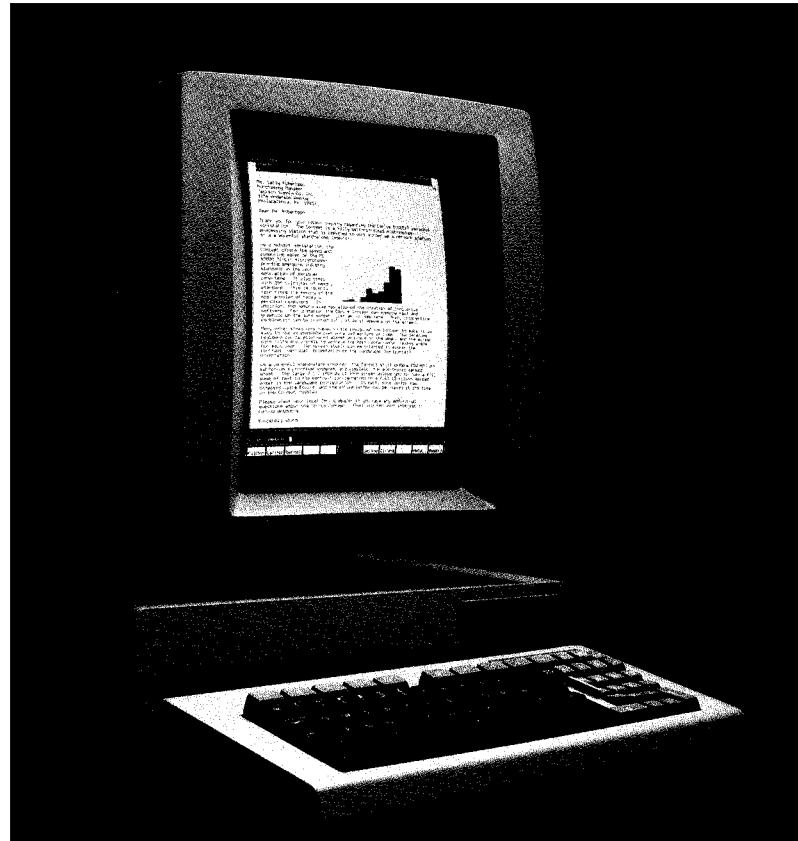


# THE CORVUS SERVICE MANUAL



Corvus Concept

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**CORVUS SYSTEMS  
CONCEPT  
PERSONAL WORKSTATION  
SERVICE MANUAL**

PART NO.: 7100-04701

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RELEASE DATE: April, 1983

This document contains three types of notations. These are, in increasing order of importance. **NOTE**, **CAUTION**, and **WARNING**. The **NOTE** indicates some action to be taken to speed or simplify a procedure. The **CAUTION** indicates that potential damage to the equipment or user data exists, and care should be taken to avoid this. The **WARNING** indicates that potential harm or injury to the service technician or operator exists, and extreme care should be taken to avoid these.

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**CHAPTER 1  
OVERVIEW**

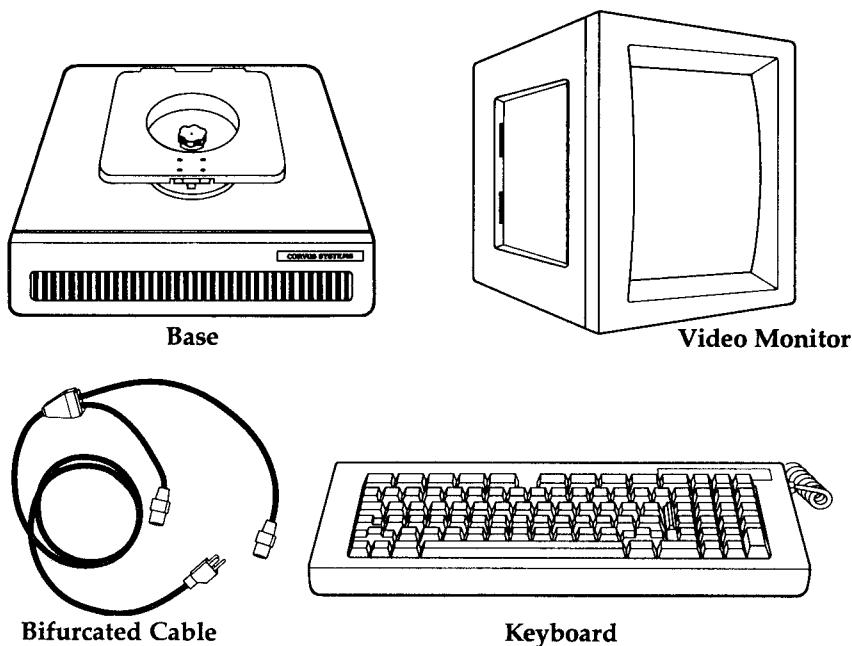
## CHAPTER 1 OVERVIEW

### 1.0 Scope of Chapter

The Corvus Concept™ Personal Workstation™ is designed with service in mind. Its modular components can be substituted during on-site servicing to minimize system down time. These modules are outlined in this chapter. Options available to enhance the Concept are also discussed.

### 1.1 Concept Modules

The Concept base contains a power supply, fan, and removable electronics tray. This tray contains the Processor Board, the Memory Board, speaker, and calendar battery. The modular design of the Concept allows easy access and replacement of the electronic subassemblies.



#### 1.1.1 Electronics Tray

The entire tray may be removed for replacement when an immediate repair is required. The Processor Board and Memory Board may be individually substituted if time permits additional troubleshooting.

##### 1.1.1.1 Processor Board

A Motorola™ MC68000 Microprocessor, Boot RAMs and ROMs, OMNINET,™ and Clock Calendar are the major components of the Processor Board. I/O circuitry is also resident on the Processor Board. Specific features include:

###### Microprocessor

- Motorola MC68000
- 16/32-bit data registers
- 24-bit memory address bus
- 16-bit data bus

###### Input/Output

- OMNINET Network interface
- Two serial asynchronous I/O ports
- Clock and calendar backup battery
- Flexible sound generator
- Two interval timers
- Four 50-pin I/O slots

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### **1.1.1.2 Memory Board**

The Memory Board provides a sophisticated scheme which produces both memory timing and video timing. The Memory Board includes:

- 256 Kbytes standard or 512 Kbytes optional memory
- Vertical and horizontal timing
- RAM timing
- Memory addressing
- Video interface
- System master clock

The 256 or 512 Kbytes is provided by 64K dynamic RAMs.

### **1.1.2 Video Monitor**

The Concept video monitor is a Ball™ HD Series display unit. Under Direct Memory Access (DMA), approximately 55K of main memory is ported directly to the 720 pixel bit mapped screen. The data is transmitted to the screen at approximately 33 Mbits per second.

The 15-inch monitor is mounted to allow the swivel or tilt of the screen for maximum operator comfort. The screen can be operated in either a vertical (portrait) or horizontal (landscape) mode. Features of the monitor are:

- 15-inch CRT
- Bit mapped display
- Vertical tilt of +17 to -13 degrees
- Horizontal swivel of 90 degrees
- 720 pixels by 560 pixel screen
- 120 characters by 56 lines in the landscape mode
- 90 characters by 72 lines in the portrait mode
- Software generated character set

### **1.1.3 Keyboard**

The compact keyboard is manufactured by Keytronics™ to Corvus specifications. Its features include:

- Selectric™ style alphanumeric keys
- Cursor movement keys
- 15-key numeric pad
- 10 programmable function keys
- Programmable character set
- Detachable coiled keyboard cable

### **1.1.4 Power Supply**

The power supply, located in the base unit, is manufactured by AC/DC.™ The Power Supply provides:

- +5VDC at 8A (60Hz, derate 10% for 50Hz)
- +12VDC at 1.7A (60Hz, derate 10% for 50Hz)
- -12VDC at 1.7A (60Hz, derate 10% for 50Hz)

The Processor and Memory Boards consume:

- 6A at 5VDC
- 130 mA at +12VDC (RS-232C)
- 170 mA at -12VDC (RS-232C)

Available power for shared I/O slots is:

- +5VDC at 500 mA
- +12VDC at 1.5A
- -12VDC at 1.3A
- -5VDC at 200 mA
- 100/120VAC or 220/240VAC selectable
- 50Hz or 60Hz
- 200 Watts

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### **1.2 Concept Options**

Corvus Systems offers an array of options for the Concept. These include software packages, storage devices, and network capability. See the Service Manual for each hardware option for complete specifications.

#### **1.2.1 Operating System Software**

Some of the software packages provided on floppy diskettes for use with the Concept are:

- CCOS Operating System
- USCD P-System Operating System
- ISO Pascal with UCSD extensions  
(native code compiler)
- FORTRAN 77 (native code compiler)
- 68000 Assembler
- EdWord™ Wordprocessor
- Corvus LogiCalc™ Electronic Spreadsheet

A complete list of current software may be obtained from the Corvus Systems Marketing Department.

#### **1.2.2 Floppy Disk Drive**

Manufactured by Tandon™ Corporation, the 8-inch Floppy Disk Drive is available with these features:

- 250 Kbytes formatted capacity
- Single-sided, single-density IBM 3740 format
- Read and write capabilities

In addition, a 5¼ inch Read-Only Disk Drive with a capacity of 140 Kbytes may be purchased from Corvus.

#### **1.2.3 Winchester Disk Drive Options**

Mass storage is provided for the Concept by a line of Winchester Disk Drives. Interface to the Concept is through a 50-pin I/O slot on the Processor Board. The drive models are:

Rev B

- Model 6—5.7 Mbytes formatted
- Model 11—10.8 Mbytes formatted
- Model 20—19.7 Mbytes formatted

H-Series

- Model 11—12.1 Mbytes formatted
- Model 20—18.4 Mbytes formatted

#### **1.2.4 Archival and Backup Options**

Archival and backup storage can be accomplished with the Floppy Disk Drive or the Corvus Mirror® option. The Mirror is used in conjunction with a video recorder to provide a copy of a Corvus Disk Drive on video tape. For details of the Mirror, see the Mirror Service Manual.

#### **1.2.5 Network Option**

Corvus OMNINET circuitry is included on the Processor Board. The OMNINET Disk Server and related hardware feature:

- One million bit per second transfer rate
- 64 possible network devices
- Twisted pair transmission cable
- 4000-foot network length

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**CHAPTER 2**  
**FUNCTIONAL DESCRIPTION**

## CHAPTER 2 FUNCTIONAL DESCRIPTION

### 2.0 Scope of Chapter

In this chapter, a functional description of the Corvus Concept is presented. The two main printed circuit assemblies of the Concept, the Processor Board and the Memory Board, will each be described.

### 2.1 Concept Processor Board

The Processor Board of the Concept can be divided into the following sections:

- Microprocessor
- Bus Buffers
- Memory Mapper
- ROM and static RAM
- OMNINET
- 50-Pin I/O Slots
- Data Communication Ports
- Interrupts
- Memory Arbitration
- Calendar
- Bell, Timer, and VIA
- Data Acknowledge

#### 2.1.1 Microprocessor

The Concept is based on the Motorola MC68000 8MHz microprocessor. It has a 16-bit bidirectional data bus, a 24-bit address bus, and sixteen 32-bit internal registers. Its address lines are buffered to go to many locations. The 64-pin design eliminates the need for data and address multiplexing by giving each data and address line a separate pin.

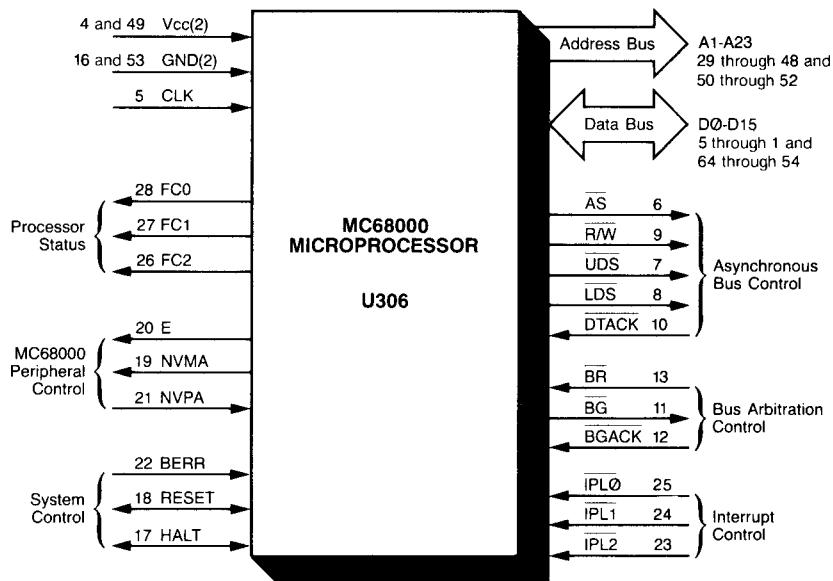


Figure 2. Motorola MC68000

### 2.1.2 Bus Buffers

The address bus is buffered from the processor by three 74LS244s at locations U507, U508, U407. Caution should be exercised as these buffers may be damaged if shorted together. The data bus is unbuffered to the on-board ROMs and static RAMs and is buffered to the I/O ports, OMNINET, and dynamic RAMs. If for any reason the address or data bus becomes defective the processor will assert the HALT signal and abort all operations.

The control signals (WRITE, UPPER & LOWER DATA STROBE, and ADDRESS STROBE) are buffered by a single 74LS244 at location U307. The function codes lines are decoded to determine Supervisor Mode and Interrupt Acknowledge. The Interrupt Acknowledge is connected to the Valid Peripheral Address Pin to indicate Auto Vectoring Interrupt Mode.

For further information on the processor, please refer to the Motorola 16-Bit Microprocessor User's Handbook.

### 2.1.3 Memory Mapper

The address space is divided into sections by a memory mapper PROM which examines the state of the address bus and selects the appropriate device.

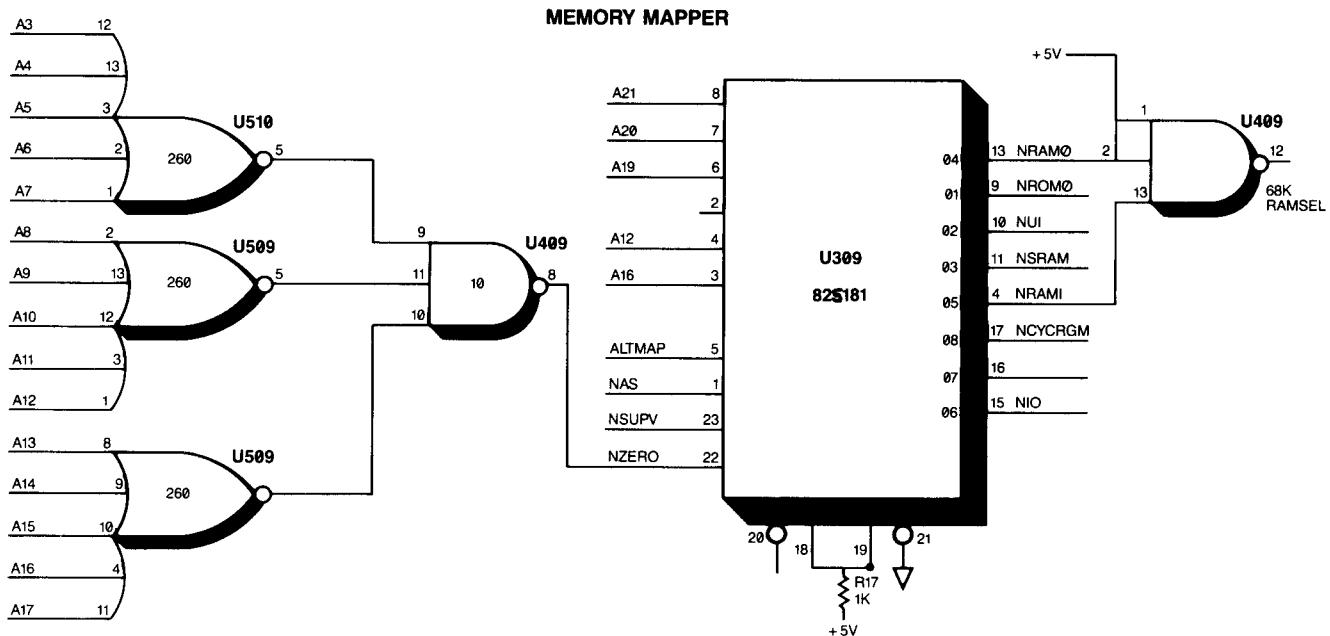


Figure 3. Memory Mapper

An 82S181 bipolar PROM examines the address lines to produce enable signals for I/O and memory. Additional inputs are NZERO, ALTMAP and NSUPERVISOR. NZERO is output from a set of gates at U309 and U510 which detect that the lower address bits are at zero. If the higher address bits are at zero and ALTMAP is zero, ROM0 will be selected for a power-on boot. If no device is selected, CYCLE ROM is asserted to prevent the processor from hanging up.

### 2.1.4 ROMs and Static RAM

There are four 24-pin RAM sockets and two 28-pin ROM sockets mounted on the Processor Board.

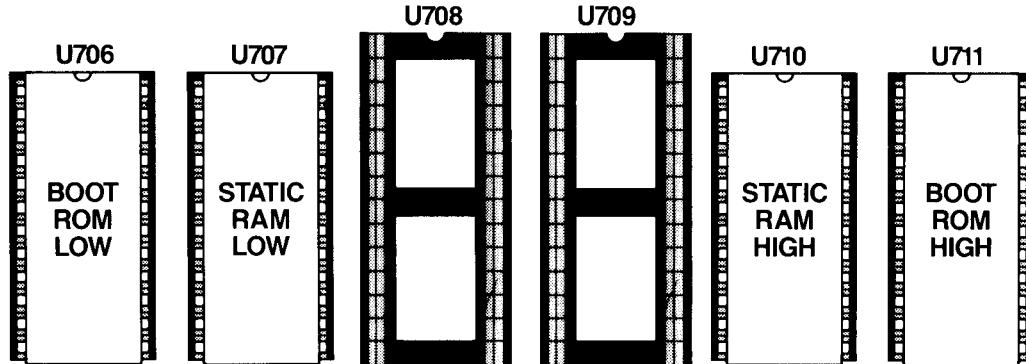


Figure 4. ROM and Static RAM Sockets

RAM sockets, locations U707 and U710, are intended to hold 2K x 8 static RAMs. These RAMs may contain system variables, jump tables, and data stored during testing. The speed of the RAM can be accounted for by jumpers K4, K5. (See Appendix H.)

The ROM0 sockets, locations U706 and U711, may hold ICs such as 2716s or 2732s. This ROM pair contains the Boot Code, initial Self Test, setup data for I/O, simple keyboard map, a character set, etc. The ROM1 sockets, locations U708 and U709, may hold such devices as 2716s, 2732s, 2764s, or other pin compatible ROMs. These ROMs may be used in loading Motorola's MACSbug for bringup and diagnostic purposes or for installing the user's firmware.

#### 2.1.5 OMNINET

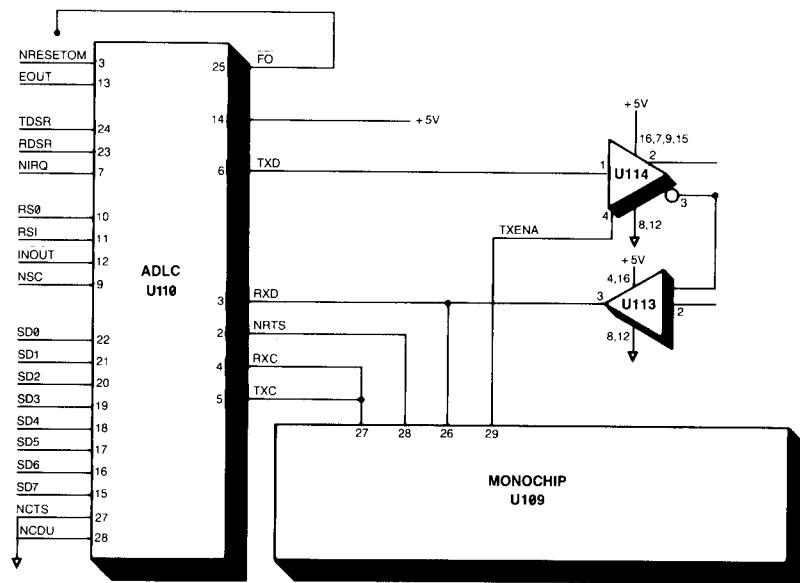
OMNINET circuitry is a self-contained unit on the Processor Board. The processor sends commands to the OMNINET transporter circuit through the I/O bus. The processor places a byte of data on the bus and strobes NOMNI. The data consists of three bytes containing an address where OMNINET is to find its command in memory. The processor checks the Versatile Interface Adapter, VIA, port A, bit 0 to see if the OMNINET is ready to receive another byte of address. OMNINET has no other connection with the processor. It talks directly to memory, preempting the processor by means of the Memory Arbiter. (See Section 2.1.9).

OMNINET'S 6801, U302, and monochip, U104, control Direct Memory Access (DMA). The Asynchronous Data Link Controller (ADLC) at U301 utilizes a pair of transmitters and receivers to balance the twisted pair cable, RS-422, for data transfer. The serial transfer rate is 1 Mbits per second. Parallel transfer by byte has a DMA rate of 125 Kbytes per second.

When OMNINET does a DMA, it takes over the address and data buses going to the Memory Board. If the MC68000 attempts to use memory during a DMA cycle it will be held off. Typically, there is a maximum one DMA cycle in 8 microseconds. During this time there can be a maximum of seven MC68000 memory accesses. DMA does not slow the MC68000 appreciably.

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**Figure 5. ADLC**

To begin the DMA of a byte, the monochip asserts a DMA request, DMAREQ. This is synchronized by the Memory Arbiter which switches the memory address and data bus from the processor to OMNINET. The Arbiter begins a memory cycle and asserts DMAGO, indicating that OMNINET is in the process of doing a DMA. Following DMAGO, DMAREQ is negated. When the memory cycle is complete DMAGO is negated and the monochip sets up to accept the data into the ADLC (only on a read) and terminates the DMA cycle. Control of the memory buses are then returned to the processor.

OMNINET produces 20 address bits. Address zero is converted into upper and lower device select before being sent to RAM. OMNINET ignores address bits 21 and up.

### 2.1.6 50-Pin I/O Slots

Four 50-pin board edge connector slots are provided to handle other local I/O, such as to a Corvus Floppy Disk Drive or Winchester Disk System.

The I/O address space is divided into eight blocks by U605. They are subdivided as shown in Table 1.

Block 0-4 (See I/O Slots Appendix F)	
Block 5	Allow reading of the NMI and IRQ lines from each of the slots on a single operation.
Block 6	Allows reading of the Clock Calendar
Block 7	Allows reading or writing to the I/O Ports. Block 7 can further be subdivided into:
0 NKBP	Keyboard
1 NSRO	Data Comm Port 0
2 NVIA	
2 NSR1	Data Comm Port 1
3 NVIA	Versatile Interface Adapter
4 NCALM	Clock calendar address and Strobe register
5 NOMNI	OMNINET Strobe
6 NOMOFF	Reset OMNINET Interrupt Flip-Flop
7 NIOSTRB	External I/O ROM Strobe

**Table 1. I/O Address Space**

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I/O slots provide access to such devices as Corvus disk systems, parallel printers etc. These slots do not support DMA because they do not share the data and address buses with the dynamic memory. They are connected to the interrupt structure.

Table 2 gives slot pin descriptions.

Pin	Concept Signal Name	Apple II™ Equivalent	Pin	Concept Signal Name	Apple II™ Equivalent
1	NIOX	I/O SEL	26	GND	GND
2	A1	A0	27	---	DMAIN
3	A2	A1	28	---	INTIN
4	A3	A2	29	NNMI-X	NMI
5	A4	A3	30	NIRQ-X	NIRQ
6	A5	A4	31	NRESET	RES
7	A6	A5	32	---	NINH
8	A7	A6	33	-12V	-12V
9	A8	A7	34	-5V	-5V
10	A9	A8	35	---	---
11	A10	A9	36	---	7MHz
12	A11	A10	37	Q3	Q3
13	A12	A11	38	NIM	PHI 0
14	A13	A12	39	---	USER 1
15	A14	A13	40	1M	PHI 1
16	A15	A14	41	NDEVX	NDEV SLCT
17	A16	A15	42	IOD7	D7
18	NWRITE	R/W	43	IOD6	D6
19	---	---	44	IOD5	D5
20	NIOSTB	I/O STROBE	45	IOD4	D4
21	---	NRDY	46	IOD3	D3
22	---	NDMA	47	IOD2	D2
23	---	INTOUT	48	IOD1	D1
24	---	DMAOUT	49	IOD0	D0
25	+5V	+5V	50	+12V	+12V

**Table 2. I/O Slot Pin Descriptions**

### 2.1.7 Data Communication Ports

Two RS-232C ports with independent baud rates can be used for an external terminal, modem, printer, or other peripheral device. They share the I/O bus and interrupt structure with other I/O devices. The connection is by 10-wire, 25-pin sub miniature 'D' female shells, connected as Data Terminal Equipment. A modem eliminator cable is necessary to communicate with equipment other than modems.

Both serial data ports are able to communicate at baud rates from 110 to 19200, with selectable parity and word size. The receive and the transmit functions can be Interrupt generating or Non-Interrupt generating as selected.

The UART Baud Generator requires a 1.818MHz frequency which is obtained by dividing the 16.364MHz system oscillator by 9 using U212 (74LS161).

Motorola's 1488 and 1489 devices, at U213, U214, U314, and U415, transmit and receive the +12 RS-232C voltages. A 470 pF capacitor is used at each RS-232C line for speed control. The keyboard interface is driven by a Schmitt trigger inverter, U115, also used to receive keyboard data.

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Three Control lines on each port are receivers: Data Set Ready (DSR), Clear to Send (CLS), and Data Carrier Detect (DCD). These can be used for handshaking or with a modem. Three Control lines Data Terminal Ready (DTR), Request To Send (RTS), and Rate Select (CH) are for output. DTR and RTS are functions of the UART, controlled by setting the UART command and control registers. CH is a bit for each port on the VIA Port B usually used for selecting between high and low speed on dual rate modems. Appendix H-2 describes the Data Communication Ports J1 and J2.

It is recommended that shielded RS-232C cables be used. If these are not available, an in-line filter is recommended. If data communication cables are strung long distances or between buildings in lightning prone areas, only Receive Data, Transmit Data, Signal Ground and Protective Ground should be used. The first three should each be connected to protective ground by a Tranzorb or other transient energy absorber.

NOTE:

*There is a requirement by some European PTTs that the user be informed when a modem has gone off-line. The driver may monitor the appropriate line, transmit a message to be displayed. Also required may be logical relationships and timing between input and corresponding output control lines. As the Concept requires no hardware relationships, PTT requirements must be fulfilled by the drivers.*

### 2.1.8 Interrupts

Six interrupt lines are served by an Auto Vectored Interrupt mechanism. The highest priority, Non-Maskable Interrupt (NMI), is not used. The two Data Com devices, the keyboard, the VIA, and OMNINET each have their own interrupt vectors. The data communication control lines shares the lowest vector with the 50-pin bus interrupt.

Although the processor can be run without interrupts, most of the I/O devices can cause interrupts so that an efficient interrupt driven operating system is created. Because 6502 I/O devices are used, which cannot produce vectors, the auto vector mode of interrupt is used. The level 7 NMI is used only when the software monitor is installed for debugging. The user cannot initiate an NMI. Interrupt Acknowledge is decoded in the following manner:

Priority Level	Signal Name	Device
7	Not Used	
6	NKEYINT	Keyboard
5	NTIMINT	VIA Timer
4	NSR0INT	RS-232C Port 0
3	NOMINT	OMNINET
2	NSR1INT	RS-232C Port 1
1	NIOCINT	Data Com/ 50-Pin Slots

Table 3. Interrupt Levels

Note that the Data Com controls and 50-pin I/O slot interrupts share the priority one interrupt. The interrupt priority can be set to any of the seven levels. An interrupt below the current level will not be served until the interrupt level is dropped to that level or below. An interrupt raises the priority level to its own level. The Return From Interrupt sets the priority to the level just prior to the interrupt. If the priority is set to 7, no interrupt can occur, thus allowing critical code sections to complete without fear of interruption. For further details, refer to the Motorola MC68000 User's Manual.

The keyboard and data communication devices are 6551 UARTS from Synertek™ Inc., Rockwell International,™ or MOS Technology.™ The Timer is part of a 6522 Versatile Interface Adapter, VIA, from the same manufacturers. Additional information about these devices can be found in the Synertek Data Catalog.

#### 1. Keyboard Interrupts

The keyboard UART, U310, acts as a receive only UART except during testing operations. Each time it

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receives a new character, it causes a level six interrupt. Key strokes cause the keyboard software driver to send a code to the current program. Key releases cancel automatic key repeat or remove qualifiers such as a shift and control.

2. Timer Interrupts

Counter U313 in the VIA is used to aid timing, including the repeat key timing. This counter interrupts every 50 microseconds with a priority level 5 interrupt. No other possible interrupt of the VIA are used.

3. Data Communication Port 0

UART U311 can be set up to interrupt on receiving or transmitting a character. It is intended for use with a terminal or modem, but can be configured for any RS-232C function. Baud rate and parity may be selected. Handshaking is covered in section 2.1.7. Each time a character is received or has been transmitted, a priority level 4 interrupt occurs.

4. Data Communication Port 1

The UART U312 is similar to that of the UART for Data Port 0. Its primary function is driving serial printers. It generates a priority level 2 interrupt.

5. OMNINET

After an operation, OMNINET generates a priority level 3 interrupt. OMNINET cannot turn the interrupt off; NOMOFF must be sent at the end of the interrupt process to turn the interrupt off (U304).

### 2.1.9 Memory Arbitration

The dynamic memory may be accessed by the MC68000 or an OMNINET DMA. A set of flip-flops and logic arbitrate when both the MC68000 and OMNINET try to access memory at the same time. The Memory Board requires RAMSEL before an access can start; RAMSEL must be negated before a new access can start. NRAMACK signals that the data in an access has been processed.

Signal names and their functions may be found in Chapter 5.

1. MC68000 Memory Access Without DMA Conflict

When the MC68000 produces an address in the dynamic memory range, 68K RAMSEL is asserted. It is then presented to the J input of JK flip-flop U204-11. After the Address Select (NAS) is asserted, the Q of the JK flip-flop U204-9 will become true at the next 16M clock. The Q (68KGO) is passed through OR Gate U203-8 to become RAMSEL. When the data has been processed by the memory, NRAMACK is asserted. NRAMACK then goes through an OR gate to become NTACK U203-11, and finally through the data acknowledge timing gates U411 and U510 to become NDTACK. After receiving NDTACK the MC68000 disasserts NAS, clearing the JK flip-flop and preparing for the next memory access.

2. DMA Without MC68000 Conflict

OMNINET asserts DMAREQ (DMA request) which is applied to the J of the JK flip-flop U104-3. At the next 16M clock the JK flip-flop asserts DMAEN (DMA enable) U104-5. One 16M clock time later NDMAGO U204-6 is asserted which sets DMAGO2 U104-9. NDMAGO tells OMNINET that the requested DMA cycle has begun, DMAGO2 U104-9 switches the memory address and data buses to OMNINET.

DMAGO is passed through OR gate U203-10 to assert RAMSEL. The assertion of DMAGO causes OMNINET to disassert DMAREQ. When NRAMACK is asserted it clears DMAEN and DMAGO, causing OMNINET to accept the data (if a read was in progress) and to complete the DMA cycle. DMAGO2 follows DMAGO one 16M clock later, switching the memory and data buses back to the MC68000. The disassertion of DMAGO removes RAMACK, preparing for the next memory cycle.

3. Collisions

If a MC68000 RAMSEL occurs when DMAEN or DMAGO is true, gate U205-6 will prevent 68KGO from occurring. When both DMAEN and DMAGO2 have been disasserted, the next 16M clock will cause 68KGO to be asserted and a memory cycle to begin as before.

If DMAEN is asserted while 68KGO is true, DMAGO will not be allowed to set. Moreover when NRAMACK is asserted it will clear DMAEN. After 68KGO is disasserted, the next 16M clock will allow DMAEN to set, beginning a DMA access now that the conflict has been removed.

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## 2.1.10 Calendar

A battery backed up calendar is provided, to clock the time and date from tenths of seconds through months. Although leap year can be set to allow February to have 29 days, the calendar does not contain a years register. The battery may be an on-board lithium or a tray-mounted NICAD. The calendar, is very similar to a watch circuit. To read or write to the calendar, an address must be written to NCALM (calendar mode), followed by an address with a strobe written to NCALM. Next, the read or write is asserted by the signal NCALRW (calendar read/write). Finally, a zero address with no strobe is written to NCALM.

### **2.1.11 Bell, Timer, and VIA**

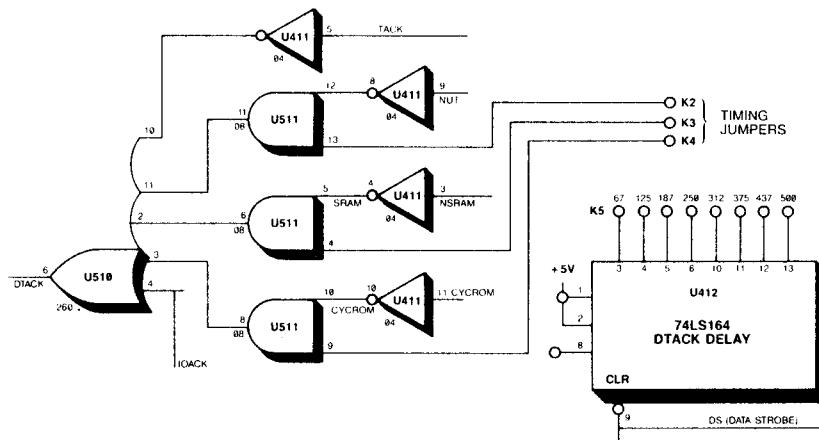
The bell is a transistor driven speaker, which is driven by the shift register in the Versatile Interface Adapter (VIA). The shift register rate is determined by one of the VIA timers and the waveform of the data loaded into the shift register. The duration, pitch and timbre of the bell are determined by the bell driver and user program.

The other VIA timer is used as a system resource. Its basic function is to perform the key wait and repeat timing. When a character key is pressed its code is used; after a wait of one half a second, the code is repeated at the rate of five times per second. If the FAST key is pressed together with any character key, that character code is immediately repeated at 15 times per second.

Three VIA inputs not so far mentioned are the two boot switches and the screen orientation switch. These are read on VIA port B bits 6, 7, and 3. The boot switches indicate whether OMNINET, a local hard disk, or floppy drive is to be used as the boot device. The orientation switch is needed to indicate whether the screen is to be used horizontally or vertically. Three outputs from the VIA are VIDOFF, VA17, VA18. VIDOFF must be zero to turn the display on. VA17 and VA18 are normally zero for display. If they are not zeroed, then other than normal areas of memory are displayed.

### **2.1.12 Data Acknowledge**

The 68000 is an asynchronous machine for memory and I/O. It asserts a memory request (derived from DATA STROBE and ADDRESS STROBE) and waits for memory acknowledge (DTACK). Memories and I/Os of different speeds are accommodated by delaying data acknowledge (DTACK) until the access is complete. In the Concept the DTACK is provided by either a state machine (dynamic RAM I/O or by the combination of the device select ROM). DTACK is provided by either a state machine (dynamic RAM, I/O) or by the combination of the device select (ROM, static RAM) and a delay. The circuitry that is involved consist of U411, U511 and U510. The delay is from a shift register (U412). The shift register clocks in ones unless cleared by DATA STROBE being negated. It has outputs at intervals of 61 nsec up to about 490 nsec which can be selected by a jumper for each of the ROM and RAM pairs. This allows for access times of zero to about 600 nsec to be used. The delay from the state machines varies by up to a microsecond (dynamic RAM) or up to 2 microseconds (I/O). Gates U411, U510 and U511 form the delayed signal into NDTACK (TP 20) Data Strobe DS can be seen at TP 19 and Not Address Strobe at TP 11. If the MC68000 encounters illegal conditions (e.g. instructions), it will halt with a low at TP 14.



**Figure 6. Data Acknowledge Timing**

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### 2.2 Concept Memory Board

The Memory Board provides most of the read/write memory for the system. It functions in eight categories:

- Horizontal Timing
- Vertical Timing
- RAM Timing
- Memory Selection
- Address Multiplexing
- Memory Array
- Memory Buffer
- Video Shift Registers and Multiplexer

The horizontal counter produces high speed timing for the system, including horizontal synchronization and blanking pulses for the video monitor. Similarly, the vertical counter produces vertical synchronization and blanking pulses. RAM timing includes Row Address Select (RAS), Column Address Select (CAS), and Multiplexer Address (MUX) times for the memory array. The video address counter provides both screen and memory refresh. Data from the memory array is read into the memory buffers and then to the processor. It may also be read to OMNINET or to the video shift registers and from there to the screen.

#### 2.2.1 Oscillator

The oscillator is a self-contained crystal oscillator with a frequency of 16.364MHz. This frequency is used as the base frequency and is divided to fit system needs.

#### 2.2.2 Horizontal Timing

A 16.364 MHz oscillator is counted by 2, 16 and 512 to produce signals of approximately 8 MHz, 1MHz and 32 KHz. 32 KHz is the horizontal scanning frequency of the monitor. The Processor Board uses the 16MHz, 8MHz and 1MHz signals to clock various devices. The horizontal timing section is comprised of an oscillator, three counters, a logic array, and flip-flops for resynchronization of signals.

Not Horizontal Blank Previous (NHBLANKP) is clocked into the 74LS174 to produce the horizontal blanking signal NHBLANK. Note that N suffixed to a signal means that the signal is asserted when it has a low voltage.

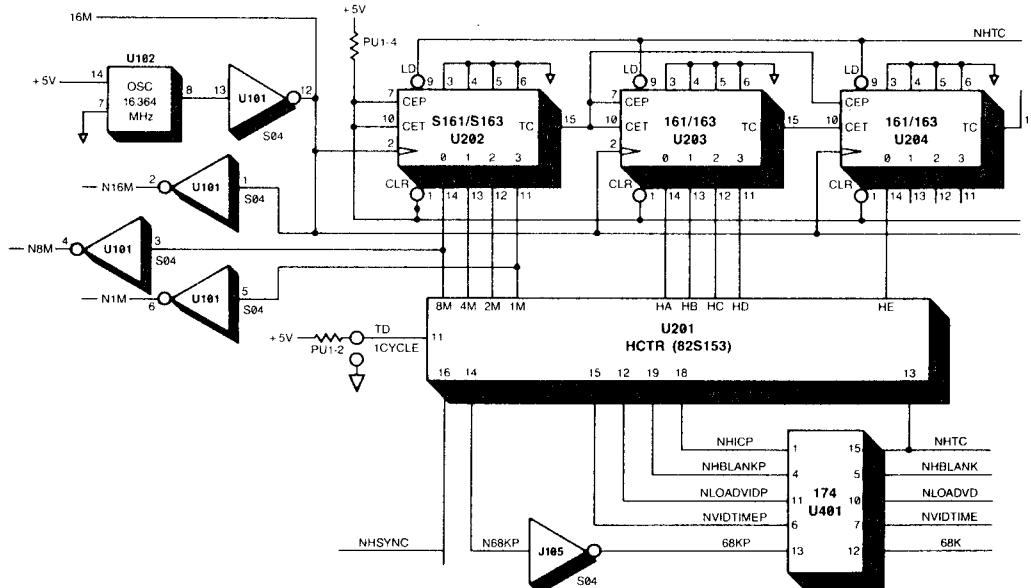


Figure 7. Horizontal Timing Circuit

The memory fetches data for the video shift registers during video-time and can read or write data for the MC68000 or OMNINET during non-video-time. NVIDTIMEP is clocked into the 74LS174 to produce the signal NVIDTIME, as are NLOADVIDP previous and 68K Previous. NLOADVID instructs the video shift registers to load the data from their data lines. 68K allows the memory to start a read or write cycle for the processor. Its timing is so chosen that a memory access will finish before the next video-time. At the video-time a memory access will start and will be complete by the next 68K-time. 1 CYCLE allows one video-time to be between each 68K-time. If 1 CYCLE is not true there will be one video cycle to every three 68K-times. Also during horizontal blank time there will be continuous 68K times and no video times. The 68K time is an enable signal: the memory makes an access when a 68K signal and a MC68000 read or write request coincide. NHSYNC provides the horizontal synchronization for the monitor.

### **2.2.3 Vertical Timing**

The vertical timing counter is comprised of similar devices to the horizontal counter. It produces the Vertical Synchronization (VSYNC) signal for the monitor, and vertical blanking (VBLANK) signal which it combines with the horizontal blank signal to enable video to the monitor. The vertical timing counter is clocked by NHBLANK and resets itself at 60Hz unless the 60Hz jumper is grounded which causes a 50Hz rate to be used. (See Appendix G). A signal HOME clears the video address counter so that every screen begins to refresh its data at the same point.

### **2.2.4 RAM Timing**

The Row Address Select (RAS), Column Address Select (CAS) and multiplexing signal are produced by a 74S195 shift register. Input logic allows either video time or the MC68000 to initiate a memory cycle. As soon as RAS time is asserted (NRASTIME is low) feedback keeps the input low until the CASTIME signal, delayed twice through a 74LS174, puts the 74S195 in the "load" condition. Logic high signals are loaded for three clock times assuring that the RAM precharge times are fulfilled.

A 74LS74 flip-flop pair, U403, controls MC68000 access to the memory. The first flip-flop sets following a MC68000 memory request (RAMSEL) and the 68K signal. A memory cycle occurs until NCAS goes high, setting the second flip-flop and asserting Data Acknowledge (NRAMACK). Eventually MC68000 will disassert RAMSEL, resetting these two flip-flops. Only when the first flip-flop is set and the second not set, is a read or a write permitted to the MC68000.

### **2.2.5 Memory Selection**

The Bank Selects and RAS, CAS, and WRITE signals are generated by 74LS139, 74LS08 and 74LS32 devices. A RAS occurs on all banks together during video-time but only on one bank at a time for the MC68000. The MC68000 may read the upper, lower or both sections of the bank in a memory access.

### **2.2.6 Video Address Counter**

This counter sequentially addresses all locations of memory displayed on the monitor, including some overlap during horizontal and vertical retrace. The counter increments during horizontal display but does not increment for most of horizontal blank. The memory accesses two banks at a time, causing the counter to be incremented by two each video time. If four banks of memory are installed, all four banks of data are loaded into the shift registers at once, clearing the memory. Jumper TJ is then set to increment the counter by four. (See Appendix G)

### **2.2.7 Memory Multiplexing**

During video time, the video address counter is selected to address the memory, otherwise the MC68000 or OMNINET addresses the memory. The signal NMUX determines whether the lower or upper part of the address goes to the memory to be strobed by RAS or CAS. Only the lower part of the video counter is necessary to refresh the memory, but all of the counter is necessary to refresh the screen. Jumpers allow selection correctly when two or four memory banks are installed. (See Appendix G)

### **2.2.8 Memory Array**

The memory is divided into 4 banks of 16 (64K) RAMS each. The banks are in turn divided into upper and lower bytes of 8 (64K) RAMS each. For full video to occur at least two banks must be installed.

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### **2.2.9      Memory Buffers**

The data from the memory is latched into buffers at the end of each 68K memory cycle. Data can be read from the buffers if the MC68000 is requesting a read. If the MC68000 is not reading, the buffers are tristate.

### **2.2.10     Video Shift Registers**

The video data stream requires a data rate of 32 MHz. To achieve this 32 bits (two words) are loaded from 2 banks each microsecond (or four words alternate microseconds if four banks are installed). The shift register is clocked at 16MHz but is split in two. Bits are taken alternately from each half during a clock cycle, thus doubling the data rate.

**CHAPTER 3**  
**DISASSEMBLY**

## CHAPTER 3 DISASSEMBLY

### 3.0 Scope of Section

The chapter describes the initial inspection and disassembly of the Corvus Concept. It is very important to perform the visual inspection described in Section 3.2 to insure that the Concept was not damaged during shipment and that the order is complete. Additional installation instructions for peripheral equipment may be found in the appropriate Installation or Service Manual.

### 3.1 Installation

See the Corvus Concept Workstation Installation Guide for installation instructions.

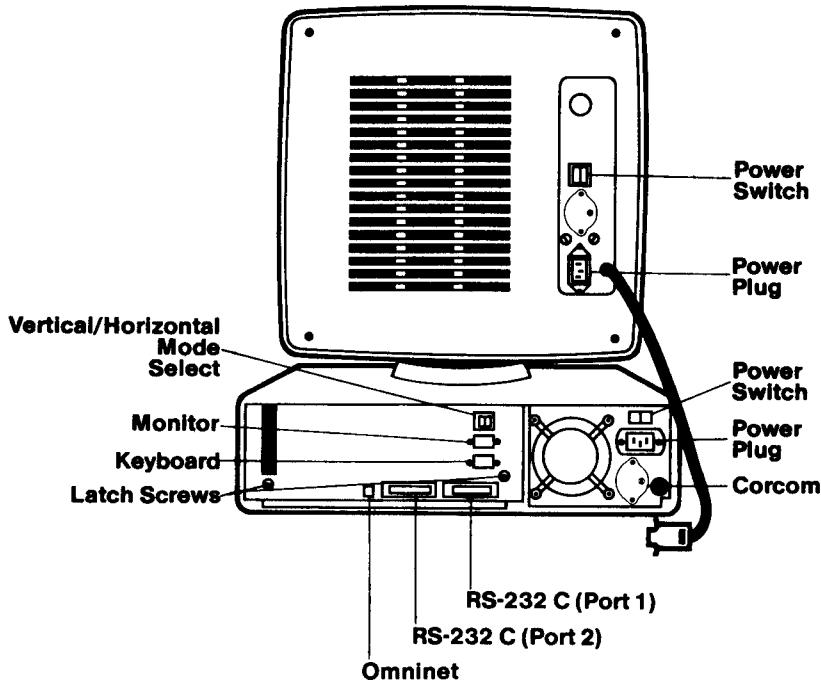


Figure 8. Concept Rear View

### 3.2 Visual Inspection

Any time a Concept is received, several checks should be performed before the Concept is installed at the customer site. Each Concept should be carefully unpacked and checked for shipping damage. External evidence of rough handling may be symptomatic of damage within the Concept.

*NOTE:*

*Any damage claims must be reported to the local office of the shipper so an inspection may be made, and a damage report filed. Also, if the damaged equipment is a new product, the Corvus Order Processing Department must be contacted for proper return procedures. If the damaged equipment is a recently serviced product being returned under an RMA number (Return Merchandise Authorization number), contact the Corvus Customer Service for proper return procedures.*

### 3.3 Video Monitor Removal and Disassembly

1. Turn the power off and remove the cables from the monitor to the base unit.
2. Remove the monitor unit from its base by pressing in the latch under the front of the monitor and carefully lifting the front of the monitor up and sliding it back.
3. Facing the front of the monitor, grasp opposite corners of the front bezel and pull carefully.
4. With the bezel off, remove the four allen head screws that hold the monitor in the cabinet. Remove the monitor from the cabinet.

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### 3.4 Keyboard Disassembly and Cleaning

The Keytronics keyboard is a complete module. If the keyboard becomes defective the entire unit should be replaced. The keyboard may become dirty causing sticky keys or poor contacts. Remove the four screws holding the keyboard within the base. The dirt inside can be blown out with dry air. The external cable should be checked for continuity.

### 3.5 Electronics Tray Disassembly and Assembly

The following procedures should be followed to remove the electronics tray from the Concept base.

1. Turn the power switches off on the base unit, video monitor, and peripheral equipment.
2. Remove all cables from the back of the base. This includes the cable from the monitor, from the keyboard, tap cable if OMNINET is being used, and the power cord. Cables to interface cards within the Concept base should be removed when the tray has been opened.
3. There are two latch screws on the back of the tray. Loosen these screws by turning the left one, as you face the back, clockwise. The latch screw on the right should be turned counterclockwise. The tray may now be pulled partially out. See Figure 9 for latch screws and cable locations.

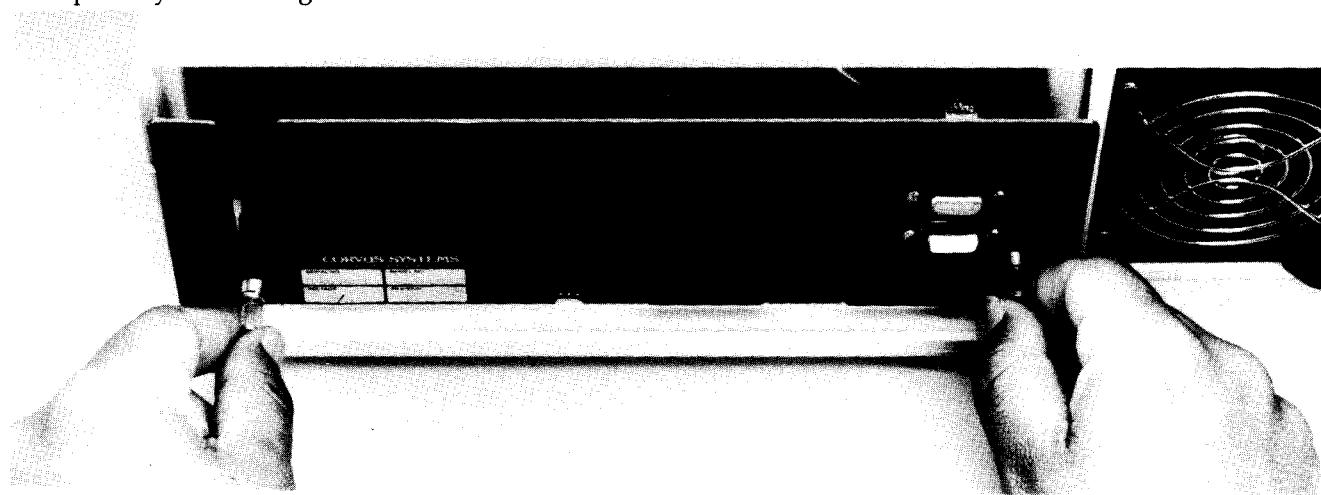


Figure 9. Latch Screws

4. To completely remove the tray, the four wire DC power cable from the Processor Board and the two wire cable from the Memory Board must be disconnected.

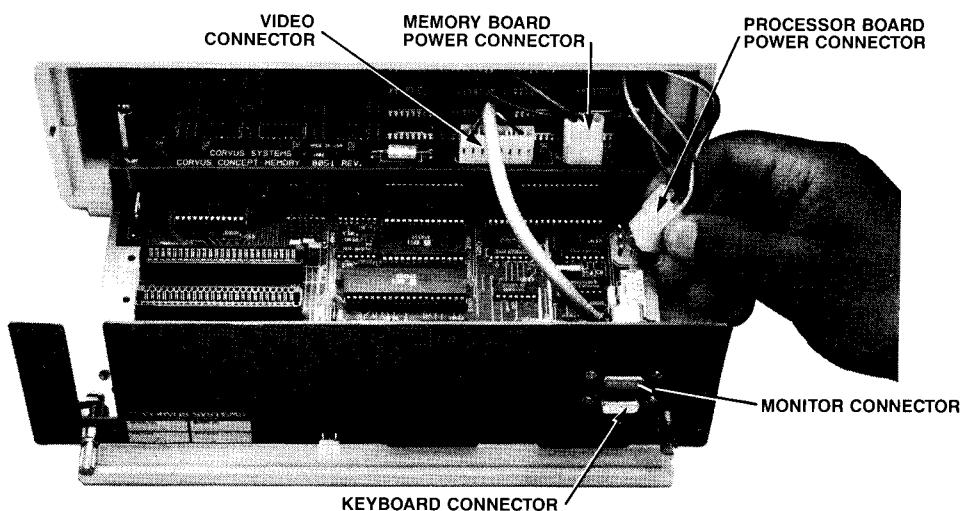


Figure 10. Electronics Tray Power Connections

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5. Pull the tray out of the base cavity. If resistance is encountered, lift slightly as you pull.
6. Disconnect the speaker wire leading to the Processor Board. Remove the four allen screws securing the speaker tray. Remove the Speaker Tray.
7. Disconnect the cable from the Memory Board. Remove the stand-offs that support the speaker tray. Remove the three flat ribbon cables at connectors J4, J5, and J6. Lift out the Memory Board.
8. Remove the four stand-offs that supported the Memory Board. Disconnect the keyboard and power switch connector at J9. (See Appendix A-3.) Remove the remaining allen screws which secure the Processor Board. To access the allen screws at the back of the tray, unscrew the retainer nuts on the latch screws. Lift out the Processor Board taking care to disengage the two serial ports from the back panel of the tray.
9. Reassemble the tray following the above steps in reverse order. Cables should be routed under the speaker tray to prevent interference when replacing the electronics tray.

### **3.6 Power Supply Removal**

1. Follow Electronic tray removal steps 1-5.
2. Carefully remove the video monitor from the base following instructions in Section 3.3.
3. Turn the base unit on its side and remove the five allen screws from the bottom of the base.
4. The top cover should now be free to remove revealing the open and exposed power supply.
5. Remove the four allen screws securing the power supply to the base.
6. Disconnect the muffin fan. Separate the six wire connector leading from the power supply to the CORCOM wire harness.
7. Remove the power supply from the base.

**CHAPTER 4**  
**ADJUSTMENTS**

## CHAPTER 4 ADJUSTMENTS

### 4.0 Scope of Chapter

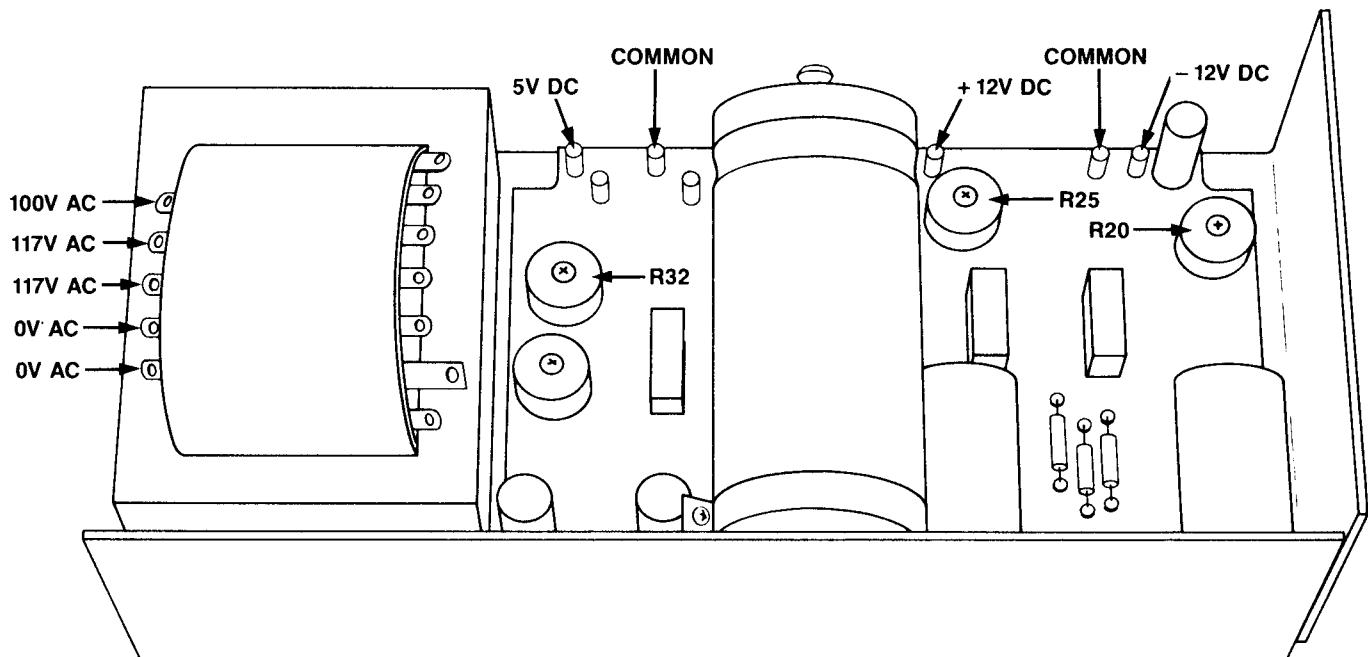
This chapter will guide you through the necessary steps to adjust the power supply and align the video monitor. Transportation and handling may necessitate these procedures.

### 4.1 Concept Power Supply Adjustments

The tools needed for the adjustment of the power supply are:

- Digital voltmeter
- Alignment tool or small screwdriver

1. Follow the Power Supply Removal and Disassembly procedures in steps 1 through 4 of section 3.6.



**Figure 11. Concept Power Supply Test Points and Adjustments**

2. While measuring the output at one of the Test Points, insert an alignment tool into the associated trim pot. Adjust to within the tolerance  $\pm 0.10$  V.

- R32 for +5VDC
- R25 for +12VDC
- R28 for -12VDC

If the power supply cannot be adjusted to within tolerance, contact Corvus Customer Service.

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### 4.2 Preparations for Video Adjustments

Tools that are required for a video adjustment are:

- CRT alignment tools
- Plastic see-through ruler
- Jumper with clip leads

1. Using a non-indelible marker, lightly trace the inner parameter of the front monitor bezel onto the screen of the CRT. This will aid when centering the raster and setting the proper vertical and horizontal lengths.
2. Perform the disassembly procedures in Section 3.3, position the exposed monitor on the base unit in the horizontal (landscape) position. Connect the monitor. Set the Screen Orientation Switch for horizontal display.

### 4.3 Video Alignment and Adjustment

Some adjustments may not be required; others may need to be performed more than once. All adjustments should be done in the horizontal mode and repeated in the vertical mode. It may be necessary to re-check adjustments in the horizontal mode.

**WARNING:**

***To prevent possible shocks it is recommended that you use one hand only when adjusting video equipment. Keep the other hand away from all equipment, preferably in a pocket.***

1. Apply power to the system allowing a minimum of 10 minutes for the monitor to warm-up and stabilize.
2. Log-on to the Concept.
3. When the Function Key labels are displayed, select the Window Manager function by holding down the command key and pressing function key F2 simultaneously. A new set of Function Key labels will appear.
4. Select the TestPtnr function key by holding down the command key and pressing Function Key F9 simultaneously. The screen will prompt the user to select a grid pattern or a pattern of pixels. A grid will be used for vertical and horizontal adjustments; pixels will be used for focusing and brightness adjustments.
5. Raster Centering

Turn the Brightness knob on the rear of the monitor to maximum. Using the two metal tabs on the yoke of the CRT, (see Figure 12) move the raster until it is centered horizontally within the lines made in Step 1 of Section 4.2.

If the raster is not parallel to the sides of the display glass, the yoke must be rotated. To rotate the yoke, slightly loosen the clamp screw on the neck of the CRT. Grasp the yoke assembly and gently rotate until the raster is properly oriented. DO NOT slide the yoke forward or backwards as this will affect horizontal linearity. Tighten the clamp screw.

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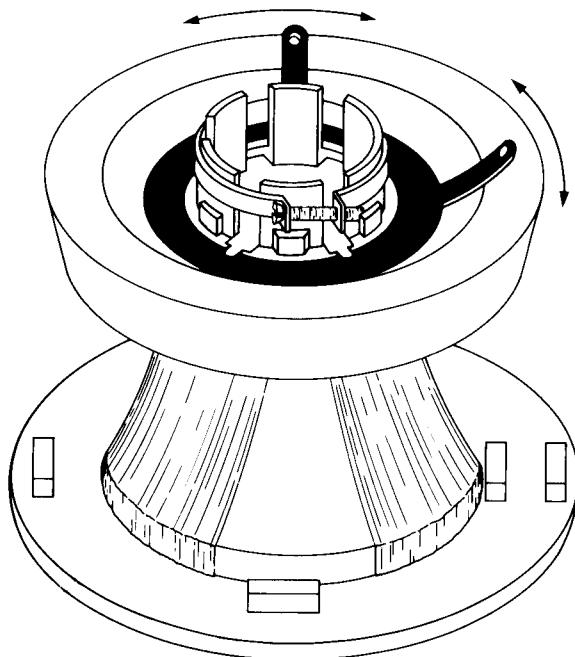


Figure 12. CRT Adjustment Yoke

6. Horizontal Data Centering

Select a grid pattern of 4 or 8. Turn the H. DATA CENT trim pot R111 (see Figure 13) until the grid is centered within the raster. A poorly aligned screen may exhibit fold-over.

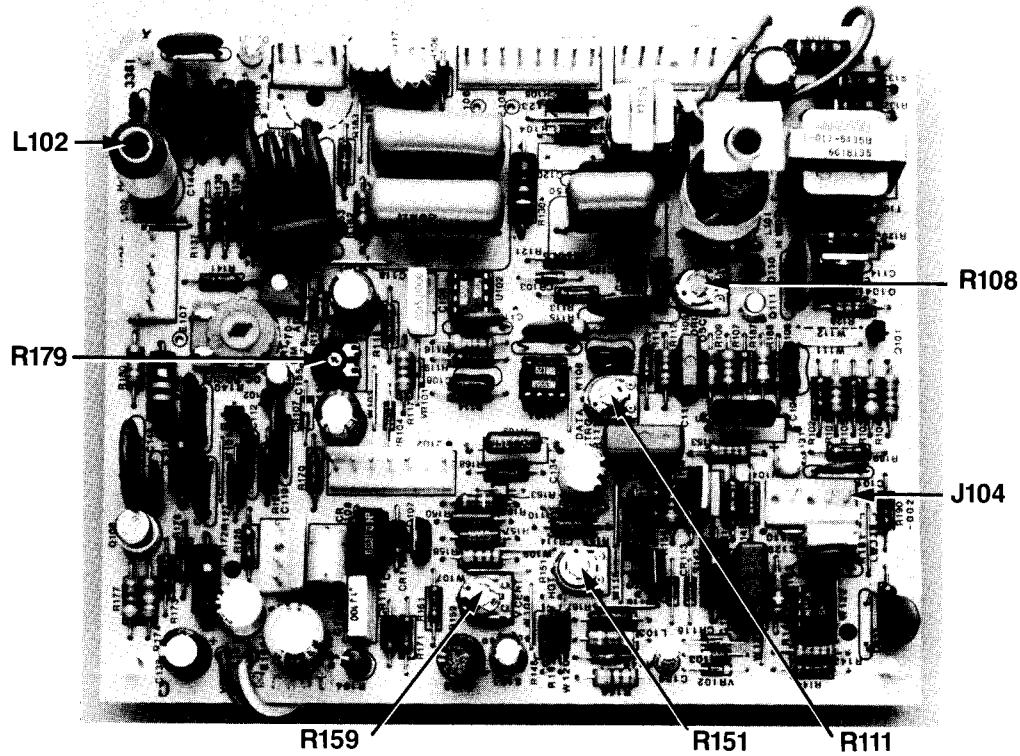


Figure 13. Horizontal and Vertical PCA

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### 7. Vertical Height

The vertical dimension of the grid, the shorter side in the landscape mode, should be 7.75 inches (19 centimeters). Measure the center line with a clear plastic ruler. Turn the Vertical Height trim pot R151 (see Figure 13) until the proper dimension is achieved.

### 8. Vertical Centering

Adjust the Vertical Centering trim pot R159 (see Figure 13) to center the display on the screen. It may be necessary to readjust the vertical height.

### 8. Horizontal Width

Ensure that the grid is centered. Using a plastic trim tool adjust L101 (see Figure 13) until the horizontal width measures 10.5 inches (27 centimeters). Use the center line of the grid for measurements. It may be necessary to repeat Steps 5 and 6.

### 9. Brightness

Turn the Brightness Limit trim pot R179 (see Figure 13) until the raster is just visible. Turn the Brightness knob on the rear of the monitor through the entire range. The display should go from fully dark to a data display with the raster just visible.

### 10. Contrast

Adjust the trim pot on the Video Board (see Figure 14) until the image begins to smear. Back up the adjustment until the image is clear and stable.

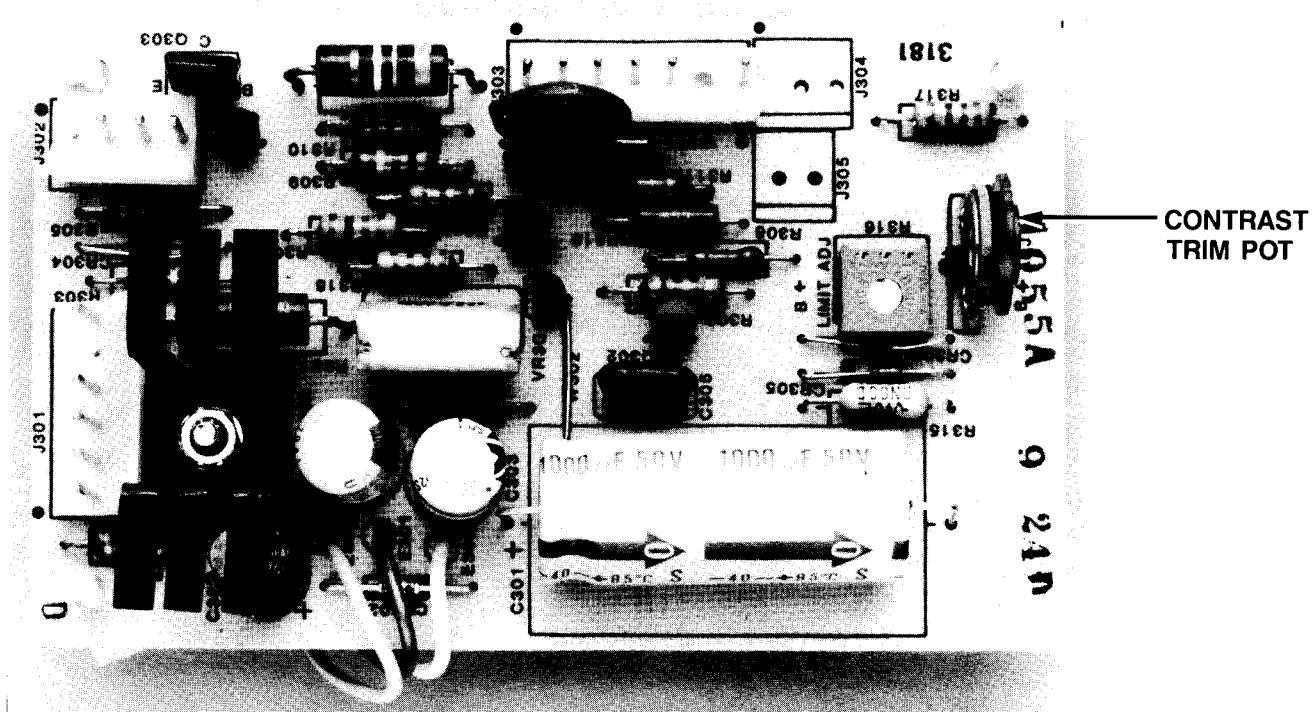


Figure 14. Video PCA

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**11. Horizontal Oscillator**

Using a shorting clip, connect J104 to the junction of C101 and R103. This allows the oscillator to run free. Turn the Horizontal Oscillator trim pot R108 until the display is stable and readable. Remove the clip and cycle the power to the monitor two or three times to insure that the oscillator will lock at the proper frequency. If the display is no longer centered, repeat Step 1.

**12. Final Display Position**

Turn the monitor to the portrait mode, vertical. The leftmost line should be parallel to the edge of the metal frame around the CRT and at a distance of 2.375 to 2.5 inches (6 to 6.4 centimeters). If the line is parallel but the distance is incorrect, readjust the Vertical Centering trim pot. If the grid is centered but the leftmost line is not parallel, the CRT must be rotated inside the frame.

**13. Focus**

To adjust the focus select a pixel pattern. With the raster just visible, the dots in the center of the screen should be clear and sharp with no tails or smearing when viewed from a distance of six feet (1.75 meters). The outer portions of the display may show slight tails, but they should not extend to the next dot. DC FOCUS, R140, and H FOCUS, L102 are used for adjustment.

**CHAPTER 5**  
**TROUBLESHOOTING**

## CHAPTER 5 TROUBLESHOOTING

### 5.0 Scope of Chapter

The Corvus Concept's modular design makes on-site, Level 1, troubleshooting fast and efficient. Level 1 troubleshooting includes initial checks and procedures to isolate defective modules. Boot problems and Self Test failures are described as are solutions.

Once the problem module has been identified, further troubleshooting may be necessary to diagnose defective modules. Level 2 troubleshooting procedures are intended for trained servicing dealers. Diagnostics are accomplished through utilization of modified Motorola MACSbug™ routines.

This chapter describes both Level 1 and Level 2 procedures, and Test Points and their associated signals.

### 5.1 Level 1 Troubleshooting

When making an on-site diagnosis, a complete spare parts kit is required.

The first step in troubleshooting is to duplicate the problem. Due to many variables such as setup, initialization procedures, software, external devices, and the environment, the problem may not repeat on a consistent basis.

Once the problem is noted, the second step is to isolate the failure by a process of elimination. Begin by eliminating sections of the system that are not required to repeat the failure. For example: If the monitor has no raster, it would be safe to eliminate the floppy drive from the system. Note that if the symptoms disappear after removing a certain section, that section may be the problem area. Do not remove peripherals needed to run the diagnostic tests.

The third step is to substitute a suspect module with a known good module. If the problem disappears, reinstall the suspect module to see if the problem returns.

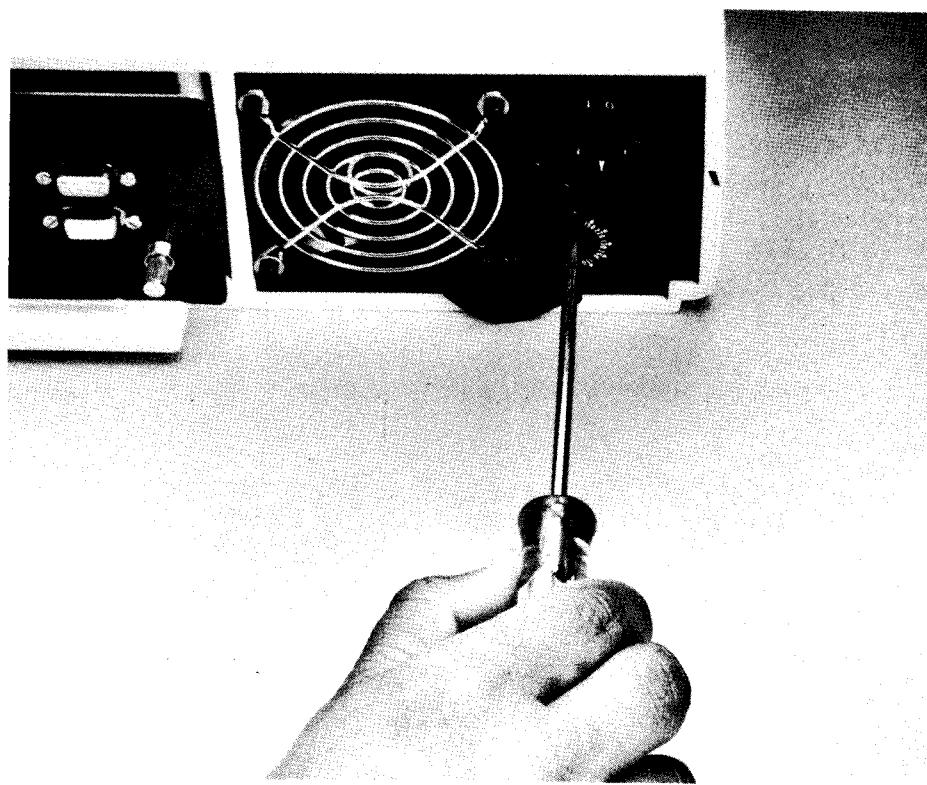
#### **CAUTION:**

**If the suspect module is burnt, discolored, or extremely hot to touch, do not substitute with a known good module. There is a risk that something external to that module caused the damage.**

#### 5.1.1 Video Monitor

The video monitor is a BALL HD series. In case of failure, the monitor unit should be returned for repair or replacement. In all cases where a malfunction of the monitor is suspected, the following guidelines should be followed prior to returning the monitor:

1. Ensure that proper signals are being sent from the video controller by substituting a known good base unit. If the monitor still does not work try the following checks.
2. Ensure that the proper AC line voltage is applied to the monitor (110 VAC, 120 VAC, 220 VAC, or 240 VAC). By loosening the left screw, the CORCOM can be adjusted to match the line voltage used in your area. (See Figure 14.) Ensure that the fuse link is good by checking for continuity.



**Figure 15. CORCOM Setting**

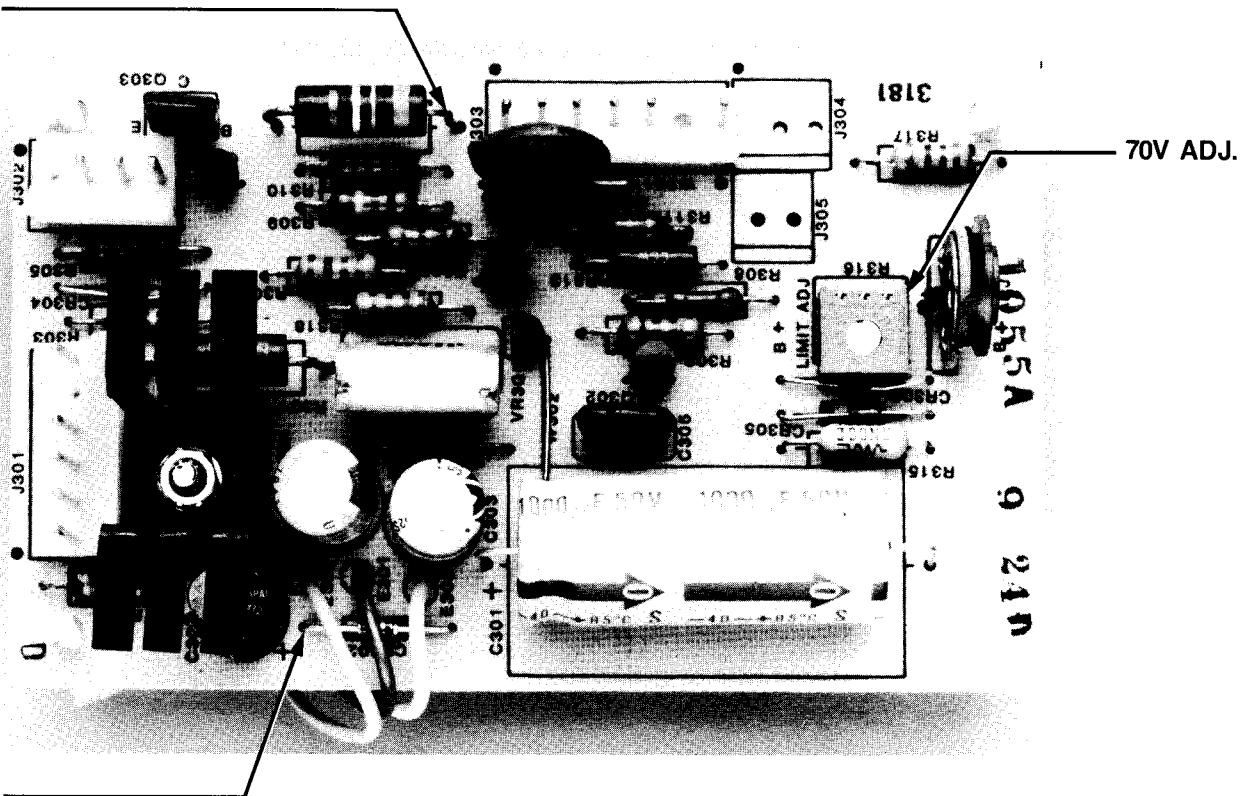
3. Check the seating of internal plugs and connectors. During shipment they may work loose.
4. Remove the four screws that hold the back panel in place. Locate the low voltage PCA at the bottom of the unit. Check for proper voltage at Test Points 301 and 302. (See Figure 16.)

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TP301 + 70V



TP302 + 35V

Figure 16. Monitor Voltage Test Points

5. Check the brightness and contrast levels by adjusting both controls through their entire range. Refer to the Video Alignment section.

### 5.1.2 Power Supply

The power supply cannot be physically eliminated from the unit. Therefore it must be checked first to verify that it is not the cause of the problem. See Section 3.6 for Disassembly and Section 4.1 for Adjustments.

1. If the DC voltages are not present, check to see if the muffin fan is turning. This indicates that the line voltage is present. If the fan does not turn, check the primary windings of the transformer with an AC voltmeter. (See Figure 11.) This voltage should be equal to the line voltage.
2. If there is no primary voltage, check the fuse link. If the fuse link is good, check the continuity of the on/off switch and ensure that the power cable is inserted snugly into the CORCOM.
3. If the voltages are incorrect, check the voltage select on the back of the unit. (See Figure 15.) Insert a slotted screwdriver into the selector and turn to the proper line voltage.

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4. With a DC voltage meter measure the voltages at the I/O slots. Measure the following pins of any 50-pin I/O slot:

- Pin 25 / +5V
- Pin 26 / GND
- Pin 33 / -12V
- Pin 34 / -5V
- Pin 50 / +12V

If any of the voltages varies more than  $\pm 5\%$ , adjust it to the proper voltage. If voltages cannot be adjusted, replace the power supply.

### 5.1.3 Power-On Self Tests

On initial power-up the Concept can self diagnose a hardware failure. The initial Self Test will verify that both data communication UARTs and the keyboard UART are in working condition. The Self Test will verify boot PROM checksums, will read and write several patterns to static RAM and dynamic RAM, interrogate the I/O slots for known devices, and will check for OMNINET duplicate host numbers.

A 555 timer operates so that the NRESET, NRESETOM, and HALT signals are held low for several clock times, resetting hardware and causing the MC68000 to begin addressing location zero, which is the first word of ROM0. The first two words are zero and set up the supervisor stack pointer and program counter. The second two words are the address of the fourth word of ROM0, to which the program counter is set. The next instruction sets the status register to 7 so that only the Non-Maskable Interrupt (NMI) can cause an interrupt. Since NMI is connected only during manufacturing, no interrupt should occur for a user. The program continues with a brief Self Test.

All on-board I/O registers are exercised. If there is an error, the Concept will attempt to inform the user by beeping the speaker, filling memory with a checkerboard pattern, displaying "bus error" and sending "bell" characters on Data Com ports. A serious problem may prevent some or all of these actions. If there is no error, the processor will perform a checksum on the ROM, and write and verify an incrementing pattern in the static RAM. If these tests are successful system variables are written into the static RAM.

Next the UARTS baud rates, parity etc., are set up to default conditions: 9600 baud for the Port 0 UART, 300 baud for the Port 1 UART, and 600 baud for the keyboard UART. The shift register and counter are set up to give a beep and the OMNINET interrupt is cleared.

The address of the first word of every 256th location is written into dynamic RAM for the first one megabyte of that memory, and then read back. The first bank must return the correct value when read. Incorrect values from the third and fourth bank will cause the system to assume that those banks were not loaded. Next, an incrementing pattern is written across all dynamic RAM and verified; the pattern increments by one byte with an extra increment each 256 locations. If this test is successful, zeros are written throughout the RAM, the display is turned on (0-VIDOFF), and a boot message appears. If the boot switches on the Processor Board are set for a choice of booting device (see Figure 17 and 18 for switch settings), the following message will appear:

CORVUS Concept INITIALIZATION (0.4)  
©COPYRIGHT 1982 CORVUS SYSTEMS, INC.  
ALL SYSTEMS PASSED  
SELECT (D,F,L,O): \_\_\_\_

If the boot switches are set for a device boot, one of the following messages will appear: "Booting from Floppy" or, if MACSbug ROMs are installed, "Booting from MACSbug."

If booting is successful, the operating system will be loaded along with full drivers for the I/O devices, a character set for the display, and a full keyboard map.

### 5.1.4 Self Test Error Codes

In the case of a system test failure, performing the checks in this section may isolate the problem. The test number and their associated system test failures are as follows:

- Test 1—UART Failure
- Test 2—PROM Checksum Failure
- Test 3—Static RAM Test Failure
- Test 4—Dynamic RAM Test Failure
- Test 5—Dynamic RAM Test Failure
- Test 6—Slot Device not Ready Failure
- Test 7—OMNINET Host Number Duplicated

If system errors 1 through 5 are indicated, power off the Concept and remove the drawer from the base unit. Reseat all socketed chips and reassemble the base unit. Power the Concept on again and check for system errors. If problems persist, substitute suspect components with known good components (UARTs, PROMs, static RAMs). A more detailed description of the Self Tests are described below.

**NOTE:**

*There will be some instances where a failure may inhibit these tests. In cases such as these a MACSbug kit, available from Corvus, is recommended. This kit consists of a pair of programmed EPROMs and a user's guide. MACSbug may be used as a 68000 monitor program. It allows a user to set and display the contents of memory, set and display address and data registers, and allows the user to program with the 68000 instruction set by entering the hexadecimal equivalents.*

**Test 1**

Test 1 failure indicates that either a data communication or the keyboard UART failed to respond in the desired way. The error message will not specify which UART is bad. Level 2 troubleshooting will be necessary to find the defective UART using a MACSbug routine. (See Level 2 Troubleshooting in Section 5.2).

If you do not have Level 2 capabilities, replace the Processor Board from your spares kit. Refer to Section 3.5 of this manual for Disassembly and Assembly instructions.

2. Test 2 failure indicates that an invalid code was detected in the boot PROMs. If this error is indicated remove the tray from the base and inspect for unseated PROMs or bent pins. If no visible damage is evident, replace ROM0-U and ROM0-L one at a time.

3. **Test 3**

Test 3 failure indicates that the static RAM is defective. The test involves two parts, a walking bit test and a marching bit test. There is only one static RAM installed in the Concept. If after replacing the RAM the test still fails, Level 2 troubleshooting will be necessary requiring MACSbug routines to diagnose the failure.

If you do not have Level 2 capabilities, replace the Processor Board. Refer to Section 3.5 of this manual for Disassembly and Assembly instructions.

4. **Test 4**

Test 4 is used to test the dynamic RAM. Like the static RAM test, it has two parts. The first part exercises RAM by walking a bit throughout memory. The second part of the test is a marching bit test. If Test 4 fails there will be no indication of where or how the test failed. Level 2 troubleshooting will be necessary. MACSbug routines enable a technician to read and write various patterns to all locations of RAM.

If you do not have Level 2 capabilities, replace the Memory Board. Refer to Section 3.5 of this manual for Disassembly and Assembly instructions.

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5. Test 5

Test 5 is used to test dynamic RAM differently than in Test 4. In this test an incrementing pattern is written to all locations of memory. Again, this test will only indicate that an error exists. To troubleshoot further, Level 2 troubleshooting is required.

If you do not have Level 2 capabilities, replace the Memory Board. Refer to Section 3.5 of this manual for Disassembly and Assembly instructions.

6. Test 6

Test 6 is used to examine the 50-pin I/O slots for known devices. The test queries slot #1 for the interface's PROM code. The test then proceeds to compare that code with the known code for a local disk or a Corvus Floppy Disk Drive, in that order. If the comparison fails to match the test then it proceeds to check the next slot's device. Once the test finds a code that it can identify it jumps to a subroutine. This subroutine is used to sync with the device. If the subroutine fails to sync with the device, the message "SYSTEM TEST ERROR 6" is returned. In this case, power the system down and back up, paying special attention to the devices coming ready. If all peripherals are ready, the Concept may not be communicating with them. Check for correct slot insertion. Replace the interface board and cable with known good ones. If System Test 6 still fails, replace peripherals one at a time with known good replacements. If these procedures do not remedy the problem, Level 2 troubleshooting will be required.

If you do not have Level 2 capabilities, replace the Processor Board. Refer to Section 3.5 of this manual for Disassembly and Assembly instructions.

7. Test 7

Test 7 will verify that the OMNINET host number is unique. This routine will store the host number into data register D0. A WHO command is then sent across the network, checking the active stations on the network. If the host number is duplicated the routine will indicate a System Test failure 7. Consult the Corvus OMNINET Disk Installation Guide for instructions for setting network device addresses.

If the problem is still not found, replace the Processor Board. Refer to Section 3.5 of this manual for Disassembly and Assembly instructions.

### 5.1.5 Boot Problems

There are four boot options available to the user:

- Debug (D)—MACSbug Debugger
- Floppy (F)—Floppy Drive
- Local (L)—Corvus Hard Disk Drive
- OMNINET (O)—Corvus Systems OMNINET local network

If a boot error is encountered, perform the following checks to verify the correct set-up procedures:

1. Boot Switches

Verify that the boot switches are set properly for the boot device. (See Figures 17 and 18). For example switches 1 and 2 should be off to boot from OMNINET. Switch 1 should be on and switch 2 off for a flat cable boot. If the switch settings are correct proceed to the next step.

The layout of the Processor Board for Revision 03 of the Corvus Concept is different than those of later Revisions (04, etc.). The boot microswitches have been relocated. The new location should be noted.

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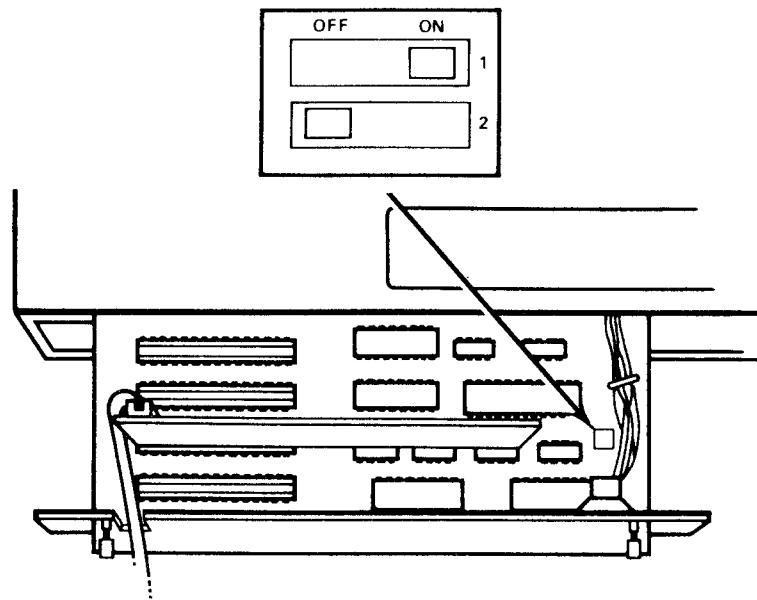


Figure 17. Rev 03 Boot Switch Settings

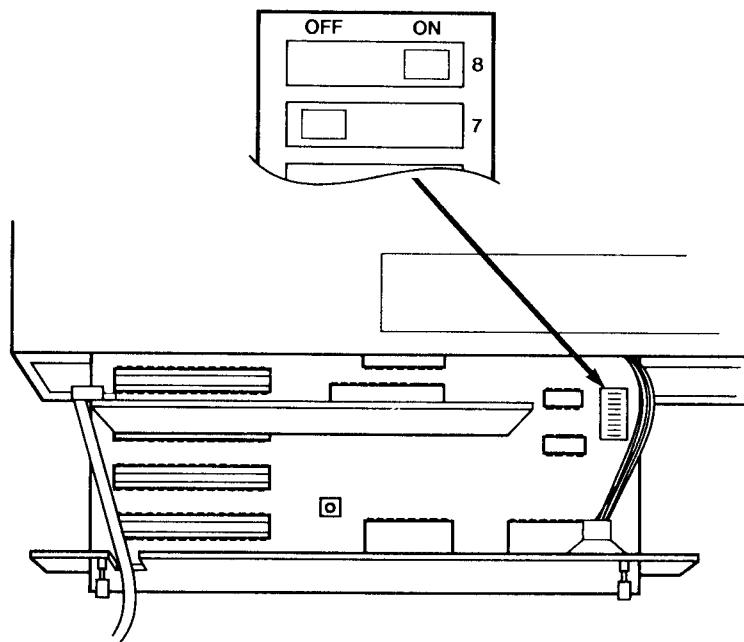


Figure 18. Rev 04 Boot Switch Settings

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If the hardware is available, change the switch settings and boot from a different device. If the change results in a successful boot, the previous boot device may be bad or the I/O buffers on the Processor Board related to that device may be defective.

Replace the Processor Board if you do not have Level 2 troubleshooting capabilities. For Disassembly and Assembly instructions, please see Section 3.5 of this manual.

2. Flat Cable Boot

When a flat cable interface will not boot the Corvus disk drive, verify that the interface is correctly installed. Refer to the Corvus Concept Workstation Installation Guide for detailed procedures. A programmed EPROM is required on the interface card in order to be recognized as a valid Corvus disk interface.

3. OMNINET Boot

If the Concept will not boot from OMNINET, ensure that each Concept has a unique host number. The Disk Server should have a host number of zero. Refer to the Corvus OMNINET Installation Guide for hardware set-up instructions.

If the OMNINET boot error persists, Level 2 troubleshooting will be necessary. If you do not have this capability, replace the Processor Board according to the instructions outlined in Section 3.5 of this manual.

4. Floppy Boot

In the event that a Floppy Drive boot error is encountered, refer to the Corvus Concept Floppy Drive Installation Guide to ensure that the proper installation procedures have been followed. After verifying correct installation, try to reboot from the Floppy Disk Drive.

If it stills fails, refer to the Floppy Drive Service Manual for Level 2 floppy drive service procedures.

### 5.2 Level 2 Troubleshooting

This level of troubleshooting is recommended for in-depth troubleshooting of the Processor Board and Memory Board. It requires a knowledge of digital troubleshooting techniques and an understanding of assembly language.

The Corvus Concept utilizes the Motorola 68000 Microprocessor and its monitor program, MACSbug, for manipulation of the processor during debug. MACSbug may be purchased from Corvus Systems. Sample routines may be found in Appendix E.

In order to facilitate troubleshooting to the component level, we have identified Test Points on the Processor and Memory Boards. A photograph of these Test Point signals and of a logic analyzer showing their relationships appear in Appendix C.

#### 5.2.1 MACSbug Installation Procedures

1. Power-off the Concept base and display.
2. Disconnect the keyboard cable, display monitor cable, and the OMNINET tap cable. Open the drawer of the base unit and remove the power supply cables connected at locations labeled J8 and J1 on the Processor Board and the Memory Board respectively. Remove any tap cables or interface cards which are currently in the drawer.
3. Lift up on the drawer assembly and completely remove it from the base unit.

*NOTE:*

*The layout of the Processor Board for Revisions 03 of the Corvus Concept is different than that of later Revisions (04, etc.). For this installation procedure, the location of the microswitches and the ROM and RAM sockets should be noted. Both Rev 03 and Rev 04 procedures are described.*

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Revision 03

4. Locate the Boot ROMs on the Processor Board at U706, ROM0U, and U711, ROM0L. Remove the ROMs at these locations if they are not version 0.5 or later. Place a ROM labeled CC 0.5 H or later in location U706 and the ROM labeled CC 0.5 L or later in location U711 on the Processor Board. (See Figure 19.)

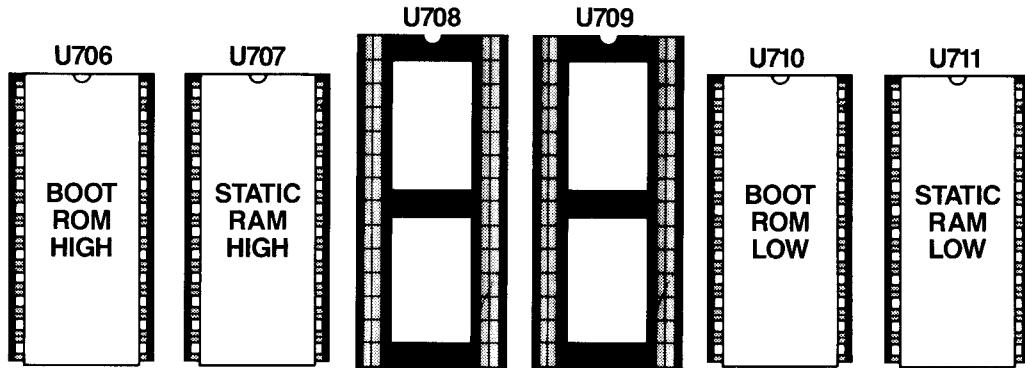


Figure 19. REV 03 ROM and RAM Locations

5. The boot microswitches, located across from the I/O slots on the Processor Board, should be set as indicated in Figure 17.
6. Place the ROM labeled MACSbug 2.0 L in location U709. Place the ROM labeled MACSbug 2.0 H in location U708 of the Processor Board. The MACSbug ROM sockets are 28-pin sockets, and the MACSbug ROMs are 24-pin devices. The sockets should have the top four pin locations unused (i.e. pins 1,2,27 and 28). Figure 19 depicts proper installation.

Revision 04 (and later)

4. Locate the Boot ROMs on the Processor Board at U706, ROM0L, and U710, ROM0U. Remove the ROMs at these locations if they are not version 0.5 or later. Place a ROM labeled CC 0.5 H or later in location U706 and the ROM labeled CC 0.5 L or later in location U706 on the Processor Board. (See Figure 20.)

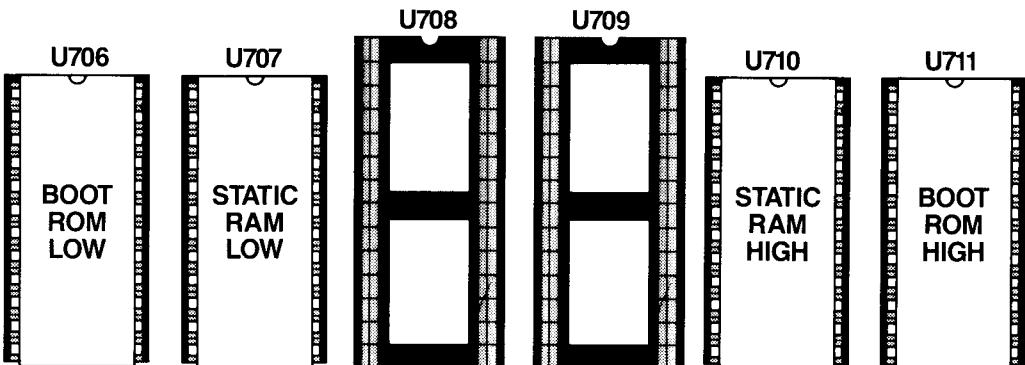


Figure 20. Rev 04 ROM and RAM Locations

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5. Set the microswitches, which are located across from the I/O slots on the Processor Board as indicated in Figure 17.
6. Place the ROM labeled MACSbug 2.0 L in location U709. Place the ROM labeled MACSbug 2.0 H in location U708 of the Processor Board. The MACSbug ROMs are 24-pin devices. The sockets should have the top four pin locations unused (i.e. pins 1,2,27 and 28). Figure 20 depicts proper installation.
7. Reconnect the cable from the speaker tray to the connector labeled J7 on the Processor Board, making sure the cable is routed down through the back side of the drawer and inside the standoff supporting the Memory Board.
8. Replace the drawer into the base unit and position the two power supply cables along the speaker tray channel to prevent chaffing of the cables. Reconnect the power supply cables to J8 on the Processor Board and J1 on the Memory Board.
9. Reconnect any tap cables or interface cards originally within the drawer.
10. Power on the display and then the base unit. The Concept will emit a beep, and then request input from the user regarding the boot device as follows:

Select the device : (D,F,L,O) :

D—Debug (MACSbug)  
F—Floppy Disk Drive  
L—Local Disk Drive  
O—OMNINET Drive

11. Select your normal disk boot option to run a quick check of the unit. If the unit does not complete the boot, check the ROM locations and verify that all pins of the ROMs are installed correctly. Repeat the procedure until the system boots. If problems persist, contact Corvus Customer Service.

### **5.2.2 Communicating with MACSbug**

Communication with MACSbug is performed through the two serial ports on the back of the Corvus Concept. When used with MACSbug, Port 1 has a default data rate of 9600 baud, parity is disabled and an 8-bit character size is assumed. An ASCII terminal must be attached to Port 1 with a null modem cable. This terminal is the MACSbug console.

MACSbug supports Port 2 as a standard RS-232C data terminal connector with a default data rate of 4800 baud, parity disabled and an 8-bit data character size. Port 2 can be used to communicate with a host computer, a printer or other serial device.

This two port communication arrangement allows the Corvus Concept to be placed in series with an ASCII terminal and a host computer. The transparent mode of MACSbug can be used to bypass the Corvus Concept. A program may be created on the host computer using the ASCII terminal and, when the program code file is generated, downloaded into the Corvus Concept for execution and debugging. This does not require the reconfiguration of the cabling.

### **5.2.3 Operating Procedures**

After the MACSbug ROMs have been installed, MACSbug can be entered before the Corvus Concept operating system is booted as follows:

1. Connect an ASCII terminal to Port 1 of the Corvus Concept.
2. Ensure that the Concept boot switches are both in the ON position.
3. Power on the Corvus Concept.
4. Select option D, for Debugger, when prompted.

MACSbug will initialize and display on the ASCII terminal connected to Port 1 with the following message:

MACSbug 2.0

\*

If these two lines do not print out, perform the following:

1. Check to see that the ASCII terminal is attached to RS-232C Port 1 using a null modem cable.
2. Ensure that the terminal's baud rate is set to 9600, parity is disabled, and an 8-bit character size is selected.

#### **5.2.4 MACSbug Routines**

MACSbug routines are useful for writing loop-back tests to diagnose static RAM, and I/O addresses. Some of the most commonly used mnemonics are:

- SM—Set Memory
- DM—Display Memory
- OP—Open address

The recommended memory starting location for static RAM is \$700.

MACSbug is a versatile tool for use in troubleshooting. Modifications should be made to the sample routines in Appendix E to fit specific needs. MACSbug routines listed are in assembly code.

### **5.3 Component Level Troubleshooting**

After isolating the failure at the board level, further troubleshooting may be desired. With the aid of troubleshooting guides, timing diagrams, and Test Points a technician may troubleshoot down to a defective component. The Processor Board contains 24 Test Points for various signals. (See Appendix C-1.)

#### **CAUTION:**

**The Processor Board consists of many layers. Damage will occur to the board if proper soldering procedures are not followed.**

#### **5.3.1 Processor Signal Descriptions**

A few major signals should be tested before checking the Test Points. The Concept will not operate unless these signals are present.

1. Clock Signals

If clock signals are incorrect or absent, a bad buffer IC, U109, 74LS04 may be present. If the inputs of this chip are bad a defective cable or Memory Board may be responsible. Proceed to the memory Section 5.3.3.

With an oscilloscope measure the signals at locations U109 pins 2 (16MHz), 6 (8MHz, Test Point 3), and 8 (1MHz). These clock signals are described in the following Section, 5.3.2, and illustrated in Appendix C-1. Timing relationships of these signals, can be found in Appendix D-1.

2. RESET

On initial power-up, the hardware generates a momentary reset. This bidirectional signal can be generated internally by the processor, or through external hardware. If this line is stuck low, check the input to the buffer U304 pin 11.

With an oscilloscope measure the RESET signal at location U402 pin 18. The RESET signal is described in the following Section and a photograph of the signal is included in Appendix C-1.

#### **5.3.2 Processor Test Points**

The Processor Board has designated Test Points to facilitate troubleshooting.

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<b>Test Point</b>	<b>Signal Name</b>	<b>Apprx. Location</b>
1	DMAGO2	U104-9
2	DMAEN	U104-5
3	8M	U103-6
4	TXENA	U114-4
5	IN/OUT	U110-12
6	NTACK	U411-5
7	TXD	U110-6
8	DTACK	U306-10
9	RAMSEL	U203-8
10	NRAMACK	U205-12
11	NAS	U307-14
12	NOMNI	U109-32
13	NOMINT	U304-8
14	HALT	U405-10
15	NWRITE	U603-11
16	IPL1	U404-7
17	IPL2	U404-6
18	IPL0	U404-9
19	DS	U308-8
20	NDTACK	U510-6
21	NSRO	U705-14
22	NDEVS	U704-4
23	NKBD	U705-15
24	NSR1	U705-13

**Table 4. Processor Board Test Points, Rev 04 & 05**

The Test Points and their signals are described in the following paragraphs. An "N" prefix on a signal name indicates that it is asserted when the signal goes low. See Appendix D-1 for proper timing relationships. Signal waveforms and Test Points are depicted in Appendix C-1.

1. Test Point 1—DMAGO2  
When asserted, the DMAGO2 signal indicates that OMNINET is in the process of doing a DMA operation. If asserted, OMNINET has total control over the memory address and data bus. If the processor attempts to access memory it will go into a wait state until the DMA operation is complete.
2. Test Point 2—DMAEN  
When the DMAREQ is asserted, it is latched into a JK flip-flop on the next 16M clock pulse. The output of this latch is the signal DMAEN.
3. Test Point 3—8M  
The 8M signal is the system clock. This clock is generated on the Memory Board and supplied to the Processor Board by means of a flat cable. The signal is then inverted and applied to the 68000 microprocessor chip.
4. Test Point 4—TXENA  
The TXENA signal is used by OMNINET. When the Concept requires data to be transmitted across the twisted pair cable of OMNINET, the 6801 asserts this signal. The TXENA enables a transmitter chip, 75174. This allows data to flow from the Advanced Data Link Controller, ADLC, to the RS-422 connector.
5. Test Point 5—IN/OUT  
The IN/OUT signal is used as the R/W line for the ADLC chip in the OMNINET. This signal controls the direction of the data flow on the data bus when enabled by EOUT and NCS.

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6. Test Point 6—NTACK  
The memory generates a data acknowledge, NTACK when RAMSEL is negated or when NRAMACK is asserted.
7. Test Point 7—TXD  
TXD is the serially transmitted data from the OMNINET ADLC chip. After the signal TXENA is asserted, the data is transmitted across the twisted pair cable.
8. Test Point 8—DTACK  
With an oscilloscope measure the signal at location U605 pin 5, Test Point 20. If the MC68000 does not receive a low signal on this line, it will go into a wait state. Check the input signals on U605.
9. Test Point 9—RAMSEL  
The Memory Board requires RAMSEL before an access can start. RAMSEL must then be negated before a new access can start. RAMSEL is derived from either the 68KRAMSEL signal or the DMAGO2 signal depending on which device has control over the memory bus.
10. Test Point 10—NRAMACK  
The memory data acknowledge signal, RAMACK, is asserted when the signal NCAS (see memory section) goes high. Once initiated, memory cycles occurs until NRAMACK is asserted. NRAMACK signals that the data in an access has been latched by the 68000.
11. Test Point 11—NAS  
This signal, when asserted, signifies a valid address is on the address bus.
12. Test Point 12—NOMNI  
In order for the processor to give OMNINET commands, the processor places a byte of data on the data bus and then strobes NOMNI. When this has occurred for three strobes, OMNINET uses the three bytes of data as an address.
13. Test Point 13—NOMINT  
The Concept processor recognizes seven levels of interrupts. OMNINET utilizes a level three interrupt. The OMNINET 6801 will generate an interrupt to the 68000 when a transaction is complete or when an error is encountered.
14. Test Point 14—HALT  
HALT is a bidirectional signal that can be asserted either by the processor or by external software. When this signal is asserted low, all control signals are inactive and the data and address buses are put in a high impedance state.
15. Test Point 15—NWRITE  
This signal identifies the data bus transfer as a read or write operation. When the signal goes low, a write is signified.
16. Test Points 16, 17 and 18—IPL0, IPL1, IPL2  
These three input pins indicate the encoded priority level of the device requesting an interrupt. Level zero indicates no devices interrupt. A level of seven, not used in the Concept at this time, is reserved for Non-Maskable Interrupts. The least significant bit is contained in IPL0 and the most significant bit contained in IPL2. See Table 4 for a list of devices and interrupt levels.
17. Test Point 19—DS  
This signal is the result of a logical NAND operation between the upper data strobe (NUDS) and lower data strobe (NLDS). The DTACK delay is cleared when the data strobe, DS, is negated.
18. Test Point 20—NDTACK  
NDTACK indicates the completion of a data transfer. When the processor recognizes NDTACK on a read cycle, data is latched and the bus cycle is terminated. When NDTACK is recognized on a write cycle, the bus cycle is terminated. Memories and I/Os of different speeds are accommodated by delaying DTACK until the access is complete.

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19. Test Points 21 and 24—NSR0, NSR1  
NSR0 and NSR1 are the chip selects for two Synertek SY6551 UARTs. The UARTs control data communications for the RS-232C Port 0 and Port 1. (See Appendix H-2.)
20. Test Point 22—NDEVS  
NDEVS is used as an enable for the addressable I/O slot. The range of addresses is from 30021 to 3009F or 30121 to 3019F HEX. Either set of addresses access the same memory locations. All addresses in this range must be odd.
21. Test Point 23—NKBD  
NKBD is used as a chip select on the SY6551 UART. This particular UART is used for keyboard communications. The signal is addressable within the range of 30F01 to 30F07 HEX. See the Memory Map chart in Appendix F.

### 5.3.3 Memory and Video Controller Test Points

The memory and video controller contains the necessary circuitry for system timing and clock generation as well as memory addressing and data control. This board supplies the necessary signals to the video monitor such as video data, sync pulses, and horizontal and vertical blanking pulses. Some key signals are described in the following paragraphs. See Table 5 for actual signal locations and Appendix C-2 for Test Point locations.

Signal Name	Board Location
16M	U101-1
HSYNC	U105-4
VSYNC	U105-2
ENVID	U301-15
LOADVID	U504-2
NVIDTIME	U401-7
MUX	U405-14
NRASTIME	U405-15
NCASTIME	U405-13
68K	U305-3
NWL, NWU	U305-3,11

Table 5. Memory and Timing Signal Locations

1. 16M  
This 16MHz signal is the basis of all timing within the Concept. This clock signal is generated by an oscillator at a frequency of 16.364 MHz. Counters divide this signal to frequencies of 8 MHz, 1 MHz and 35 KHz.
2. HSYNC  
The HSYNC is generated on the Memory Board by a horizontal counter, HCTR, Revision 7. This signal is a 3  $\mu$ s pulse which is used to hold the video screen in place horizontally.
3. VSYNC  
VSYNC similar to the HSYNC, is generated on the Memory Board by an 82S153. It locks the video screen in place vertically. The frequency of this signal will differ between the 50 Hz and 60 Hz monitors. Jumper TF determines the vertical frequency. VCTR, the vertical counter, and HCTR can be reprogrammed. They are not EPROMS but have sufficient spare states to be reprogrammed.

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4. ENVID

This signal blanks the video screen when negated. The blanking is accomplished by clearing the video data shift registers. The signal is output from the HCTR and VCTR.

5. LOADVID

LOADVID loads data from the RAM into the video shift registers. This pulse occurs close to the end of NVIDTIME. See Appendix D for the proper timing relationships.

6. NVIDTIME

When the video requires a data input or refreshing, the signal NVIDTIME is asserted. NVIDTIME is 1.02275 MHz, asserted and negated for a total of 488.87 ns. Video access and processor access of memory cannot occur at the same time. The processor may or may not require the memory base, but video time must be consistent and accurate.

7. NMUX

During NVIDTIME, the video address counter is selected to address the memory. The signal NMUX determines whether the upper or lower part of the address goes to the memory to be stored by RAS and CAS.

The signal NRASTIME is derived from the horizontal counter. It is used in conjunction with the Bank Select to create the Row Address Select, RAS, for the various banks of memory.

9. NCASTIME

NCASTIME is derived from the vertical counter. It is used with the Bank Select to create the Column Address Select, CAS, for the various banks of memory.

10. 68K

The 68K signal allows the memory to do a read or write cycle for the processor. The processor cannot access at this time. NVIDTIME and 68K cannot occur simultaneously.

11. NWL, NWU

These signals are used as the R/W lines for the upper and lower RAM banks and are active low signals.

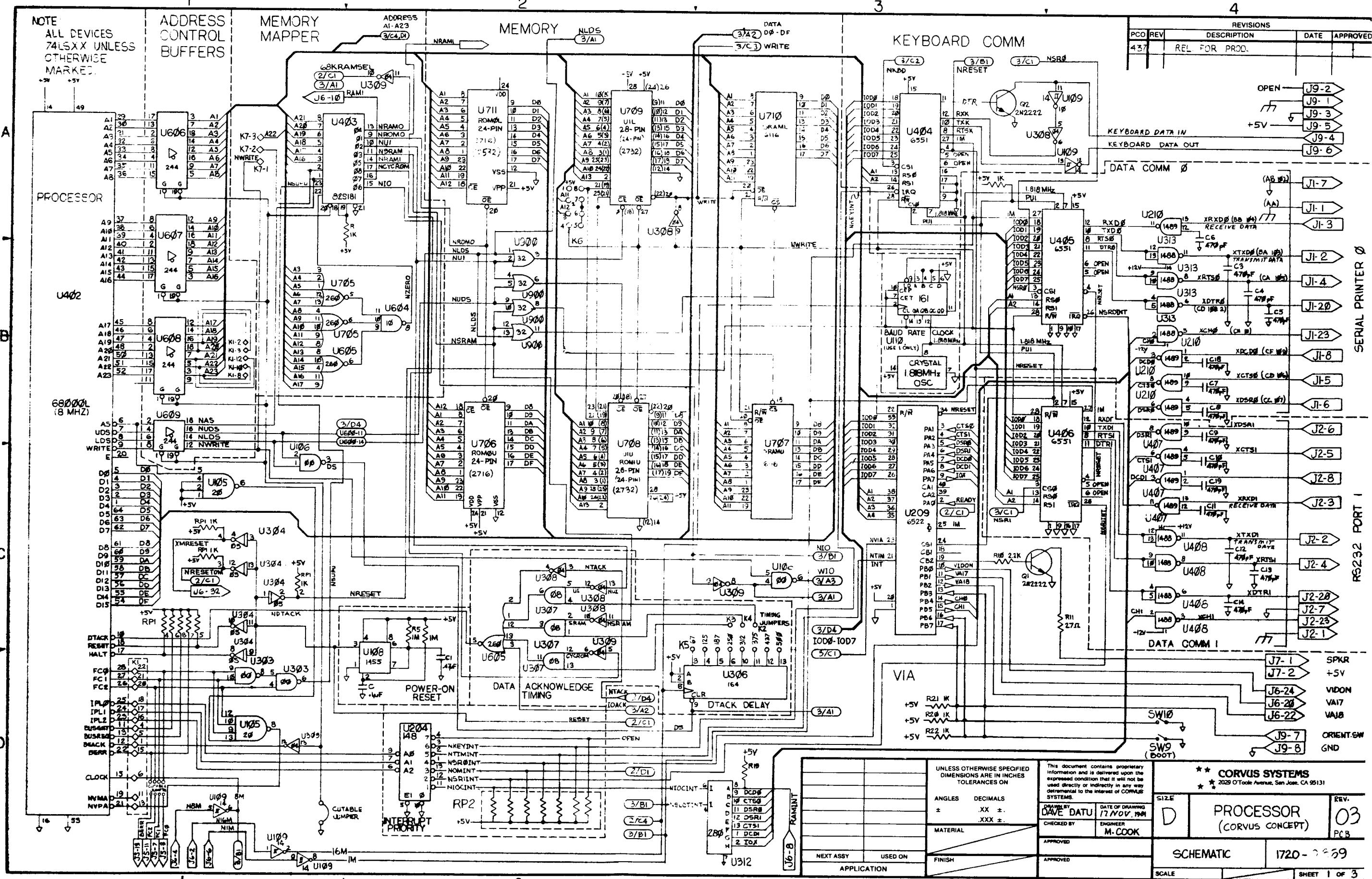
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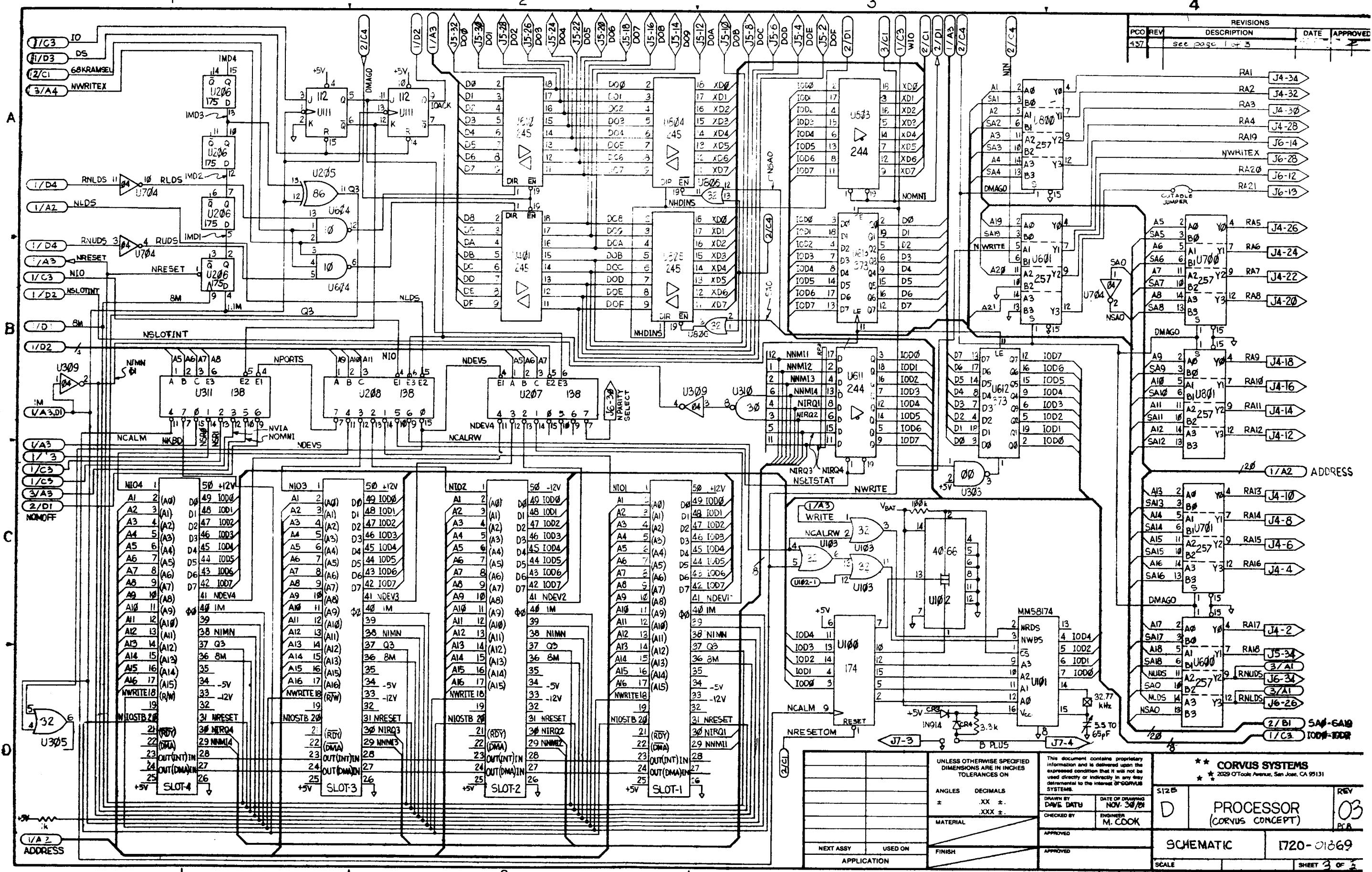
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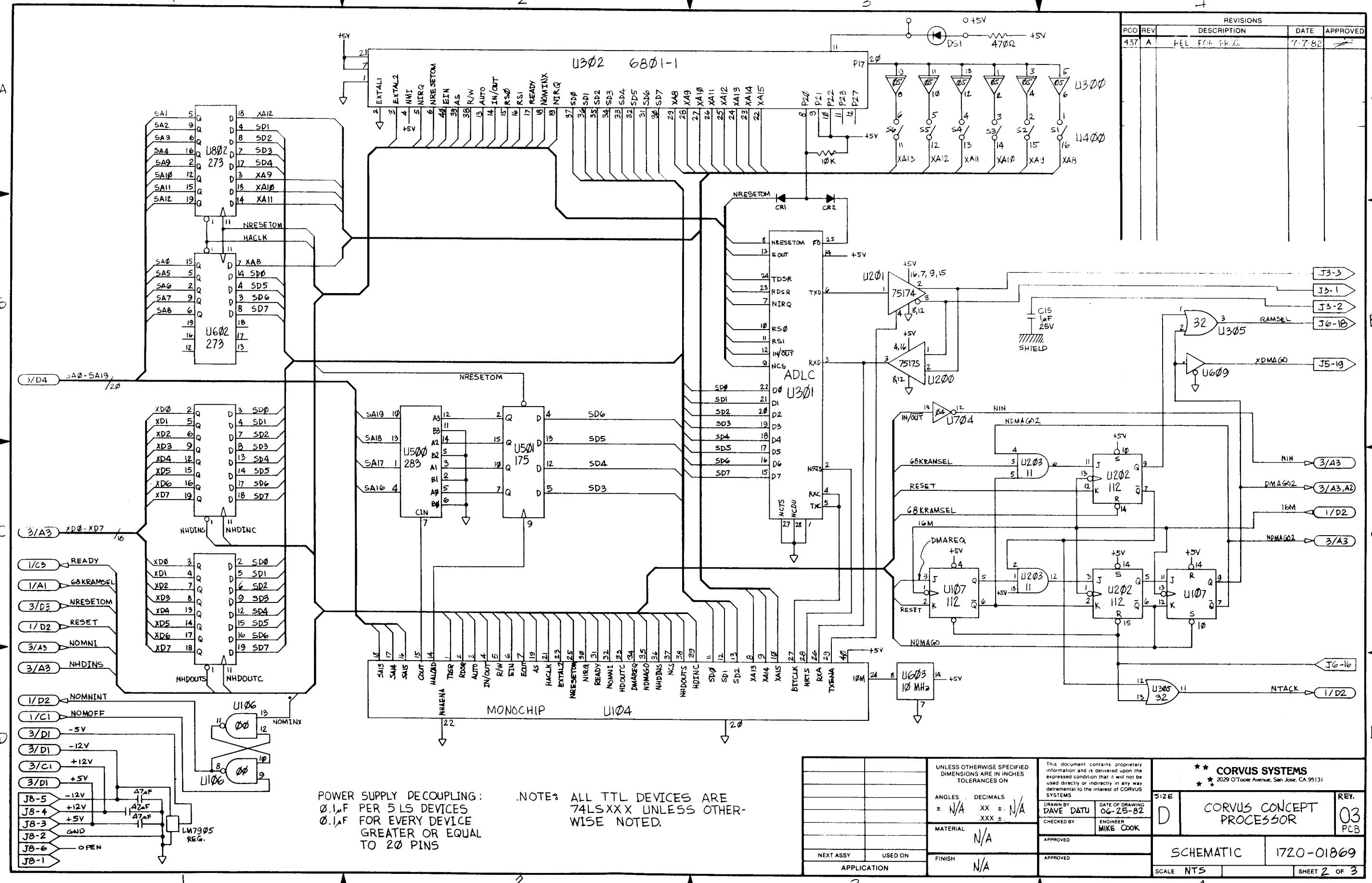
**CORVUS DEALER SERVICE**

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**APPENDIX A  
SCHEMATICS AND  
ASSEMBLY DRAWINGS**



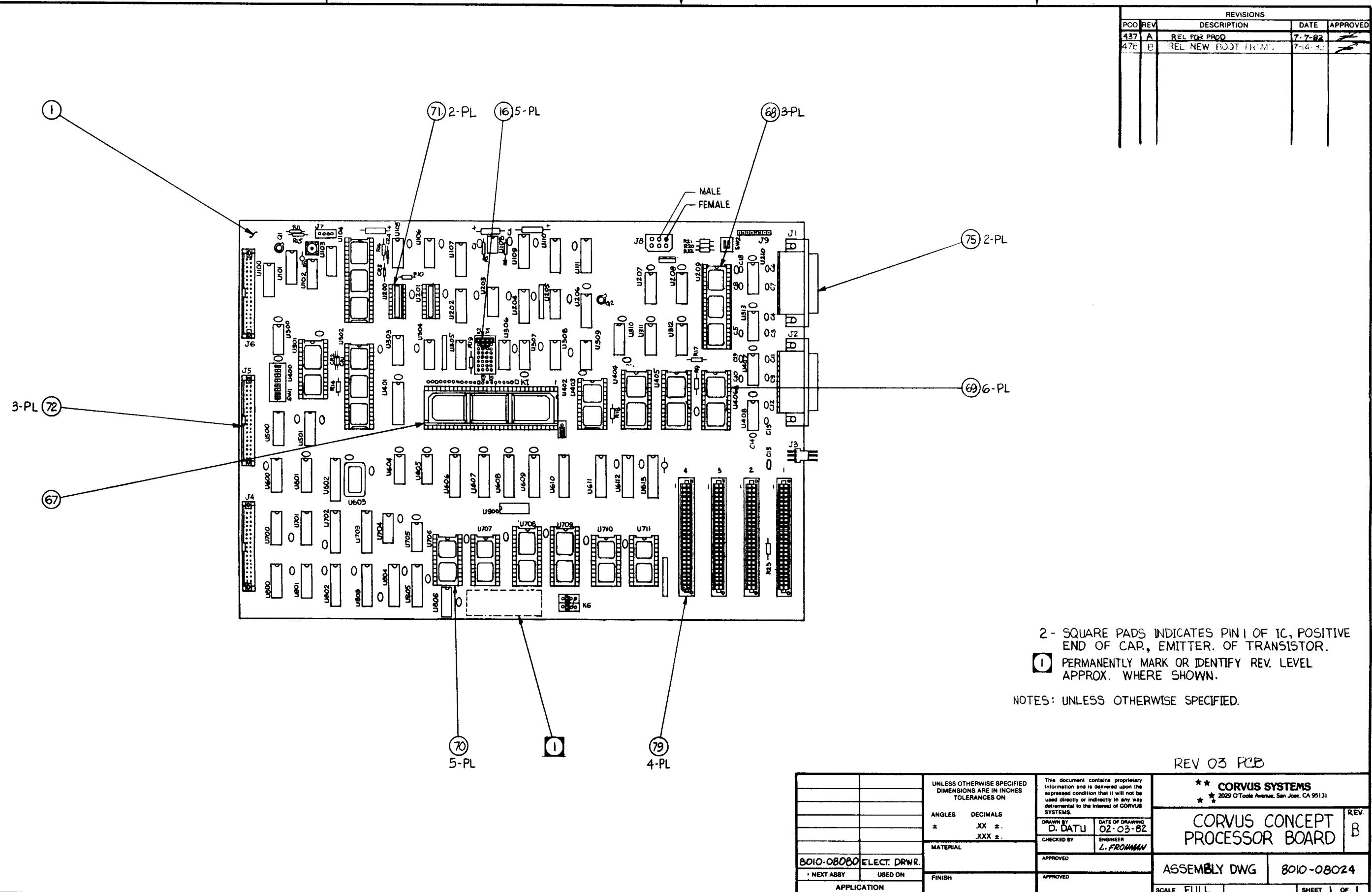




POWER SUPPLY DE COUPLING  
0.1 $\mu$ F PER 5 LS DEVICES  
0.1 $\mu$ F FOR EVERY DEVICE  
GREATER OR EQUAL  
TO 20 PINS

NOTE: ALL TTL DEVICES ARE  
74LSXXX UNLESS OTHERWISE  
NOTED.

		UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON	This document contains proprietary information and is delivered upon the expressed condition that it will not be used directly or indirectly in any way detrimental to the interest of CORVUS SYSTEMS		★★ CORVUS SYSTEMS ★★ 2029 O'Toole Avenue, San Jose, CA 95131	
ANGLES	DECIMALS		DRAWN BY <b>DAVE DATU</b>	DATE OF DRAWING <b>06-25-82</b>	SIZE <b>D</b>	<b>CORVUS CONCEPT PROCESSOR</b>
± N/A	XX ± N/A XXX ±	CHECKED BY <b>ENGINEER MIKE COOK</b>	APPROVED			
MATERIAL	N/A	APPROVED		SCHEMATIC		1720-01869
NEXT ASSY	USED ON	FINISH	N/A	SCALE NTS	SHEET 2 OF 3	
APPLICATION						



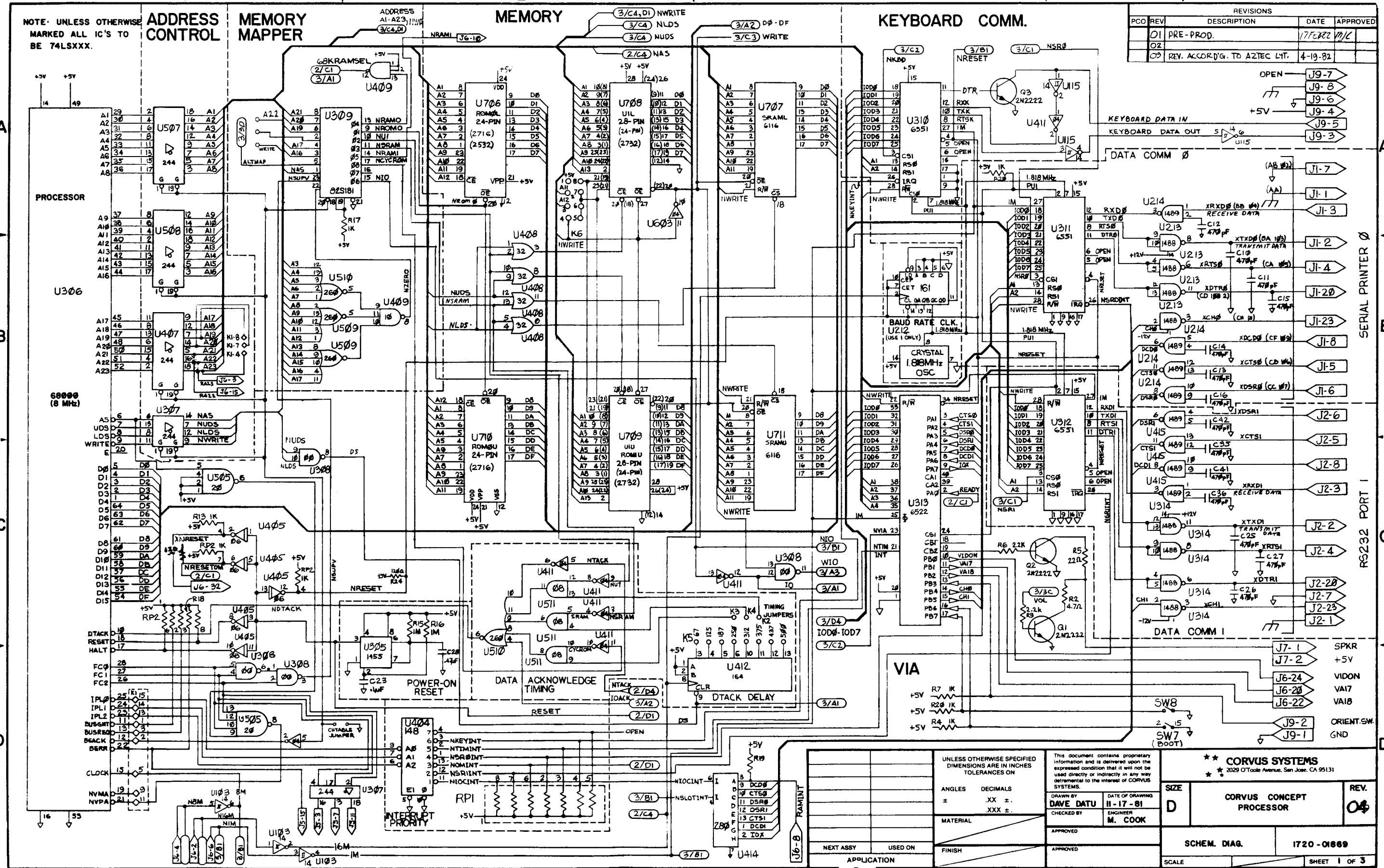
2 - SQUARE PADS INDICATES PIN 1 OF IC, POSITIVE END OF CAP., Emitter. OF TRANSISTOR.

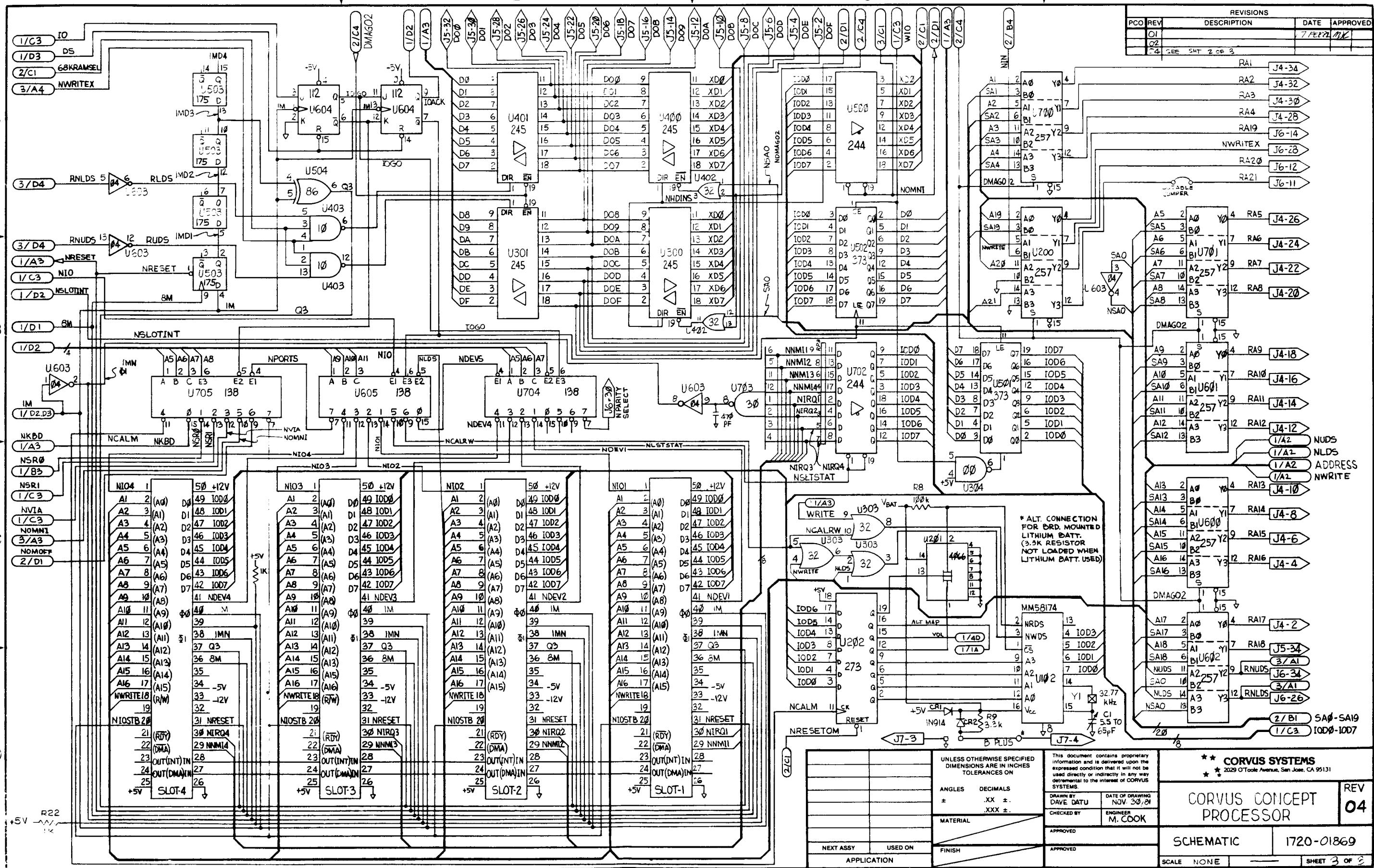
**1** PERMANENTLY MARK OR IDENTIFY REV. LEVEL APPROX. WHERE SHOWN.

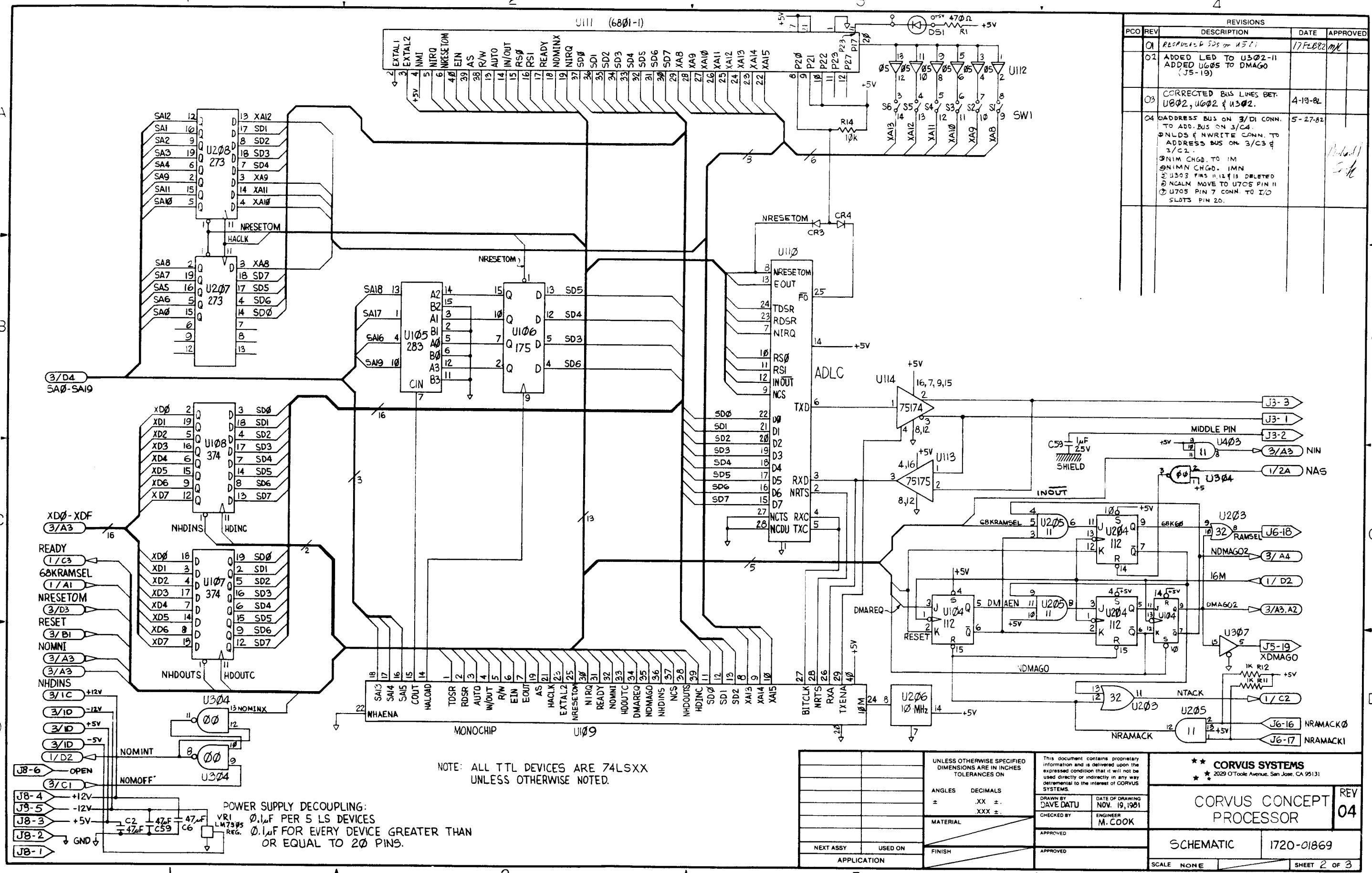
NOTES: UNLESS OTHERWISE SPECIFIED.

REV 03 PCB

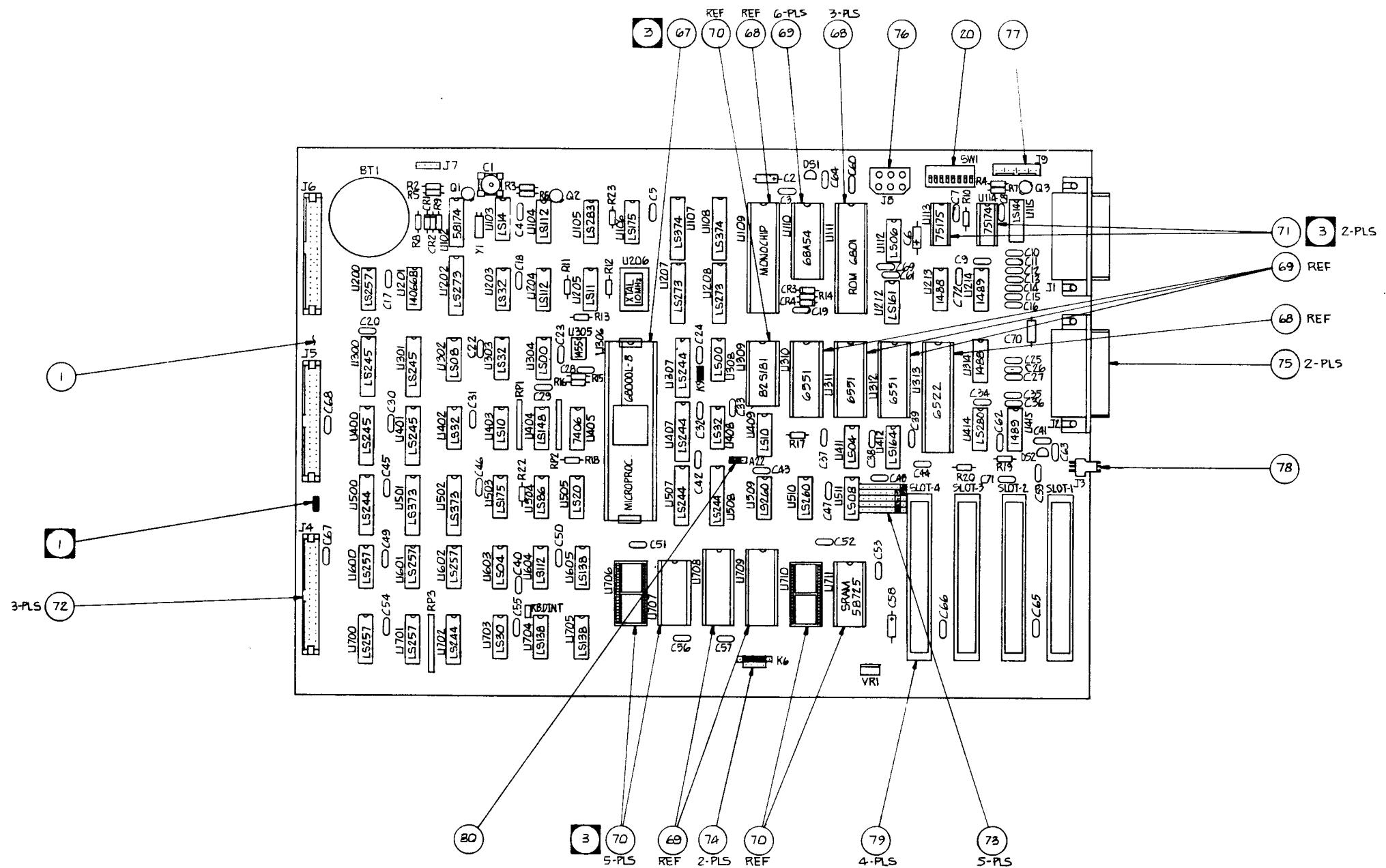
		UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON	This document contains proprietary information and is delivered upon the expressed condition that it will not be used directly or indirectly in any way detrimental to the interest of CORVUS SYSTEMS.	★★ CORVUS SYSTEMS ★ ★ 2029 O'Tools Avenue, San Jose, CA 95131
		ANGLES      DECIMALS	DRAWN BY D. DATU	REV.
		± .XX ± . .XXX ± .	DATE OF DRAWING 02-03-82	
		MATERIAL	CHECKED BY L. FROHMAN	B
8010-08080	ELECT. DRWR.		APPROVED	
• NEXT ASBY	USED ON	FINISH	APPROVED	ASSEMBLY DWG      8010-08024
APPLICATION			SCALE    FULL	SHEET    1 OF 1







REVISIONS			
PCO	REV	DESCRIPTION	DATE APPROVED
S78	C	ADD. REF DES.	8-9-82
579	D	UPDATE (ENG G)	8-19-82
669	E	CAP CHNGD - ITEM 7	9-9-82
678	F	CHNGD ITEMS 84 & 85	10-6-82
713	G	ADD ITEMS TO LM	10-12-82
708	H	LM CHNGD ONLY	10-14-82
710	J	LM CHNGD ONLY	10-14-82
748	K	CHNGD ITEM 55 (LM)	10-25-82
773	L	LM / ENGG CHNGD	11-12-82
776	M	BOOT PROM CHNGD (LM)	11-12-82
799	N	ADD ITEM 18 (RN3)	11-10-82
860	-	AWK INSTR CHNGD ONLY	1-14-83
/	/	CHNGD - SEE PCO # 860 CHNGD C70 TO 47UF CHNGD RN3 TO RP3	2-9-83
/	/	UPDATE (SEE ECO # 860)	2-18-83
/	/	K6, K9, & A22 REV. - ECO#B60	2-23-83
910	Q	ADD ITEM 9G (LM)	2-18-83
987	R	REL. OF REV.B PCB	3-1-83



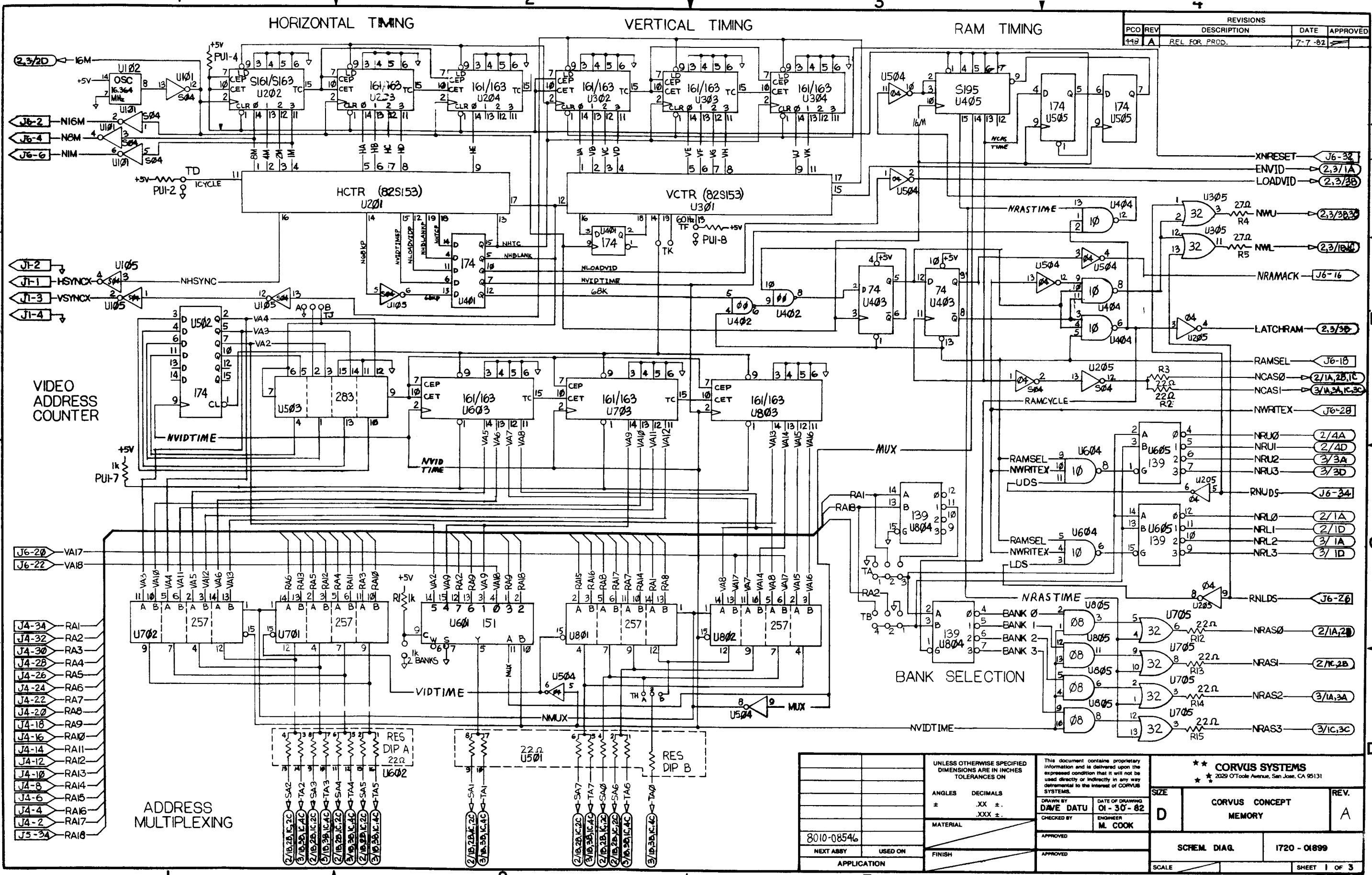
3 SOCKETS TO BE INSTALLED DURING ASSY. - DEVICES TO BE INSTALLED AFTER PROGRAMMING OR DURING TEST

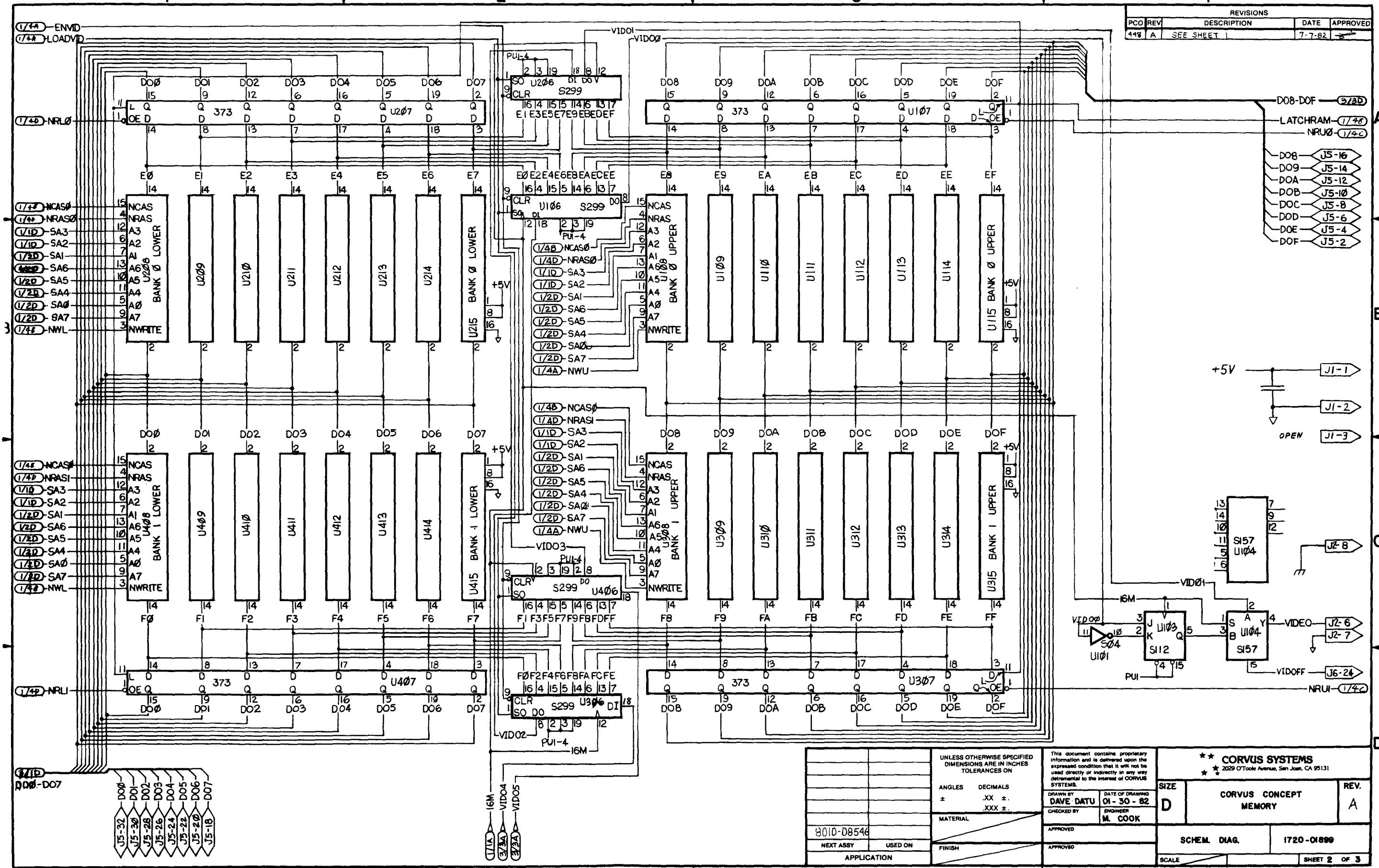
2 SQUARE PADS INDICATES PIN#1 OF IC, POSITIVE END CAP

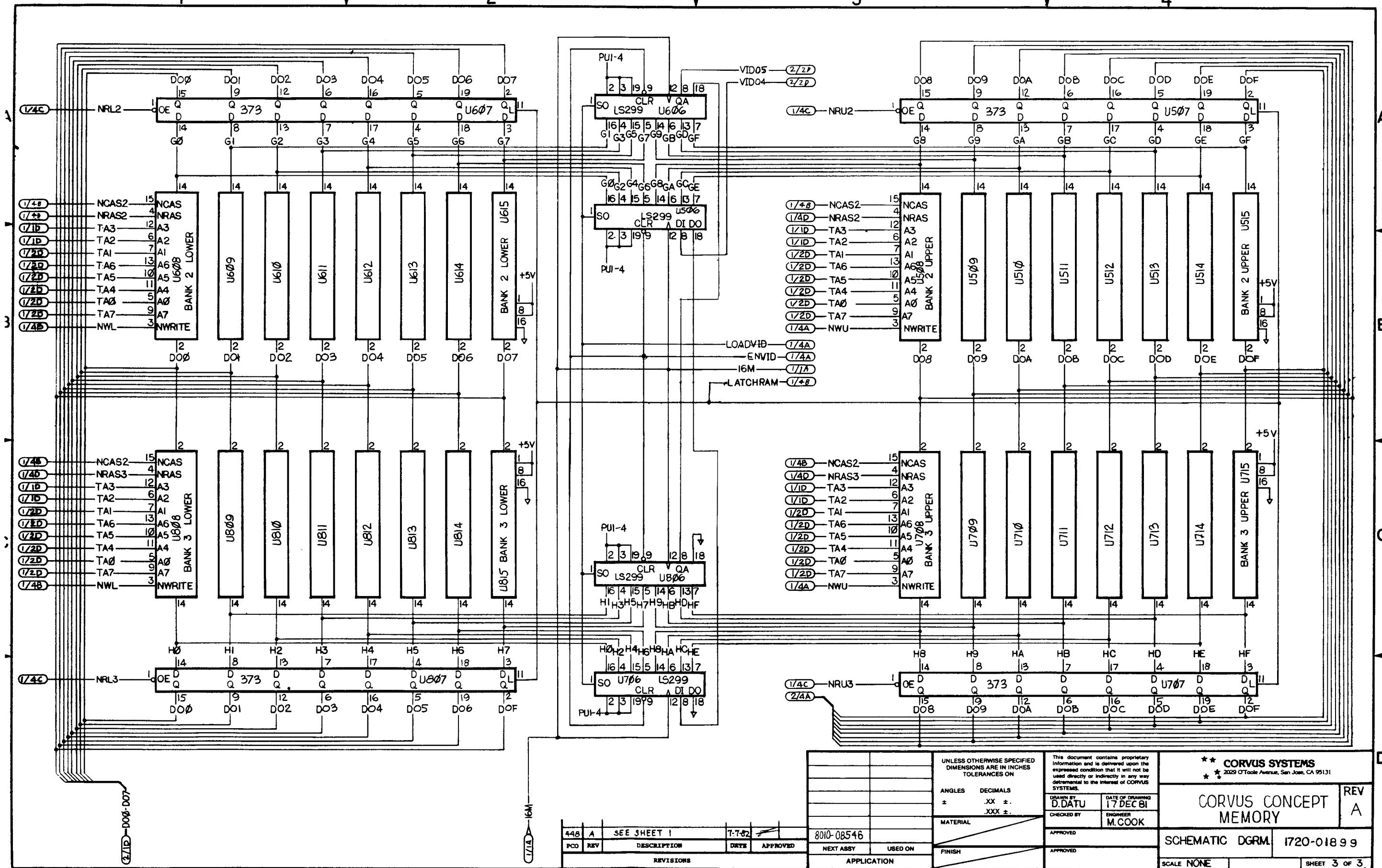
1 PERMANENTLY MARK OR IDENTIFY REV. LEVEL TO BE LOCATED WHERE APPROX. SHOWN

NOTES: UNLESS OTHERWISE SPECIFIED:

		UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON ANGLES DECIMALS $\pm .XX \pm .XXX$	This document contains proprietary information and is delivered upon the expressed condition that it will not be used directly or indirectly in any way detrimental to the interest of CORVUS SYSTEMS.	★ ★ CORVUS SYSTEMS ★ ★ 2029 O'Toole Avenue, San Jose, CA 95131
		DRAWN BY D.D. DATE OF DRAWING 2-9-83	CHECKED BY ENGINEER L.FROHMAN	CORVUS CONCEPT PROCESSOR BOARD
		MATERIAL	APPROVED	REV. R
		NEXT ASSY	USED ON	P/N 8010-08024
		APPLICATION	FINISH	SCALE 1 X SHEET 1 OF 1







2/10 - Dog - D07

16M  
11A

448	A	SEE SHEET 1
PCO	REV	DESCRIPTION
REVISIONS		

	7-7-82	<i>[Signature]</i>	
	DATE	APPROVED	8010-085
			NEXT ASSY

		MATERIAL
16	USED ON	FINISH
APPLICATION		

APPROVED  
APPROVED

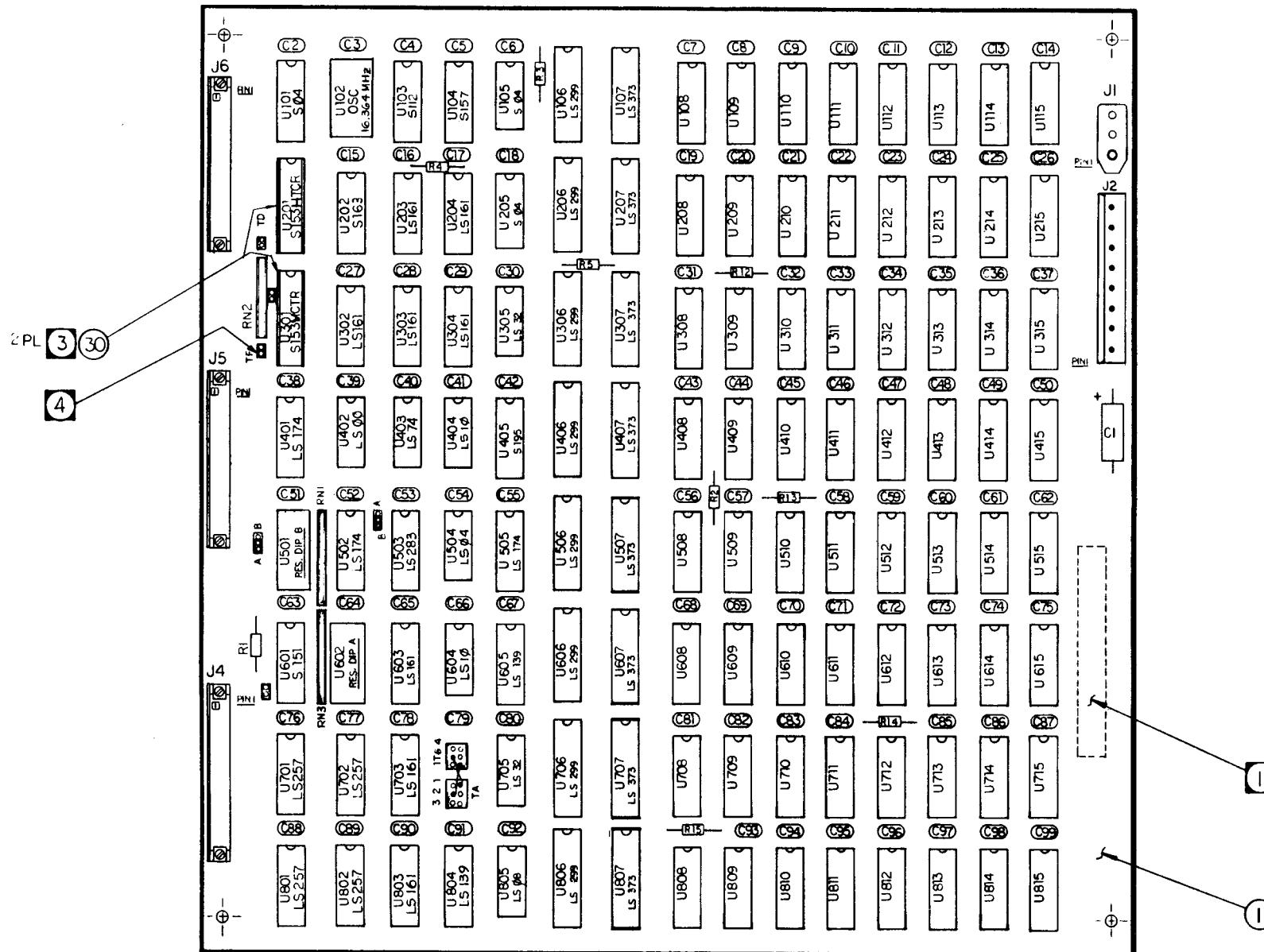
OK	MEMORY	
	SCHEMATIC DGRM.	I720
	SCALE NONE	

0-01895  
SHEET 3 OF

10 of 10

Page 1

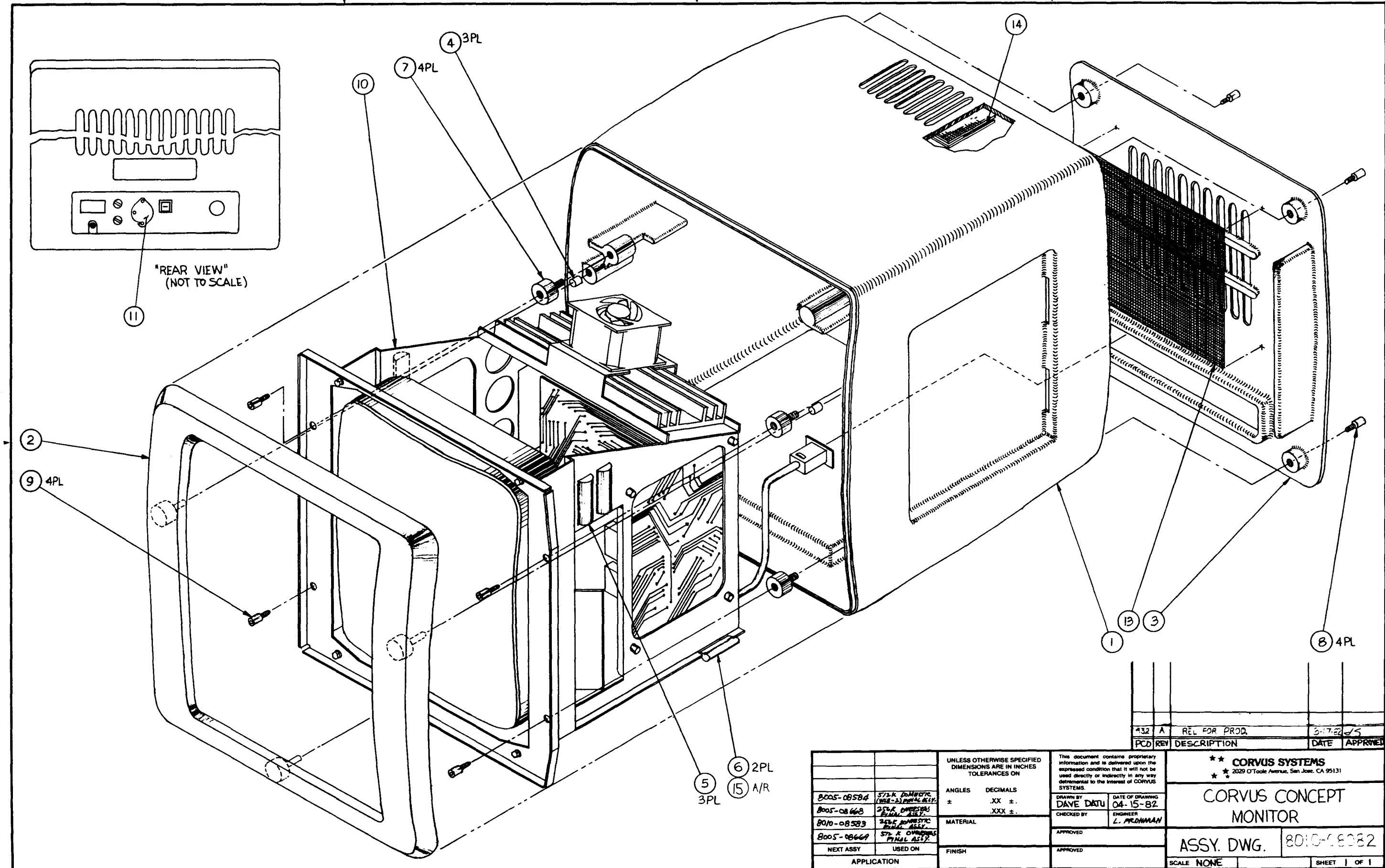
REVISIONS			
PCO	REV	DESCRIPTION	DATE APPROVED
498	A	REL FOR PROD	7-3-82
535	B	ADD REWORK INST	8-6-82
637	C	CHG ITEM 26	8-26-82
713	D	ADD ITEMS TO L/M	10-12-82
771	E	CHG TOLERANCE ON XLTO (LM)	11-12-82
916	F	ADD ITEM 44 (LM)	2-18-83

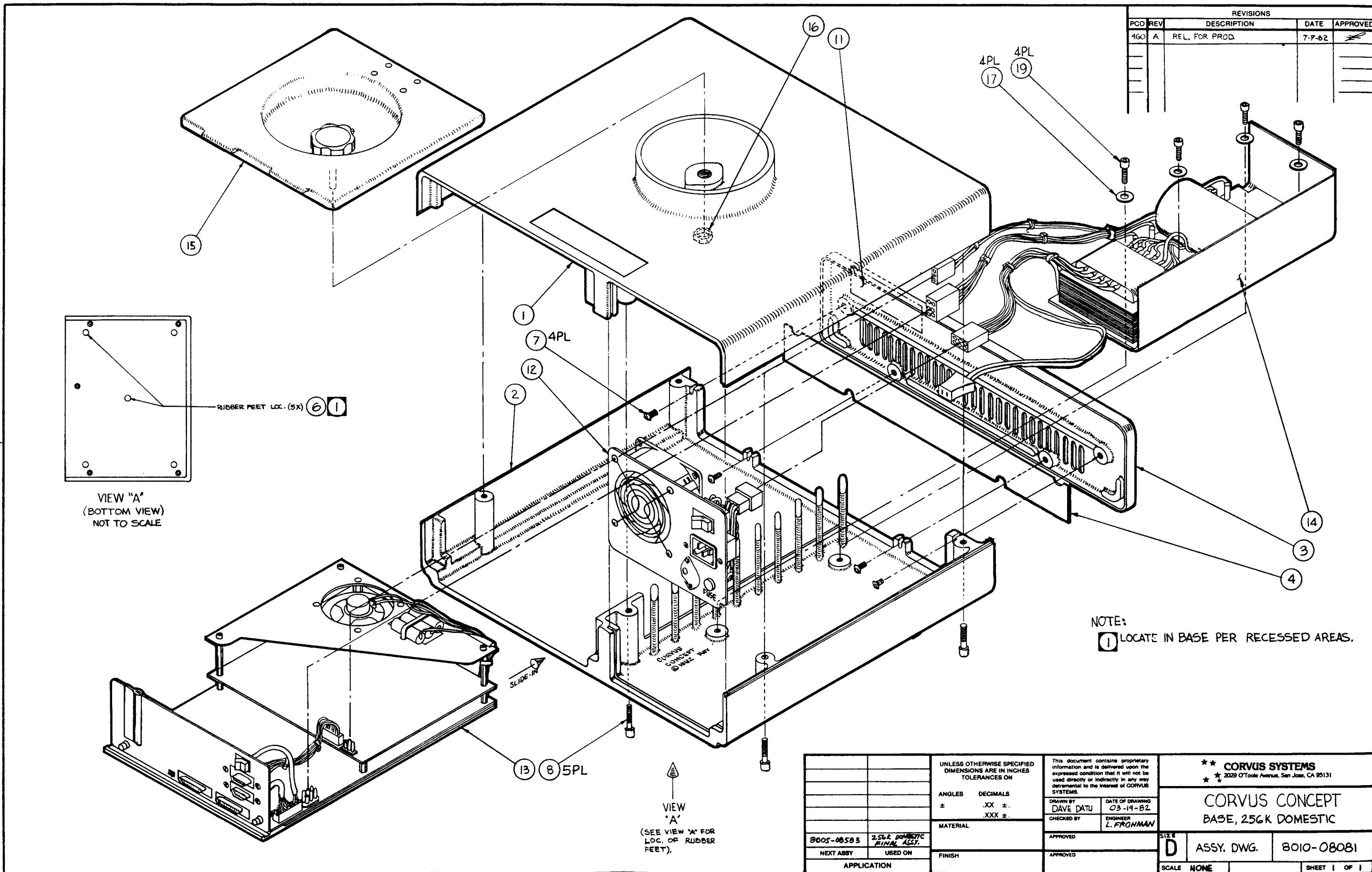


- 4** INSTALL 2-POS. JUMPER FOR 50 Hz OPERATION.  
**3** INSTALL SOCKETS DURING ASSY-DEVICES WILL BE INSTALLED  
AFTER PROGRAMMING OR DURING TEST.  
 2-SQUARE PAD INDICATE PIN 1 OF IC, POSITIVE END OF CAPACITOR.  
**1** PERMANENTLY MARK OR IDENTIFY REV. LEVEL APPROX WHERE SHOWN.

NOTES: UNLESS OTHERWISE SPECIFIED.

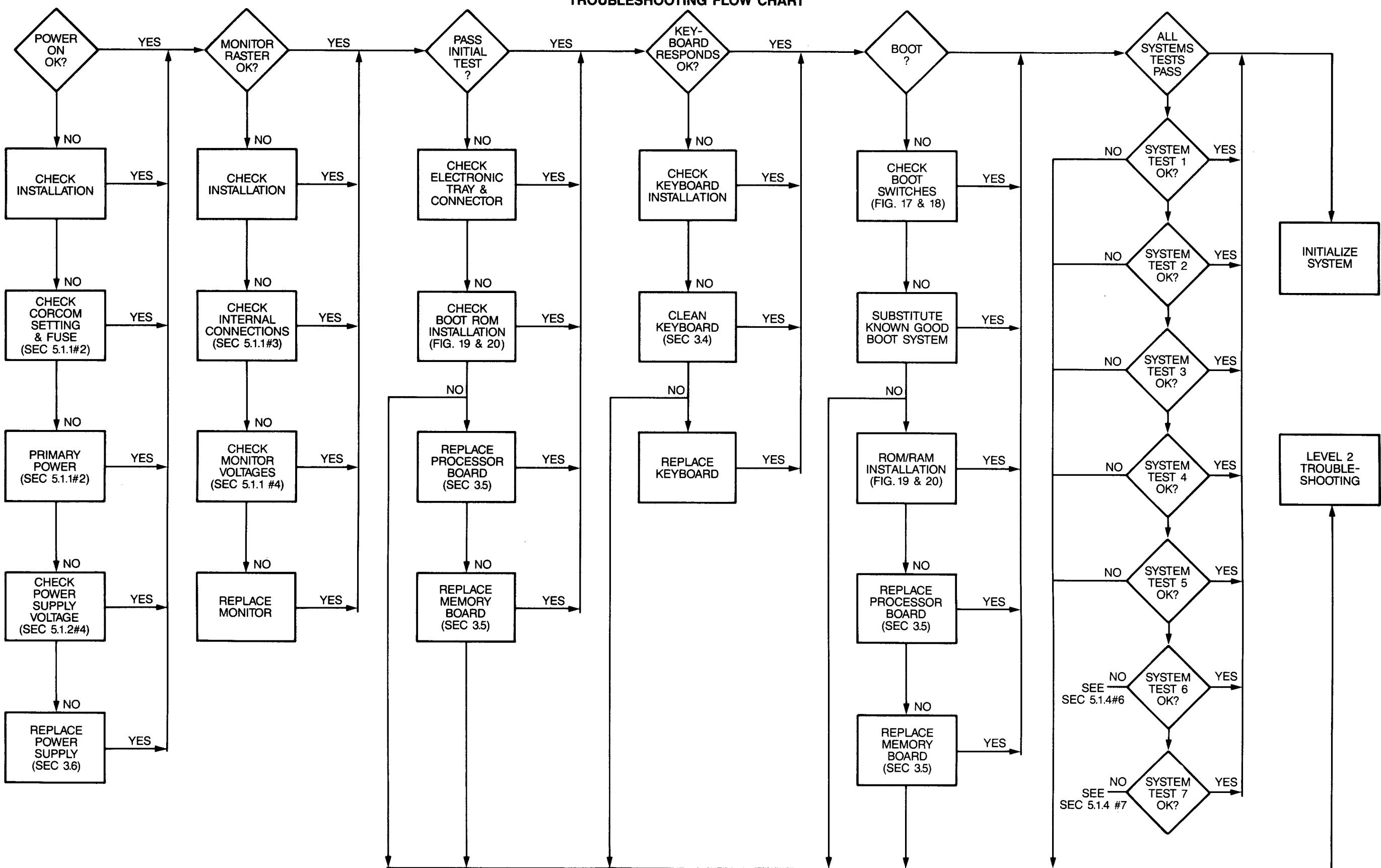
		UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON	★ ★ CORVUS SYSTEMS ★ ★ 2029 O'Toole Avenue, San Jose, CA 95131	
ANGLES	DECIMALS		DRAWN BY H. BUI	DATE OF DRAWING 4/20/82
± .XX	± .XXX		CHECKED BY Sue - Maria	ENGINEER L. FRONIAN
MATERIAL			APPROVED <i>H. Bui</i>	ASSY. DWG. 8010-08546
6010-08670	S/T/K, ELEC. PLATE, ASSY.	APPLICATION	FINISH	SCALE 3/2 SHEET 1 OF 1
NEXT ASSY	USED ON			





**APPENDIX B  
TROUBLESHOOTING FLOW CHART**

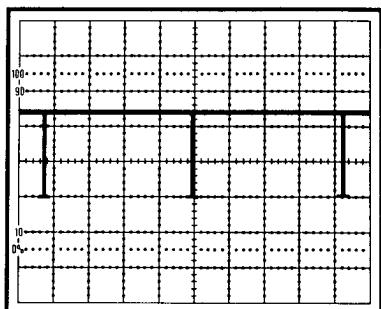
## **LEVEL ONE TROUBLESHOOTING FLOW CHART**



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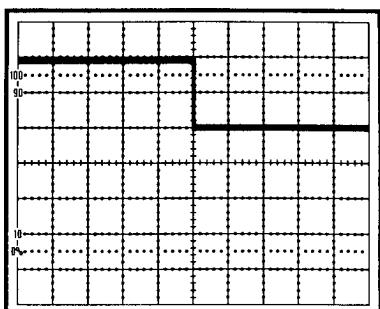
**APPENDIX C-1  
PROCESSOR BOARD  
TEST POINT SIGNALS**

**TP 13 NOMNIT**



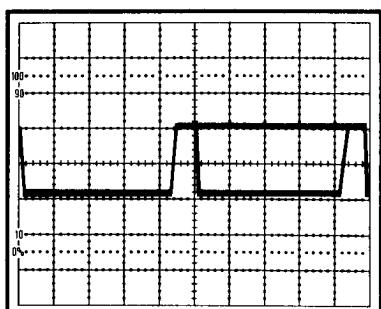
2V/DIV @ 2 ms

**TP 14 HALT**



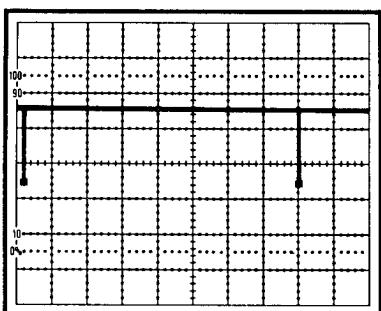
2V/DIV @ 2 us

**TP 15 NWRITE**



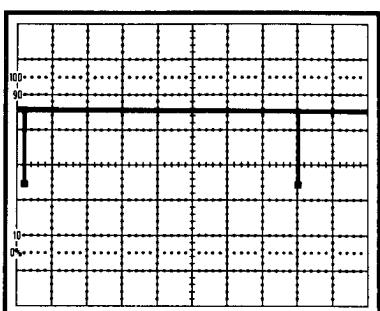
2V/DIV @ 2 us

**TP 16 IPL1**



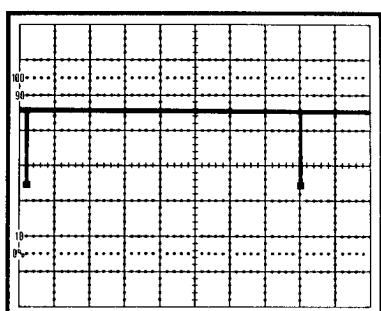
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**TP 17 IPL2**



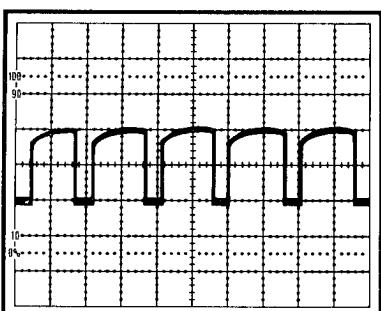
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**TP 18 IPL0**



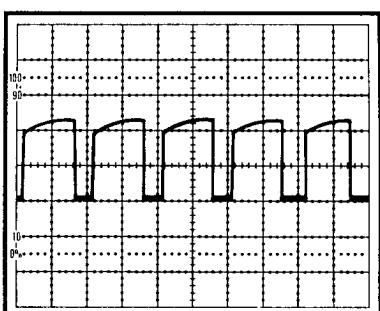
2V/DIV @ 10 ms

**TP 19 DS**



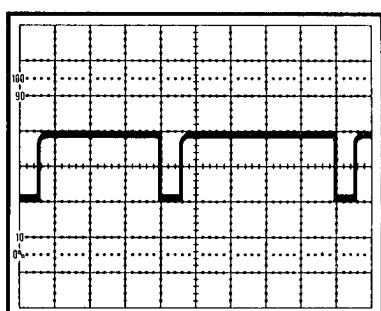
2V/DIV @ .5 us

**TP 20 NDTACK**



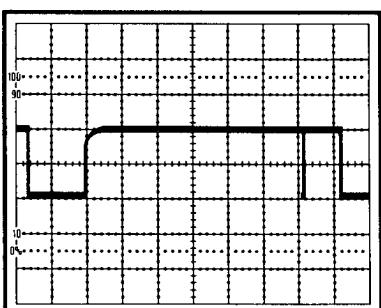
2V/DIV @ .5 us

**TP 21 NSRO**



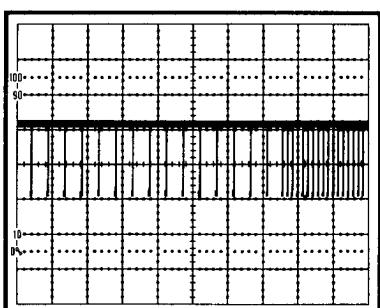
2V/DIV @ 2 us

**TP 22 NDEVS**



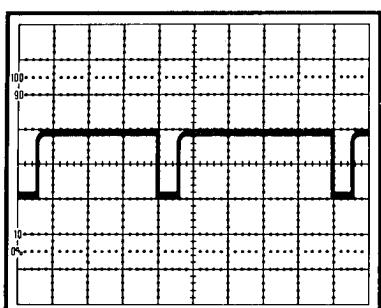
2V/DIV @ 1 us

**TP 23 NKBD**

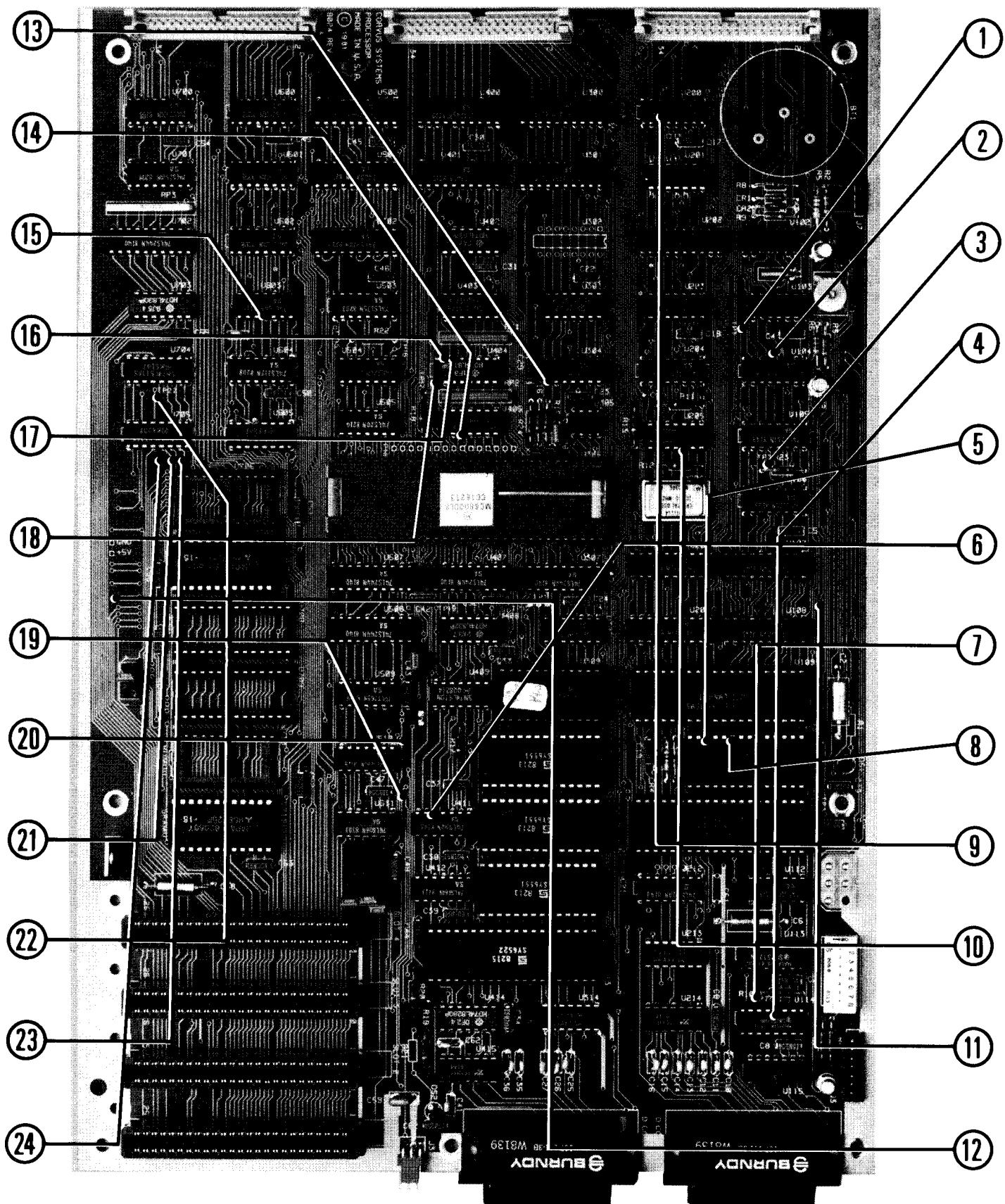


2V/DIV @ 1 ms

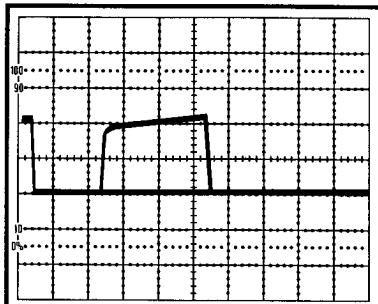
**TD 24 NSRI**



2V/DIV @ 2 us

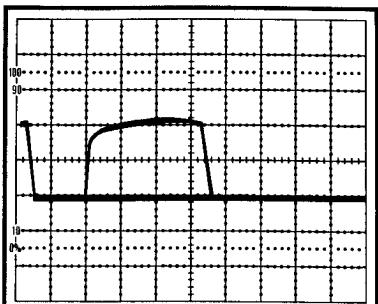


**TP 1**      **DMAG02**



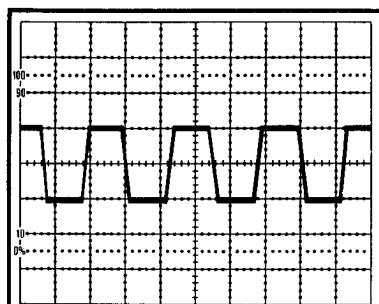
2V/DIV      @    .2 us

**TP 2**      **DMAEN**



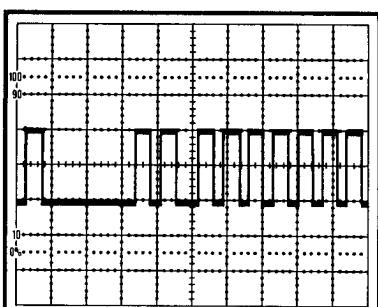
2V/DIV      @    .2 us

**TP 3**      **8M**



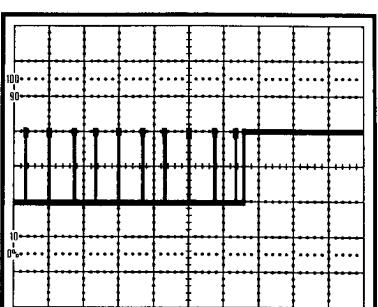
2V/DIV      @    .05 us

**TP 4**      **TXENA**



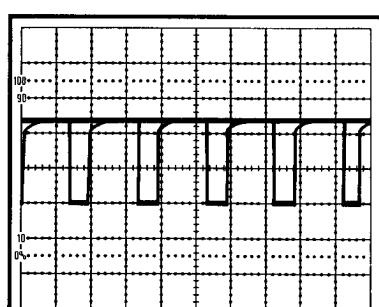
2V/DIV      @    2 ms

**TP 5**      **IN/OUT**



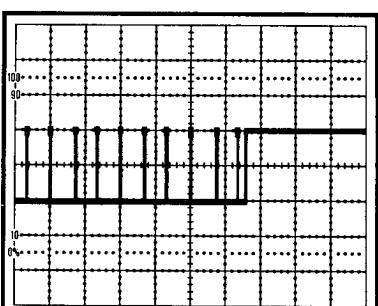
2V/DIV      @    2 us

**TP 6**      **NTACK**



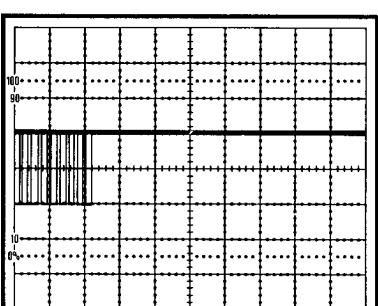
2V/DIV      @    .5 us

**TP 7**      **TXD**



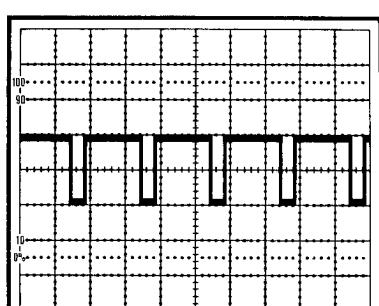
2V/DIV      @    2 us

**TP 8**      **NCS**



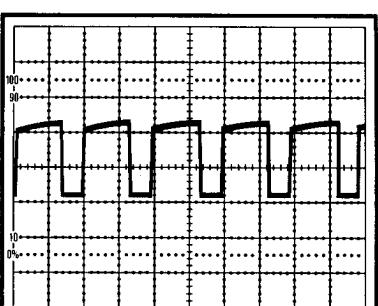
2V/DIV      @    5 ms

**TP 9**      **RAMSEL**



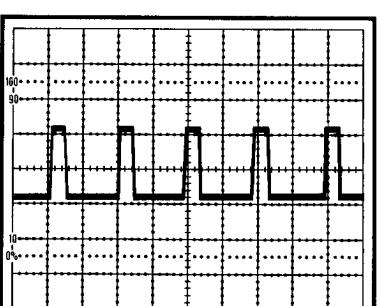
2V/DIV      @    .5 us

**TP 10**      **NRAMACK**



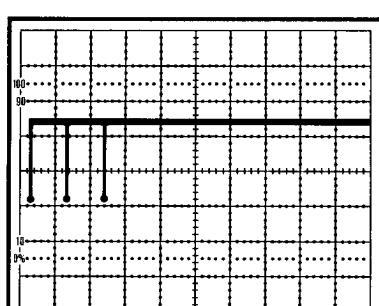
2V/DIV      @    .5 us

**TP 11**      **NAS**



2V/DIV      @    .5 us

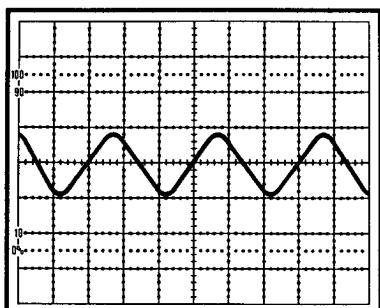
**TP 12**      **NOMNI**



2V/DIV      @    .1 us

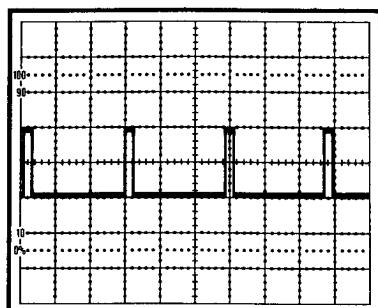
**APPENDIX C-2  
MEMORY BOARD  
TEST POINT SIGNALS**

**MTP 1 16M**



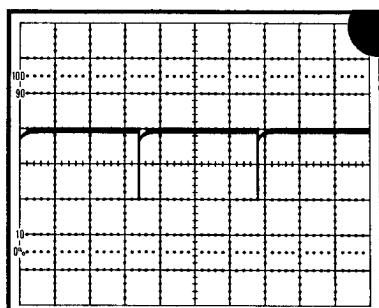
2V/DIV @ .02 us

**MTP 2 HSYNC**



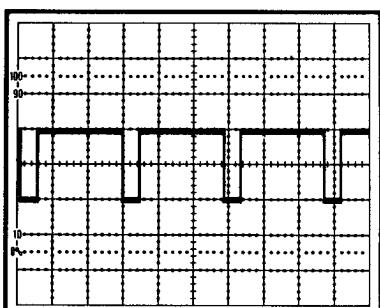
2V/DIV @ 10 us

**MTP 3 VSYNC**



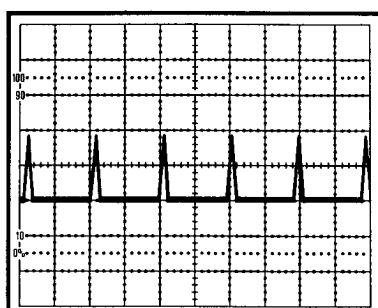
2V/DIV @ 5 ms

**MTP 4 ENVID**



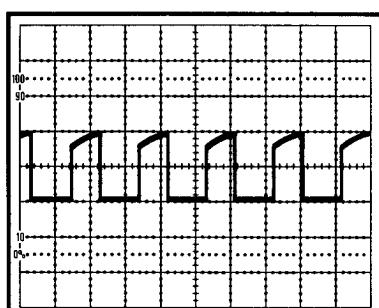
2V/DIV @ 10 us

**MTP 5 LOADVID**



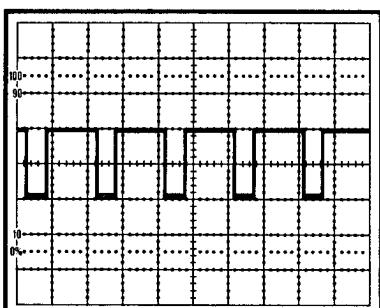
2V/DIV @ 10 us

**MTP 6 NVIDIA TIME**



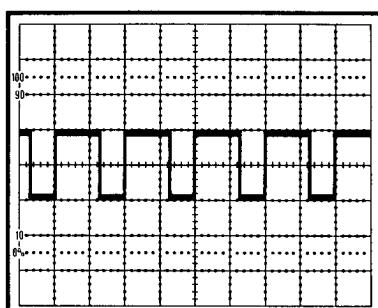
2V/DIV @ .5 us

**MTP 7 MUX**



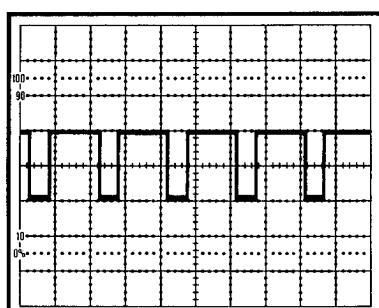
2V/DIV @ .5 us

**MTP 8 NRASTIME**



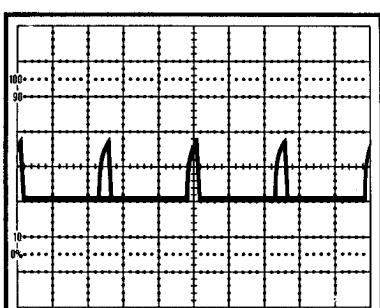
2V/DIV @ .5 us

**MTP 9 NLASTIME**



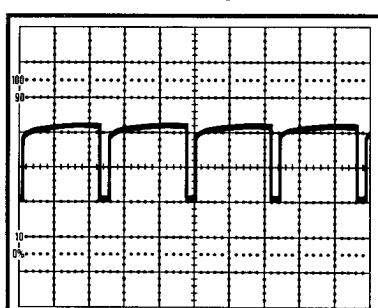
2V/DIV @ .5 ms

**MTP 10 68K**



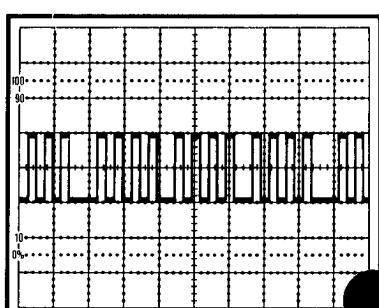
2V/DIV @ .2 us

**MTP 11 N10L**

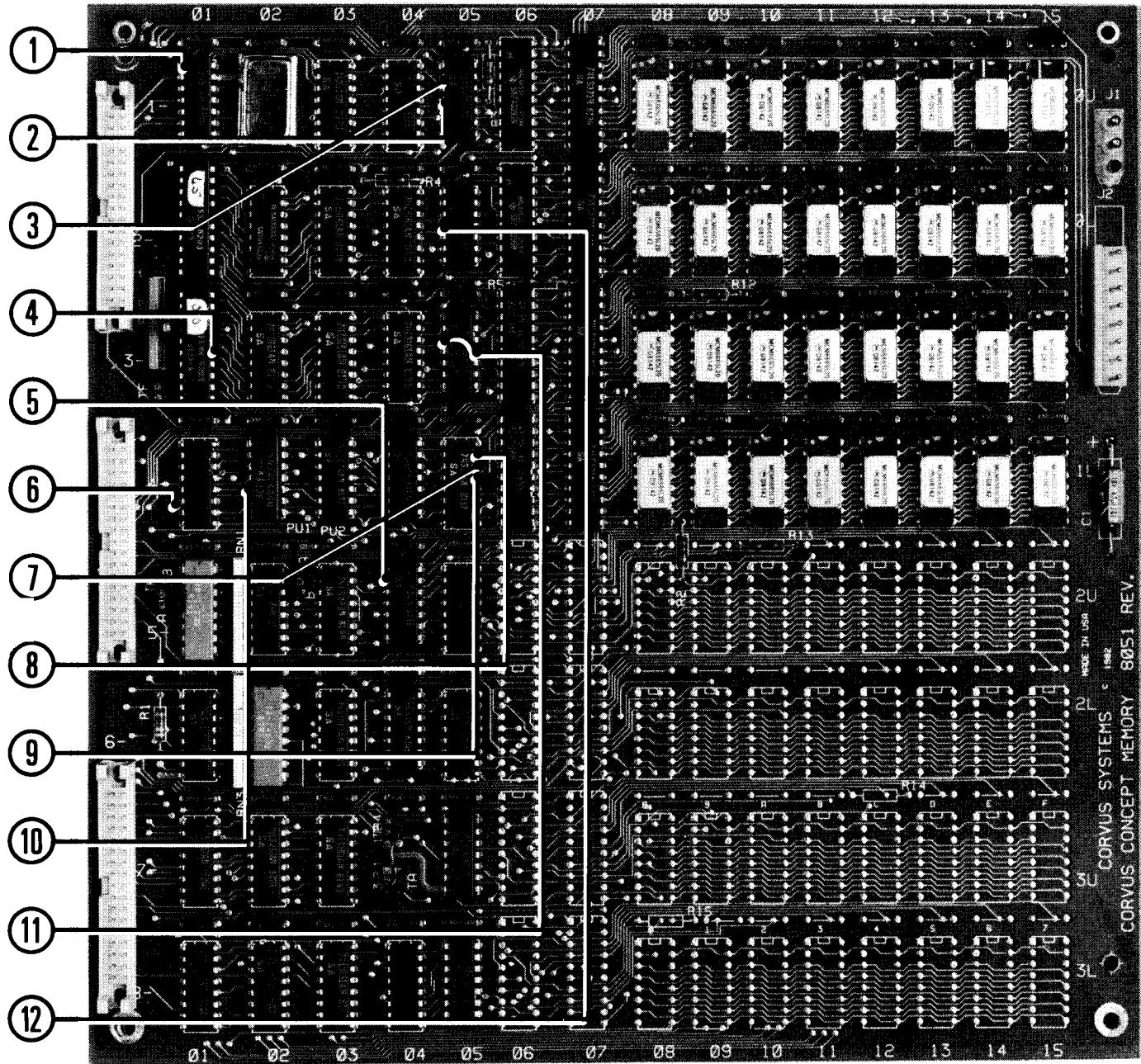


2V/DIV @ 2 us

**MTP 12 LATCHRAM**



2V/DIV @ 2 us



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**APPENDIX D  
TIMING CHARTS**

## APPENDIX D TIMING DIAGRAMS

The following charts require specific tests and routines to be executing. A dual trace oscilloscope is required on the following steps. The programs that are listed below are available from Corvus only to authorized Corvus Concept service dealers. It is recommended that backups be made of the diagnostic floppy. In instances where the 50 pin I/O slots are defective, a copy on a network system will be helpful. The following steps are to indicate timing relationships between key signals and not their waveshapes.

### D.1 Processor Timing

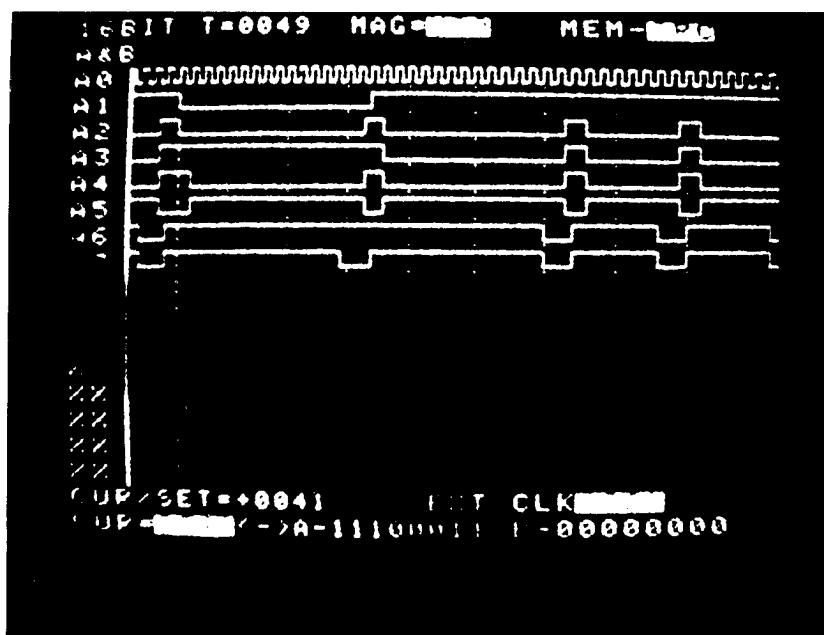
Setup: MACSbug

Option: DM 80000

External Clock: 16 MHz

Trigger: NAS (U103-2)

**Processor Timing Diagrams**



A0 — 8MHz — U103-6  
 A1 — NWRITE — U307-9  
 A2 — NAS — 307-14  
 A3 — NUDS — 307-7

A4 — NLDS — U307-12  
 A5 — DS — U308-8  
 A6 — NTACK — U411-5  
 A7 — NDTACK — U510-6

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## CORVUS DEALER SERVICE

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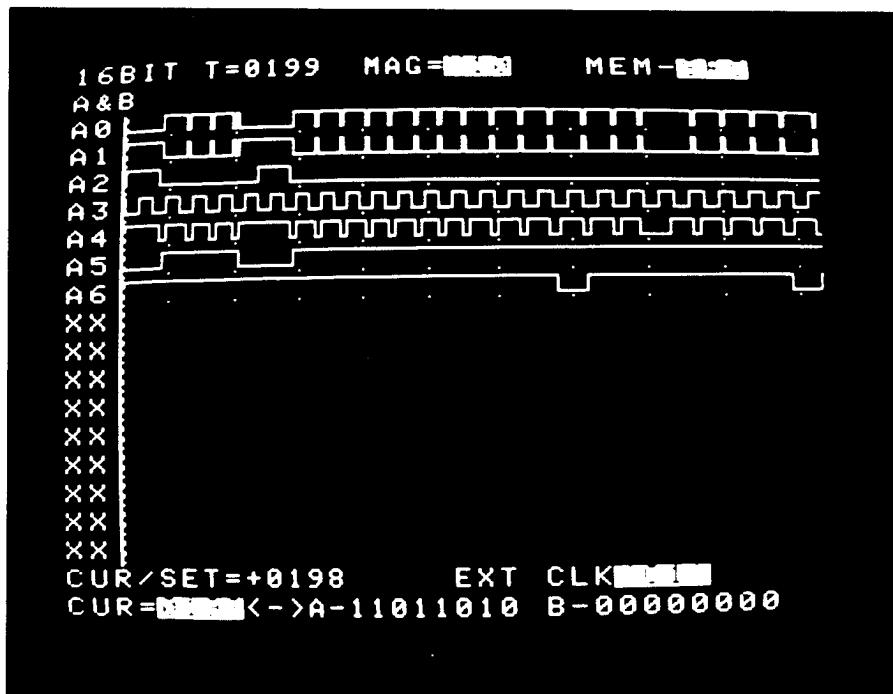
### D.2 Local Drive Boot

Setup: Boot Local Drive

External Clock: 1 Mz

Trigger: NIO

Local Drive Boot Timing Diagram



A0 — NIO — U605-44

A1 — IO — U604-33

A2 — IOGO — U604-5

A3 — IOACK — U605-3

A4 — NEVS — U605-15

A5 — NIO2 — U605-13

A6 — NDEV2 — U704-13

A7 — NIOSTB — U705-7

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## CORVUS DEALER SERVICE

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### D.3 Omninet Signals

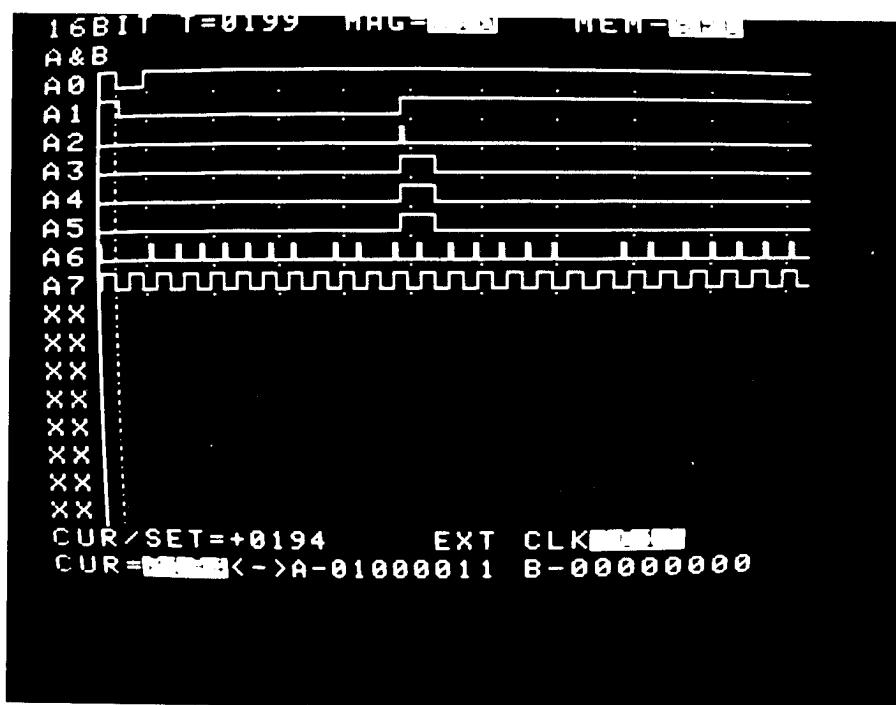
Setup: O Test

Option: Send Set

External Clock: 16 Mz

Trigger: NOMNI 3rd pass

Omninet Timing Diagram



A0 — NOMNI — U109-32  
A1 — READY — U109-311  
A2 — DMAREQ — U109-34  
A3 — DMAEN — U104-5

A4 — DMAGO2 — U104-9  
A5 — RAMSEL — U203-8  
A6 — 68KRAMSEL — U205-5  
A7 — NRAMACK — U205-11

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## CORVUS DEALER SERVICE

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### D.4 Ram Access Timing

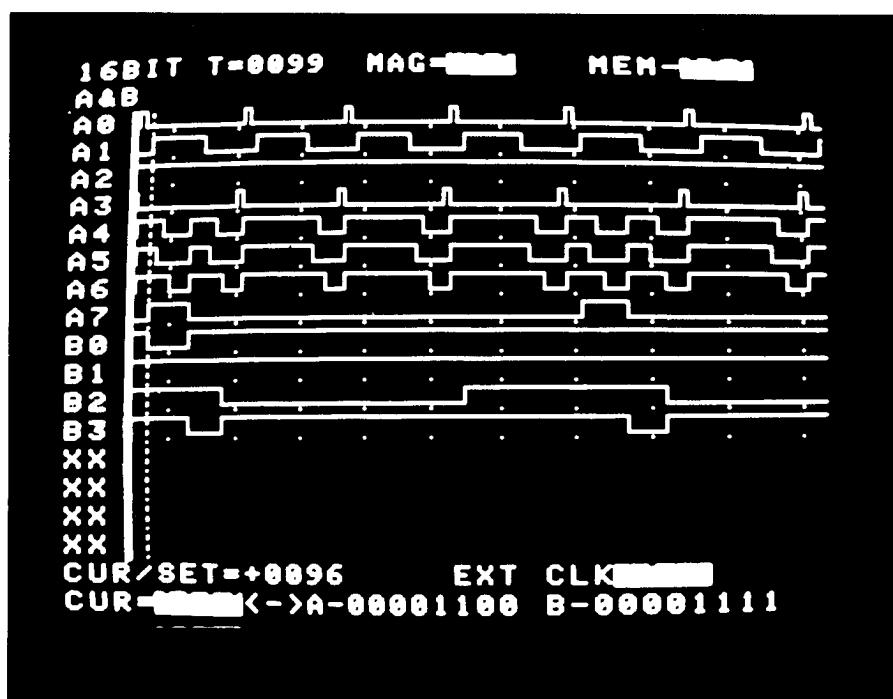
Setup: MAGSbug

Optional Clock: DM 80000 or Location in Question

External Clock: 16 Mz

Trigger: LATCHRAM

Ram Access Timing Diagram



A0 — 68K — MU401-12  
A1 — NVIDTIME — MU401-7  
A2 — ENVID — MU301-15  
A3 — LOADVID — MU504-2  
A4 — MUX — MU405-14  
A5 — NRASTIME — MU405-15

A6 — NCASTIME — MU405-13  
A7 — LATCHRAM — MU205-4  
B0 — NWU — MU305-3  
B1 — NWL — MU305-11  
B2 — RAMSEL — MU604-9  
B3 — NRAMACK — MU504-4

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**APPENDIX E-1  
MACSBUG COMMANDS**

## APPENDIX E-1 MACSBUG COMMANDS

A detailed explanation of the features of MACSbug can be found in the Motorola MACSbug User's Guide. There are two mnemonics that will be used extensively:

- Set Memory (SM)
- Display Memory (DM)

The following sequence is an example of their use:

### MACSBUG 2.0

\*SM 80000 OF 5A AA 22 00 11 ; sm is the command to set memory.  
; 80000 is the address in memory.  
; OF 55 AA is the data to be written.

\*DM 80000

80000 OF 5A AA 22 00 11 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00

These two commands will aid in diagnosing a memory failure. For example:

bank 1 (256k)  
bank 1 bank 3 (512k)

80000 OF 5A AA 22 00 11 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00

bank 0 bank 2 (512K)  
bank 0 (256K)

Each bank can then be divided into upper and lower bytes.

OF	5A
upper byte	lower byte

The byte can then be further divided into eight bits.

0	F	5	A
0000	1111	0101	1010
/	/	/	/
it (F)	bit (8)	bit (7)	bit (0)

DM is the command to display memory. The computer will respond with the contents of the specified address plus the next sixteen locations.

This memory dump can be further divided down into segments.

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**CORVUS DEALER SERVICE**

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**APPENDIX E-2**  
**MACSBUG ROUTINES**

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## CORVUS DEALER SERVICE

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### APPENDIX E-2 MACSBUG ROUTINES

The following routines require Motorola's 68000 monitor program MACSbug. This monitor program may be purchased from Corvus Systems. The following routines are here for examples and may be modified to fit specific needs. Upon entering MACSbug, memory must be set to the listed hexadecimal equivalents. A recommended memory starting location would be static RAM location \$700.

#### TESTZERO

				1*	ident	testzero	
				2*	;TEST ZERO LOAD ZERO FOREVER AT BANK ZERO LOCATION		
				3*			\$80000
0000	207C	0008	0000	4*	test0	move. 1	#\$80000, a0
0006	4280			5*	clr. 1	d0	
0008	3080			6*	test0x	move. w	d0, (a0) ; moves zeros into \$8000
000A	60FC			7*	bra. s	test0x	
				8*			
				9*	; TEST ONE LOAD \$FFFF FOREVER AT BANK ZERO LOCATION		
				10*			\$80000
000C	207C	0008	0000	11*	test1	move. 1	#\$80000, a0
0012	303C	FFFF		12*	move	#\$ffff, d0	
0016	3080			13*	test1x	move	d0, (a0) ; moves \$ffff into \$80000
0018	60FC			14*	bra. s	test1x	
				15*			
				16*	; TEST TWO AND THREE, SAME AS TEST ZERO AND ONE BUT		
				17*			FOR BANK ONE
				18*	;---TEST TWO LOAD ZERO FOREVER AT LOCATION \$80002		
001A	207C	0008	0002	19*	test2	move. 1	#\$80002, a0
0020	4280			20*	clr. 1	d0	
0022	3080			21*	test2x	move. w	d0, (a0) ; moves zeros into \$80002
0024	60FC			22*	bra. s	test2x	
				23*			
				24*	;--TEST THREE LOAD ZERO FOREVER AT LOCATION \$80002		
0026	207C	0008	0002	25*	test3	move. 1	#\$80002, a0
002C	303C	FFFF		26*	move	#\$ffff, d0	
0030	3080			27*	test3x	move	d0, (a0) ; moves \$ffff into \$80002
0032	60FC			28*	bra. s	test3x	
				29*			
				30*	; TEST FOUR FILLS \$80000 TO END OF MEMORY WITH ZERO		
0034	207C	0008	0000	31*	test4	move. 1	#\$80000, a0
003A	4280			32*	clr. 1	d0	
003C	30C0			33*	test4x	move. w	d0, (a0)+ ; moves zero into \$80000
				34*			and increments memory
003E	60FC			35*	bra. s	test4x	
				36*			
				37*	; TEST FIVE FILLS \$80000 TO END WITH \$FFFF		
0040	207C	0008	0000	38*	test5	move. 1	#\$80000, a0
0046	303C	FFFF		39*	move	#\$ffff, d0	
004A	30C0			40*	test5x	move. w	d0, (a0)+ ; moves \$ffff into
				41*			all of memory
004C	60FC			42*	bra. s	test5x	
				43*			

**CORVUS DEALER SERVICE**

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					44* ; TEST SIX READ FROM LOCATION \$80000 BANK ZERO
004E	207C	0008	0000	45* test6	move. 1 #\$\$80000, a0
0054	3010			46* test6x	move. w (a0), d0 ; reads from \$80000 and
				47* ;	writes data to d0
0056	60FC			48*	bra. s test6x
				49* ;	
				50* ; TEST SEVEN READS FROM BANK ONE AT LOCATION \$80002	
0058	207C	0008	0002	51* test7	move. 1 #\$\$80002, a0
005E	3010			52* test7x	move. w (a0), d0
0060	60FC			53*	bra. s test7x
				54* ;	
				55* ; TEST EIGHT WRITE DO TO \$80000 AD READ IT BACK	
0062	207C	0008	0000	56* test8	move. 1 #\$\$80000, a0
0068	4280			57*	clr. 1 d0
006A	3080			58* test8x	move. w d0, (a0)
006C	3210			59*	move. w (a0), d1
006E	60FA			60*	bra. s test8x
				61* ;	
				62* ; TEST NINE WRITE ZERO TO BANK ONE AT LOCATION	
				63* ; \$80002 AND READ IT BACK	
0070	207C	0008	0002	64* test9	move. 1 #\$\$80002, a0
0076	4280			65*	clr. 1 d0
0078	3080			66* test9x	move. w d0, (a0)
007A	3210			67*	move. w (a0), d1
007C	60FA			68*	bra. s test9x
				69* ;	
				70* ; TEST TEN FILLS RAM WITH AN INCREMENTING PATTERN	
007E	207C	0008	0000	71* test10	move. 1 #\$\$80000, a0
0084	30C0			72* test10x	move d0, (a0)+
0086	5240			73*	addq #1, d0
0088	60FA			74*	bra. s test10x
				75* ;	
				76* ; TEST ELEVEN SEND DATACOMM ZERO	
	00030F21			77* ddata0	equ \$30f21
	00030F23			78* dstat0	equ \$30f23
	00030F25			79* dcomm0	equ \$30f25
	00030F27			80* dcont0	equ \$30f27
	000000AB			81* commd0	equ \$ab
	00000037			82* contr0	equ \$37
	00000007			83* txready	equ \$07
008A	13FC	00AB	0003	84* test11	move. b #commd0, dcomm0. 1
0090	0F25				
0092	13FC	0037	0003	85*	move. b #contr0, dcont0. 1
0098	0F27				
009A	103C	0040		86*	move. b #'@', d0
009E	0839	0007	0003	87* test11x	btst #txready, dstat0. 1
00A4	0F23				
00A6	66F6			88*	bne. s test11x
00A8	13C0	0003	0F21	89*	move. b d0, ddata0. 1
00AE	60EE			90*	bra. s test11x

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## CORVUS DEALER SERVICE

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92\* ; TEST TWELVE SENDS FROM DATACOMM ONE

00030F41		93* ddata1	equ	\$30F41		
00030F43		94* dstat1	equ	\$30f43		
00030F45		95* dcomm1	equ	\$30f45		
00030F47		96* dcont1	equ	\$30f47		
000000AB		97* commd1	equ	\$ab		
00000037		98* contr1	equ	\$37		
00B0	13FC	00AB	0003	99* test12	move. b	#commd1, dcomm1. 1
00B6	0F45					
00B8	13FC	0037	0003	100*	move. b	#contr1, dcont1. 1
00BE	0F47					
00C0	103C	0040		101*	move. b	#'@', d0
00C4	0839	0007	0003	102* test12x	btst	#txready, dstat1. 1
00CA	0F43					
00CC	66F6			103*	bne. s	test12x
00CE	13C0	0003	0F41	104*	move. b	d0, ddata1. 1
00D4	60EE			105*	bra. s	test12x
				106*	end	
COMMDO	000000AB		DDATA0	00030F21	TEST10X	000084+
COMM1	000000AB		DDATA1	00030F41	TEST11	00008A+
CONTRO	00000037		DSTAT0	00030F23	TEST11X	00009E+
CONTR1	00000037		DSTAT1	00030F43	TEST12	0000B0+
DCOMMO	00030F25		TEST0	000000+	TEST12X	0000C4+
DCOMM1	00030F45		TEST0X	000008+	TEST1X	000016+
DCONTO	00030F27		TEST1	00000C+	TEST2	00001A+
DCONT1	00030F47		TEST10	00007E+	TEST2X	000022+
TEST3	000026+		TEST7	000058+		
TEST3X	000030+		TEST7X	00005E+		
TEST4	000034+		TEST8	000062+		
TEST4X	00003C+		TEST8X	00006A+		
TEST5	000040+		TEST9	000070+		
TEST5X	00004A+		TEST9X	000078+		
TEST6	00004E+		TXREADY	00000007		
TEST6X	000054+					

**APPENDIX E-3  
SELF-TEST ROUTINES**

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**CORVUS DEALER SERVICE**

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**APPENDIX E-3  
SELF-TEST ROUTINES**

The following routines are derived from the Concept's Self Test. There are some differences between these routines and that of the Self Test, however they are functionally identical.

				1*	ident	ramtest	
0000				2*	start	org	\$0
	00000000			3*	rambase	equ	\$0000
	00000700			4*	srambeg	equ	rambase+\$700
	00000F00			5*	sramend	equ	srambeg+\$800
	00080000			6*	dspbase	equ	\$80000
	0000E000			7*	dsplen	equ	\$0e000
	0008E000			8*	dspend	equ	dspbase+dsplen
	00000400			9*	ramxbug	equ	rambase+\$400
	00010000			10*	rombase	equ	\$10000
	00002000			11*	romlen	equ	\$2000
	00012000			12*	romend	equ	rombase+romlen
				13*	;		
				14*	; SRAM TEST WALKBIT AND MARCHING		
0000	4DFA	0006+		15*	lea	ramtst1, a6	; loads starting address into a6
0004	6100	0130		16*	max	bsr	trapp ; jumps out to MACSbug
0008	207C	0000	0700	17*	Ramtst1	move. 1	#srambeg, a0
000E	6100	006E		18*		bsr	walkbit
0012	660C			19*		bne. s	rt1err
0014	227C	0000	0F00	20*		move. 1	#sramend, a1
001A	6100	0094		21*		bsr	march
001E	670A			22*		beq. s	ramtst2
0020	2C3C	0000	0001	23*	rt1err	move. 1	#\$0001, d6
0026	6100	010E		24*		bsr	trapp
				25*	;		
002A	207C	0008	E000	26*	ramtst2	move. 1	#dpend, a0
0030	6100	004C		27*		bsr	walkbit
0034	660A			28*		bne. s	rt2err
0036	6100	00C4		29*		bsr	ramsize
003A	6100	0074		30*		bsr	march
003E	670A			31*		beq. s	memtest
0040	2C3C	0000	0002	32*	rt2err	move. 1	#\$0002, d6
0046	6100	00EE		33*		bsr	trapp
				34*	;		
004A	6100	0090		35*	memtest	bsr	inctest
004E	670A			36*		beq. s	memclr
0050	2C3C	0000	0003	37*		move. 1	#\$0003, d6
0056	6100	00DE		38*		bsr	trapp
				39*	;		
005A	207C	0000	0F00	40*	memclr	move. 1	#sramend, a0
0060	227C	0000	0EFE	41*		move. 1	#sramend-2, a1
0066	6100	00BE		42*		bsr	zeroram
006A	2A3C	0000	0001	43*		move. 1	#01, d5
0070	207C	0008	0000	44*		move. 1	#dspbase, a0

## CORVUS DEALER SERVICE

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0076	6100	0084		45*	bsr	ramsize
007A	6100	00AA		46*	bsr	zeroram
				47* ;		
007E	2448			48* walkbit	move. 1	a0, a2
0080	2248			49*	move. 1	a0, a1
0082	D3FC	0000	0010	50*	adda. 1	#\$10, a1
0088	303C	FFFE		51* wb1	move. w	#\$ffffe, d0
008C	3480			52* wb2	move. w	d0, (a2)
008E	B052			53*	cmp. w	(a2), d0
0090	661C			54*	bne. s	wberr
0092	E358			55*	rol	#1, d0
0094	65F6			56*	bcs. s	wb2
0096	303C	0001		57*	move. w	#\$0001, d0
009A	3480			58* wb3	move. w	d0, (a2)
009C	B052			59*	cmp. w	(a2), d0
009E	660E			60*	bne. s	wberr
00A0	E340			61*	as1	#1, d0
00A2	64F6			62*	bcc. s	wb3
00A4	D5FC	0000	0002	63*	adda. 1	#2, a2
00AA	B5C9			64*	cmpa. 1	a1, a2
00AC	6DDA			65*	blt. s	wb1
00AE	4E75			66* wberr	rts	
				67* ;		
00B0	2448			68* march	move. 1	a0, a2
00B2	4280			69*	clr. 1	d0
00B4	34C0			70* mr1	move. w	d0, (a2) +
00B6	B5C9			71*	cmpa. 1	a1, a2
00B8	66FA			72*	bne. s	mr1
00BA	3400			73*	move. w	d0, d2
00BC	4642			74*	not. w	d2
00BE	3222			75* mr2	move. w	-(a2), d1
00C0	B240			76*	cmp. w	d0, d1
00C2	6616			77*	bne. s	mrerr
00C4	3482			78*	move. w	d2, (a2)
00C6	B5C8			79*	cmpa. 1	a0, a2
00C8	66F4			80*	bne. s	mr2
00CA	3002			81*	move. w	d2, d0
00CC	4642			82*	not. w	d2
00CE	3212			83* mr3	move. w	(a2), d1
00D0	B240			84*	cmp. w	d0, d1
00D2	6606			85*	bne. s	mrerr
00D4	34C2			86*	move. w	d2, (a2) +
00D6	B5C9			87*	cmpa. 1	a1, a2
00D8	66F4			88*	bne. s	mr3
00DA	4E75			89* mrerr	rts	
				90* ;		
00DC	2448			91* inctest	move. 1	a0, a2
00DE	323C	0101		92*	move. w	#\$101, d1
00E2	34C1			93* ito1	move. w	d1, (a2) +
00E4	E359			94*	rol. w	#1, d1
00E6	B5C9			95*	cmpa. 1	a1, a2
00E8	6DF8			96*	blt. s	ito1
00EA	2448			97*	move. 1	a0, a2

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## CORVUS DEALER SERVICE

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00EC	323C	0101		98*	move. w	#\$101, d1
00F0	B25A			99* ito2	cmp. w	(a2)+, d1
00F2	6606			100*	bne. s	it99
00F4	E359			101*	rol. w	#1, d1
00F6	B5C9			102*	cmpa. 1	a1, a2
00F8	6DF6			103*	blt. s	ito2
00FA	4E75			104* it99	rts	
				105* ;		
00FC	227C	0009	0000	106* ramsize	move. 1	#\$90000, a1
0102	0C97	0001	2000	107*	cmpi. 1	#romend, (sp)
0108	6E1A			108*	bgt. s	ramsize9
010A	23FC	000F	FFFC	109* ramsiz1	move. 1	#\$ffffc, \$ffffc. 1
0110	000F	FFFC				
0114	23FC	000B	FFFC	110*	move. 1	#\$bfff, \$bfff. 1
011A	000B	FFFC				
011E	2279	000F	FFFC	111*	move. 1	\$ffffc. 1, a1
0124	4E75			112* ramsiz9	rts	
				113* ;		
0126	4298			114* zeroram	clr. 1	(a0)+
0128	B1C9			115*	cmpa. 1	a1, a0
012A	6FFA			116*	ble. s	zeroram
012C	BABC	0000	0001	117*	cmp. 1	#01, d5
0132	6702			118*	beq. s	trapp
0134	4E75			119*	rts	
0136	4E4F			120* trapp	trap	#15
0138	0000			121*	data. w	0
013A	4E75			122*	rts	
	00000004+			123*	end	max
DSPBASE	00080000	MAX		000004+	RAMSIZ1	00010A+
DSPEND	0008E000	MEMCLR		00005A+	RAMSIZ9	000124+
DSPLEN	0000E000	MEMTEST		00004A+	RAMSIZE	0000FC+
INCTEST	0000DC+	MR1		0000B4+	RAMTST1	000008+
IT99	0000FA+	MR2		0000BE+	RAMTST2	00002A+
IT01	0000E2+	MR3		0000CE+	RAMXBUG	00000400
IT02	0000F0+	MRERR		0000DA+	ROMBASE	00010000
MARCH	0000B0+	RAMBASE		00000000	ROMEND	00012000
ROMLEN	00002000	WB1		000088+		
RT1ERR	000020+	WB2		00008C+		
RT2ERR	000040+	WB3		00009A+		
SRAMBEG	00000700	WBERR		0000AE+		
SRAMEND	00000F00	ZERORAM		000126+		
START	000000+					
TRAPP	000136+					
WALKBIT	00007E+					

**APPENDIX F-1**  
**GENERAL MEMORY AND I/O MAPS**

## APPENDIX F-1 GENERAL MEMORY AND I/O MAPS

The following is a Memory and I/O Map of the Corvus Concept. Concept uses memory from 0 to \$0FFFFF. I/O is in the range \$030000 to \$03FFFF. In the boxes are recommended addresses. "x" means "don't care." All addresses are hexadecimal. Actual addresses are shown, with possible alternate addresses in parentheses.

Static RAM 000008- 000FFF (000008- 00FFFF)	ROM 0 000000- 000007 010000- 011FFF (-01FFFF)	ROM 1 (020000- 02FFFF)	I/O 030000- 03FFFF	Dynamic RAM 080000-0FFFFF
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# NOTE: address bits 12, 13, 14, 15 = X  
: addresses must be odd

DEVS I/O slot registers	IO1 ROM	IO2 ROM	IO3 ROM	IO4 ROM	SLOT STAT	CALENDAR R/W	I/O PORTS
	*	*	*	*	30AxX		RS 232 Keys Etc. 030Exx-
0300xx- 0301xx	302xx 303xx	304xx 305xx	306xx 307xx	308 309xx	30Bxx	030Cxx- 030Dxx	030Fxx

\* see I/O ROM equivalences below

BIT	0	1	2	3	4	5	6	7
SLOT	NNMI 1	NNMI 2	NNMI 3	NNMI 4	NIRQ 1	NIRQ 2	NIRQ 3	NIRQ 4

When an I/O slot NMI or IRQ interrupt occurs:

1. SlotINT causes an interrupt
2. Slotstat is read to find out which slot interrupted and whether it was an NMI or IRQ.

I/O SLOT DMA is not supported.

Key- Board 30Fxx	Dcomm 1 30F2x	Dcomm 2 30F4x	VIA 30F6x 30F7x	Calendar ALTMAP Volume 30F8x	OMNINET Strobe 30FAx	OMNINET Interrupt Off 030FCx	IOSTRB 039FFF
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**APPENDIX F-2**  
**ROM MAPPING OF I/O SLOTS**

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**CORVUS DEALER SERVICE**

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**APPENDIX F-2  
ROM MAPPING OF I/O SLOTS**

To compare the address of a Corvus interface card when plugged in a Concept or an Apple II™ use this table.

The initial \$C of APPLE is replaced by a \$30. The lower three nibbles shifted left and 1 added.

Concept	Apple II™	I/O SLOT
\$30201	\$C100	
\$30203	\$C101	
\$30205	\$C102	
\$30207	\$C103	1
\$303FF	\$C1FF	
\$30401	\$C200	
\$30403	\$C201	
		2
\$305FF	\$C2FF	
\$30601	\$C300	
		3
\$307FF	\$C3FF	
\$30801	\$C400	
		4
\$309FF	\$C4FF	
\$39FE1-\$39FFF	\$CFF0-\$FFFF	IOSTRB

IOSTRB is only available in 16 locations.

Note that the 6502 code will not execute on a 68000. However the ROM ID and various tables may be useful. Drivers must be written in 68000 code and included in the operating system or attached using the INSTALL command. The 68000 code can be generated by Pascal or FORTRAN compilers as well as by the 68000 Assembler.

**APPENDIX F-3  
VIA GENERAL PURPOSE I/O PORT  
(SYNERTEK 6522)**

**APPENDIX F-3  
VIA GENERAL PURPOSE I/O PORT  
(SYNERTEK 6522)**

\$30F61	ORB, IRB	Output register B, Input register B
\$30F63	ORA, IRA	Output register A, Input register A handshake
\$30F65	DDRB	Data direction register B (0 = in, 1 = out)
\$30F67	DDRA	Data direction register A (0 = in, 1 = out)
\$30F69	T1L-L, T1C-L	Timer 1 latch low byte, write latch, read counter
\$30F6B	T1L-H	Timer 1 latch high byte
\$30F6D	T1L-L	
\$30F6F	T1L-H	
\$30F71	T2L-L, T2C-L	
\$30F73	T2C-H	
\$30F75	SR	Shift Register
\$30F77	ACR	Auxiliary Control Register
\$30F79	PCR	Peripheral Control Register
\$30F7B	IFR	Interrupt Control Register
\$30F7D	IER	Interrupt Enable Register
\$30F7F	ORA	Output register A, Input register A, no handshake

Port A -- DDRA (30F67) to preset to 80

ORA (30F7F) to read/write

0	Ready (OMNINET)	Input
1	Clear to send	DC0 Input
2	Clear to send	DC1 Input
3	Dataset ready	DC0 Input
4	Dataset ready	DC1 Input
5	Data carrier detect	DC0 Input
6	Data carrier detect	DC1 Input
7	IOX exclusive OR of above signals for interrupt	Output

Port B -- DDRB (30F65) preset to 37

ORB (30F61) to read/write

0	Video off	Output
1	Video address 17	Output
2	Video address 18	Output
3	Horizontal/vertical switch	Input
4	CH Rate select	DC0 Output
5	CH Rate select	DC1 Output
6	Boot switch 0	Input
7	Boot switch 1	Input

Note: The inputs are used in non-latching mode.

The bell speaker is controlled by the timer 2 and shift register.

The interrupt timer is timer 1.

For more detail see the Synertek 6522 application notes and handbook.

**APPENDIX F-4**  
**OMNINET**

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**CORVUS DEALER SERVICE**

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**APPENDIX F-4**  
**OMNINET**

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\$30FA1-\$30FBF	Transporter register
\$30FC1-\$30FDF	Reset OMNINET interrupt

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For OMNINET operation refer to the OMNINET user's guide.

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**APPENDIX F-5**  
**CLOCK/CALENDAR/ALTMAP/VOLUME**

**APPENDIX F-5**

**CLOCK/CALENDAR/ALTMAP/VOLUME**

\$030F81

The clock/calendar is a CMOS device with 'awkward' timing. The registers of the clock/calendar are addressed by data at \$030F81. Data bits 0-3 are the register address. Bit 4 is the chip enable. Bits 5, 6 and 7 must be 0. Firstly the address must be written with the chip enable = 1. Then the address must be rewritten with the chip enable = 0. Thirdly the register read or write is performed at address \$030C01. Finally \$10 is written to \$030F81 to deselect the chip. The data to or from the chip is on bits 0 to 3.

Bit 5 is the volume control for the bell. A zero must be written to bit whenever this register is written to, except when a quiet bell is sound. When the quiet bell has stopped sounding, a zero must again be written to this bit.

Bit 6 selects between the Concept memory mapping and an alternate Memory mapping. Whenever this register is written to, this bit must be set to zero.

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**APPENDIX F-6**  
**DATA COMMUNICATION AND KEYBOARD REGISTERS**

## APPENDIX F-6 DATA COMMUNICATION AND KEYBOARD REGISTERS

The keyboard and Data Com use a 6551 UART from Synertek or Rockwell. For Data Com (and keyboard) the following relations are needed:

Register	Keyboard	Data Com 1	Data Com 2
Data	\$030F01	\$030F21	\$030F61
Status	\$030F03	\$0303F23	\$030F43
Command	\$030F05	\$030F25	\$030F45
Control	\$030F07	\$030F27	\$030F47

Command Register Bits							
7	6	5	4	3	2	1	0
--	--	--	--	--	--	--	--
x	x	0	x	x	x	x	x
0	0	1	x	x	x	x	x
0	1	1	x	x	x	x	x
1	0	1	x	x	x	x	x
1	1	1	x	x	x	x	x
x	x	x	0	x	x	x	x
x	x	x	1	x	x	x	x
x	x	x	x	0	0	x	x
x	x	x	x	0	1	x	x
x	x	x	x	1	0	x	x
x	x	x	x	1	1	x	x
x	x	x	x	x	x	0	x
x	x	x	x	x	x	1	x
x	x	x	x	x	x	0	x
x	x	x	x	x	x	1	x

no parity transmitted or received, no check  
 Odd parity transmitted and received  
 Even parity transmitted and received  
 Mark parity transmitted, no parity check  
 Space parity transmitted, no parity check  
 Normal transmit, receive (no echo)  
 Echo mode (received data is retransmitted)  
 Tx INT disabled, RTS off, Transmitter off  
 Tx INT enabled, RTS on, Transmitter on  
 Tx INT disabled, RTS on, Transmitter on  
 Tx INT disabled, RTS on, Transmit BREAK  
 IRQ interrupt enabled from bit 3 of status  
 IRQ interrupt disabled  
 Disable receiver, disable all interrupts  
 Enable receiver, enable all interrupts

Control Register Bits (7 6 5 4)				Control Register Bits (3 2 1 0)			
7	6	5	4	0	16x external clock	8	1200 Baud
--	--	--	--	1	50 Baud	9	1800 Baud
0	x	x	x	2	75 Baud	A	2400 Baud
1	x	x	x	3	109.92 Baud	B	3600 Baud
x	0	0	x	4	134.58 Baud	C	4800 Baud
x	0	1	x	5	150 Baud	D	7200 Baud
x	1	0	x	6	300 Baud	E	9600 Baud
x	1	1	x	7	600 Baud	F	19200 Baud

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## CORVUS DEALER SERVICE

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### Status Register Bits

Bit	Value		
0	0	No parity error	self clearing
	1	Parity error	
1	0	No Framing error	self clearing
	1	Overrun	
	1	Receive register full	(cleared by read data)
4	0	Transmit register full	(not ready for new data)
	1	Transmit register empty	(cleared by write data)
5	0	DCD low	(hard-wired low)
	1	DCD high	
6	0	DSR low	(hard-wired low)
	1	DSR high	
7	0	No interrupt request	
	1	Interrupt request	

Note: Writing to the status register resets status bit 2

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### Interrupt priority

7	Non maskable interrupt	not installed
6	Keyboard	
5	Timer	
4	Data Com 0	
3	OMNINET	
2	Data Com 1	
1	Data Com control/Apple slots	
0	Normal (no interrupt)	

When an interrupt occurs, the priority is automatically raised to the level of that interrupt, preventing further interrupts of the same priority or below. A return-from-interrupt restores the priority at the time of the interrupt. Most interrupts are self clearing; that is the reading of the status of the resource clears the interrupt. OMNINET interrupts must be cleared by accessing \$030FC1 (NOMOFF). Data Com control line interrupts must be cleared by complementing bit 7 of VIA port A.

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**CORVUS DEALER SERVICE**

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**Memory Mapper Equivalents (PROM addresses and data) Signetics 82S181**

Device 22 23 1 2 3 4 5 6 7 8  
pin

Device A9 A8 A7 A6 A5 A4 A3 A2 A1 A0  
Address

Concept	N	N	N	A*	A	A	**	A	RESOURCE
BUS	ZERO	SUPV	AS	22	16	17		19	HEX
name	0	X	0	0	0	0	0	20	ADDRESS
	1	X	0	0	0	0	0	0	000, 100
	X	X	0	0	1	0	0	0	ROM0
								0	000, 100
								0	SRAM
								0	1111011 FB
								0	0
								0	200, 300
								0	ROM0
								0	020, 120
								0	220, 320
								0	ROM1
								0	010, 110
								0	210, 310
								0	I/O
								0	030, 130
								0	230, 330
								0	DRAM
								0	X04, X14
								0	X24, X34
								0	X84, X94
								0	XA4, XB4

Here X is 0 or 1

Here x can  
be 0, 1, 2, 3

N NNNNNN

C IRRSRR

Y OAAROO

all other locations should be programmed to 7E

C MMAMM

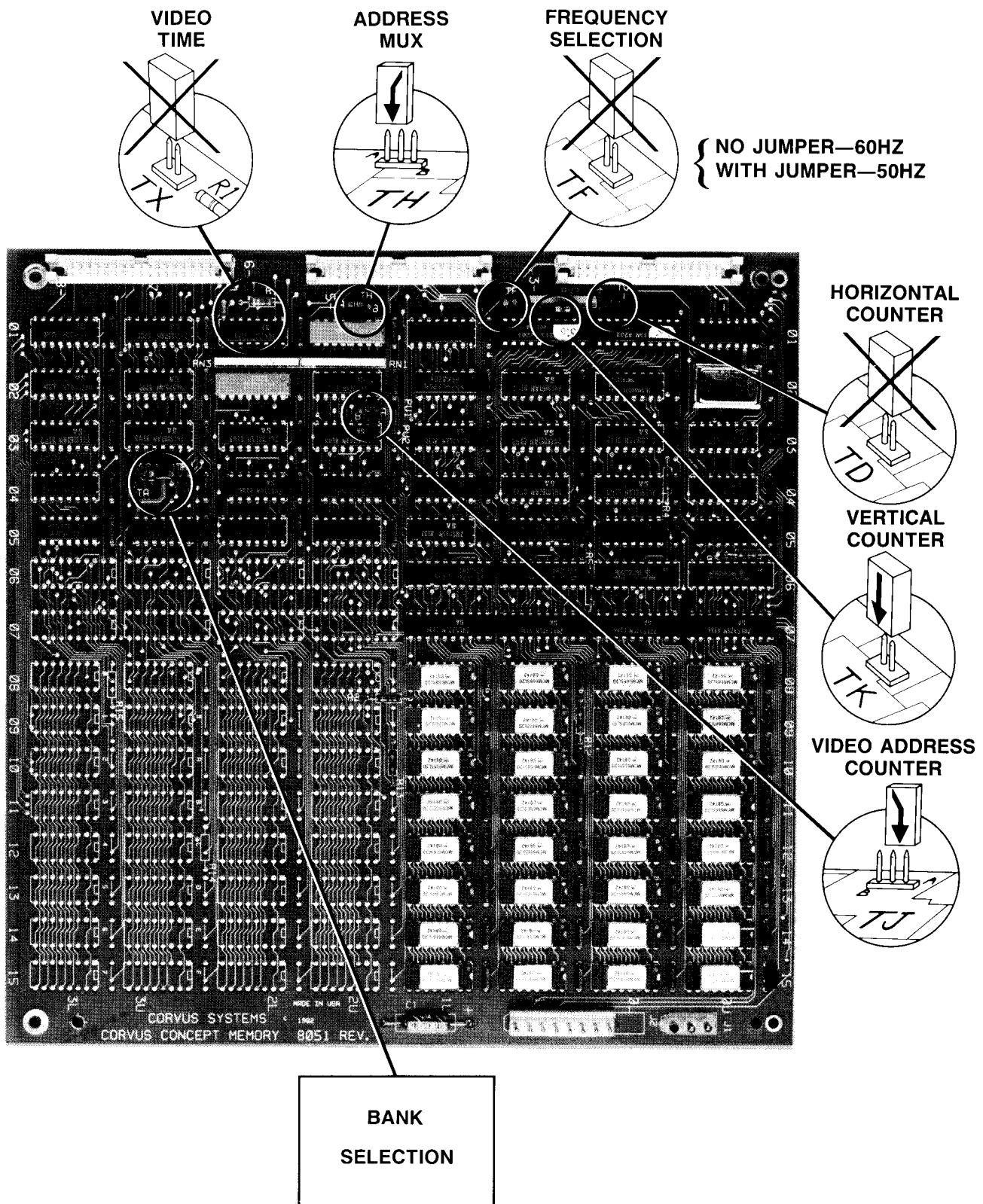
L 10M10

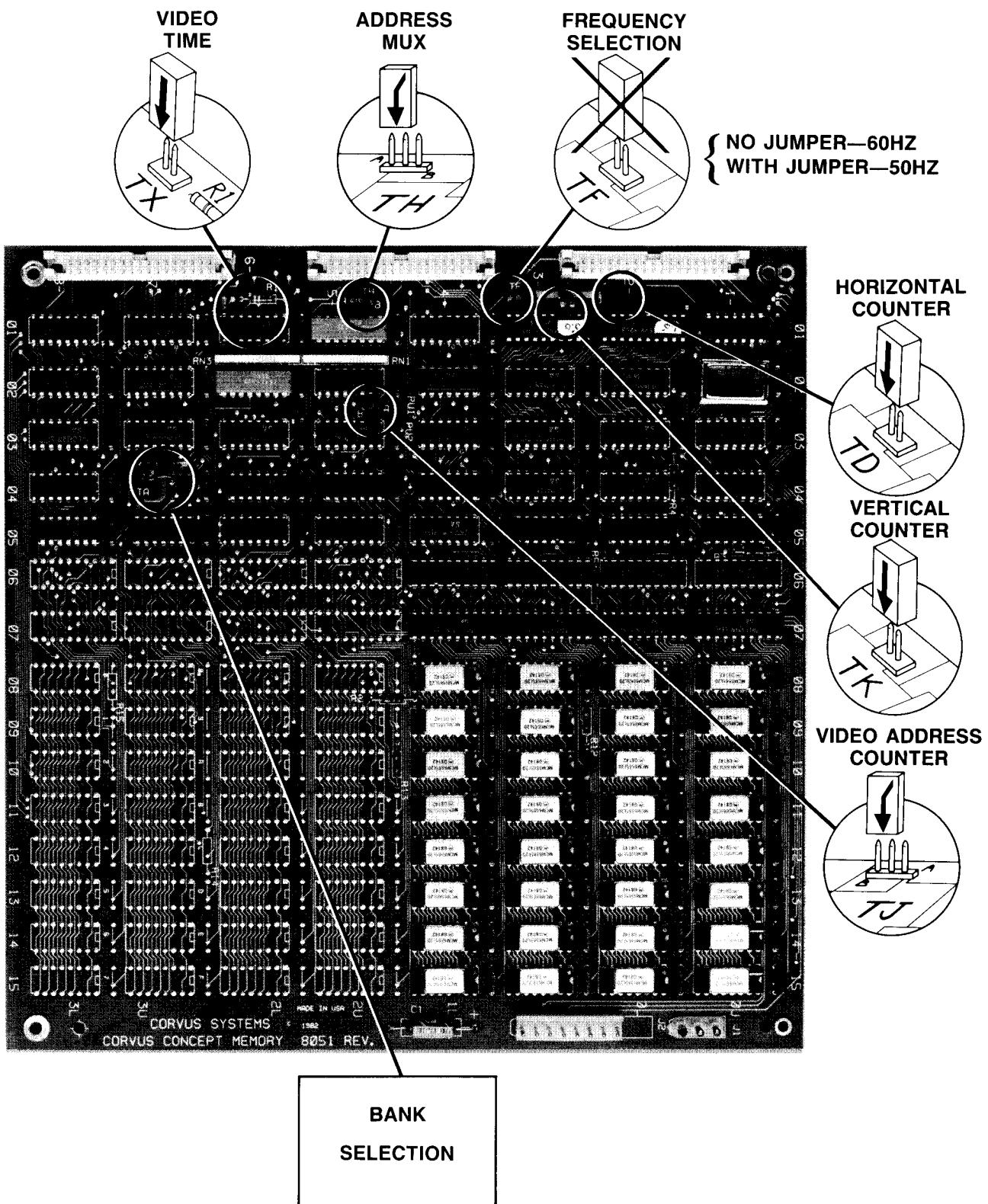
\* Board level testers may jumper WRITE  
this pin instead of A22

E

\*\* This pin is ALTMAP. It should always be zero for Concept.  
It can be jumpered.

**APPENDIX G**  
**MEMORY BOARD JUMPER LAYOUT**





**APPENDIX H  
CONNECTOR**

## APPENDIX H-1

### 50-PIN I/O SLOT DESCRIPTION

<b>Pin</b>	<b>Name</b>	<b>Description</b>
1	NIOX	This line is normally high. When IOSLOT X is referenced, this line goes low. It can drive 20 LSTTL loads.
2-17	A1-A16	The buffered address bus. These address lines are always driven, and can supply 20 LSTTL loads from an I/O card.
18	NWRITE	This line goes low before 1M goes low, when the microprocessor writes to the I/O card. It remains low until after the cycle has occurred. NWRITE can drive 20 LSTTL loads total.
19	OPEN	
20	NIOSTB	This line goes low when an odd address between \$39FE1 and \$39FFF is selected.
21	OPEN	This is not READY.
22	OPEN	This is not DMA.
23	INTOUTX	Daisy chained interrupt line.
24	DMAOUTX	DMA daisy chain, could be used for IO card priority. DMA is NOT IMPLEMENTED!
25	+5V	500mA total current is available for all I/O cards.
26	Ground	System Electric Ground
27	DMAIN	Daisy chained DMA (DMA is not implemented)
28	INTIN	Daisy chained interrupt priority in.
29	NNMIX	'Non Maskable Interrupt' X. When the MC68000 interrupt priority is zero, a zero on this line will cause an interrupt. The source of the interrupt can then be determined by reading NSLOTMT.
30	NIRQX	Interrupt request. Similar function to NNMIX
31	NRESET	This line is pulled low by the processor power-on-reset signal. It should not be pulled low by the I/O card. If the I/O card pulls on this line some circuits are reset but the indeterminate.
32	OPEN	
33	-12V	200 mA per card
34	-5V	100 mA per card
35	OPEN	
36	8M	8.182 MHz (not 7.15 MHz)
37	Q3	assymetric 2.0455 MHz
38	N1M	1.02275 MHz clock, inverse of 1M
39		Common pullup
40	1M	1.02275 MHz clock
41	NDEVX	This line goes low to address registers on I/O cards. It can drive TTL loads. It is low only when N1M is high.
42-49	DI00-DI07	Bidirectional data lines. These lines are buffered except when the microprocessor reads from the I/O slot.
50	+12V	200 mA per card

**APPENDIX H-2**  
**DATA COMMUNICATION PORTS J1 AND J2**

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**CORVUS DEALER SERVICE**

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**APPENDIX H-2**  
**DATA COMMUNICATION PORTS J1 AND J2**

<b>Pin</b>	<b>V.24</b>	<b>RS-232C</b>	<b>Function</b>
1	101	AB	Protective Ground
2	103	BA	Transmitted Data
3	104	BB	Received Data
4	105	CA	Request to Send
5	106	CB	Clear To Send
6	107	CC	Data Set Ready
7	102	AB	Signal Ground
8	109	CF	Data Carrier Detect
20	108	CD	Data Terminal Ready
23	111	CH	Data Signal Rate select (high/low Baud Rate dual speed modems)

All other pins are open.

**APPENDIX H-3**  
**BOARD CONNECTORS J4, J5, AND J6**

**APPENDIX H-3**  
**BOARD CONNECTORS J4, J5, AND J6**

Pin	J4 Name	J5 Name	J6 Name
1	Gnd	Gnd	Gnd
2	RA17	DOF	N16M
3	+5V	+5V	RA23
4	RA16	DOE	N8M
5	Gnd	Gnd	Gnd
6	RA15	DOD	N1M
7	+5V	+5V	+5V
8	RA14	DOC	RAMINT
9	Gnd	Gnd	Gnd
10	RA13	DOB	NRAM1
11	+5V	+5V	RA21
12	RA12	AOB	RA20
13	Gnd	Gnd	Gnd
14	RA11	DO9	RA19
15	+5V	+5V	RA22
16	RA10	DO8	NRAMACK
17	Gnd	Gnd	Gnd
18	RA9	DO7	RAMSEL
19	+5V	+5V	+5V
20	RA8	DO6	VA17
21	Gnd	Gnd	Gnd
22	RA7	DO5	VA18
23	+5V	+5V	+5V
24	RA6	DO4	VIDOFF
25	Gnd	Gnd	Gnd
26	RA5	DO3	RNLDS
27	+5V	+5V	+5V
28	RA4	DO2	NWRITEX
29	Gnd	Gnd	Gnd
30	RA3	DO1	NPARITYSELECT
31	+5V	+5V	+5V
32	RA2	DO0	XNRESET
33	Gnd	Gnd	Gnd
34	RA1	RA18	RNUDS

**APPENDIX H-4**  
**ADDITIONAL CONNECTORS**

## APPENDIX H-4 ADDITIONAL CONNECTORS

### **OMNINET Connector J3**

J3 has 3 pins. The center pin is shield, the outer two push-pull balance signal lines between 0 and 5V.

### **Speaker and Battery Connector J5**

Pin	Description
1	Speaker
2	+5V
3	Battery
4	Gnd

### **PCA Power Connector J8**

Pin	Description
1	Shield
2	Ground
3	+5V
4	+12V
5	-12V
6	Open

### **Keyboard and Orientation Switch Connector J9**

Pin	Description
1	Ground
2	Orientation switch
3	Keyboard data out
4	+5V
5	Keyboard data in
6	Ground
7	Open
8	Shield

**APPENDIX I**  
**CONCEPT PARTS LIST**

**APPENDIX I  
CONCEPT SPARES**

DESCRIPTION	PART NO.
MONITOR	8010-08082
KEYBOARD	8010-08083
ELECTRONICS DRAWER 512K	8010-08670
PROCESSOR BOARD	8010-08024
256K MEMORY BOARD	8010-08051
512K MEMORY BOARD	8010-08546
POWER SUPPLY	8010-08522
BIFORCATED CABLE	6010-02007
AC PANEL ASSY.	8010-08091
DC HARNESS	8010-08520
BATTERIES	4000-02982
RIBBON CABLES	8010-08523
MONITOR FRONT BEZEL	3100-01881
BASE TOP FOAM	3100-01889
BASE BOTTOM FOAM	3100-01890
FRONT PANEL FOAM	3100-01891
SWIVEL PLATE	3100-01896
MUFFIN FAN	2600-02080
MC68000 PROCESSOR	3265-01492
H BOOT ROM 2716	8105-09411
L BOOT ROM	8105-09412
UARTS (S46551)	3210-01472
VIA UART	3210-01473
H MACSBUG ROM	8105-09534
L MACSBUG ROM	8105-09535
MONOCHIP	8115-03023
MC68A54 IC	3210-01274
6801 V8.A IC	3265-02762
MEMORY MAPPER	8105-09011
HORIZONTAL COUNTER	8110-02076
VERTICAL COUNTER	8110-02944
75174 DRIVER	3210-01271
75175 RECEIVER	3210-01272
STATIC RAMS	3250-01458
DYNAMIC RAM	3255-01370
MEMORY UPGRADE	
ALLEN 4-40 X 1/4	2800-01867
ALLEN 10-32 X 2 1/2	2800-02151
LOCKWASHER #6	2800-01191
HEX ALLEN 6-32 X 1/2	2800-02234
HEX ALLEN 6-32 X 3/8	2800-01177
ALLEN 8-32 X 1/2	2800-01186
ALLEN 10-32 X 1/4	2800-01859
STANDOFF 6-32	2850-02016
RIGHT GRIPLATCH	2800-02019
LEFT GRIPLATCH	2800-02018
SERVICE MANUAL	7100-04701
CONCEPT ADMINISTRATION MANUAL	7100-04699
SERVICE DISKETTE	7100-04699
CONCEPT BINDER	7200-04616
DEALER REPAIR TAGS	7200-04618

**APPENDIX J  
SPECIFICATIONS**

## APPENDIX J SPECIFICATIONS

### Microprocessor

- Motorola MC68000
- 32-Bit Data Registers
- 24-Bit Memory Address Bus

### Memory

- 256 Kbytes Standard
- 512 Kbytes Optional

### Input/Output

- OMNINET Network Interface
- Two Serial Asynchronous Controllers
- Clock/Calendar with Battery Backup
- Flexible Sound Generator with Speaker
- Two interval Timers

### Video Monitor

- 15-Inch CRT (35MHz)
- Bit Mapped Display
- 720 Pixels by 560 Pixels
- 120 Characters by 56 Lines in Landscape Mode
- 90 Characters by 72 Lines in Portrait Mode
- Software Generated Character Set

### Keyboard

- 91 Key Detached Keyboard
- Selectric R Style Keyboard
- 15 Keyboard Numeric Keypad
- 10 Programmable Function Keys
- Cursor Control Keys

### Operating Systems and Software

- UCSD Pascal File Structure
- ISO Pascal with UCSD Extensions (Native Code Compiler)
- FORTRAN '77 (Native Code Compiler)
- 68000 Assembler
- EdWord™ Word Processor
- LogiCalc™ Electronic Spread Sheet
- CP/M Compatability

### Electrical Specifications

- 100/120 or 220/240 Volts AC, Selectable
- 50 or 60 Hz
- 200 Watts

### Physical Dimensions

	Height (in/cm)	Depth (in/cm)	Width (in/cm)	Weight (lbs/kg)
Video Monitor	14/35.6	15/38.1	15/38.1	41/18.6
Base	4.5/11.4	15/38.1	17/43.2	24.5/11.2
Keyboard	3/7.6	8/20.3	17/43.2	4.7/2.1
Total Unit (Without Keyboard)	21/53.3	15/38.1	17/43.2	65.5/29.8