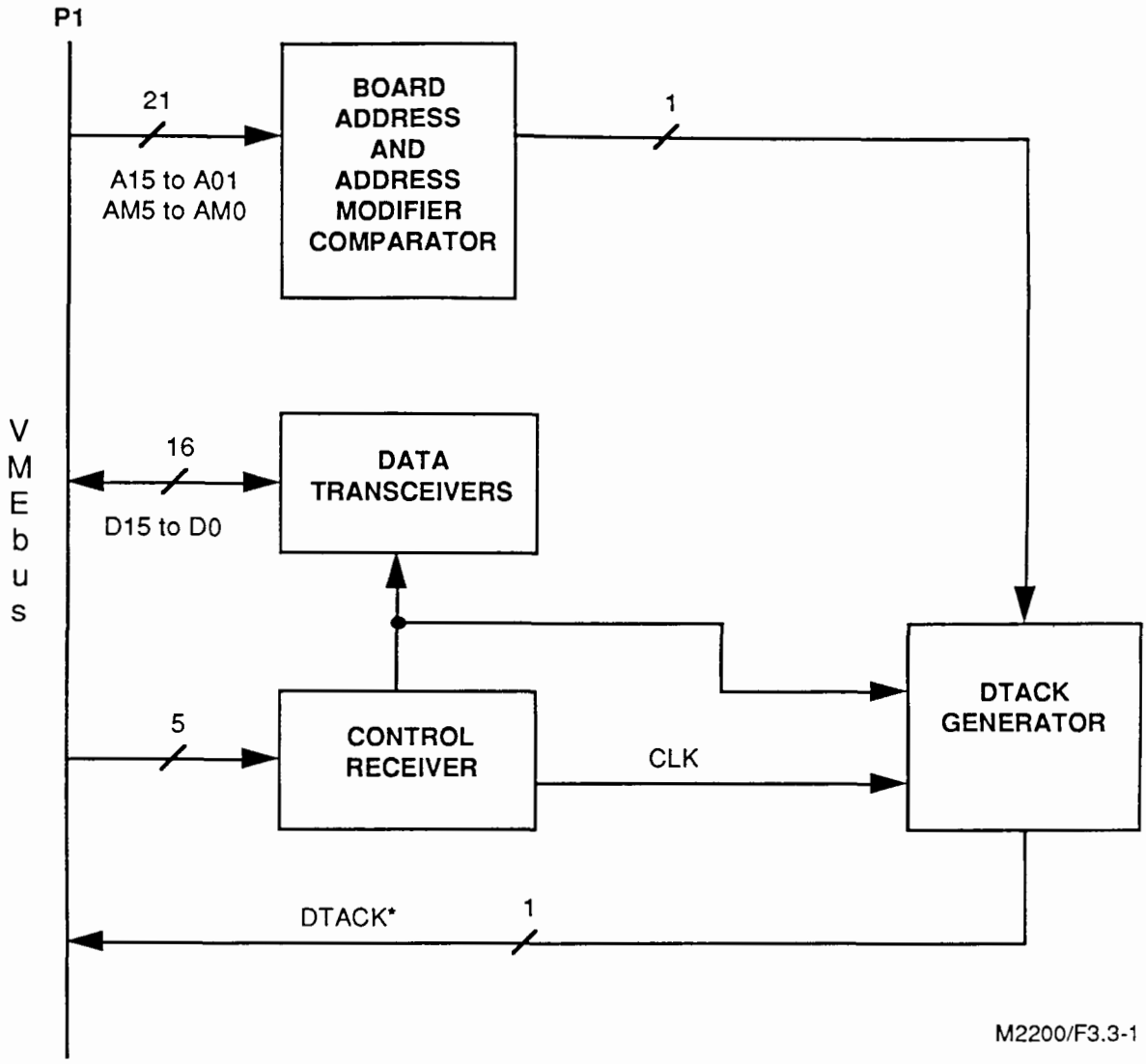


Figure 3.3-1 VMEbus Interface Logic and Interface Signals

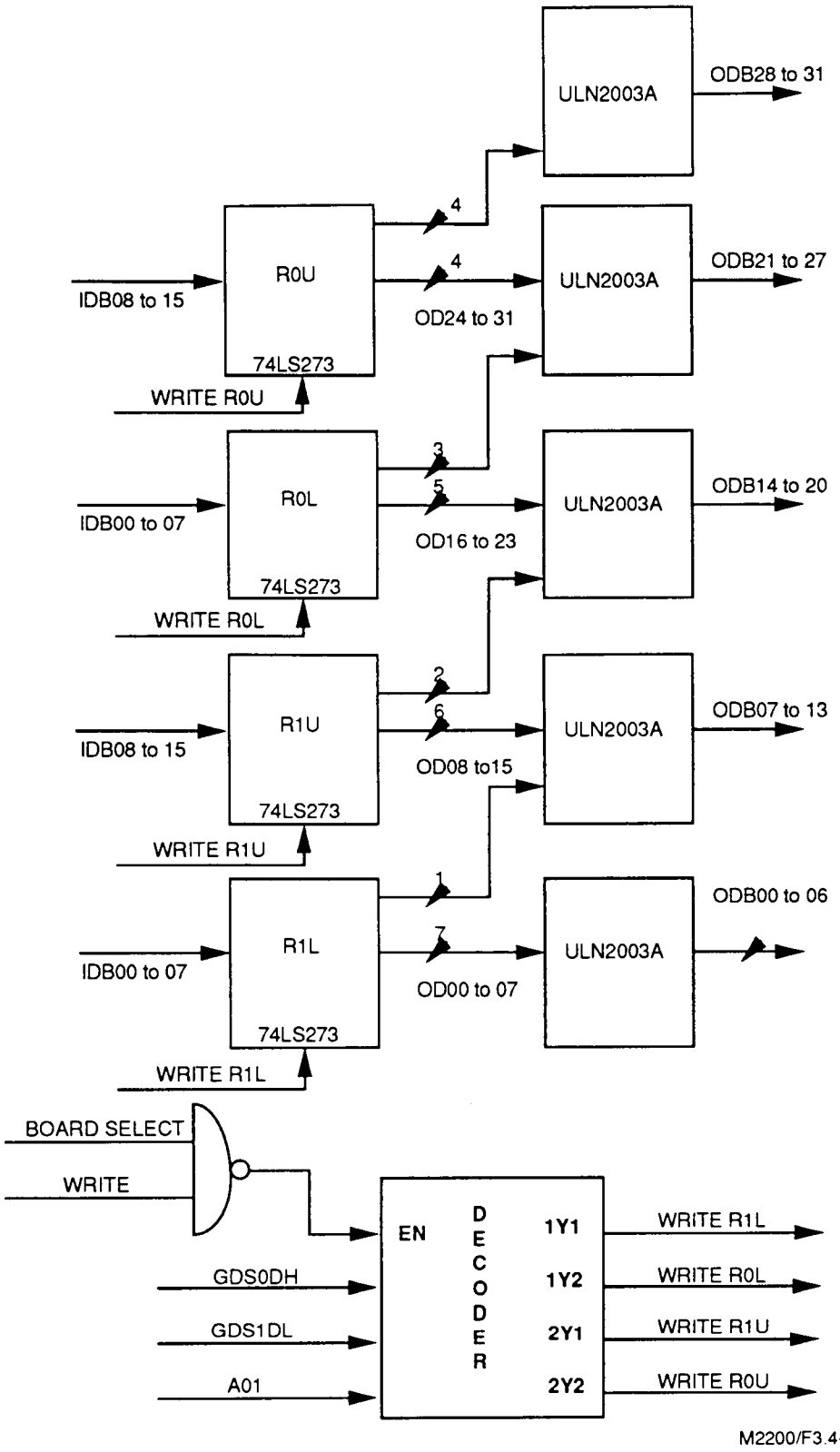


Figure 3.4-1. Output Registers and Driver Functional Block Diagram

3.5 OUTPUT RELAY

A typical output relay is shown in Figure 3.5-1. Optional contact protection electronics is shown. Each of the 32 relays is driven from the output logic shown in Figure 3.4-1. The relay contacts are routed to two front panel DIN connectors whose pin assignments are specified in Section 5. When using contact protection electronics, connect the negative supply to P3/P4 even output connector pins (A2, A4, A6, etc.) and connect the load to P3/P4 odd output connector pins (A1, A3, A5, etc.).

3.6 CONTACT PROTECTION

The use of proper contact protection is essential to achieve the specified contact life expectancy of the relays used on this board, particularly when relays are used to switch inductive loads. Circuits that may normally be considered resistive can contain capacitance and inductance in associated wiring that can cause excessive arcing of relay contacts and reduce contact life.

Inductive loads generate large transient voltages when the energizing circuit is opened. These transients can be 40 or 50 times the value of the applied supply voltage and can cause serious damage to relay contacts.

Figure 3.5-1 shows a contact protection network that is suitable for most applications where these types of relays are used and space is provided on the Relay Output Board to accommodate these components. Formulas are shown below to calculate these R and C values:

$$C = \frac{I^2}{10} \geq 0.001 \text{ MFD}$$

$$R = \frac{E}{10(I)^X} \geq 0.5 \text{ ohms}$$

where: C =microfarads

R = ohms

E = DC volts or 1.4 x rms voltage (immediately prior to contact closure)

$$X = 1 + \frac{50}{E}$$

I = amperes (immediately prior to contact opening)

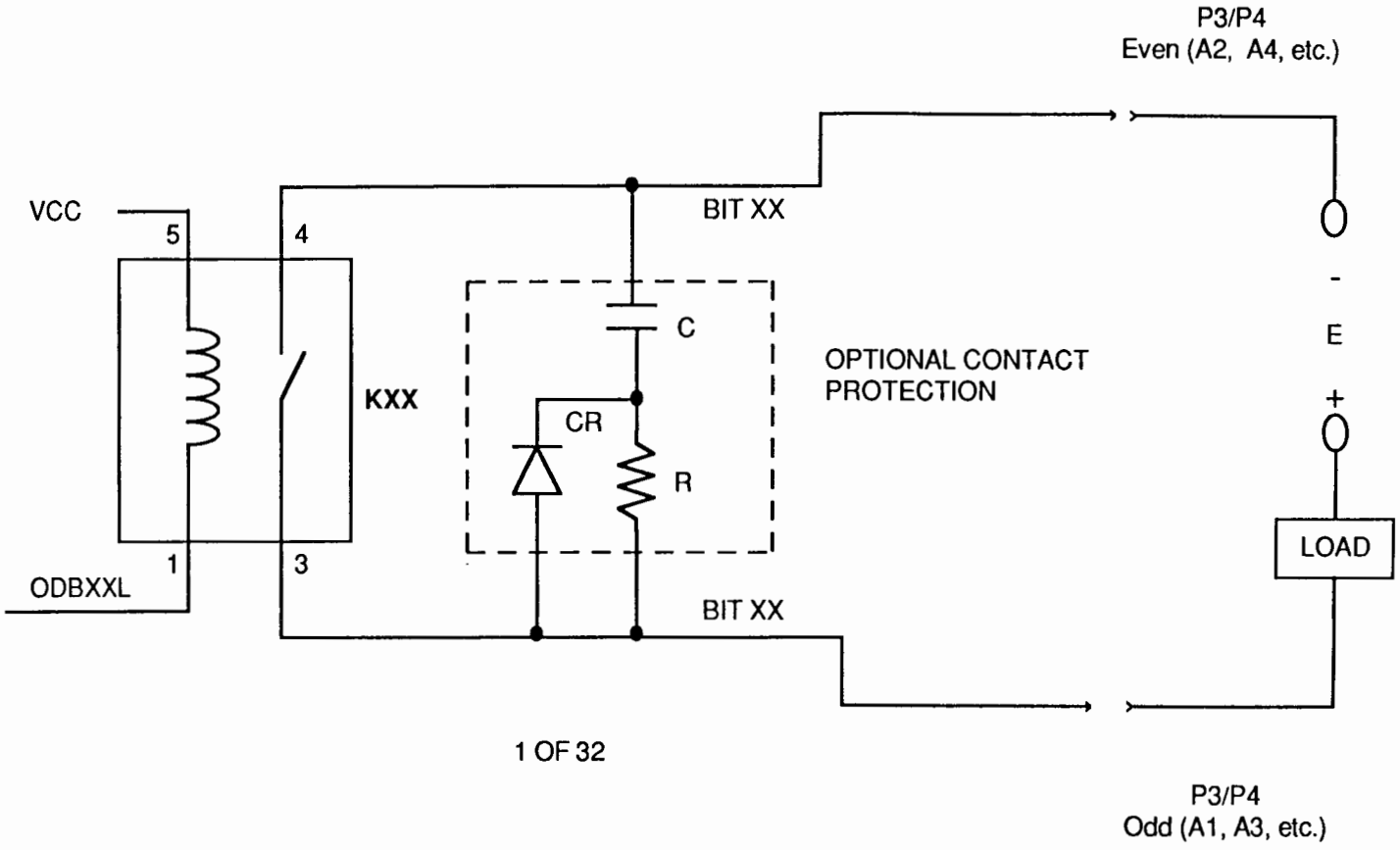


Figure 3.5-1. Typical Output Relay

Also, C may be increased up to 10 times the calculated value to aid in the reduction of transients when switching inductive loads.

High current loads (capacitive or resistive) at high voltages should be avoided due to the resultant large RFI emissions that could cause false triggering of adjacent logic circuits. Additional external arc suppression may be required for applications such as switching highly inductive AC loads at voltages above 100 VAC.

The board has some specific values for these components. They were determined by using the previous formulas. Contact the factory for assistance in determining the values for the contact protection circuitry that will best fit your situation.

SECTION 4

PROGRAMMING

4.1 INTRODUCTION

The four 8-bit Output Data Registers are accessed as two 16-bit registers or as four 8-bit registers. These registers latch output data, which provide inputs to the relay drivers as specified in Section 3.

Fourteen address bits, A15 to A02, are used for address decoding to generate a board select signal which activates the board for a data transfer. The base address selection information is provided in Section 5.

Because the Relay Output Board supports only 8- or 16-bit data transfers, attempts to execute longword transfers will result in no response from the board. This will force a bus timeout error from the system.

4.2 REGISTER MAP

Address bits A15 to A02 are selected by Address Select DIP switches. Therefore, XXX in the relative address space represents that portion of the address that is switch selectable. More detailed information concerning base address selection is provided in Section 5.

RELATIVE ADDRESS	MNEMONIC	NAME/FUNCTION
$XXX0	DR0	DATA REGISTER 0
$XXX1	DR1	DATA REGISTER 1
$XXX2	DR2	DATA REGISTER 2
$XXX3	DR3	DATA REGISTER 3

4.3 REGISTER BIT DEFINITIONS

Register Bit Definitions are shown in Table 4.3-1.

Table 4.3-1. Register Bit Definitions

$XXX0 DR0

BIT 15	BIT 14	BIT 13	BIT 12	BIT 11	BIT 10	BIT 9	BIT 8
OUTPUT DATA							
OD31	OD30	OD29	OD28	OD27	OD26	OD25	OD24

$XXX1 DR1

BIT 7	BIT 6	BIT 5	BIT 4	BIT 3	BIT 2	BIT 1	BIT 0
OUTPUT DATA							
OD23	OD22	OD21	OD20	OD19	OD18	OD17	OD16

$XXX2 DR2

BIT 15	BIT 14	BIT 13	BIT 12	BIT 11	BIT 10	BIT 9	BIT 8
OUTPUT DATA							
OD15	OD14	OD13	OD12	OD11	OD10	OD9	OD8

$XXX3 DR3

BIT 7	BIT 6	BIT 5	BIT 4	BIT 3	BIT 2	BIT 1	BIT 0
OUTPUT DATA							
OD7	OD6	OD5	OD4	OD3	OD2	OD1	OD0

M2200/T4.3-1

SECTION 5

CONFIGURATION AND INSTALLATION

5.1 UNPACKING PROCEDURES

****
* CAUTION *
****

SOME OF THE COMPONENTS ASSEMBLED ON VMIC'S PRODUCTS MAY BE SENSITIVE TO ELECTROSTATIC DISCHARGE AND DAMAGE MAY OCCUR ON BOARDS THAT ARE SUBJECTED TO A HIGH ENERGY ELECTROSTATIC FIELD. UNUSED BOARDS SHOULD BE STORED IN THE SAME PROTECTIVE BOXES AS SHIPPED. WHEN THE BOARD IS TO BE LAID ON A BENCH FOR CONFIGURING, ETC., IT IS SUGGESTED THAT CONDUCTIVE MATERIAL BE INSERTED UNDER THE BOARD TO PROVIDE A CONDUCTIVE SHUNT.

Upon receipt, any precautions found in the shipping container should be observed. All items should be carefully unpacked and thoroughly inspected for damage that might have occured during shipment. The board(s) should be checked for broken components, damaged printed-circuit board(s), heat damage, and other visible contamination. All claims arising from shipping damage should be filed with the carrier and a complete report sent to VMIC together with a request for advice concerning the disposition of the damaged item(s).

5.2 PHYSICAL INSTALLATION

****
* CAUTION *
****

DO NOT INSTALL OR REMOVE BOARDS WHILE POWER IS APPLIED.

De-energize the equipment and insert the board into an appropriate slot of the chassis. While ensuring that the board is properly aligned and oriented in the supporting card guides, slide the board smoothly forward against the mating connector until firmly seated.

5.3 JUMPER AND SWITCH LOCATIONS

Refer to Figure 5.3-1 for the locations of the jumpers and switches described in this section.

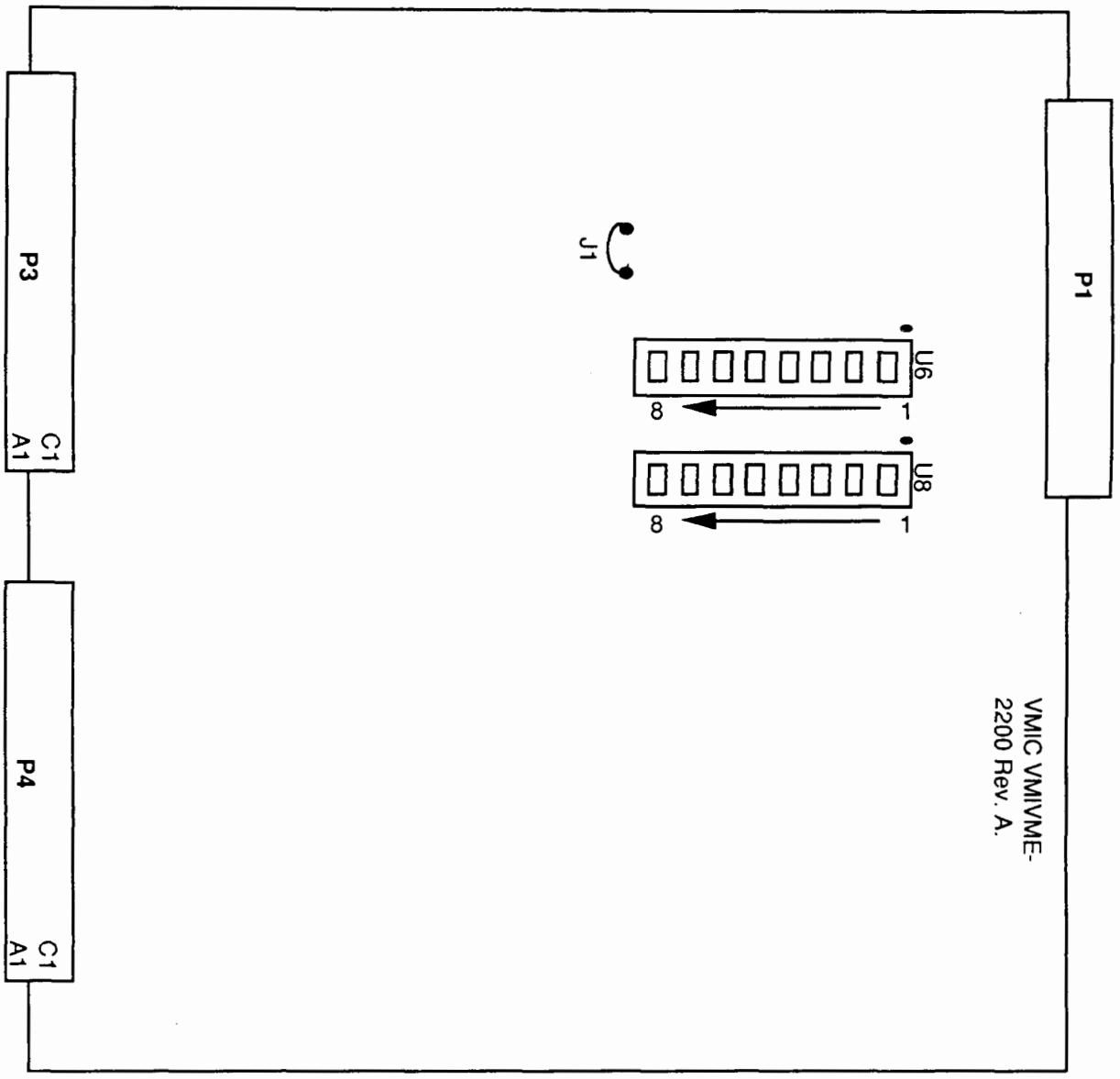


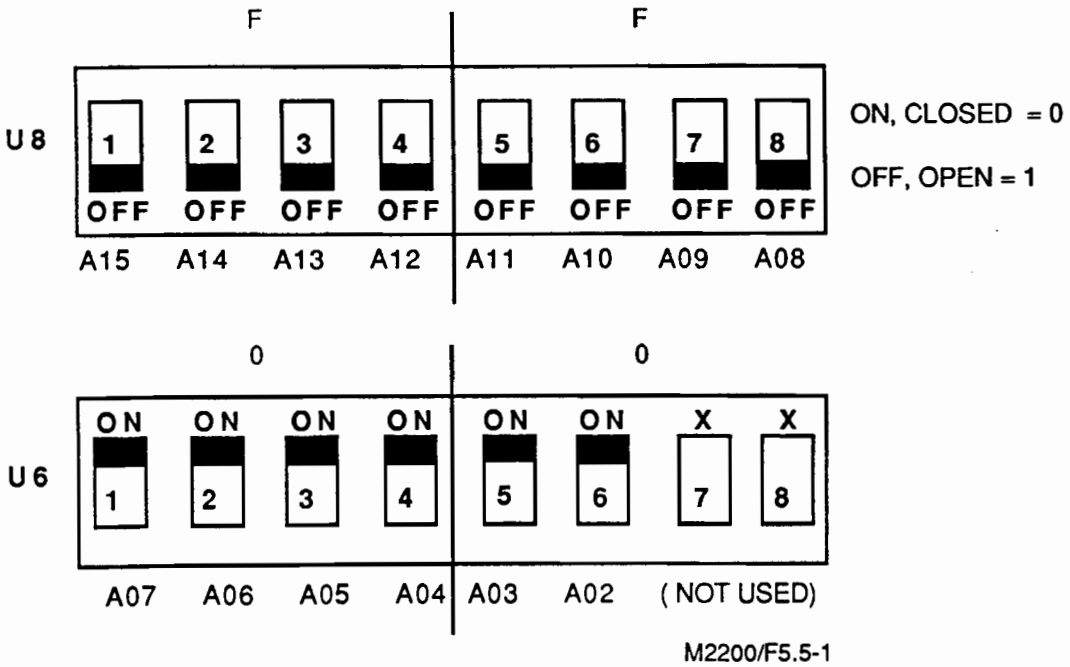
Figure 5.3-1. Jumper and Switch Locations

5.4 ADDRESS MODIFIERS

The Relay Output Board is configured at the factory to respond to short supervisory I/O access. This configuration can be changed by installing the jumper J1, to enable the board to respond to short nonprivileged I/O access.

5.5 ADDRESS SELECTION SWITCHES

Figure 5.5-1 below shows the two addressing DIP switches and their use in the addressing scheme.



Example

For the VMIVME-2200 to respond to a base address of (FF00), the U6 and U8 switches would be set accordingly.

Figure 5.5-1. Address Selection Switches

5.6 I/O CABLE AND FRONT PANEL CONNECTOR CONFIGURATION

The I/O connectors (P3 and P4) on the Relay Output Board are 64-pin DIN standard and were selected by VMIC because of their high quality. Although these connectors are generally used with flat-ribbon cables, a variety of cables and mating connectors are available for most user requirements. The user should refer to VMIC's Connector and I/O Cable Application Guide (VMIC Document No. 825-000000-006) for additional information concerning the variety of possible cabling and connector types available. I/O connector pin configurations for P3 and P4 are shown in Figure 5.6-1. Details concerning I/O connections are shown in Figure 5.6-2. This figure has conductor No. 1 shown at the bottom of the connector as it plugs into the header due to pin No. 1 of P3 and P4 being mounted as shown. Connector pin assignments for the 32 output channels of the VMIVME-2200 are shown in Table 5.6-1. When cabling to a VMIVME-2220 equipped with optional contact protection, connect the load to P3/P4 odd channel and connect the power supply negative polarity to P3/P4 even channel. See Section 3.5 for more details.

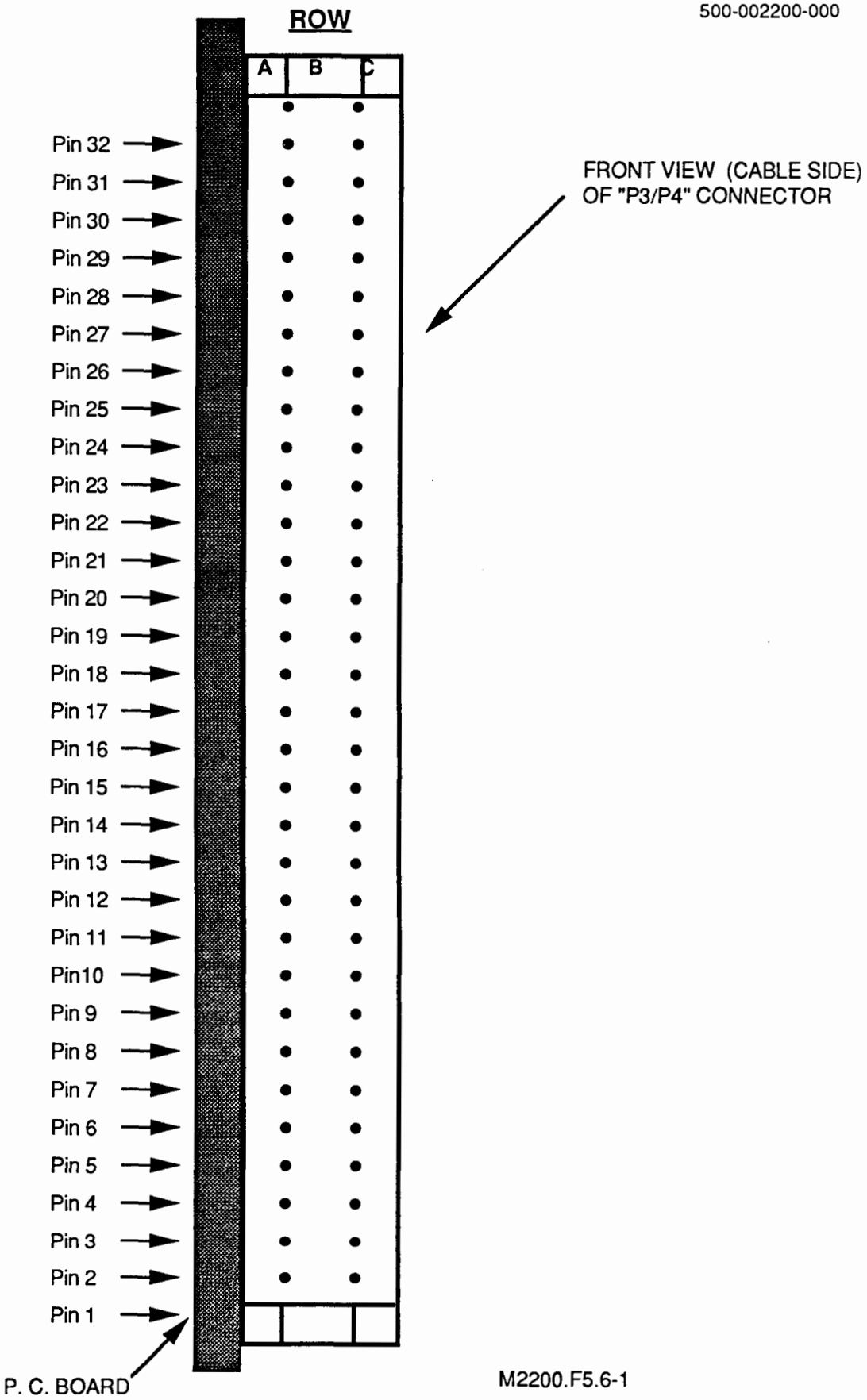


Figure 5.6-1. P3/P4 Connector Pin Assignments

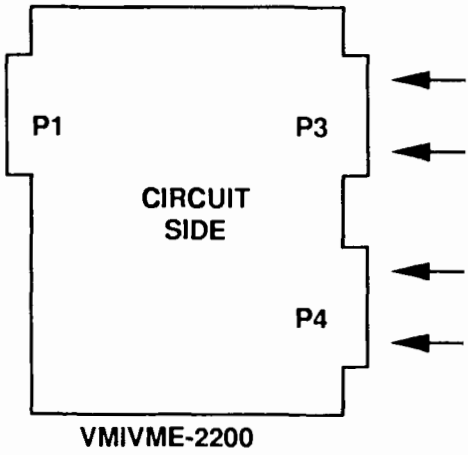
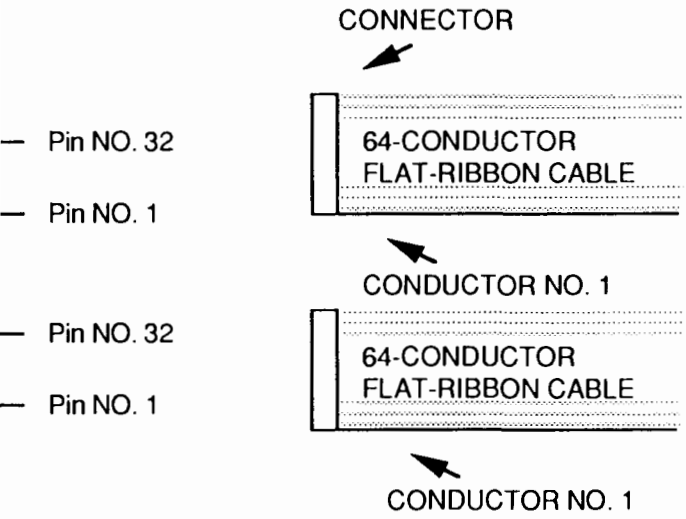


Figure 5.6-2.



M2200/F5.6-2

Cable Connector Configuration

Table 5.6-1. P3, P4 Pin/Channel Assignments

P3		P4	
A32	Bit 31	A32	Bit 15
A31	Bit 31	A31	Bit 15
A30	Bit 30	A30	Bit 14
A29	Bit 30	A29	Bit 14
A28	Bit 29	A28	Bit 13
A27	Bit 29	A27	Bit 13
A26	Bit 28	A26	Bit 12
A25	Bit 28	A25	Bit 12
A24	Bit 27	A24	Bit 11
A23	Bit 27	A23	Bit 11
A22	Bit 26	A22	Bit 10
A21	Bit 26	A21	Bit 10
A20	Bit 25	A20	Bit 09
A19	Bit 25	A19	Bit 09
A18	Bit 24	A18	Bit 08
A17	Bit 24	A17	Bit 08
A16	Bit 23	A16	Bit 07
A15	Bit 23	A15	Bit 07
A14	Bit 22	A14	Bit 06
A13	Bit 22	A13	Bit 06
A12	Bit 21	A12	Bit 05
A11	Bit 21	A11	Bit 05
A10	Bit 20	A10	Bit 04
A09	Bit 20	A09	Bit 04
A08	Bit 19	A08	Bit 03
A07	Bit 19	A07	Bit 03
A06	Bit 18	A06	Bit 02
A05	Bit 18	A05	Bit 02
A04	Bit 17	A04	Bit 01
A03	Bit 17	A03	Bit 01
A02	Bit 16	A02	Bit 00
A01	Bit 16	A01	Bit 00

M2200/T5.6-1

SECTION 6

MAINTENANCE

6.1 MAINTENANCE

This section of the technical manual provides information relative to the care and maintenance of VMIC's products. Should the products malfunction, the user should verify the following:

a. Software
b. System configuration
c. Electrical connections
d. Jumper or configuration options
e. Boards fully inserted into their proper connector location
f. Connector pins are clean and free from contamination
g. No components of adjacent boards are disturbed when inserting or removing the board from the VMEbus card cage
h. Quality of cables and I/O connections

User level repairs are not recommended. Contact VMIC for a Return Material Authorization (RMA) Number. This RMA Number must be obtained prior to any return.

6.2 MAINTENANCE PRINTS

The appendix(ices) to this manual contain(s) drawings and diagrams for reference purposes.

APPENDIX A

ASSEMBLY DRAWING, PARTS LIST, AND SCHEMATIC

NOTES:

*OPTION TABLE

OPTION	REFERENCE	PART NO.
X-XX-10-1-X	U1,U2	74ALS645-1
X-XX-10-0-X	U1,U2	74ALS640-1
X-01-10-X-X	C8-C39	.1uF,100V,X7R
X-02-10-X-X	C8-C39	47uF,100V,X7R
X-03-10-X-X	C8-C39	.02uF,100V,X7R
X-01-10-X-X	R3-R34	33 OHM,1/4W
X-02-10-X-X	R3-R34	15 OHM,1/4W
X-03-10-X-X	R3-R34	75 OHM,1/4W
0-XX-10-X-X	K1-K32	MERCURY RELAY
1-XX-10-X-X	K1-K32	DRY REED RELAY
X01,02,03-10-X-X	CR1-CR32	1N4148

REVISIONS

REV.	DESCRIPTION	BY	DATE	APPR.
B	CHANGES PER ECO 88-0196	KWard	11/1/88	M. SPANGLER
C	CHANGES PER ECO 90-0037	E.M. GREEN	10/9/91	K. A. P.
D	CHANGES PER ECO 94-0755	E.M. GREEN	11/4/94	gg

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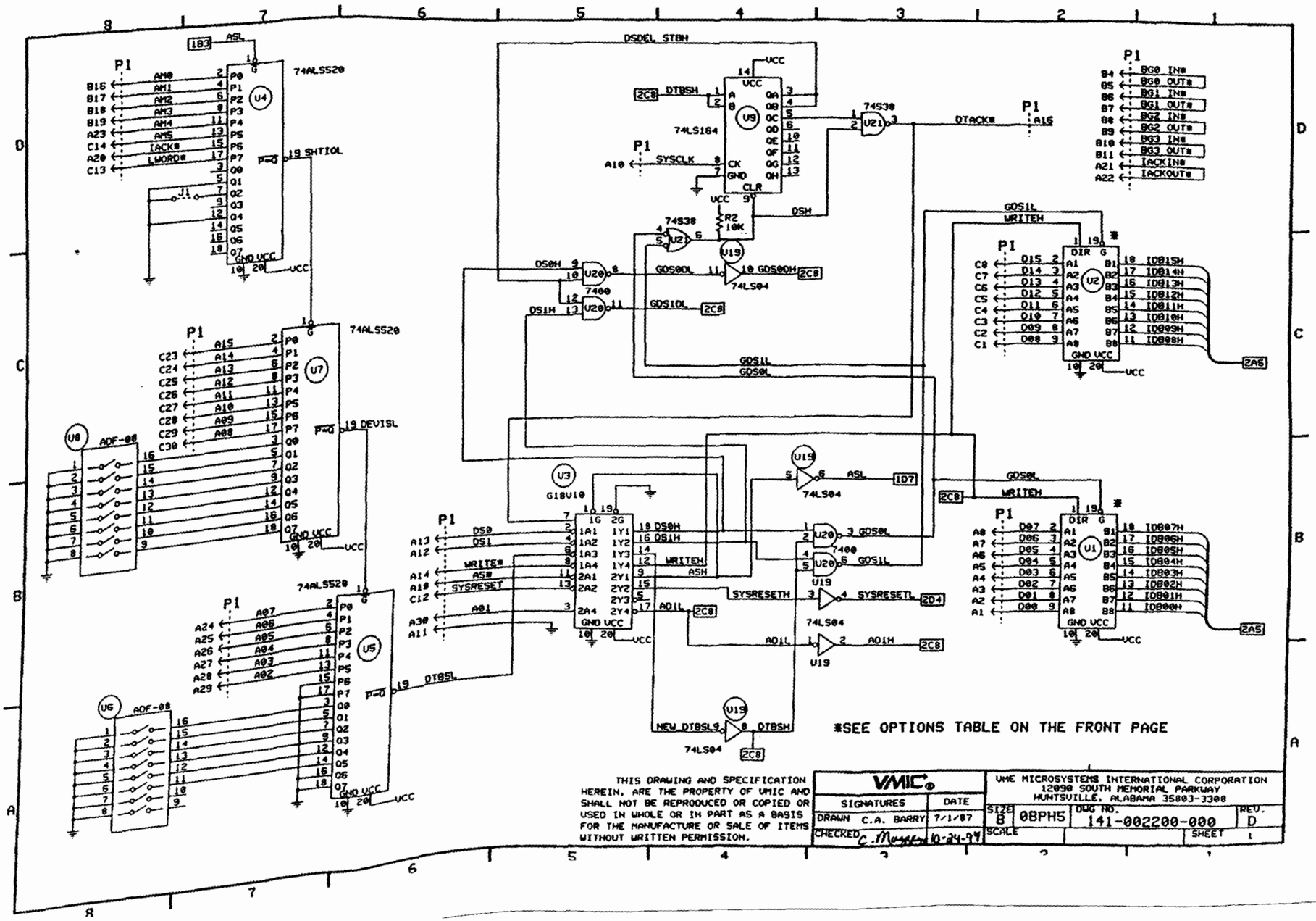
SIGNATURES	DATE
DRAWN C.A BERRY	3/8/88
PROJ. ENG. M. SPANGLER	3/8/88
ENG. MGR. P.A.R.	3/8/88
PROD. D. FOWLER	3/8/88
Q.A. S. KEAGLE	3/8/88

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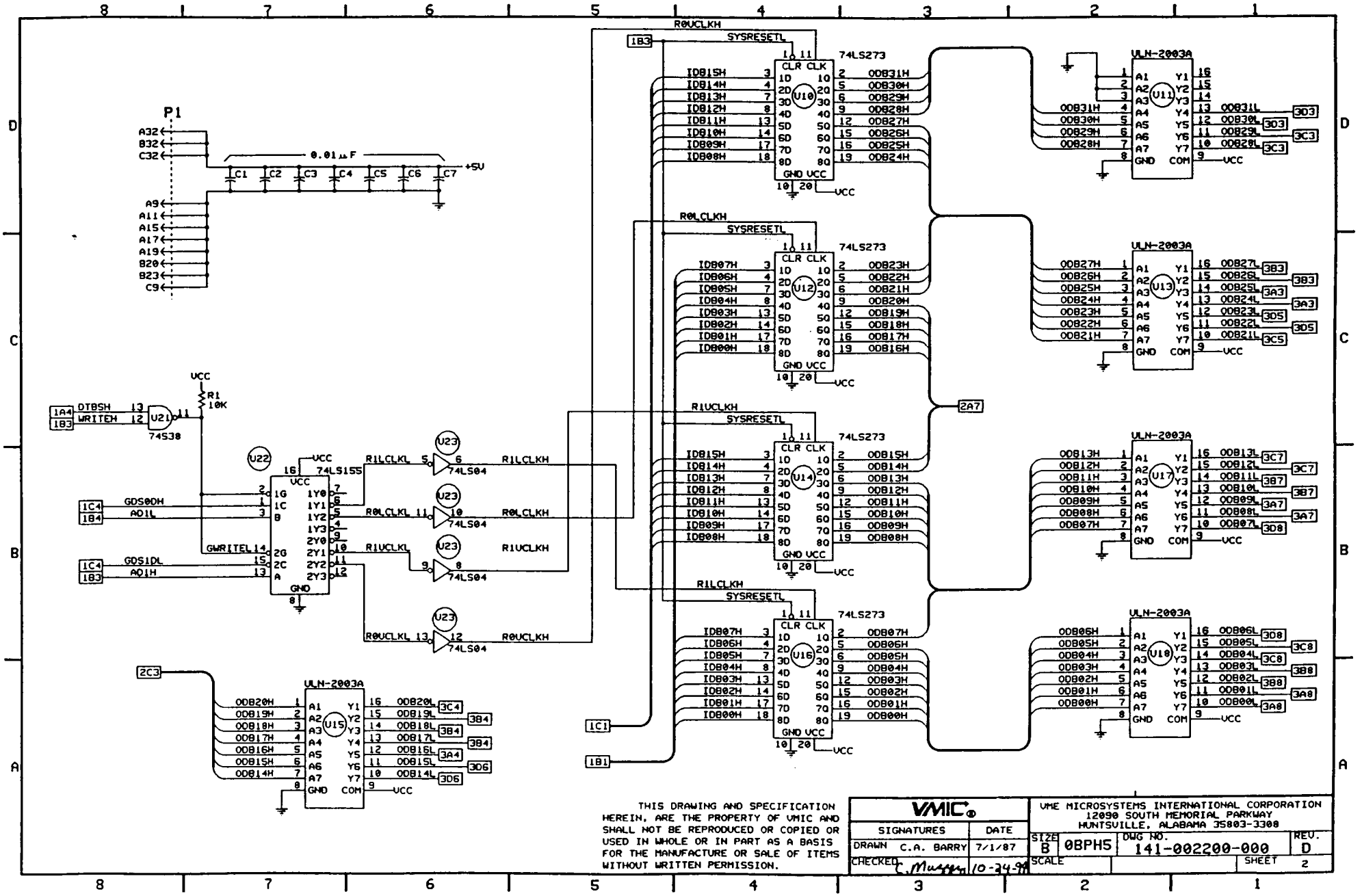
VMIVME- 2200 SCHEMATIC

SIZE		DWG NO.	REV.
B	0BPH5	141-002200-000	D
SCALE		SHEET A1	



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SIGNATURES	DATE			
DRAWN C.A. BARRY	7/1/87	SIZE 8	0BPH5	DWG NO. 141-002200-000 REV. D
CHECKED C. Mooney	10-24-97	SCALE		SHEET 1



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SIGNATURES	DATE
DRAWN C.A. BARRY	7/1/87
CHECKED C. Musgrave	10-24-90

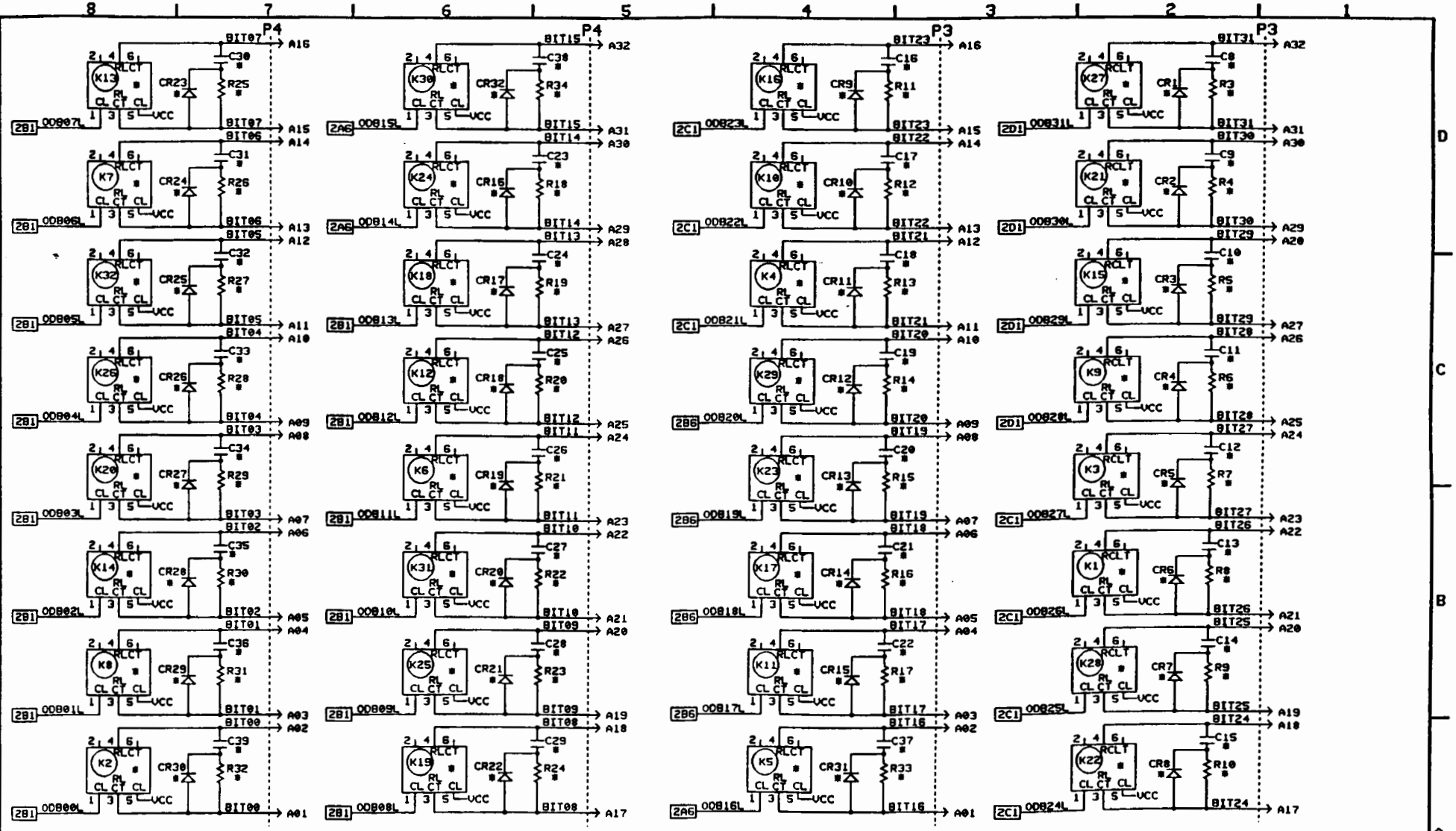
VMIC

VME MICROSYSTEMS INTERNATIONAL CORPORATION
12090 SOUTH MEMORIAL PARKWAY
HUNTSVILLE, ALABAMA 35803-3308

SIZE	DWG NO.	REV.
B	0BPH5 141-002200-000	D

SCALE

SHEET 2



*SEE OPTIONS TABLE ON THE FRONT PAGE

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VMIC®		
SIGNATURES		DATE
DRAWN	C.A BARRY	7/1/91
CHECKED	L. Musser	10-24-91

VME MICROSYSTEMS INTERNATIONAL CORPORATION
12090 SOUTH MEMORIAL PARKWAY
HUNTSVILLE, ALABAMA 35803-3308

SIZE	DWG NO.	REV.
B	0BPH5 141-002200-000	D
SCALE		SHEET 3 OF 3

SIZE	DWG NO	REV
A	132-012200-000	E

NOTES:

1. FOR SCHEMATIC DIAGRAM SEE 141-012200-000.
2. FOR TEST PROCEDURE SEE 510-002200-000.
3. FOR DOCUMENT SET SEE 110-002200-000.

REVISION STATUS OF 332
A
B
B
C
D

REVISIONS

REV	DESCRIPTION	DATE	APPROVED
A	RELEASE PRODUCT PER ECO 92-0301	9/21/92	G.T.M.
B	CHANGE PER ECO 93-0382	5/4/94	A.J.
C	CHANGE PER ECO 93-0736	5/4/94	A.J.
D	CHANGE PER ECO 94-0737	12/16/94	A.J.
E	ADD RIVET P1/P2 PER ECO 00-0455	8/3/00	TLT

UNLESS OTHERWISE SPECIFIED	SIGNATURES		DATE
DIMENSIONS ARE IN INCHES TOLERANCES ON: 2 PL. DECIMALS ± 3 PL. DECIMALS ± ANGLES ± FRACTIONS ±	DRAWN:	C. MUZZEY	10/18/91
	PROJ.ENG.:	G. MEARES	10/18/91
	ENG.MGR.:	G. MEARES	10/18/91
	PROD.:	S. CROWSON	9/22/92
	Q.A.:	S. KEAGLE	9/22/92
	MAGNETIC MEDIA FILENAME FOR PACKAGE: 132-012200-000-E.EXE		

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VMIC® HUNTSVILLE, ALABAMA 35803-3308
VME MICROSYSTEMS INTERNATIONAL CORPORATION

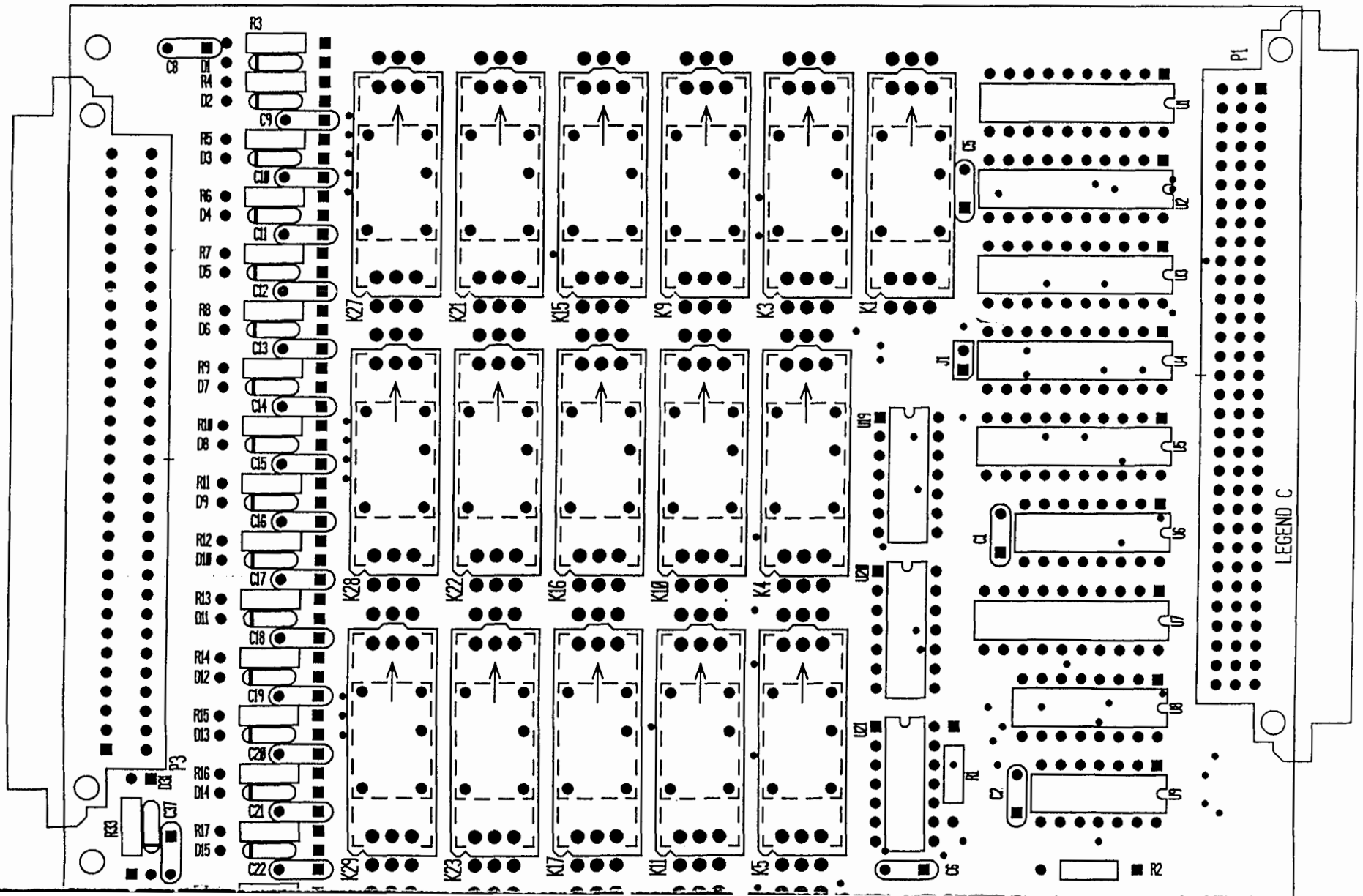
ASSEMBLY DRAWING
VMIVME-2200

SIZE	FSCM NO.	DWG NO.
A	OBPH5	132-012200-000

SCALE		SHEET
NONE		1 OF 7

P4
P2
VMIVME MODEL 2200 ASSY.NO.332-012200-
VMIC

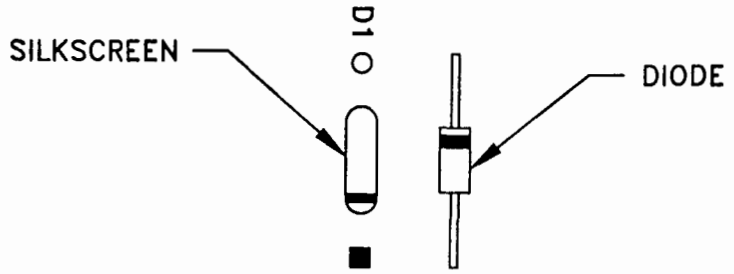
SIZE	DWG NO	SHT	REV
B	132-012200-000	2	



ASSEMBLY INSTRUCTIONS: (333-012200-000 REV A ONLY)

INSERT D1 THROUGH D32 AS FOLLOWS:

INSERT THE SIDE OF THE DIODE WITH THE BAND ON IT, CATHODE, INTO PIN 2, THE ROUND HOLE. INSERT THE OTHER SIDE, ANODE, INTO PIN 1, THE SQUARE HOLE. SEE FIGURE BELOW FOR PROPER INSERTION.



COMPONENT SIDE VIEW
INSERT PART OPPOSITE SILKSCREEN.

REWORK LEGEND:

A. REWORK INSTRUCTIONS SHALL BE ACCOMPLISHED ON THE COPPER REVISION(S) INDICATED AND WILL BECOME A PART OF THE ASSEMBLED BOARD.

B. REWORK INSTRUCTION SYMBOLS:

1. PIN ONE DOT ■
2. DRILL HOLE ●
3. DISCONNECT TRACE ×
4. TRACE ON INTERNAL LAYER ------
5. TRACE ON EXTERNAL LAYER ———

INSTRUCTIONS:

NOTES:

1. A. ALL ASSEMBLED BOARDS SHALL BE IDENTIFIED WITH THE ASSEMBLED BOARD PART NUMBER. THIS NUMBER INCLUDES THE CURRENT REVISION LETTER LISTED IN THE "REVISION STATUS OF 332" BLOCK (SEE SHEET 1). THE RESULTING PART SHALL BECOME A 332-012200-ABC (REV).

B. THE PART NUMBER FIELDS "ABC" WILL COINCIDE WITH THE OPTIONAL PARTS INSTALLED IN THE COMPLETED ASSEMBLY. IF NO OPTIONAL PARTS ARE USED IN A FIELD, THAT FIELD WILL DEFAULT TO "0".

C. IF NECESSARY, REMOVE AND REPLACE 332 REVISION LETTER WITH CURRENT REVISION LETTER USING EITHER A REMOVABLE NON-SMEARING BLACK INK OR A LABEL.

2. SOLDER COMPOSITION COMPLIES WITH MIL-STD-2000.

3. SEE DRAWING 150-000022-000 FOR THE ASSEMBLY AND INSTALLATION OF THE FRONT PANEL.

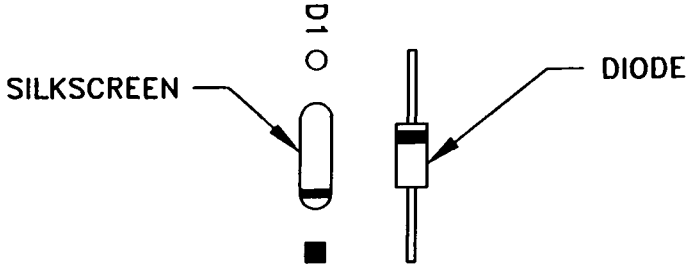
4. SEE ASSEMBLY INSTRUCTIONS, PAGE 2A, FOR PROPER INSERTION OF D1 THROUGH D32.

EFFECTIVITY: ECO 93-0382 (333-012200-000 REV A)

INSTRUCTIONS: REWORK

STEP 1

VERIFY, FOR D1 THROUGH D32, THAT THE CATHODE, THE SIDE SIDE WITH THE BAND ON IT, IS INSERTED INTO PIN 2, THE ROUND HOLE, AND THAT THE OTHER SIDE IS INSERTED INTO PIN 1, THE SQUARE HOLE. SEE FIGURE BELOW. IF THESE PARTS ARE INSTALLED INCORRECTLY, REMOVE DIODES AND INSERT NEW ONES AS SHOWN BELOW.



CORRECT PLACEMENT FOR D1 THROUGH D32.
COMPONENT SIDE VIEW
INSERT PART OPPOSITE SILKSCREEN.

EFFECTIVITY: ECO 94-0737 (332-012200-000 REV B & EARLIER)

INSTRUCTIONS: REWORK

STEP 1

REMOVE U3 (74LS240) FROM PC BOARD AND DISCARD.

EFFECTIVITY: ECO 94-0737 (333-012200-000 REV B & EARLIER)

INSTRUCTIONS: REWORK

STEP 1 (SOLDER SIDE)

CUT TRACE AT U3 PIN 3 TO DISCONNECT U3 PIN 3 FROM U19 PIN 1.

STEP 2 (SOLDER SIDE)

CUT TRACE AT U3 PIN 7 TO DISCONNECT U3 PIN 7 FROM U19 PIN 3.

STEP 3 (SOLDER SIDE)

CUT TRACE AT U3 PIN 17 TO DISCONNECT U3 PIN 17 FROM P1 PIN A30.

STEP 4 (SOLDER SIDE)

CUT TRACE AT U5 PIN 19 TO DISCONNECT U5 PIN 19 FROM U19 PIN 9.

STEP 5

ACQUIRE FROM STOCK ONE 20 PIN ELEVATED SOCKET, P/N 321-001320-081. TRIM PINS 1 AND 15 SO THAT THE TRIMMED PINS DO NOT COME INTO CONTACT WITH THE PC BOARD WHEN INSTALLED.

STEP 6

ATTACH A STANDARD MODIFICATION WIRE, APPROX. 5" LONG, TO EACH OF THE PINS TRIMMED IN STEP 5.

STEP 7 (COMPONENT SIDE)

INSTALL MODIFIED SOCKET INTO LOCATION U3, FEEDING MOD WIRES THROUGH THE UNUSED HOLES OF U3, AND SOLDER SOCKET INTO PLACE.

EFFECTIVITY: ECO 94-0737 (333-012200-000 REV B & EARLIER)
INSTRUCTIONS: REWORK (CONTINUED)

STEP 8
CONNECT MOD WIRE ATTACHED TO MODIFIED SOCKET PIN 1 TO U3 PIN 9 AND TRIM EXCESS.
STEP 9
CONNECT MOD WIRE ATTACHED TO MODIFIED SOCKET PIN 15 TO U19 PIN 3 AND TRIM EXCESS.
STEP 10
CONNECT U3 PIN 3 TO P1 PIN A30.
STEP 11
CONNECT U5 PIN 19 TO U3 PIN 6.
STEP 12
CONNECT U3 PIN 7 TO P1 PIN A16.
STEP 13
CONNECT U3 PIN 14 TO U19 PIN 9.
STEP 14
CONNECT U3 PIN 17 TO U19 PIN 1.

EFFECTIVITY: ECO 94-0737 (332-012200-000 REV B & EARLIER)
INSTRUCTIONS: REWORK

STEP 1
PROGRAM U3, P/N 303-001175-000, WITH FILE 2200-03A.JED, AND INSERT INTO SOCKET AT U3.

EFFECTIVITY: ECO 00-0455 (332-012200-000 REV C & EARLIER)
INSTRUCTIONS: REWORK

STEP 1
PROCESS IMPROVEMENTS, NO REWORK REQUIRED. (INSTALLATION OF RIVET IN P1 & P2 CONNECTOR).

END OF REWORK INSTRUCTIONS

PARTS LIST

VMIC | CODE OBPH5 | DRAWING NUMBER 132-012200-000 REV: E | CHECKER/DATE C. Muzzey 7-28-00 |

ITEM	ABC	REF. DES.	QTY.	PART NO.	DESCRIPTION	MANUFACTURER
1			1	333-012200-000	BOARD: PC, RAW, 4 LAYERS	
2			1	317-000101-000	FRONT PANEL: EXTRUDED EJECTOR, TWO 64 PIN CUTOUTS NO LED (SEE NOTE 3)	
3				DELETED		
4			1	324-002200-100	LABEL: ID, 2200, FRONT PANEL (SEE NOTE 3)	
5				DELETED		
6				DELETED		
7				DELETED		
8				DELETED		
9		P3,4	4	328-250000-010	SCREW: M2.5, PAN HEAD, PHILLIPS, CROSS RECESSED SS, 10MM LENGTH	OPEN SOURCE
10		P3,4	4	328-250001-025	NUT: HEX, 2.5MM, METRIC, SS	OPEN SOURCE
11		REF. P3,4	A/R	316-000002-000	LOCTITE: SMALL SCREW THREADLOCKER 222	
12				DELETED		
13		C1-7	7	315-205001-103	CAP: .01uF, .200 LEAD SPACE, 20%, 50V, Z5U, CERAMIC MONOLYTHIC	OPEN SOURCE

ITEM	ABC	REF. DES.	QTY.	PART NO.	DESCRIPTION	MANUFACTURER
14		P3,4	2	321-000013-105	CONNECTOR: FLAT CABLE, LEVEL II, 64 PIN, RIGHT ANGLE MALE, W/ EJECTOR LATCHES, 30u" GOLD, WAVE SOLDER, TYPE C, SERIES 120	120-964-033A (PANDUIT)
15		J1	1	321-000016-021	TERMINAL: PC BOARD, POST/POST, SINGLE ROW, .100" SPACING, .094" THICK INSULATOR, TIN FINISH, 2 POST	OPEN SOURCE
16		P1	1	321-000054-001	CONNECTOR: DIN, 96 PIN, WAVE SOLDER, ANGLED, TYPE C P1, MALE	100-096-033 (PANDUIT)
17		P2	1	321-000054-002	CONNECTOR: DIN, 96 PIN, WAVE SOLDER, ANGLED, TYPE C P2, MALE	100-096-033 (PANDUIT)
18		U20	1	331-300400-000	IC: DIGITAL, QUAD 2-INPUT NAND GATE, PLASTIC DIP	SN7400N (TI)
19		U19,23	2	331-300404-600	IC: DIGITAL, HEX INVERTER, PLASTIC DIP	SN74LS04N (TI)
20		U21	1	331-300438-700	IC: DIGITAL, QUAD 2-INPUT NAND BUFFER, PLASTIC DIP	SN74S38N (TI)
21		U22	1	331-304155-600	IC: DIGITAL, DUAL 1 OF 4 DECODER, PLASTIC DIP	SN74LS155N (TI)
22		U9	1	331-304164-600	IC: DIGITAL, 8-BIT SHIFT REGISTER, PLASTIC DIP	SN74LS164N (TI)
23		U3	1	303-001175-000	PROGRAMMED GAL: FILE: 2200-03A.PLD, A PROGRAMMED G18V10 (331-300132-200)	
24		U10,12,14,16	4	331-304273-600	IC: DIGITAL, OCTAL D FLIP FLOP, PLASTIC DIP	SN74LS273N (TI)
25		U4,5,7	3	331-304520-100	IC: DIGITAL, 8-BIT IDENTITY COMPARATOR, PLASTIC DIP	SN74ALS520N (TI)
26		U11,13,15,17,18	5	331-309019-030	IC: INTERFACE, 7 CHANNEL, 50V OUTPUT, 500mA INPUT 5V TTL, CMOS, PLASTIC DIP	ULN2003A (SPRAGUE)

ITEM	ABC	REF. DES.	QTY.	PART NO.	DESCRIPTION	MANUFACTURER
27		R1,2	2	347-000000-103	RESISTOR: 10K OHM, 1/4W, 5%, CARBON FILM	OPEN SOURCE
28		U6,8	2	351-000000-080	SWITCH: LOW PROFILE, PC MOUNT, DIP, 8 POS., TAPE SEAL	ADF-08PCT (AUGAT)
29		U3	1	321-001320-001	SOCKET: DIP, 20 PIN, .300 ROW, STAMPED AND FORMED (SEE SHEETS 3A AND 3B BEFORE INSTALLING)	2-641602-(3,1,5) (AMP)
30		P1,2	4	328-250570-000	FASTENER: AVTRONIC FASTENING SYSTEMS FOR DIN CONN. 9.96MM LENGTH, 2.5MM DIAMETER, ALUMINUM	1189-2510 (AVDEL CHERRY TEXTRON)
31						
32						
33	1BC	U1,2	2	331-304645-110	IC: DIGITAL, OCTAL BUS TRANSCEIVER, PLASTIC DIP	SN74(ALS,AS)645A-1N (TI)
34	2BC	U1,2	2	331-304640-110	IC: DIGITAL, OCTAL BUS TRANSCEIVER, 20 PIN, PLASTIC DIP	SN74ALS640A-1N (TI)
35						
36	A0C	C8-39,R3-34,D1-32	N/A		(NO PARTS REQUIRED FOR THIS OPTION)	
37	A1C	C8-39	32	315-210001-104	CAP: .1uF, RADIAL, .200 LEAD SPACE, +/-20% (OR BETTER) 100V, X7R, CERAMIC MONOLYTHIC	C317C104M1R5CA (KEMET)
38	A1C	R3-34	32	347-000000-330	RESISTOR: 33 OHM, 1/4W, 5%, CARBON FILM	OPEN SOURCE
39	A1C	D1-32	32	348-104148-000	DIODE: SWITCHING, HIGH CONDUCTANCE, ULTRA FAST DO-35 RADIAL LEAD, THRU HOLE (SEE NOTE 4)	1N4148 (PHILIPS)

ITEM	ABC	REF. DES.	QTY.	PART NO.	DESCRIPTION	MANUFACTURER
40	A2C	C8-39	32	315-210001-474	CAP: .47uF, RADIAL, .200 LEAD SPACE, +/-20% (OR BETTER) 100V, X7R, CERAMIC MONOLYTHIC	C340C474M1R5CA (KEMET)
41	A2C	R3-34	32	347-000000-150	RESISTOR: 15 OHM, 1/4W, 5%, CARBON FILM	OPEN SOURCE
42	A2C	D1-32	32	348-104148-000	DIODE: SWITCHING, HIGH CONDUCTANCE, ULTRA FAST DO-35 RADIAL LEAD, THRU HOLE	1N4148 (PHILIPS)
43	A3C	C8-39	32	315-210001-223	CAP: .022uF, RADIAL, .200 LEAD SPACE, +/-20% (OR BETTER) 100V, X7R, CERAMIC MONOLYTHIC	C32(2,3)C223M1R5CA (KEMET)
44	A3C	R3-34	32	347-000000-750	RESISTOR: 75 OHM, 1/4W, 5%, CARBON FILM	OPEN SOURCE
45	A3C	D1-32	32	348-104148-000	DIODE: SWITCHING, HIGH CONDUCTANCE, ULTRA FAST DO-35 RADIAL LEAD, THRU HOLE	1N4148 (PHILIPS)
46						
47	AB0	K1-32	32	345-000002-010	RELAY: MERCURY WETTED, 1 AMP, 5V, 120 OHM COIL RESISTENCE	852A05B1A (CLARE)
48	AB1	K1-32	32	345-000004-005	RELAY: DRY REED, 1 FORM A, AXIAL, 5V, 500 OHM COIL RESISTENCE	LGK101-1-5 (STANDEX)

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