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XVME-103

RAM/ROM Memory Module

P/N 74103-001B

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xycom
Technical Publication Department
750 North Maple Road
Saline, MI 48176-1292
313-429-4971
313-429-1010 (fax)

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1.1 **OVERVIEW**

The XVME-103 RAM/ROM Memory Module is a single-high, VMEbus compatible board that can accommodate up to 4 Mbytes of RAM, 8 Mbytes of EPROM, 4 Mbytes of FLASH or 4 Mbytes of EEPROM. The module is designed with an on-board battery backup circuit to provide power to CMOS RAM devices in the event of a power failure.

The XVME-103 has eight 32-pin JEDEC sockets, which are divided into two separate memory banks, containing four sites each. Each bank is designed to employ memory devices of the same type and speed, and each bank can be independently configured (via jumpers and switches) in terms of:

- VME Address
- Address Modifier Decode
- Memory Device Speed
- Memory Device Type
- Memory Device Size
- Memory Backup Power Source

The XVME-103 RAM/ROM Memory Module has power down memory protection circuitry which prevents data from being written to memory when the power supply voltage falls below 4.65 volts. The module also has the option of asserting SYSRESET under this condition. Another option is to drive SYSFAIL when a low battery is detected on power up.

The XVME-103 supports 8-bit and 16-bit data transfers, including read modify write (RMW) cycles.

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1.2 MANUAL STRUCTURE

The purpose of Chapter One is to introduce the general specifications and functional capabilities of the XVME-103. Chapter Two will develop the various aspects of module installation and operation.

Chapter One	A general description of the memory module, including functional and environmental specifications, and VMEbus compliance information.
Chapter Two	Information covering switch/jumper options, memory chip and cardcage installation procedures.
Appendix A	Backplane signal/pin descriptions.
Appendix B	Quick reference guide of jumper and switch configurations, and memory device timing.
Appendix C	Block diagram, assembly drawing, and schematics.

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1.3 MODULE OPERATIONAL DESCRIPTION

Figure 1-1 below shows an operational block diagram of the XVME-103 RAM/ROM Memory Module.

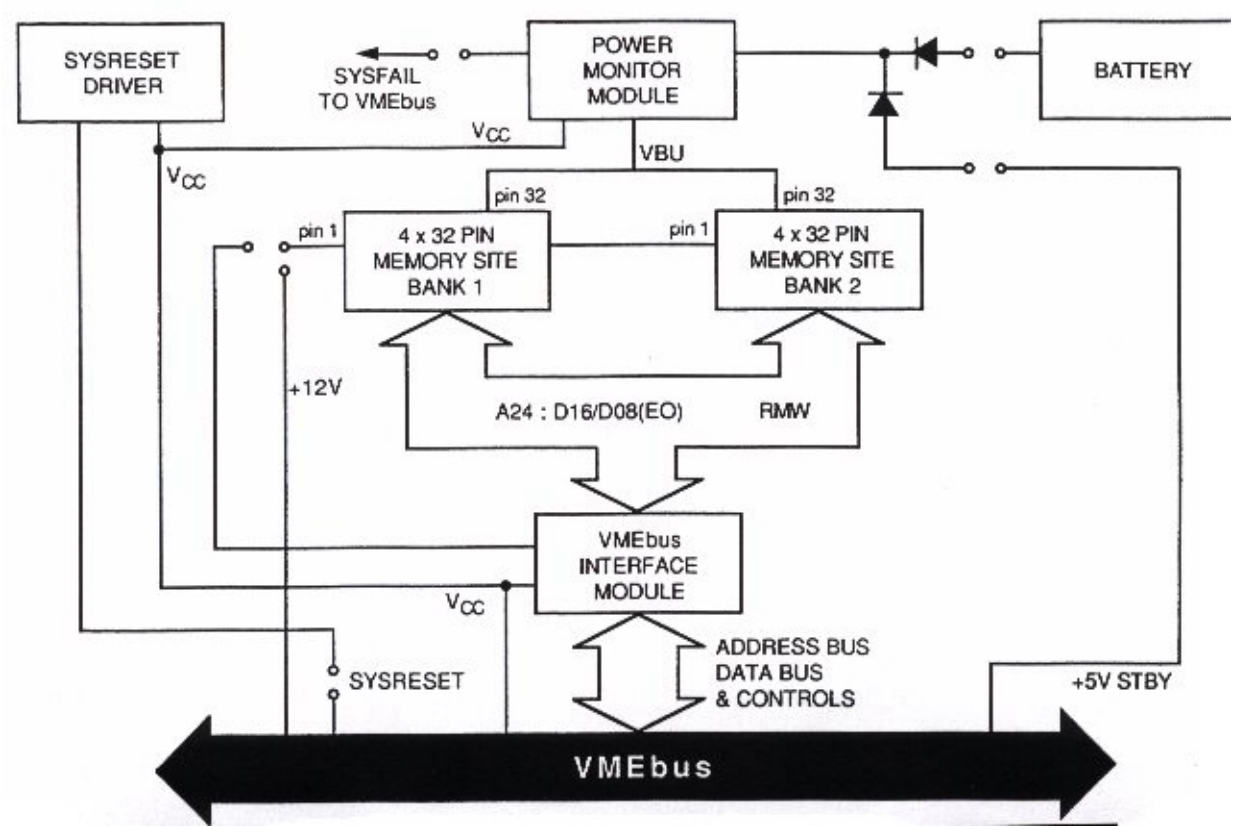


Figure 1-1. Operational Block Diagram

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1.4 SPECIFICATIONS

Table 1-1 lists the XVME-103 Memory Module's Hardware Specifications.

Table 1-1. XVME-103 Memory Module Hardware Specifications

Characteristic	Specification
Maximum Memory Capacity:	2 Banks of 4 sites
RAM	4 Mbytes Total
EPROM	8 Mbytes Total
FLASH	4 Mbytes Total
EEPROM	4 Mbytes Total
Device Sizes Supported:	
RAM	128K by 8 up to 512K by 8
EPROM	128K by 8 up to 1024K by 8
FLASH	128K by 8 up to 512K by 8
EEPROM	128K by 8 up to 512K by 8
Device Speeds Supported:	50, 100, 150, 200 ns
Power Requirements:	+5 V @ .7A typ. .9 A max.
Battery Rating:	1.9 Amp hours
Battery Life:	3.0 years typ. (using a 628128 Hitachi RAM or equivalent device)

VMEbus Compliance

Complies with VMEbus Specifications, IEEE 1014, Rev C.1

- A24:D16/D08(EO)DTB Slave for memory banks
- 4 BUS GRANT INs are connected to their respective BUS GRANT OUTs
- IACKIN is connected to IACKOUT
- SINGLE - 3U Form Factor
- Supports RMW

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Table 1-2 lists the XVME-103 Memory Module's Environmental Specifications.

Table 1-2. Memory Module Environmental Specifications

Characteristic	**Specification**
Temperature:	
Operating	0° to 65° C (32° to 149° F)
Non-operating	-40° to 85° C (-40° to 185° F)
Humidity:	5% to 95% RH non-condensing (Extreme low humidity conditions may require special protection against static discharge)
Altitude:	
Operating	Sea level to 10,000 ft. (3048 m)
Non-Operating	Sea level to 50,000 ft. (15240 m)
Vibration:	
Operating	5 to 2000 Hz .015" peak to peak 2.5 g peak acceleration
Non-operating	5 to 2000 Hz .030" peak to peak 5.0 g peak acceleration
Shock:	
Operating	30 g peak acceleration, 11 msec duration
Non-operating	50 g peak acceleration, 11 msec duration

NOTE

To meet the shock and vibration specifications, you must secure the on-board battery with the Ty-Wrap included with the XVME-103. Refer to Chapter 2 for information on how to secure it.

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2.1 INTRODUCTION

This chapter explains how to configure the XVME-103 Memory Module before installing the module into a VMEbus system. Information on jumper and switch options and locations is also included.

2.2 LOCATION OF COMPONENTS RELEVANT TO INSTALLATION

The jumpers, switches, memory sockets, and the VMEbus P1 connector on the XVME-103 Memory Module are illustrated in Figure 2-1 below.

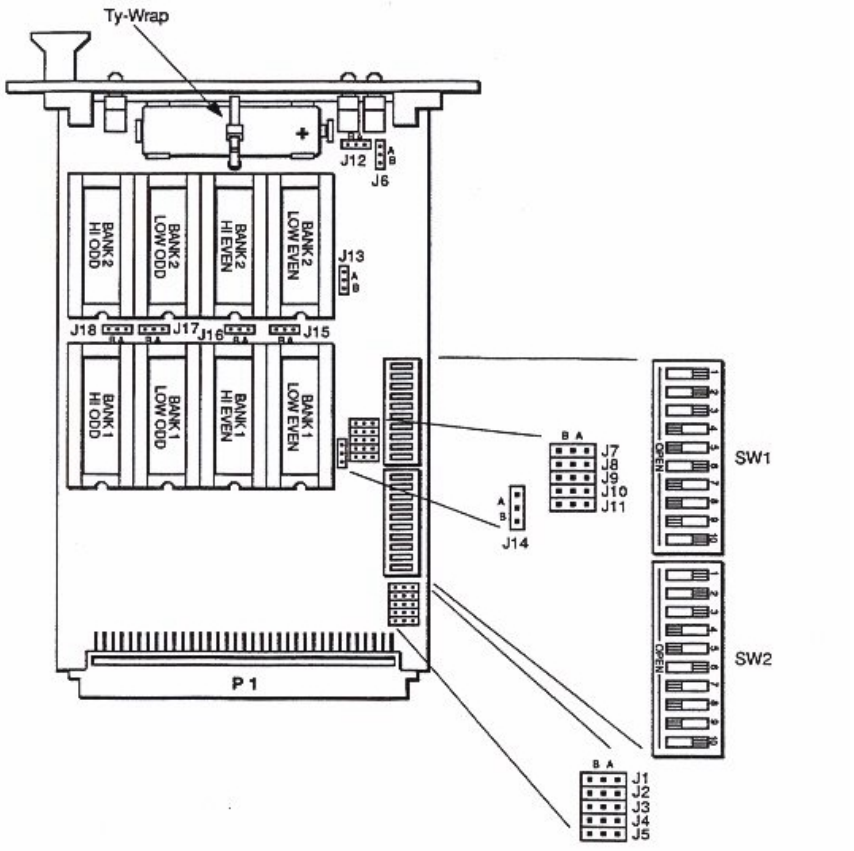


Figure 2-1. Location of Jumpers, Switches, Sockets and Connectors

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2.3 **JUMPER AND SWITCH LIST**

Prior to installing the XVME-103 Memory Module, it is necessary to configure several switch and jumper options. Table 2-1 provides a list of all the switches and jumpers.

Table 2-1. Switch and Jumper List

Switch	**Description**
SW1	Configuration Bank 1, SYSRESET
SW2	Configuration Bank 2, SYSFAIL
Jumper	**Description**
J1	VME Address A23 Bank 2
J2	VME Address A22 Bank 2
J3	VME Address A21 Bank 2
J4	VME Address A20 Bank 2
J5	VME Address A19 Bank 2
J6	+5VSTBY, Alternate Power Source
J7	VME Address A23 Bank 1
J8	VME Address A22 Bank 1
J9	VME Address A21 Bank 1
J10	VME Address A20 Bank 1
J11	VME Address A19 Bank 1
J12	Battery, Alternate Power Source
J13	VCC or VBU Bank 2
J14	VCC or VBU Bank 1
J15	Program FLASH Bank 1
J16	Program FLASH Bank 2
J17	Program FLASH Bank 1
J18	Program FLASH Bank 2

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2.4 JUMPER AND SWITCH DESCRIPTIONS

The two memory banks are independently configurable, via jumpers and switches, to define six different memory module parameters:

- VME Address
- Address Modifier Decode
- Memory Device Speed
- Memory Device Size
- Memory Device Type
- Memory Backup Power Source

The following subsections examine these jumper and switch options in detail, showing specifically when and how jumpers should be configured.

2.4.1 VME Address

Five jumpers exist for each bank (10 total) to define the VMEbus address. Table 2-2 lists the jumpers and their definitions. The bank will occupy a VMEbus address space of four times the memory chip size. The bank must be assigned to a boundary which is a multiple of four times the memory chip size.

Table 2-2. VME Base Address Select Bank 1 & 2

BANK 1								
Base Address Bit	**128K x 8**		**256K x 8**		**512K x 8**		**1024K x 8**	
	= 1	= 0	= 1	= 0	= 1	= 0	= 1	= 0
A23(J7)	A	B	A	B	A	B	A	B
A22(J8)	A	B	A	B	A	B	A	B
A21(J9)	OUT	B	OUT	B	OUT	B	A	A
A20(J10)	OUT	B	OUT	B	A	A	A	A
A19(J11)	OUT	B	A	A	A	A	A	A
BANK 2								
A23(J1)	A	B	A	B	A	B	A	B
A22(J2)	A	B	A	B	A	B	A	B
A21(J3)	OUT	B	OUT	B	OUT	B	A	A
A20(J4)	OUT	B	OUT	B	A	A	A	A
A19(J5)	OUT	B	A	A	A	A	A	A

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2.4.2 **Memory Device Size**

The XVME-103 contains two switch settings per Bank that determine the device size. Table 2-3 shows the memory device size for Banks 1 and 2.

Table 2-3. Memory Device Size (Bank 1 and Bank 2)

BANK 1	**SWITCH 1 POSITION**	
	1	**2**
128K x 8 Devices	Closed*	Closed*
256K x 8 Devices	Closed	Open
512K x 8 Devices	Open	Closed
1024K x 8 Devices	Open	Open
BANK 2	**SWITCH 2 POSITION**	
	1	**2**
128K x 8 Devices	Closed*	Closed*
256K x 8 Devices	Closed	Open
512K x 8 Devices	Open	Closed
1024K x 8 Devices	Open	Open

*XVME-103 factory default configuration

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The following is an example of the jumpers and switch settings required to install 256Kx8 EPROMS in bank 1.

Example:
27020 256Kx8 EPROMs are to be installed in bank 1 with a VMEbus base address of 900000 Hex.

J7 A
J8 B
J9 B
J10 Out
J11 A
Switch 1 Position 1 Closed
Switch 1 Position 2 Open

Bank 1 will reside in memory address: 900000 Hex. through 9FFFFF Hex.

Figure 2-2 shows the memory map for the XVME-103 and Figure 2-3 (on the following page) shows the bank addressing four times the memory chip size.

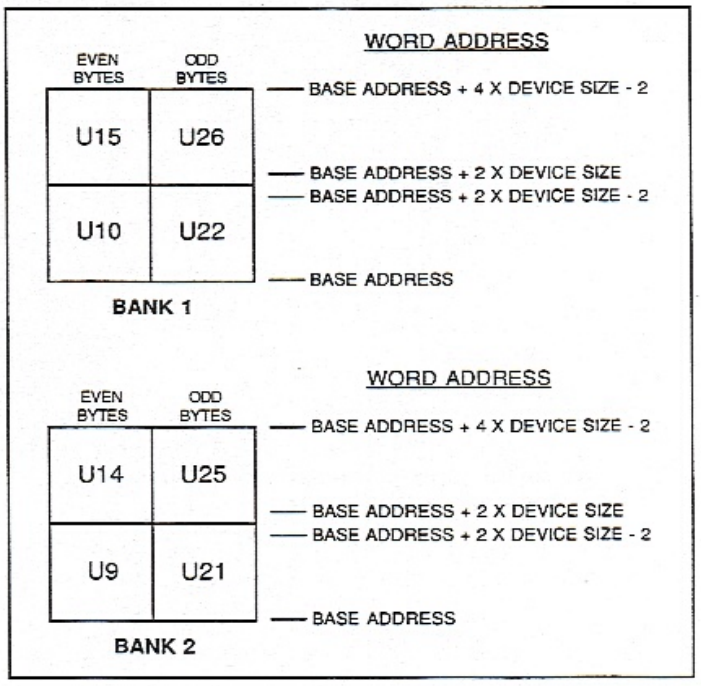


Figure 2-2. XVME-103 Memory Map

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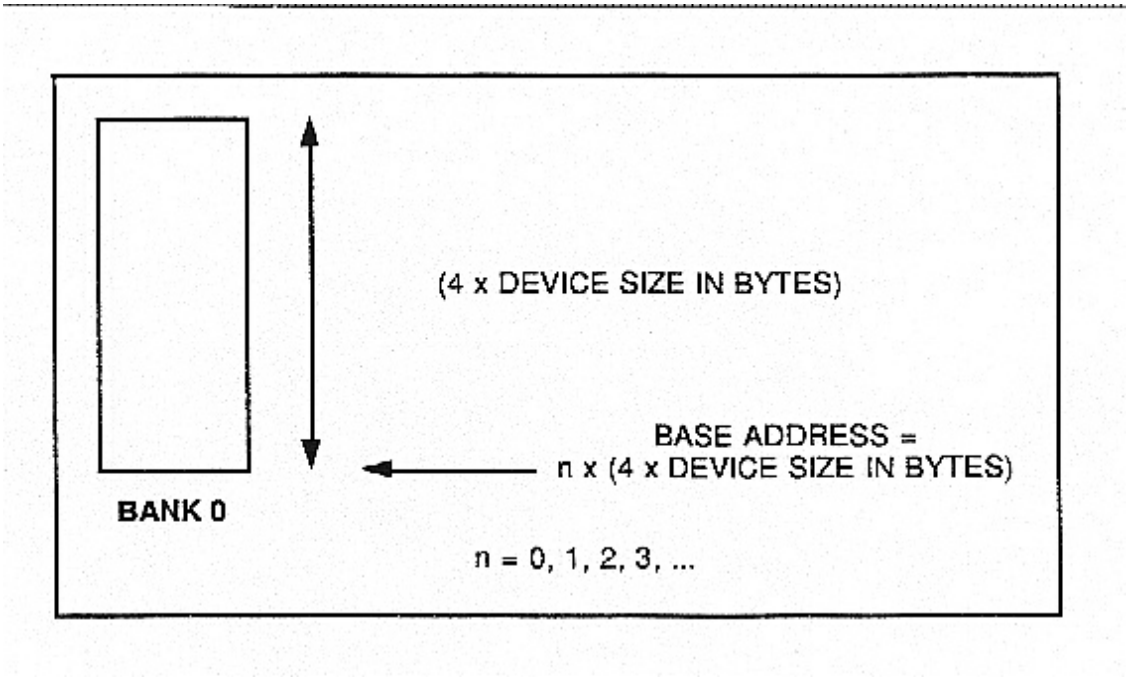


Figure 2-3. Addressing - 4 x Chip Size

2.4.3 **Address Modifier Decode**

The address modifier decode uses three switch settings for each bank (6 total). The first switch setting is privilege select. When the switch is closed, the bank will respond only to supervisor accesses. When open, the bank will respond to supervisor and non-privileged accesses. During each access of a bank, that bank's LED will momentarily light on the front panel.

The second switch setting is program access select. When open, the module will respond to program accesses. When closed, the module does not respond to program accesses.

The third switch setting is data access select. When this switch is open, the bank will respond to data accesses. When closed, the bank does not respond to data accesses.

Table 2-4, on the following page, lists these switch settings and their definitions.

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Table 2-4. Address Modifier Switches

BANK 1
SWITCH 1 POSITION

7 Closed Supervisory only AM2=1
7 Open* Supervisory & non-privileged AM2=no preference

8 Open* Data Access - Responds to address modifier codes 3DH or 39H
8 Closed No Data Access - Will not respond to 3DH or 39H

9 Open* Program Access - Responds to address modifier codes 3EH or 3AH
9 Closed No program access - Will not respond to 3EH or 3AH

BANK 2
SWITCH 2 POSITION

7 Closed Supervisory only AM2=1
7 Open* Supervisory & non-privileged AM2=no preference

8 Open* Data Access - Responds to address modifier codes 3DH or 39H
8 Closed No Data Access - Will not respond to 3DH or 39H

9 Open* Program Access - Responds to address modifier codes 3EH or 3AH
9 Closed No Program Access - Will not respond to 3EH or 3AH

*Factory default configuration

The two switch settings (8 & 9) are independent of one another. When both the data access select and program access select switch positions are closed, the bank is disabled from VMEbus accesses.

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2.4.4 **Memory Device Speed**

Two switch settings exist for each bank to define the speed of the memory devices. Selections are 50, 100, 150, and 200 ns access times. Table 2-5 lists the switches and speed definition for each device.

Table 2-5. Memory Device Speed Switch

BANK 1	**SWITCH 1 POSITION**	
	5	**6**
50 ns	Closed	Closed
100 ns	Closed	Open
150 ns	Open*	Closed*
200 ns	Open	Open
BANK 2	**SWITCH 2 POSITION**	
	5	**6**
50 ns	Closed	Closed
100 ns	Closed	Open
150 ns	Open*	Closed*
200 ns	Open	Open

*XVME-103 factory default configuration

VMEbus access timing is a function of the memory device speed of the bank being accessed. Data strobe asserted to DTACK* asserted will typically be 100 ns plus the chosen access time. Data strobe negated to DTACK* negated will typically be 40 ns.

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2.4.5 **Memory Device Type**

There are two switch settings and five jumpers per Bank on the XVME-103 that determine the device type. These switch settings are listed in Tables 2-6 and 2-7, on the following page.

Table 2-6. Memory Device Pinout Jumpers (Bank 1)

BANK 1					
MEMORY TYPE	**SWITCH 1**		**J15**	**J17**	**J14**
	3	**4**			
EPROM	Closed	Closed	B	B	A
RAM*	Closed*	Open*	B*	B*	A*, B**
+5V FLASH (WR/RD) +12V FLASH (Read)	Open	Closed	B	B	A
EEPROM	Open	Closed	B	B	A
+12V FLASH (Write/Read)	Open	Closed	A	A	A

* Factory Default Configuration
**B if backup source is needed. See Section 2.6 to configure backup source.

Jumpers J15 and J17 are used to supply +12V to the programming pin VPP needed to program +12V FLASH. If +5V FLASH is used or programming will not be done to the +12V FLASH device, the B position must be selected.

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Table 2-7. Memory Device Pinout Jumpers (Bank 2)

BANK 2					
MEMORY TYPE	**SWITCH 2**		**J16**	**J18**	**J13**
	3	**4**			
EPROM	Closed	Closed	B	B	A
RAM*	Closed*	Open*	B*	B*	A*, B**
+5V FLASH (WR/RD) +12V FLASH (RD)	Open	Closed	B	B	A
EEPROM	Open	Closed	B	B	A
+12V FLASH (Write/Read)	Open	Closed	A	A	A

* Factory Default Configuration
**B if backup source is needed. See Section 2.6 to configure backup source.

Jumpers J16 and J18 are used to supply +12V to the programming pin VPP needed to program +12V FLASH. If the +5V FLASH is used or programming will not be done to the +12 FLASH device, the B position must be selected.

NOTE
The XVME-103 does accept +5V FLASH if it conforms to the standard JEDEC pinout, as shown in Figure 2-6.

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Figures 2-4 through 2-6 show the memory chip pinouts for EPROM, SRAM, and FLASH/EEPROM.

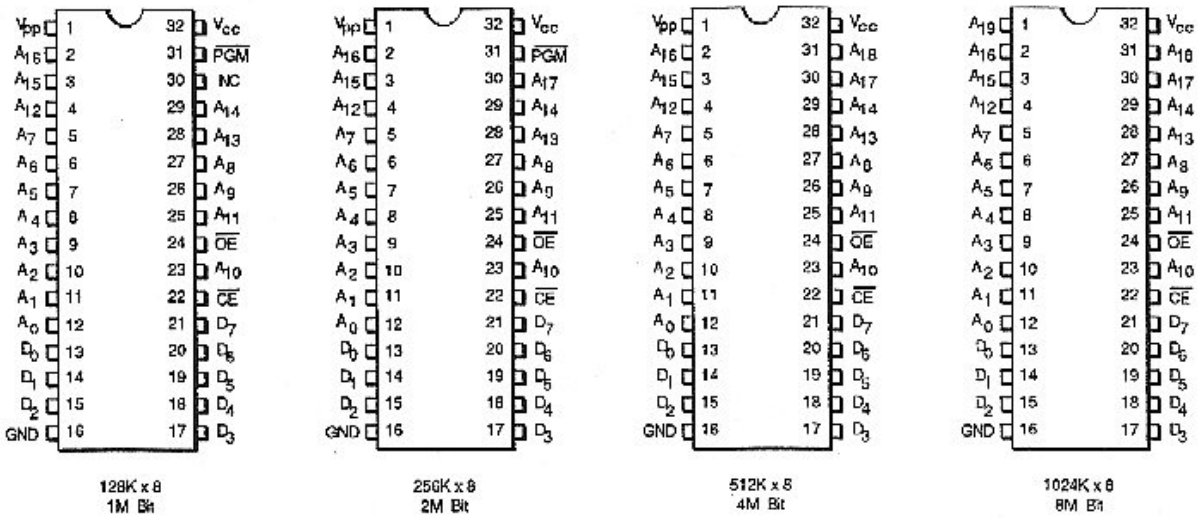
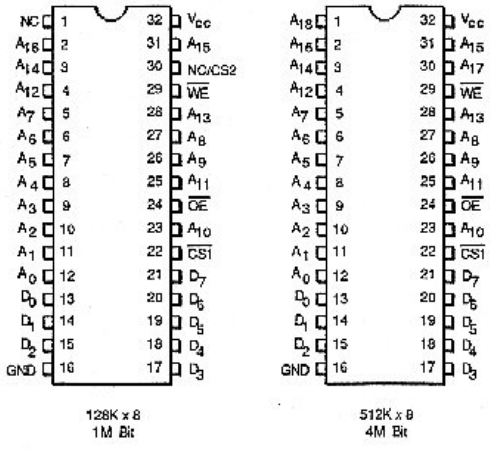


Figure 2-4. EPROM Memory Chip Pinouts



2-5. SRAM Memory Chip Pinouts

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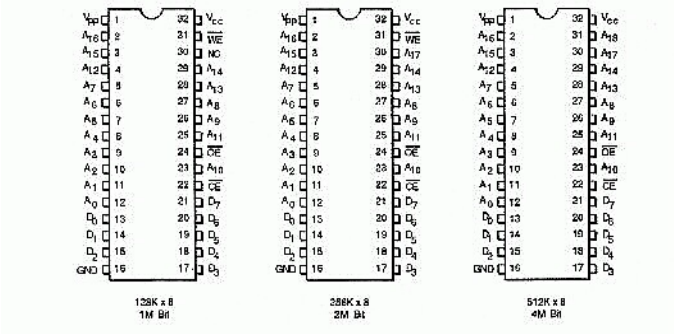


Figure 2-6. FLASH/EEPROM Memory Chip Pinouts

2.4.6 **SYSRESET* Driver**

A SYSRESET* driver is provided to assert SYSRESET* when the power monitor circuitry detects that Vcc is less than 4.65V. To enable the SYSRESET* driver, open switch 1, position 10. To disable the SYSRESET* driver, close switch 1 position 10. Default = switches closed.

2.4.7 **SYSFAIL* Driver**

A SYSFAIL* driver is provided to assert SYSFAIL* when a low battery is detected at power up. A low battery LED on the front panel will also light. To enable the SYSFAIL* driver, open switch 2 position 10. To disable the SYSFAIL* driver, close switch 2 position 10. Any access to either bank will deassert the SYSFAIL* driver once asserted. Default = switches closed.

NOTE
If the SYSFAIL* signal is asserted by the XVME-103, it can be cleared by any access to the board. The low battery LED will remain on even if the SYSFAIL* signal has been deasserted by an access to the XVME-103.

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2.5 INSTALLING MEMORY CHIPS ON THE XVME-103

As previously mentioned, there are a total of eight 32-pin sockets intended for use by RAM, EPROM, FLASH, and EEPROM devices on the XVME-103 Module.

Installing memory in any of the sockets requires setting the proper jumpers and installing the memory devices. This

NOTE
Static precautions should be exercised when handling the memory chips, especially the CMOS RAM chips.

procedure is detailed on the next page.

NOTE
Memory configuration jumpers should be set before installing memory devices.

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- With all power removed from the board, locate the proper socket. Refer to Figure 2-1 for the location of sockets and banks.

- Refer to the notched end of the memory chips as shown in Figure 2-7.

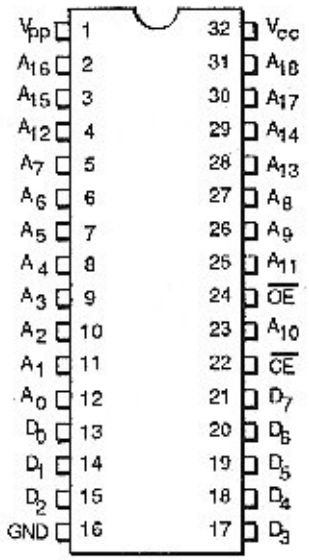


Figure 2-7. Notched End of the Memory Chip

- Line up the pins on each chip with the socket holes found at the inside top of each socket location, and push each chip firmly and evenly into place.

- Check to make sure that the chips are fully seated in the bottom of the sockets, with no pins bent or out of alignment in the sockets.

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2.6 MEMORY BACKUP POWER

During power loss, CMOS RAM chips may have an alternative power source connected to retain the data stored. Two alternative power sources are available: the on board battery or the +5V STDBY signal from the VMEbus. The following chart shows the jumper configuration for each option.

Table 2-8. Jumper Configuration for each Option

Alternative Power Source	J12	J6
None*	A*	OUT*
On-Board Battery	B	OUT
3.6V On +5V STDBY	A	B**
+5V On +5V STDBY	A	A**

**Factory default configuration*

***If +5V STDBY voltage is equivalent to battery voltage of approximately 3.6V, select B. If +5V STDBY voltage is equivalent to VCC voltage of approximately +5V, select A.*

In order to achieve maximum battery life, RAM chips must have a small data retention current. Most static RAM suppliers have chips that guarantee very low data retention currents. To calculate the typical battery life, use the following equation:

$$\text{Hours of battery life} = \frac{1{,}900{,}000}{((n \times IsB) + 22)}$$

where:

IsB = the data retention current required by the particular RAM chips, in micro amperes

n = the number of RAM chips selected to be battery backed

Example:

Hitachi 628128LP-12 RAM chips have a typical IsB of 2uA:

$$\text{Battery Life} = \frac{1{,}900{,}000}{((8 \times 2) + 22)} = 50000 \text{ hours} = 5.7 \text{ years}$$

Each bank can be individually configured to either have or not have backup battery power, as shown by the jumper settings below:

Bank 1
- No backup power = J14A
- Backup power = J14B

Bank 2
- No backup power = J13A

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Backup power = J13B

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If backup power is not needed for either bank, J6 should be in the OUT position and J12 should be in the A position.

If EPROM, FLASH or EEPROM is installed in any bank, the Vcc jumper, (J14A for Bank 1 and J13A for Bank 2) should be installed to prevent drawing current from the alternate power source.

2.7 SECURING THE ON-BOARD BATTERY

After the sockets have been populated, secure the on-board battery with the included Ty-Wrap. Follow the steps below to install the Ty-Wrap (refer to Figure 2-1 to determine placement of the Ty-Wrap).

Insert the pointed end of the Ty-Wrap through the hole adjacent to the battery. The Ty-Wrap should be fed through from the component side of the XVME-103.

Bring the pointed end of the Ty-Wrap up between the edge of the board and the front panel, slipping the pointed end through the sqaure hole in the opposete end of the Ty-Wrap.

Continue to pull the pointed end through the square hold until the Ty-Wrap is tight against the battery. You can cut the Ty-Wrap to remove the excess.

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3.1 INTRODUCTION

This chapter focuses on programming the Real Time Clock (RTC). It gives a complete description of each of the RTC registers, as well as procedures for programming the various functions of the RTC.

The following is a list of Acronyms and Abbreviations used in this chapter.

ACRONYM AND ABBREVIATION LIST

AIE	Alarm Interrupt Enable
AF	Alarm Flag
CIE	Carry Interrupt Enable
CF	Carry Flag
ENB	Enable
RTC	Real Time Clock

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3.2 REAL TIME CLOCK/READABLE BANK INFORMATION PORT

All writes and reads to the Real Time Clock are at odd memory locations (D7-D0). The Real Time Clock uses 16 registers, and the remaining odd memory locations in the 1K address space are shadowed on 32 byte blocks. Table 3-1, shows the location of the registers.

The device type and size for the two banks are readable at even locations (D15-D8) in the same Short I/O address space as the Real Time Clock. This is readable only and is shadowed 1K times. Table 3-1 shows register addressing and Table 3-2 shows data bit definitions.

Table 3-1. Register Addressing

Offset from 1K Base Address	Real Time Clock/Configuration Register
0	Configuration Reg.
1	RTC Register 1
2	Configuration Reg.
3	RTC Register 3
4	Configuration Reg.
5	RTC Register 5
6	Configuration Reg.
7	RTC Register 7
8	Configuration Reg.
9	RTC Register 9
A	Configuration Reg.
B	RTC Register B
C	Configuration Reg.
D	RTC Register D
E	Configuration Reg.
F	RTC Register F
10	Configuration Reg.
11	RTC Register 11
12	Configuration Reg.
13	RTC Register 13
14	Configuration Reg.
15	RTC Register 15
16	Configuration Reg.
17	RTC Register 17
18	Configuration Reg.
19	RTC Register 19
1A	Configuration Reg.
1B	RTC Register 1B
1C	Configuration Reg.
1D	RTC Register 1D
1E	Configuration Reg.
1F	RTC Register 1F
20	Same as 00
21	Same as 01
.	.
.	.
.	.

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Table 3-2. Data Bit Definitions

Bit		Bit Location
D15	Memtypelb	Determines Memory Type Bank 1 (upper bit)
D14	Memtypela	Determines Memory Type Bank 1 (lower bit) 00=EPROM 01=SRAM 10=FLASH/EEPROM
		Determines Memory Size Bank 1 (upper bit)
D13	Memsizelb	Determines Memory Size Bank 1 (lower bit) 00=128K x 8 01=256K x 8 10=512K x 8 11=1024K
D12	Memsizela	x 8
		Determines Memory Type Bank 2 (upper bit)
D11	Memtype2b	Determines Memory Type Bank 2 (lower bit) 00=EPROM 01=SRAM 10=FLASH/EEPROM
D10	Memtype2a	Determines Memory Size Bank 2 (upper bit)
		Determines Memory Size Bank 2 (lower bit) 00=128K x 8 01=256K x 8 10=512K x 8 11=1024K
D9	Memsize2b	x 8
D8	Memsize2a	
D7-D0	Real Time Clock Bits	

3.3 REGISTER MAP

Table 3-3, on the following page, shows the address map of the 16 RTC registers. The registers are accessed on odd-byte addresses, beginning at the base address of the XVME-103 in the VMEbus Short I/O space.

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Table 3-3. RTC Register Map

RTC Reg. Offset	Bit Definitions								Register Name
01h	*	1 Hz	2 Hz	4 Hz	8 Hz	16 Hz	32 Hz	64 Hz	64 Hz Counter
03h	*	c-s_{40}	c-s_{20}	c-s_{10}	c-s_8	c-s_4	c-s_2	c-s_1	Seconds Counter
05h	*	c-mi_{40}	c-mi_{20}	c-mi_{10}	c-mi_8	c-mi_4	c-mi_2	c-mi_1	Minutes Counter
07h	*	*	c-h_{20}	c-h_{10}	c-h_8	c-h_4	c-h_2	c-h_1	Hours Counter
09h	*	*	*	*	*	c-w_4	c-w_2	c-w_1	Day of Week Counter
0Bh	*	*	c-d_{20}	c-d_{10}	c-d_8	c-d_4	c-d_2	c-d_1	Day Counter
0Dh	*	*	*	c-mo_{10}	c-mo_8	c-mo_4	c-mo_2	c-mo_1	Month Counter
0Fh	c-y_{80}	c-y_{40}	c-y_{20}	c-y_{10}	c-y_8	c-y_4	c-y_2	c-y_1	Year Counter
11h	ENB	1 Hz	2 Hz	4 Hz	8 Hz	16 Hz	32 Hz	64 Hz	64 Hz Alarm
13h	ENB	a-s_{40}	a-s_{20}	a-s_{10}	a-s_8	a-s_4	a-s_2	a-s_1	Seconds Alarm
15h	ENB	a-mi_{40}	a-mi_{20}	a-mi_{10}	a-mi_8	a-mi_4	a-mi_2	a-mi_1	Minutes Alarm
17h	ENB	*	a-h_{20}	a-h_{10}	a-h_8	a-h_4	a-h_2	a-h_1	Hours Alarm
19h	ENB	*	*	*	*	a-w_4	a-w_2	a-w_1	Day of Week Alarm
1Bh	ENB	*	a-d_{20}	a-d_{10}	a-d_8	a-d_4	a-d_2	a-d_1	Day Alarm
1Dh	CF	*	*	CIE	AIE	*	*	AF	Control Register A
1Fh	RAM_7	RAM_6	RAM_5	RAM_4	TEST	30 sec ADJ	RESET	Start/ Stop	Control Register B

NOTE
Bits indicated by '*' are unused. These bits are unchanged during write operations and will always read '0' during read operations.

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3.4 REGISTER DESCRIPTIONS

The functions of the bits in the RTC registers are described in detail in the following sections.

3.4.1 64 Hz Counter (RTC Register 01h)

The 64 Hz Counter Register is a read-only register which can be used to gain access to time values with greater resolution than one second. The bits in this register will toggle from '0' to '1' at the indicated frequency. For example, the 2 Hz bit (bit 5) will change from '0' to '1' twice per second.

This register is clocked by an internal 128 Hz source. An internal "carry" occurs each time the 128 Hz clock rolls over, indicating that the data in the 64 Hz Counter Register is changing. The length of the carry operation is 125 µs. If the 64 Hz Counter Register is being read during this time, the Carry Flag (CF) (bit 7 of Control Register A) will be set to '1'. The data read during this time is not valid, so the register must be read again. Refer to the procedure for reading the RTC time in section 3.4.3.

The 64 Hz Counter Register can only be reset using the RESET or 30-sec. ADJ operations. Refer to the description of these bits in Control Register B in section 3.4.7.3

3.4.2 Seconds, Minutes, Hour Counter Registers (RTC Registers 03h, 05h, 07h)

These registers are used to set or read the RTC time of day using the 24-hour system. Each of the registers is encoded in BCD format. For example, 59 seconds is expressed in the Seconds Counter Register as '01011001'.

Similar to the 64 Hz Counter Register, an internal carry will occur in the Seconds Counter Register once each second. The length of the internal carry is 125 µs. If the Seconds Counter Register is being read during this time, the CF (bit 7 of Control Register A) will be set to '1'. The data read during this time is not valid, so the register must be read again. Refer to the procedure for reading the RTC time in section 3.5.3

None of these registers is affected by RESET. The Seconds Counter and Minutes Counter registers are affected by the 30-sec. ADJ operation. Refer to the description of these bits in Control Register B in section 3.4.7.3

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3.4.3 Day of Week Counter Register (RTC Register 09h)

The Day of Week Counter Register is used to set or read the day of the week. The day is encoded with a value from 0 to 6, according to the following chart.

Data	0	1	2	3	4	5	6
Day of Week	Sun.	Mon.	Tue.	Wed.	Thu.	Fri.	Sat.

3.4.4 Day, Month, and Year Counter Registers (RTC Registers 0Bh, 0Dh, 0Fh)

These registers are used to set or read the RTC calendar date. Each of these registers is encoded in BCD format. For example, the 25th day of the month would be encoded in the Day Counter Register as '00100101'.

Only the last two digits of the year are used. Leap years are automatically recognized (Note: A year whose last two digits are a multiple of four is recognized as a leap year).

3.4.5 64 Hz Alarm - Day Alarm Registers (RTC Registers 11h through 1Bh)

These registers are used to set the time at which the RTC triggers an alarm condition. Bit 7 of each of these registers is the register's enable (ENB) bit. If an alarm register's ENB bit is set, the RTC uses that register in its comparison to its corresponding counter register to determine if the alarm time has been reached. Two or more alarm registers may be enabled at a time. When the values in the counter registers match the corresponding values in the enabled alarm registers, the alarm condition is met. This can be thought of as a logical AND of the alarm registers that are enabled. The RTC then sets the Alarm Flag (AF) bit in Control Register A. Since interrupts from the RTC are not used on the XVME-103, the AF bit is the only indication to the host processor that the alarm time has been reached.

3.4.6 Control Register A (RTC Register 1Dh)

CF	*	*	CIE	AIE	*	*	AF

The only bits that are used in this register are the CF and the AF bits. Since interrupts from the RTC are not used on the XVME-103, the Carry Interrupt Enable (CIE) and Alarm Interrupt Enable (AIE) bits are unused and should always be written as '0'.

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3.4.6.1 **Carry Flag (CF)**

The CF bit indicates that an internal carry has overlapped with a read from the 64 Hz Counter Register or a carry occurred from the Seconds Counter Register. After each read operation, the CF bit should be polled to ensure that the data read is valid. If the CF bit is set after a read operation, the data is not valid and must be read again. Refer to the procedure for reading the RTC time in section 3.4.2

The CF bit can be reset by writing a '0' to it during any period except the carry period. A write of '1' to this bit is invalid.

3.4.6.2 **Alarm Flag (AF)**

The AF bit indicates to the host processor that the time specified in the enabled alarm registers has been reached. This bit will remain set as long as the corresponding counter registers match the alarm registers. When the alarm condition is no longer true, the AF bit will automatically be cleared to '0'.

The AF bit may be reset by writing a '0' to it during any period except the alarm period. In other words, writing a '0' to the AF bit while the alarm condition is still true will reset the bit to '0' but only momentarily. The AF bit will be set again immediately due to the alarm condition. A write of '1' to this bit is invalid.

3.4.7 **Control Register B (RTC Register 1Fh)**

RAM_7	RAM_6	RAM_5	RAM_4	TEST	ADJ	RESET	Start/Stop

NOTE
The TEST bit should always be set to '0'. User functions are not guaranteed if the TEST bit has been set to '1'.

The bits in this register are used to control the operation of the RTC. It contains four defined bits which are used to test, adjust, reset, start or stop the counter. The other four bits may be employed by the user as read-write bits to be used as RAM or flag bits.

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3.4.7.1 **RAM**

These bits may be used as RAM or as flag bits at the user's discretion. These are readable/writable bits which retain their state upon power down. These bits may only be used if the TEST bit has been set to '0'.

3.4.7.2 **TEST**

This bit is used to test the RTC at the factory and should always be set to '0' by the user's program. Failure to do so will result in improper operation of the RTC.

3.4.7.3 **ADJ (30-Second Adjust)**

This bit is used to execute the 30-second adjustment feature of the RTC, which can be used to automatically synchronize the RTC to another clock source. When a '1' is written to this bit, the Minutes Counter Register will be adjusted according to the value in the Seconds Counter Register. If the Seconds Counter Register value is less than 30, the Minutes Counter Register is unchanged. Otherwise, a carry will occur in the Minutes Counter Register. The 64 Hz Counter Register and the Seconds Counter Register are both reset to 00h.

After being written to '1', the ADJ bit will remain set for 250 µs while the 30-second adjust operation takes place. The bit will then be reset to '0' automatically.

3.4.7.4 **RESET**

This bit is used to reset the 64 Hz Counter Register to 00h to initialize the dividing circuit. This operation is typically done with the counter stopped in order to set the RTC time and date before restarting the RTC.

After being written to '1', the RESET bit will remain set for 250 µs while the reset operation takes place. The bit will then be reset to '0' automatically.

3.4.7.5 **Start/Stop**

This bit is used to start and stop the RTC. When a '0' is written to this bit, the RTC stops counting. When a '1' is written to this bit, counting begins (or continues).

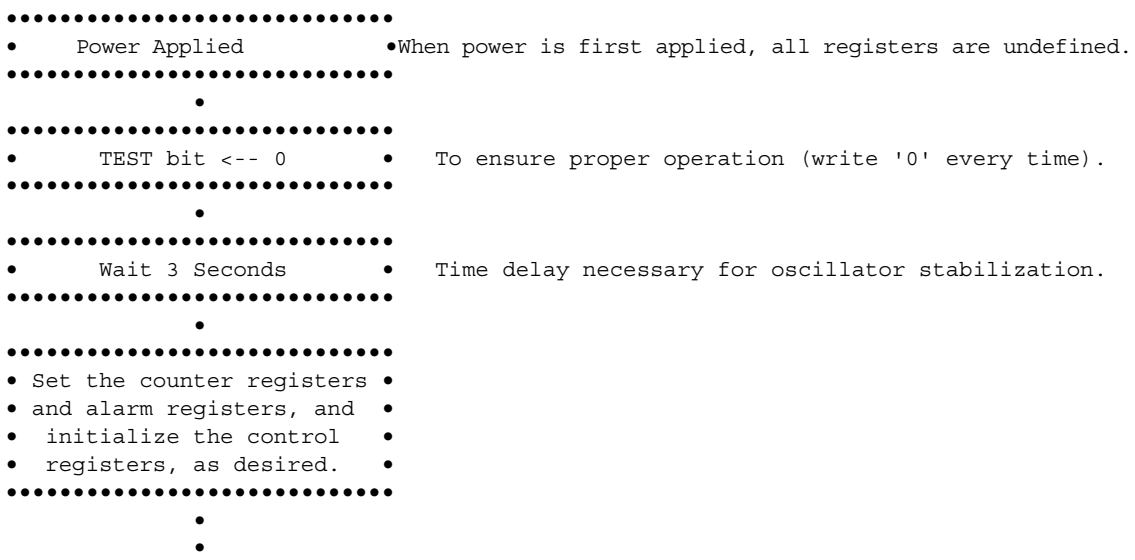
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3.5 PROGRAMMING PROCEDURES

This section describes the programming procedures required for the RTC. Included are procedures for initializing the RTC, setting or reading the RTC, using the alarm function, and using the RTC as a long term timer.

3.5.1 Power-on Initialization

The RTC on the XVME-103 must be initialized after power is first applied to the device. Initialization is only required when the power is initially turned on. As long as battery backup is enabled, the RTC will not need to be initialized after the VMEbus system is powered up. Follow the procedure for initializing the RTC registers as indicated in the flow chart and instructions below.



NOTE
The RTC chip has no hardware means for resetting the registers. Therefore, after power is first applied to the device, all registers must be initialized.

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Follow the procedure below to initialize the RTC after initial power is applied:

1. The TEST bit (bit 3 of Control Register B) is undefined after initial power up. Therefore, calendar/clock operation is also undefined. Set the TEST bit to '0' before continuing with initialization.

2. Delay for 3 seconds before continuing with initialization. This time is required for oscillator stabilization within the RTC chip.

3. Since interrupts from the RTC are not used on the XVME-103, clear the CIE (bit 4 of Control Register A) and AIE (bit 3 of Control Register A) bits to '0'.

4. The Start/Stop bit (bit 0 of Control Register B) is undefined at power-up. This bit should be cleared to '0' to stop the clock in order for the time to be set.

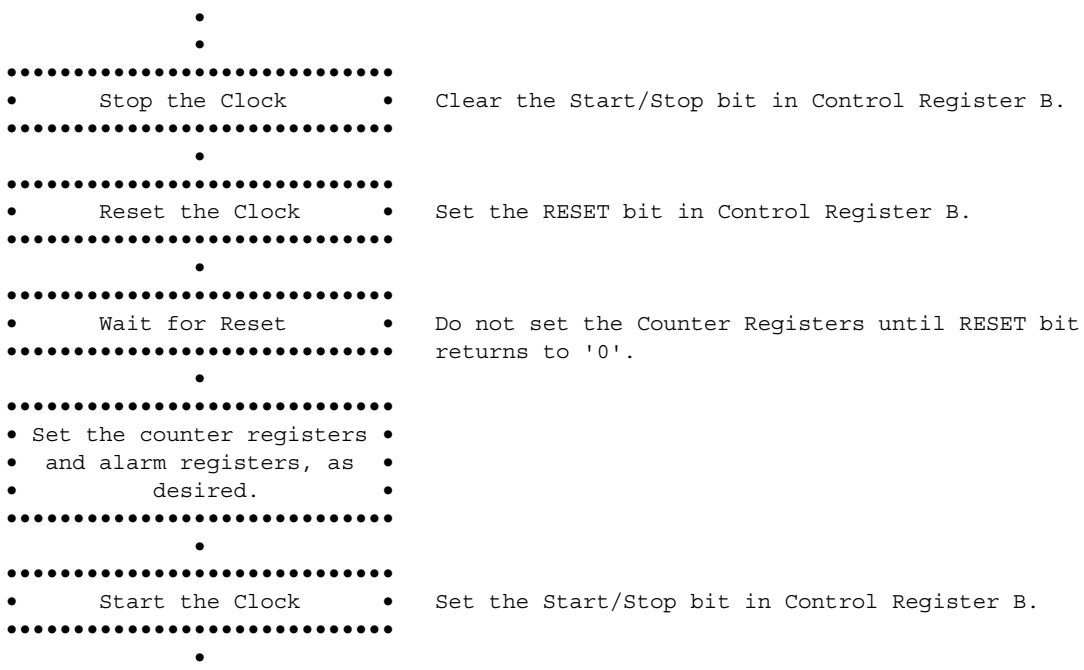
3.5.2 **Time Setting Procedure**

There are two ways that the RTC time can be set. If the date and time are to be set from scratch, the clock should be stopped. This is the easiest way for the RTC time to be set. Alternatively, RTC registers can be set while the clock is running. Both methods are described in the following sections.

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3.5.2.1 **Setting the Time with the RTC Stopped**

If all of the date and time registers need to be set, stopping the clock is the preferred method for initializing the RTC. The procedure for setting the RTC time while it is stopped is described in the flow chart and instructions below.



Follow the procedure below to set the RTC time with the clock stopped:

1. Stop the RTC by clearing the Start/Stop bit (bit 0 of Control Register B) to '0'. The clock will then be stopped, but no registers will be affected.

2. Since the 64 Hz Counter Register is a read-only register, it must be reset with the RESET bit. Reset the 64 Hz Counter Register by setting the RESET bit (bit 1 of Control Register B) to '1'.

3. Wait for the reset operation to conclude by polling the RESET bit until it has been reset to '0'. The RTC automatically clears the RESET bit when the reset operation is complete.

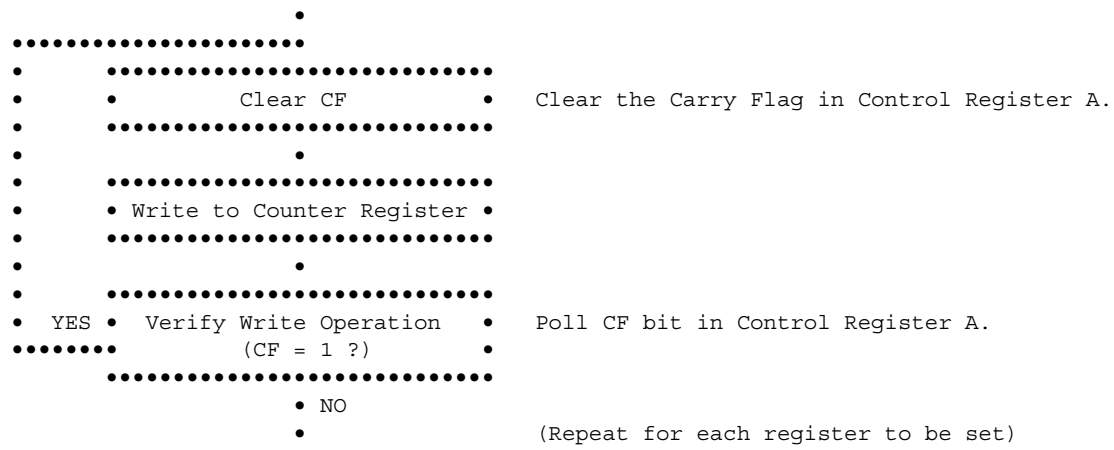
4. Set the Seconds Counter through Year Counter Registers to the desired values. Except for the Day of Week Counter Register, these registers are encoded in BCD format.

5. Start the RTC by setting the Start/Stop bit (bit 0 of Control Register B) to '1'.

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3.5.2.2 **Setting Registers with the RTC Running**

If only one or a few of the date and time registers need to be set, they can be set while the RTC is running. The algorithm is more complicated, involving verification of the write operations by checking the CF. The procedure for setting the RTC time while it is running is described in the flow chart and instructions below.



Follow the procedure below to set the RTC time with the clock running:

1. Clear the CF bit in Control Register A to '0'. Note: To prevent the AF bit from being cleared as well, set the AF bit to '1' for the write operation.

2. Set the desired time or date register by writing to the appropriate counter register (RTC Registers 03h to 0Fh).

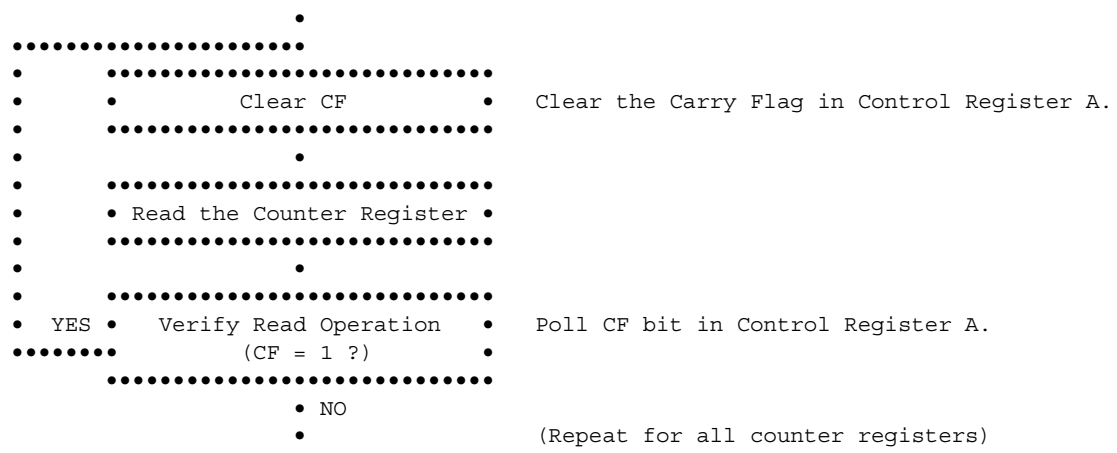
3. Poll the CF bit in Control Register A. If the CF bit is '0', the write operation was successful and the time or date register has been set.

4. If the CF bit is '1', a carry has occurred and the procedure must be repeated. The internal carry period lasts for a maximum of 125 µs. Wait 125 µs before attempting the procedure again. Restart the procedure by clearing the CF bit to '0' (Step 1).

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3.5.3 **Time Reading Procedure**

The following flow chart and instructions demonstrate the procedure for reading the RTC time and date. Reading the RTC time and date requires the use of the CF to validate the data read from the counter registers.



Follow the procedure below to read the RTC time and date:

1. Since interrupts are not used, there is no need to be concerned with handling an interrupt from a carry operation. (The CIE and AIE bits in Control Register A should always be written with '0').

2. Clear the CF bit in Control Register A to '0'. Note: To prevent the AF bit from being cleared as well, set the AF bit to '1' for the write operation.

3. Read the desired time or date register by reading from the appropriate counter register (RTC Registers 03h to 0Fh).

4. Poll the CF bit in Control Register A. If the CF bit is '0', the read operation was successful and the time or date register data is valid.

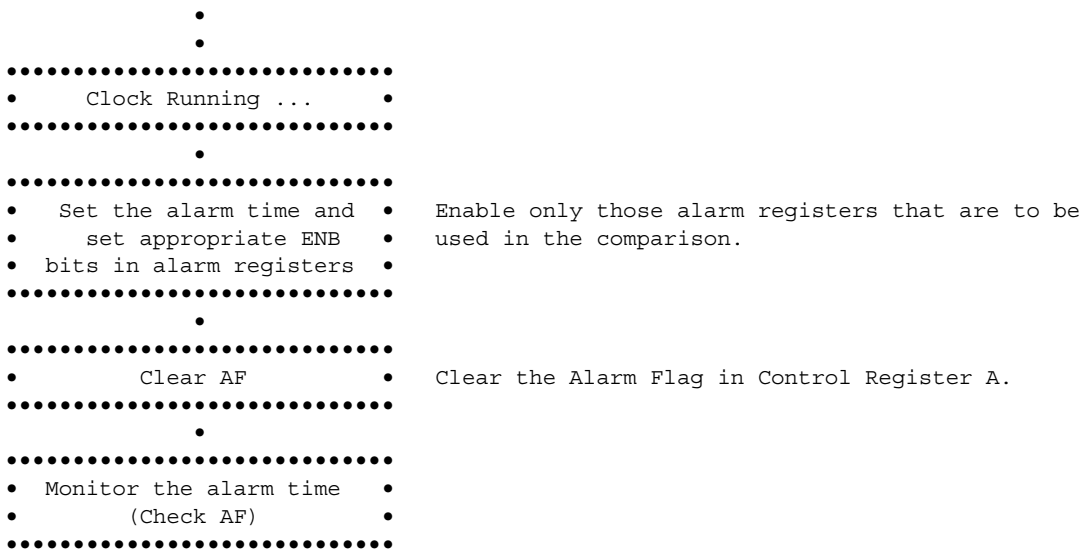
5. If the CF bit is '1', a carry has occurred and the procedure must be repeated. The internal carry period lasts for a maximum of 125 µs. Wait 125 µs before attempting the procedure again. Restart the procedure by clearing the CF bit to '0' (Step 2).

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3.5.4 **RTC Alarm Function**

The RTC alarm function can be used to determine when the RTC time has reached a specified time, without having to read the entire set of RTC registers. The alarm time is specified by the user, and when the RTC time reaches the alarm time, the AF is set. The alarm registers (64 Hz, Seconds, Minutes, Hours, Day of Week, and Day) each have an enable (ENB) bit which controls whether that register is used in the comparison. Two or more alarm registers may be enabled simultaneously.

The following flow chart and instructions demonstrate the procedure for setting up the RTC alarm function.



Follow the procedure below to setup and monitor the alarm function:

1. Since interrupts are not used, there is no need to be concerned with handling an interrupt from a the alarm function. (The AIE and CIE bits in Control Register A should always be written with '0').

2. Determine which of the alarm registers needs to be used in the comparison. For those registers, set the desired alarm time and set the ENB bit to '1'.

3. Clear the AF bit in Control Register A to '0'. Note: To prevent the CF bit from being cleared as well, set the CF bit to '1' for the write operation.

4. Monitor the AF bit in Control Register A until it becomes set to '1'. When this occurs, the alarm time has been reached. The AF bit will remain set as long as the RTC time matches the alarm time. The AF bit can be cleared by writing a '0' to it, but will be set again immediately if the alarm condition is still met. To avoid this, either set the alarm time to a different time, or clear all of the ENB bits of the alarm registers.

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3.5.5 **Application as a Long Term Timer**

The RTC can be used as a long-term timer and will keep accurate track of the year, month and day. If used in this application, setting the correct date is required. The RTC will properly handle the number of days in each of the twelve months, including leap years.

> **NOTE**
> A year whose lower two digits are divisible by four is recognized as a leap year.

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A.1 VMEBUS SIGNAL IDENTIFICATION

Table A-1 (on pages 1 through 5) shows the VMEbus Signal Identification. Table A-2, on page 6, shows the Backplane P1 pin assignments.

Table A-1. VMEbus Signal Identification

Signal Mnemonic	Connector and Pin Number	Signal Name and Description
ACFAIL*	1B:3	AC FAILURE: Open-collector driven signal which indicates that the AC input to the power supply is no longer being provided, or that the required input voltage levels are not being met.
IACKIN*	1A:21	INTERRUPT ACKNOWLEDGE IN: Totem-pole driven signal. IACKIN* and IACKOUT* signals form a daisy-chained acknowledge. The IACKIN* signal indicates to the VME board that an acknowledge cycle is in progress.
IACKOUT*	1A:22	INTERRUPT ACKNOWLEDGE OUT: Totem-pole driven signal. IACKIN* and IACKOUT* signals form a daisy-chained acknowledge. The IACKOUT* signal indicates to the next board that an acknowledge cycle is in progress.
AM0-AM5	1A:23 1B:16, 17 18, 19 1C:14	ADDRESS MODIFIER (bits 0-5): Three-state driven lines that provide additional information about the address bus, such as: size, cycle type, and/or DTB master identification.
AS*	1A:18	ADDRESS STROBE: Three-state driven signal that indicates a valid address is on the address bus.

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Table A-1. VMEbus Signal Identification (Continued)

Signal Mnemonic	Connector and Pin Number	Signal Name and Description
A01-A23	1A:24-30 1C:15-30	ADDRESS BUS (bits 1-23): Three-state driven address lines that specify a memory address.
A24-A31	2B:4-11	ADDRESS BUS (bits 24-31): Three-state driven bus expansion address lines.
BBSY*	1B:1	BUS BUSY: Open-collector driven signal generated by the current DTB master to indicate that it is using the bus.
BCLR*	1B:2	BUS CLEAR: Totem-pole driven signal generated by the bus arbitrator to request release by the DTB master if a higher level is requesting the bus.
BERR*	1C:11	BUS ERROR: Open-collector driven signal generated by a slave. It indicates that an irrecoverable error has occurred and the bus cycle must be aborted.
BG0IN* - BG2IN*	1B:4,6, 8,10	BUS GRANT (0-3) IN: Totem-pole driven signals generated by the Arbiter or Requesters. Bus Grant In and Out signal indicates to this board that it may become the next bus master.
BG0OUT* - BG3OUT*	1B:5,7, 9,11	BUS GRANT (0-3) OUT: Totem-pole driven signals generated by Requesters. These signals indicate that a DTB master in the daisy-chain requires access to the bus.

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Table A-1. VMEbus Signal Identification (Continued)

Signal Mnemonic	Connector and Pin Number	Signal Name and Description
BR0*-BR3*	1B:12-15	BUS REQUEST (0-3): Open-collector driven signals generated by Requesters. These signals indicate that a DTB master in the daisy-chain requires access to the bus.
DS0*	1A:13	DATA STROBE 0: Three-state driven signal that indicates during byte and word transfers that a data transfer will occur on data bus lines (D00-D07).
DS1*	1A:12	DATA STROBE 1: Three-state driven signal that indicates during byte and word transfers that a data transfer will occur on data bus lines (D0-D15).
DTACK*	1A:16	DATA TRANSFER ACKNOWLEDGE: Open-collector driven signal generated by a DTB slave. The falling edge of this signal indicated that valid data is available on the data bus during a read cycle, or that data has been accepted from the data bus during a write cycle.
D00-D15	1A:1-8 1C:1-8	DATA BUS (bits 0-15): Three-state driven, bi-directional data lines that provide a data path between the DTB master and slave.
GND	1A:9,11, 15,17,19, 1B:20,23 1C:9 2B:2,12, 22,31	GROUND

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Table A-1. VMEbus Signal Identification (Continued)

Signal Mnemonic	Connector and Pin Number	Signal Name and Description
IACK*	1A:20	INTERRUPT ACKNOWLEDGE: Open-collector or three-state driven signal from any master processing an interrupt request. It is routed via the backplane to slot 1, where it is looped-back to become slot 1 IACKIN* in order to start the interrupt acknowledge daisy-chain.
IRQ1* IRQ7*	1B:24-30	INTERRUPT REQUEST (1-7): Open-collector driven signals, generated by an interrupter, which carry prioritized interrupt requests. Level seven is the highest priority.
LWORD*	1C:13	LONGWORD: Three-state driven signal indicates that the current transfer is a 32-bit transfer.
(RESERVED)	2B:3	RESERVED: Signal line reserved for future VMEbus enhancements. This line must not be used.
SERCLK	1B:21	A reserved signal which will be used as the clock for a serial communication bus protocol which is still being finalized.
SERDAT	1B:22	A reserved signal which will be used as a transmission line for serial communication bus messages.
SYSCLK	1A:10	SYSTEM CLOCK: A constant 16-MHz clock signal that is independent of processor speed or timing. It is used for general system timing use.

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Table A-1. VMEbus Signal Identification (Continued)

Signal Mnemonic	Connector and Pin Number	Signal Name and Description
SYSFAIL*	1C:10	SYSTEM FAIL: Open-collector driven signal that indicates that a failure has occurred in the system. It may be generated by any module on the VMEbus.
SYSRESET*	1C:12	SYSTEM RESET: Open-collector driven signal which, when low, will cause the system to be reset.
WRITE*	1A:14	WRITE: Three-state driven signal that specifies the data transfer cycle in progress to be either read or written. A high level indicates a read operation, a low level indicates a write operation.
+5V STDBY	1B:31	+5 VDC STANDBY: This line supplies +5 VDC to devices requiring battery backup.
+5V	1A:32 1B:32 1C:32 2B:1,13,32	+5 VDC POWER: Used by system logic circuits.
+12V	1C:31	+12 VDC POWER: Used by system logic circuits.
-12V	1A:31	-12 VDC POWER: Used by system logic circuits.

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A.2 BACKPLANE CONNECTOR P1

The following table lists the P1 pin assignments by pin number order. (The connector consists of three rows of pins labeled rows A, B, and C.)

Table A-2. P1 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(1)	A17
22	IACKOUT*	SERDAT(1)	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

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Tables B-1, B-2, B-3, and B-4 list the jumpers, switch bits, and their function.

Table B-1. Bank 1 Configuration Switches

Bank 1		
Switch 1		
Switch Position	**Description**	**1=Open, 0=Closed**
1 2	Bank 1 Memory Size (Upper Bit) Bank 1 Memory Size (Lower Bit)	00=128K x 8 01=256K x 8 10=512K x 8 11=1024K x 8
3 4	Bank 1 Memory Type (Upper Bit) Bank 1 Memory Select (Lower Bit)	00=EPROM 01=SRAM 10=FLASH/EEPROM
5 6	Bank 1 Speed Select (Upper Bit) Bank 1 Speed Select (Lower Bit)	00=50 NS Access 01=100 NS Access 10=150 NS Access 11=200 NS Access
7 8 9	Bank 1 Supr/Nonpriv Select Bank 1 Data Access Bank 1 Program Access	0=Supr 1=Supr/Nonpriv 1=Respond to Prog. Acc 0=Don't Respond 1=Respond to Data Acc 0=Don't Respond

J14 is used to select VBU or VCC to the power pin (pin 32)

VCC = A pos VBU = B pos

J15 and J17 are used to supply +12V to the programming pin VPP needed to program FLASH. If FLASH is not used or programming will not be done to the device, select the A position.

+12V = B position

else = A position

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Table B-2. VME Base Address Select Bank 1

BANK 1								
Base Address Bit	**128K x 8**		**256K x 8**		**512K x 8**		**1024K x 8**	
	= 1	= 0	= 1	= 0	= 1	= 0	= 1	= 0
A23(J7)	A	B	A	B	A	B	A	B
A22(J8)	A	B	A	B	A	B	A	B
A21(J9)	OUT	B	OUT	B	OUT	B	A	A
A20(J10)	OUT	B	OUT	B	A	A	A	A
A19(J11)	OUT	B	A	A	A	A	A	A

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Table B-3. Bank 2 Configuration Switches

Bank 2		
Switch 2		
Switch Position	**Description**	**1=Open, 0=Closed**
1 2	Bank 2 Memory Size (Upper Bit) Bank 2 Memory Size (Lower Bit)	00=128K x 8 01=256K x 8 10=512K x 8 11=1024K x 8
3 4	Bank 2 Memory Type (Upper Bit) Bank 2 Memory Type (Lower Bit)	00=EPROM 01=SRAM 10=FLASH/EEPROM
5 6	Bank 2 Speed Select (Upper Bit) Bank 2 Speed Select (Lower Bit)	00=50 NS Access 01=100 NS Access 10=150 NS Access 11=200 NS Access
7 8 9	Bank 2 Supr/Nonpriv Select Bank 2 Data Access Bank 2 Program Access	0=Supr 1=Supr/Nonpriv 1=Respond to Prog. Acc 0=Don't Respond 1=Respond to Data Acc 0=Don't Respond

J13 is used to select VBU or VCC to the power pin (pin 32)

VBU = A pos VCC = B pos

J16 and J18 are used to supply +12V to the programming pin VPP needed for +12V FLASH to program. If FLASH is not used or programming will not be done to device, select the A position.

+12V = B position
else = A position

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Table B-4. VME Base Address Select Bank 2

BANK 2								
Base Address Bit	**128K x 8**		**256K x 8**		**512K x 8**		**1024K x 8**	
	= 1	= 0	= 1	= 0	= 1	= 0	= 1	= 0
A23(J1)	A	B	A	B	A	B	A	B
A22(J2)	A	B	A	B	A	B	A	B
A21(J3)	OUT	B	OUT	B	OUT	B	A	A
A20(J4)	OUT	B	OUT	B	A	A	A	A
A19(J5)	OUT	B	A	A	A	A	A	A

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Table B-5 shows the jumper configuration for battery backup options.

Table B-5. Jumper Configuration

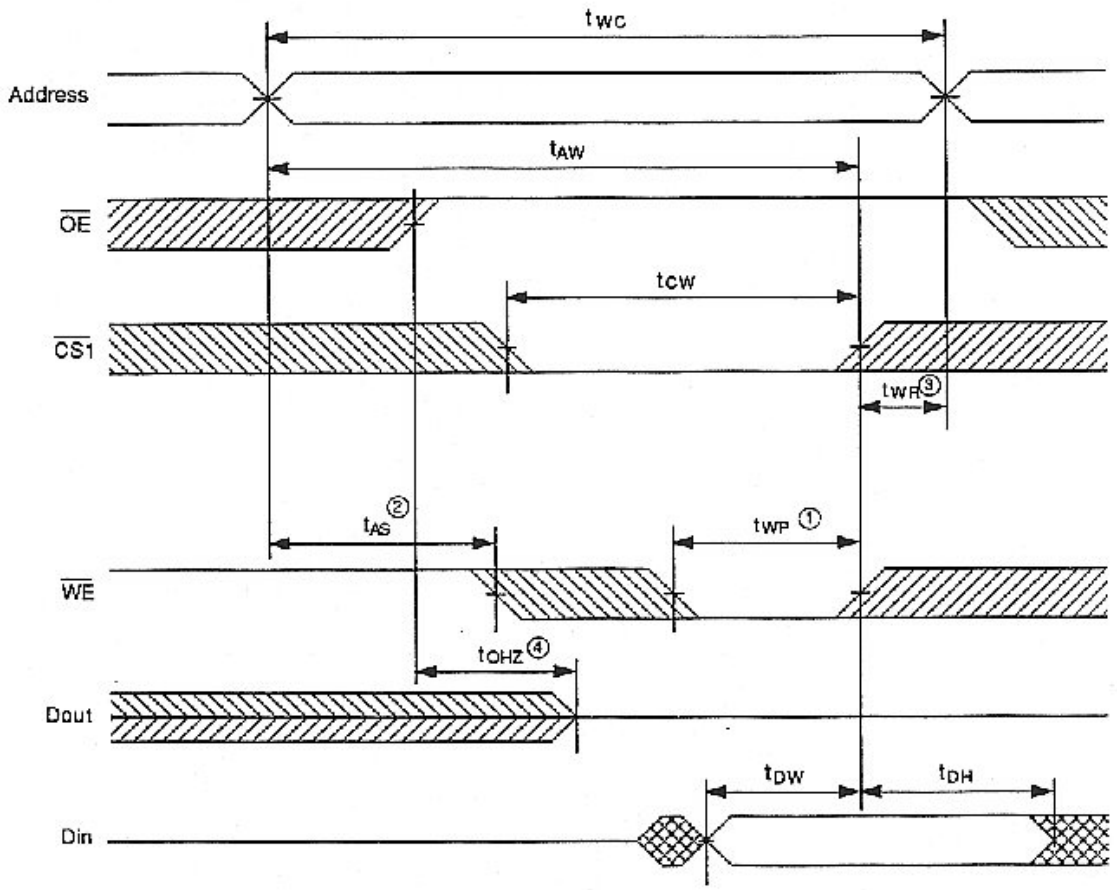
Alternative Power Supply	J12	J6
None*	A*	OUT*
Battery	B	OUT
3.6V On +5V Standby	A	B
+5V On +5V Standby	A	A

*Factory shipped configuraton

Table B-6. Device Parameters For Memory Sites Banks 1 and 2

RAM Device Parameter Must be		Chosen Access Times			
		50_2NS	**100_3NS**	**150_4NS**	**200_5NS**
t_{CO}	≤	50	100	150	200
t_{AA}	≤	79.5	129.5	179.5	235.5
t_{OE}	≤	65.5	115.5	165.5	229.5
t_{OLZ}	≥	0	0	0	0
t_{OHZ}	≤	47.5	47.5	47.5	47.5
t_{RC}	≤	50	100	150	200
t_{AS}	≤	16	16	16	16
t_{AW}	≤	74	124	174	224
t_{CW}	≤	45	95	145	195
t_{WP}	≤	60	110	160	210
t_{WR}	≤	12.5	12.5	12.5	12.5
t_{DH}	≤	9.5	9.5	9.5	9.5
t_{DW}	≤	50.5	100.5	150.5	200.5
t_{WC}	≤	50	100	150	200

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1 A write occurs during the overlap of a low CS1 and a low WE. A write begins at the latest transition among CS1 going low, and WE going low. A write ends at the earliest transition among CS1 going high, and WE going high. Twp is measured from the beginning of write to the end of write.

2 Tas is measured from the address valid at the beginning of write.

3 Twr is measured from the earliest of CS1 or WE going high to the end of the write cycle.

4 During this period, I/O pins are in output state; therefore, the input signals of the opposite phase to the outputs must not be applied.

Figure B-1. Write Timing Waveform

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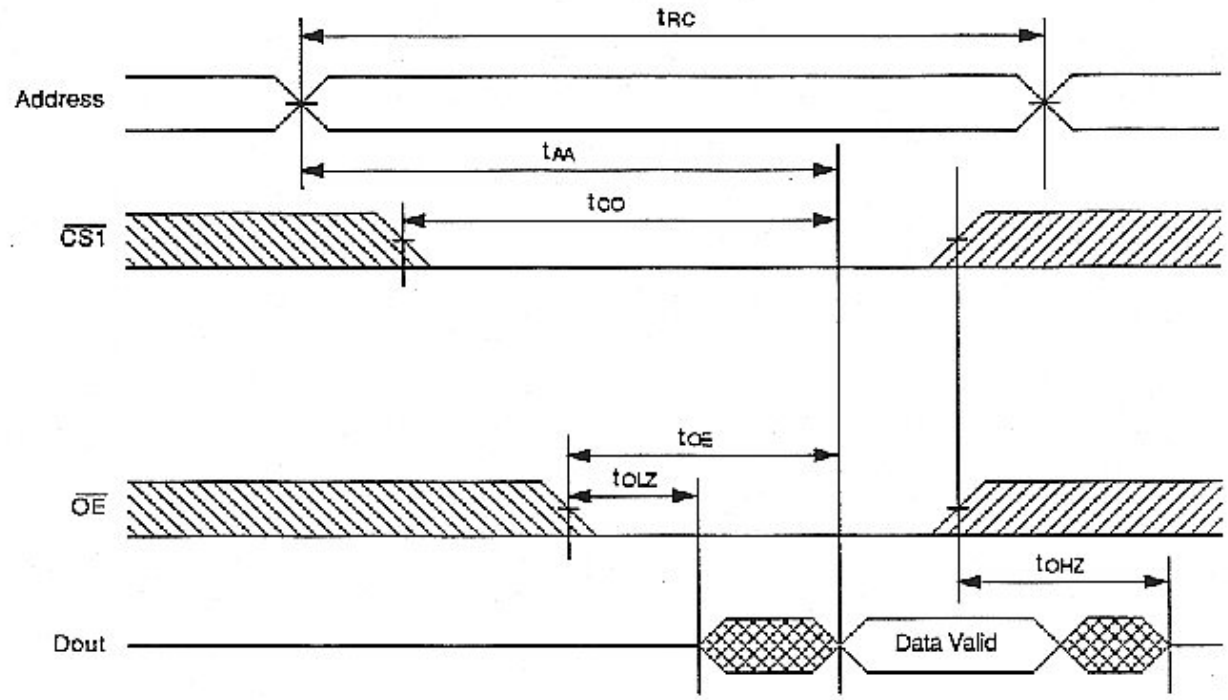


Figure B-2. Read Timing Waveform

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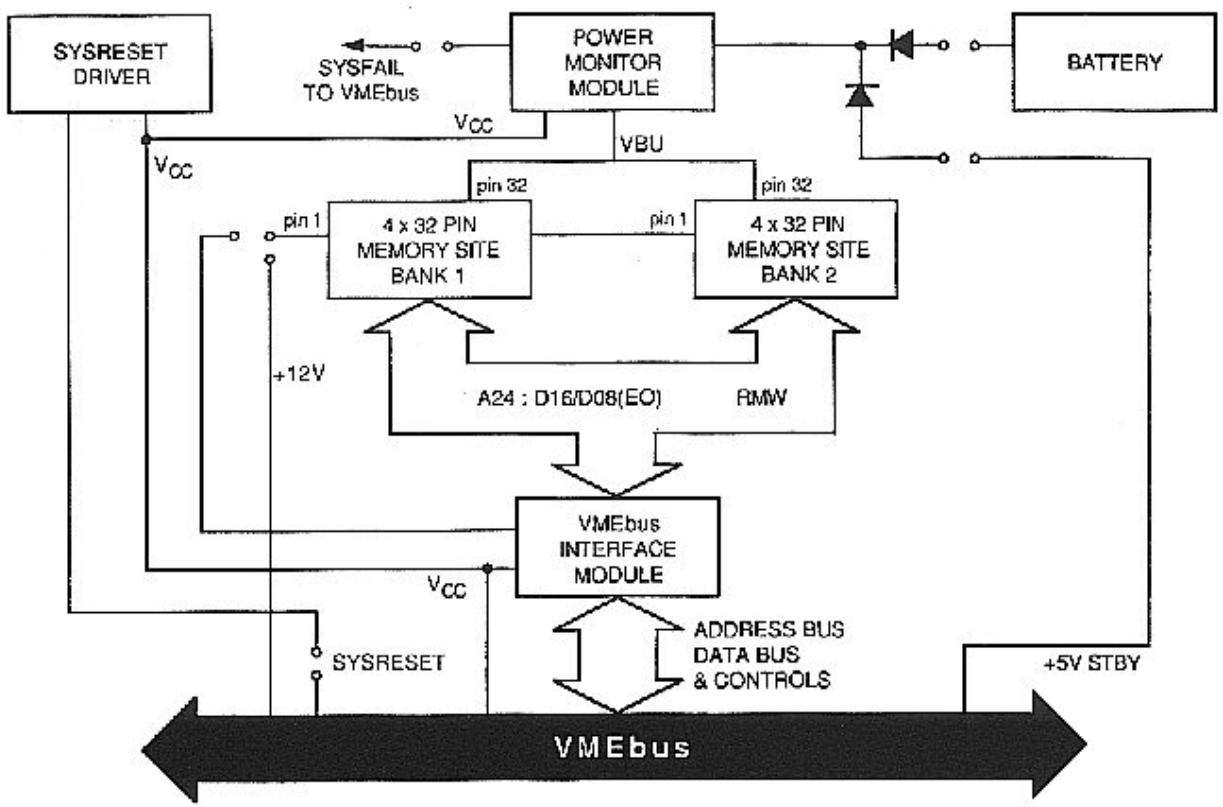


Figure C-1. XVME-113 Block Diagram

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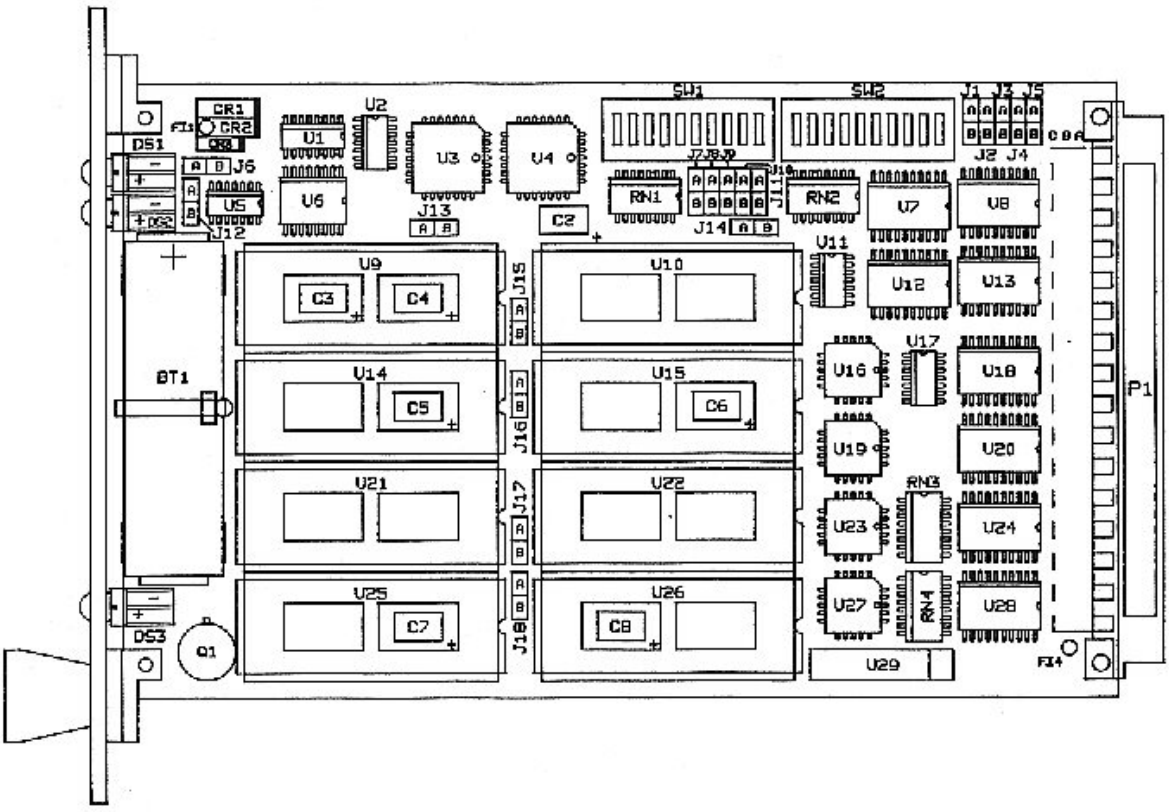
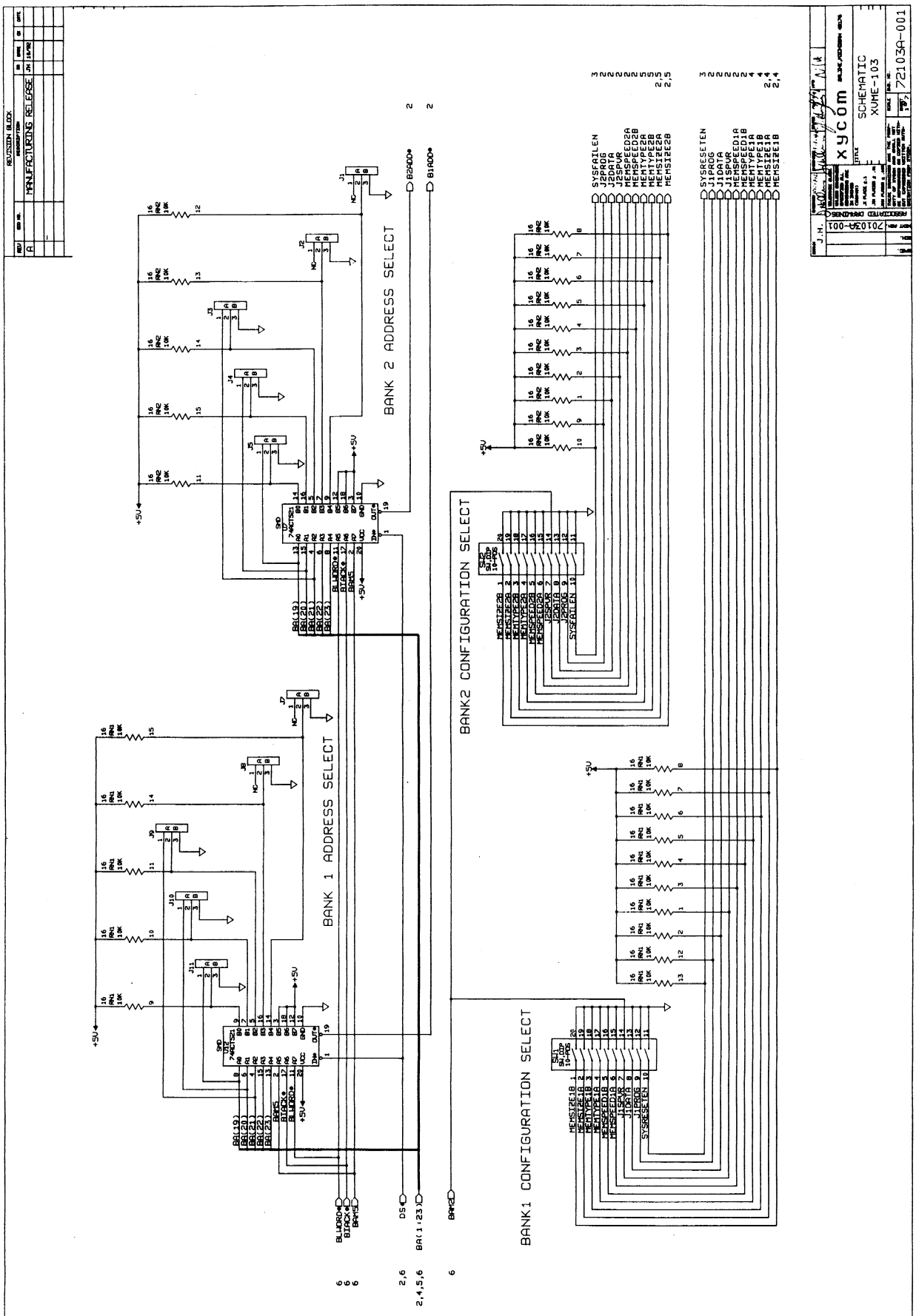


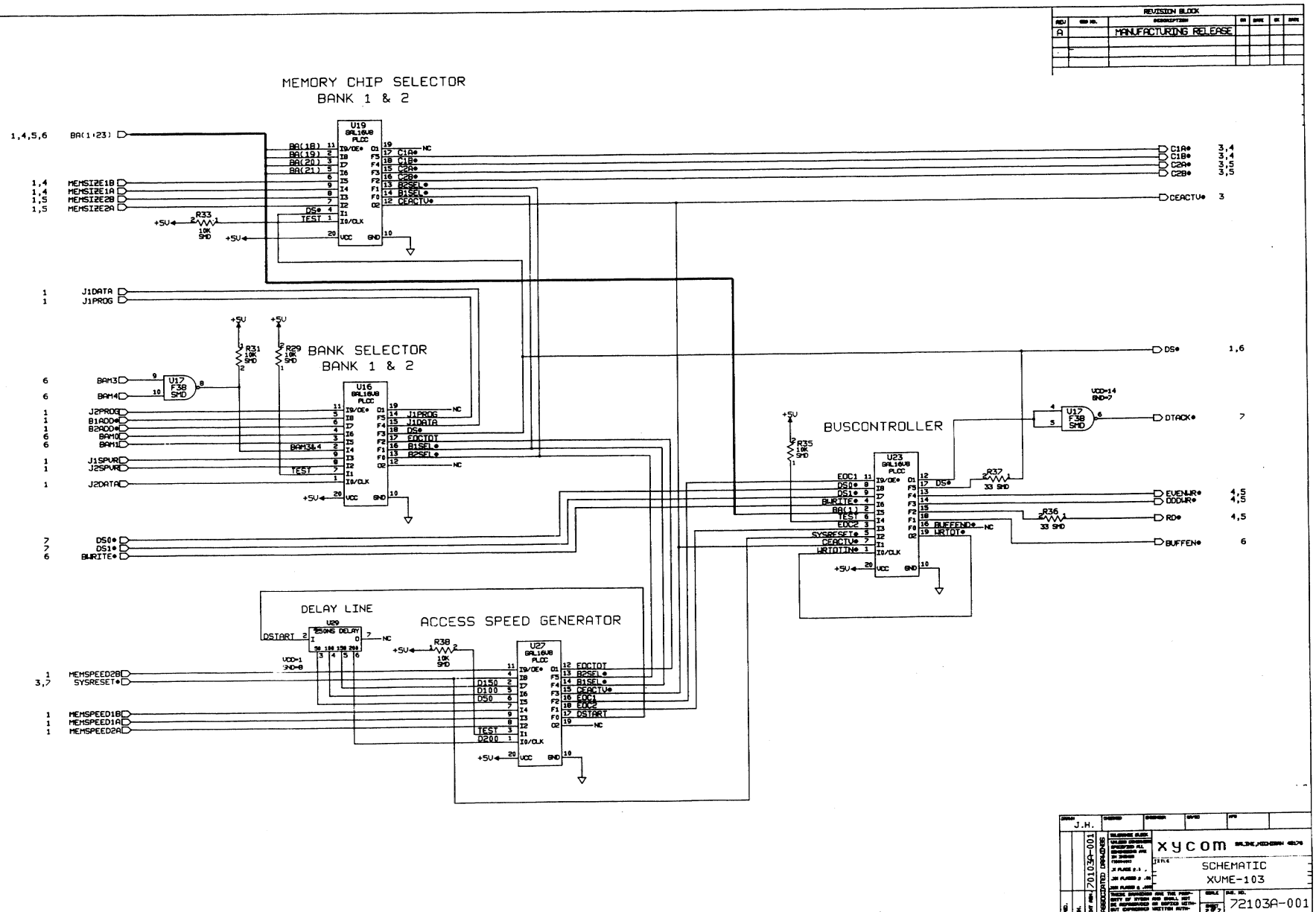
Figure C-2. Assembly Drawing

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XVME-103 Schematic, Sheet 1 of 7

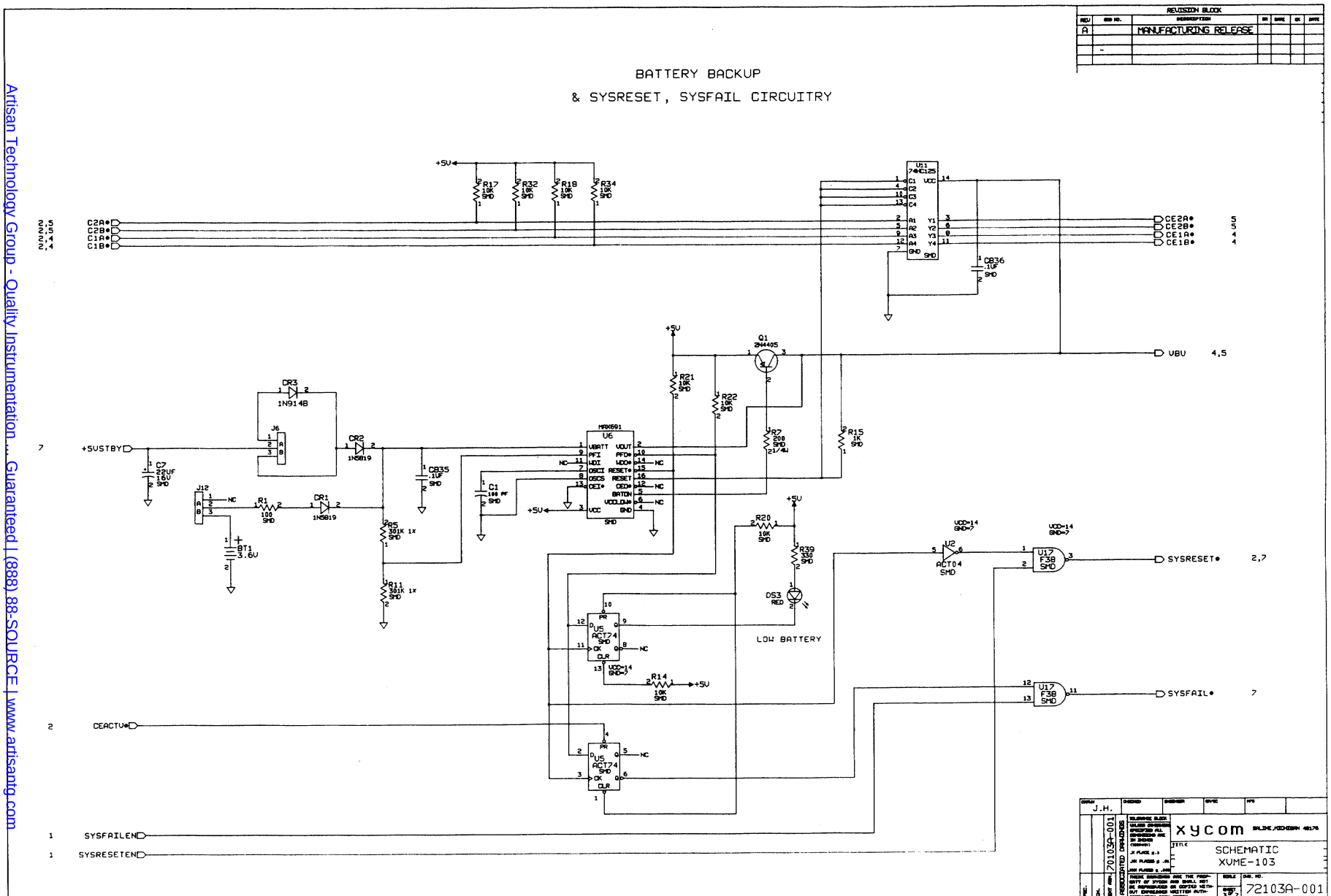
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XVME-103 Schematic, Sheet 2 of 7

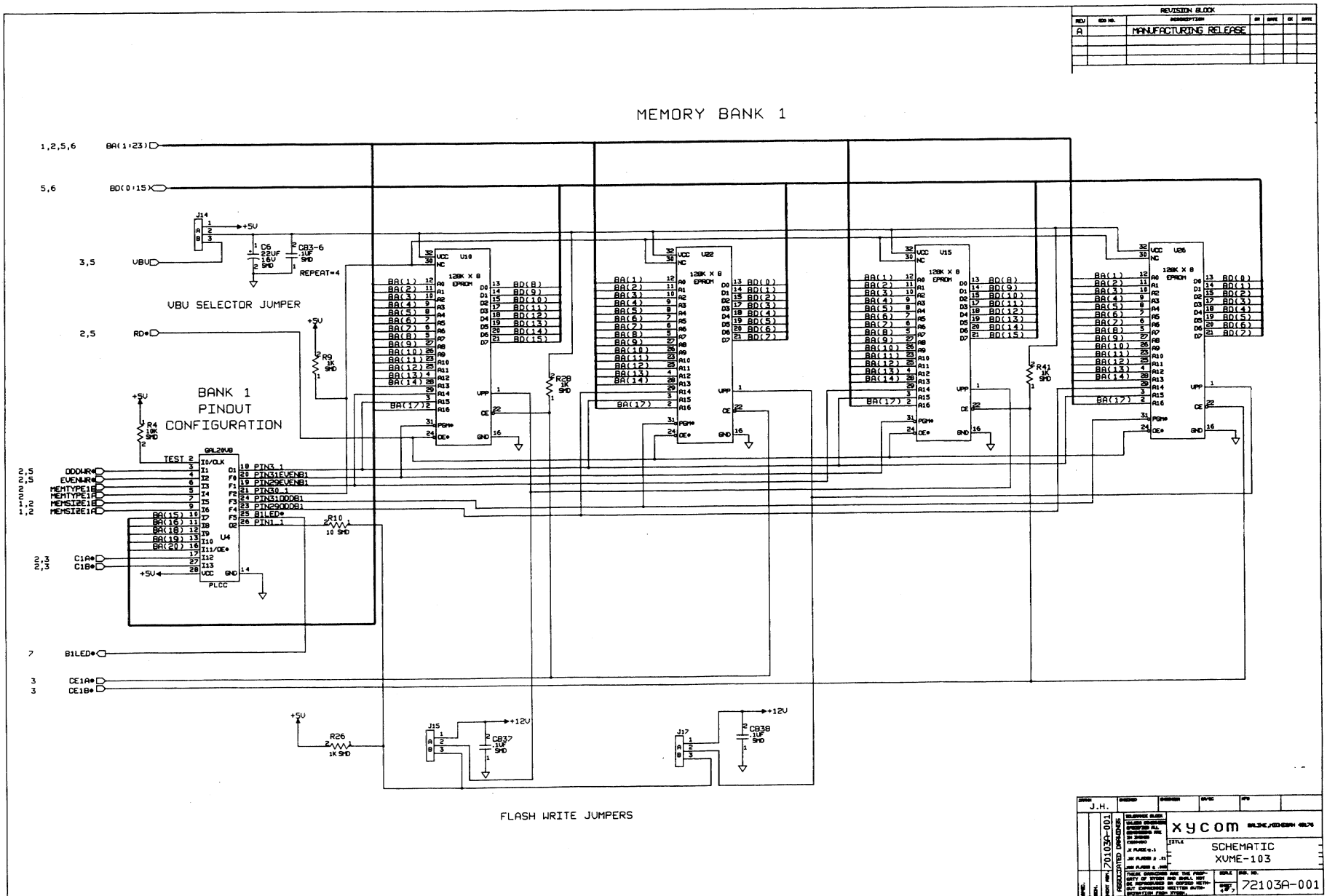
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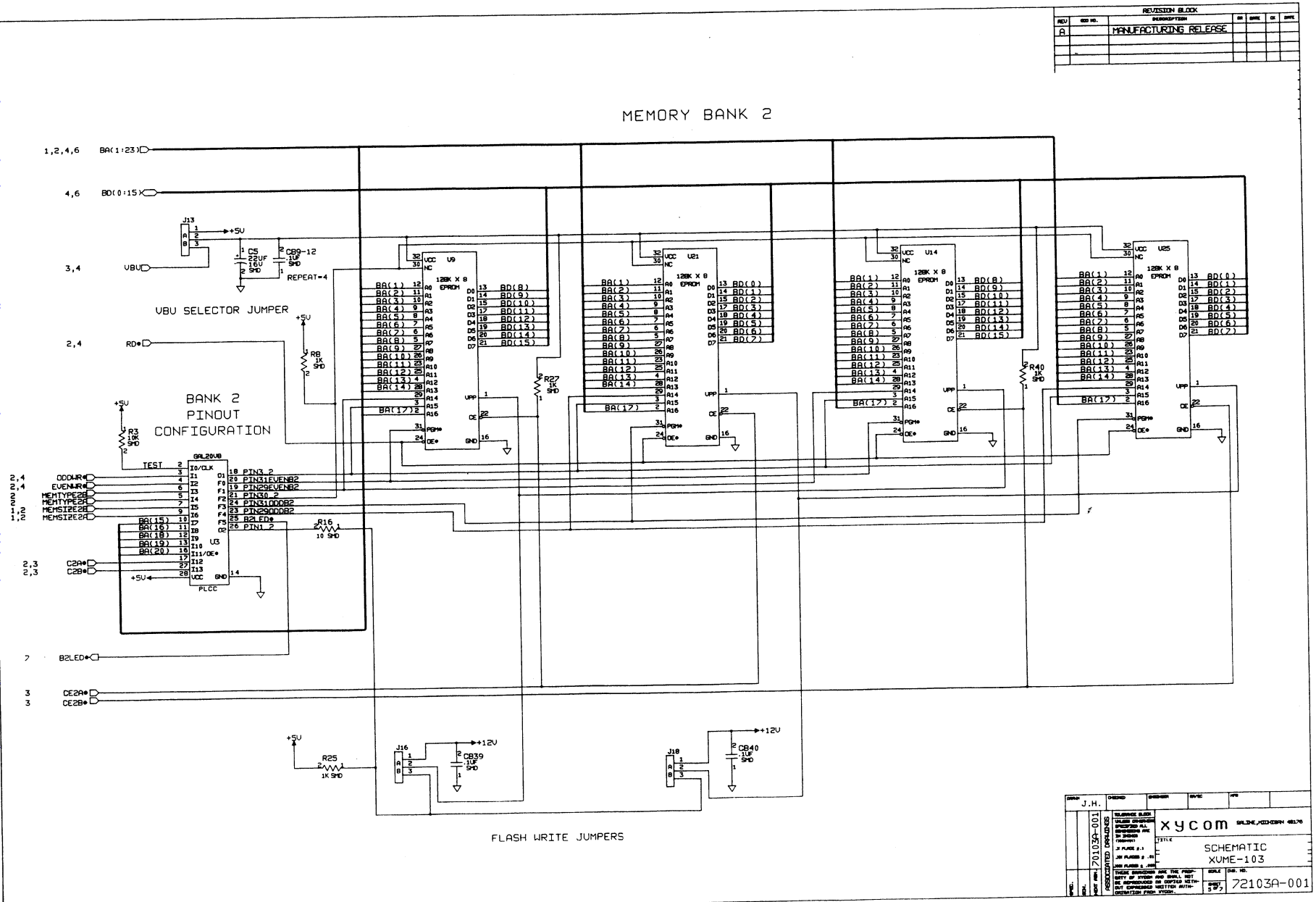
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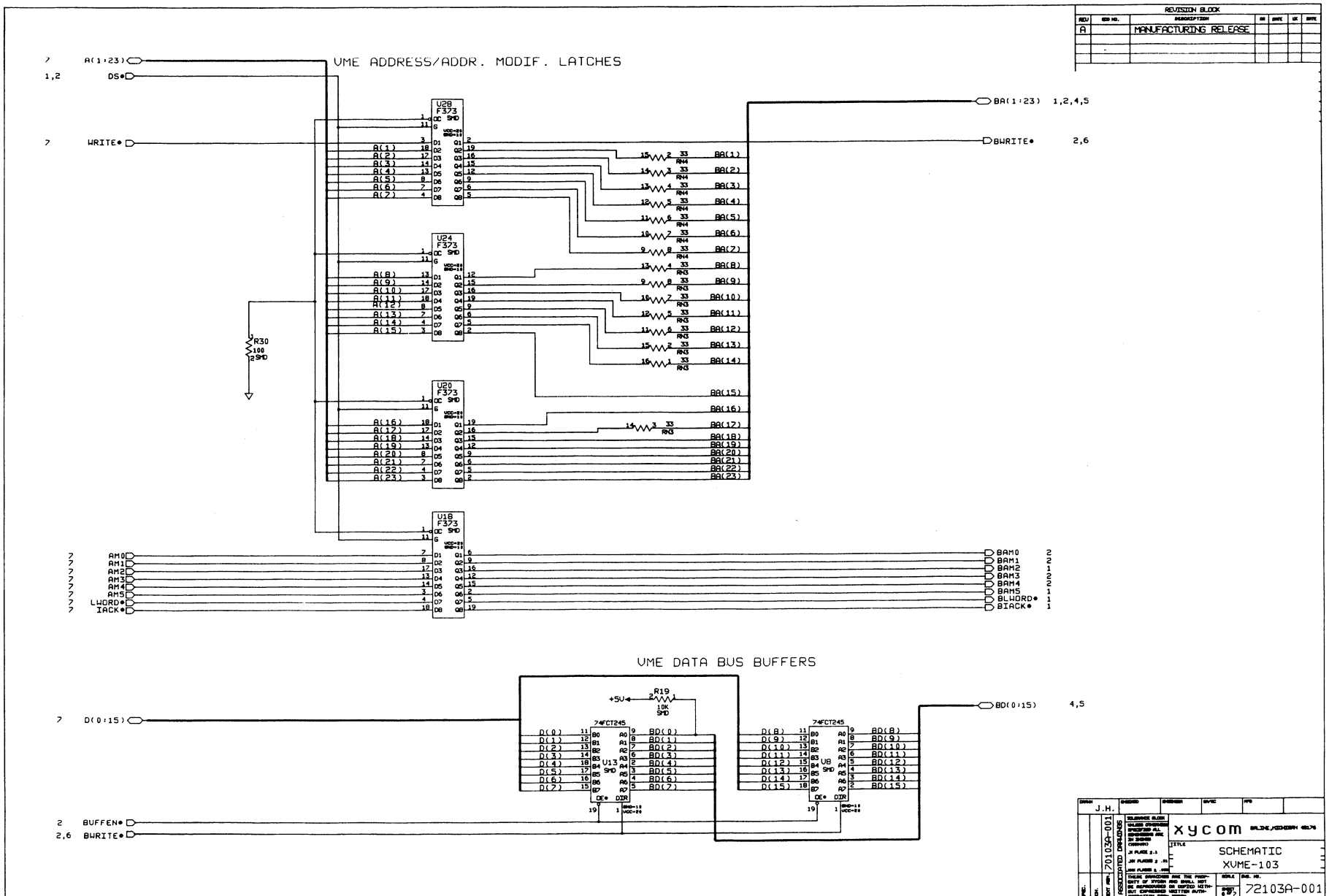
XVME-103 Schematic, Sheet 3 of 7

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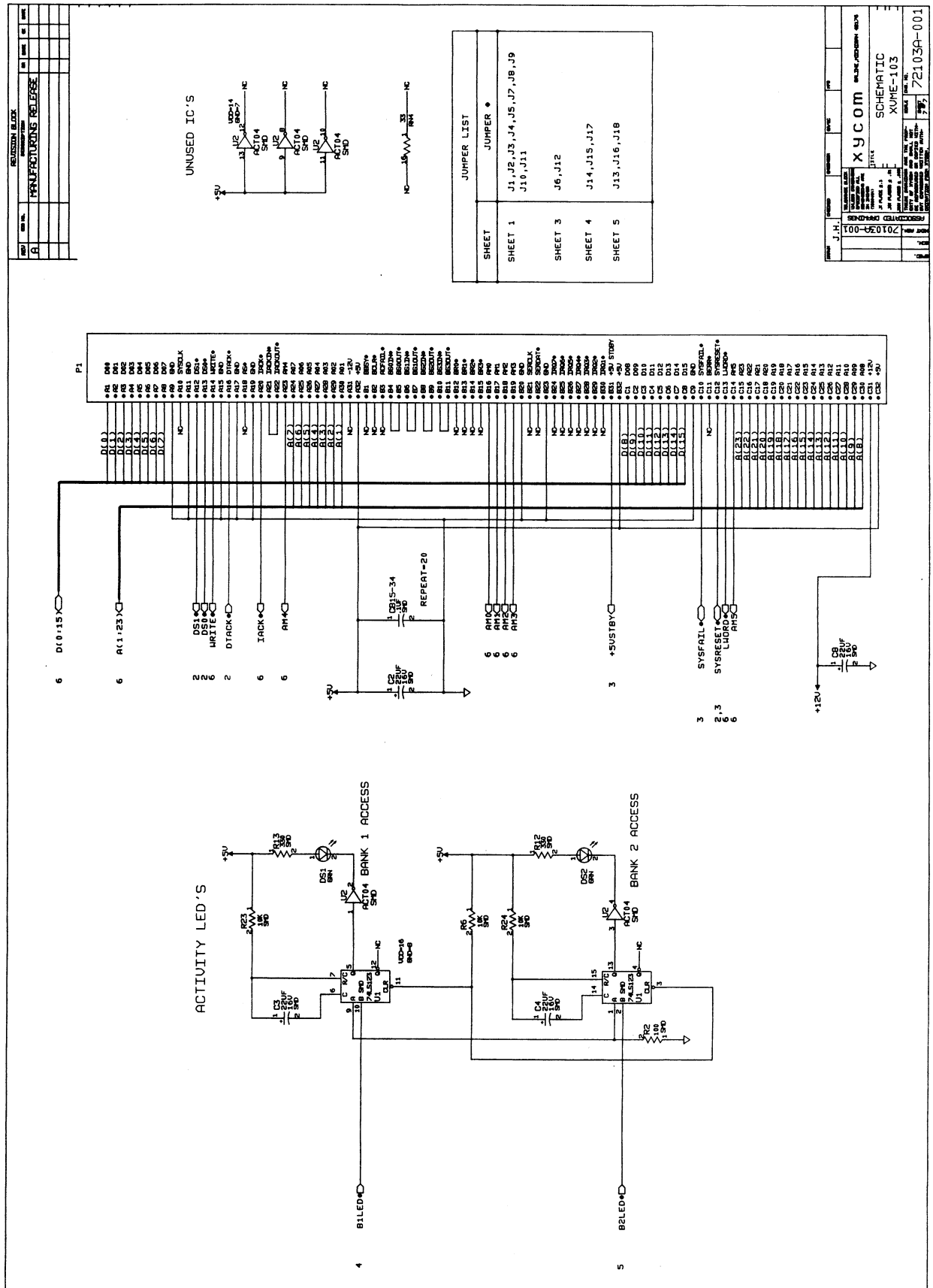




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