

C5001/MU
MICROCOMPUTER
SYSTEM
USER'S GUIDE

PRELIMINARY VERSION

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1.1. GENERAL INFORMATION

This manual provides the information necessary for unpacking, installation, basic operation and level 1 maintenance of the Onyx C5001/MU Microcomputer System. It is organized into the following sections for quickly locating the necessary information.

o SECTION 1 - INTRODUCTION

Provides general information about this manual and its use. It also provides an introduction to the C8002 System with a description of the major subassemblies.

o SECTION 2 - CONTROLS AND INDICATORS

Provides a general description of all internal and external controls and indicators used by the C5001/MU System and their purpose.

o SECTION 3 - I/O INTERFACE

Provides a description of all I/O interface connectors on the C5001/MU System and their use.

o SECTION 4 - INSTALLATION

Provides the necessary procedures for installation planning, unpacking, assembly and expansion of the C5001/MU Microcomputer System.

o SECTION 5 - OPERATION

Provides the general procedures for initializing and operating the C5001/MU System using the OASIS Operating System.

o SECTION 6 - MAINTENANCE

Provides the necessary routine preventive maintenance procedures and fault isolation procedures used for level 1 maintenance of the C5001/MU Microcomputer System.

1.1.1. Use of Note, Caution and Warning

Within this manual there are three headings which are used to call the reader's attention to specific text passages. These headings and their use is described below.

NOTE

This symbol is used to highlight specific text information, conditions or procedures.

CAUTION

This symbol denotes a procedure or condition which will result in damage to or destruction of the equipment.

WARNING

This symbol denotes a procedure or condition which may result in personal injury or loss of life if not observed.

1.1.2. Updates and Revisions

Although this manual was checked for technical accuracy at the time of publication, subsequent revisions and/or updates may occur. In order for the user to receive updates to this manual complete the "Request for Update" form, found in the back of this manual, and return it to Onyx Systems.

When new updates are received the instructions for updating this manual will be included. In general all changes to text will be denoted by a vertical bar (|) to the left of the affected text, and all changes to figures and tables will be denoted by a bullet (o) placed to the left of the affected title.

1.1.3. Related Publications

The following list of related publications may be referenced from the text contained in this manual and may serve to enhance or clarify specific text passages within this document.

- o Onyx C8001 MU System, Hardware Reference Manual

1.2. C5001/MU GENERAL DESCRIPTION

The C5001/MU Microcomputer System is a 8-bit, general purpose microcomputer, housed in a single table top enclosure. This enclosure contains necessary d.c. power supplies, cooling, fixed "Winchester" disk storage, magnetic cartridge tape transport and the system's logic circuitry (p.c. boards), reference Figure 1-1.

Internally, the C5001/MU System is composed of three (3) basic printed circuit board assemblies, with an additional memory board if the memory expansion option is installed, reference Figure 1-2. The basic printed circuit boards are:

- o Z80 MU Board
- o Z80 MU I/O Board
- o IMI 5000 Controller Board
- o Z80 MU Memory Board (optional memory expansion)

In addition to these logic boards there are several other key elements provided in the C5001/MU Microcomputer System, these are listed below (reference Figure 1-2 for locations).

- o D.C. Switching Power Supply
- o Fixed "Winchester" Disk Drive
- o Magnetic Cartridge Tape Transport

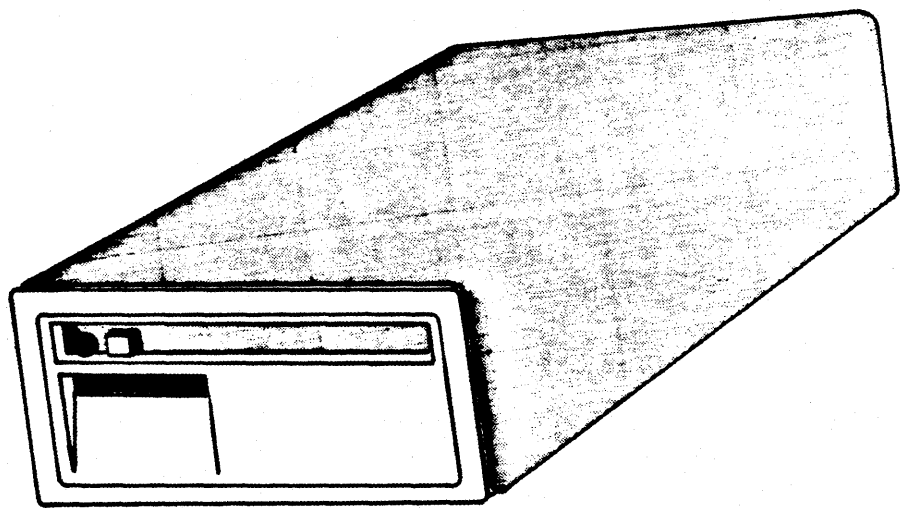


Figure 1-1 C5001/MU Microcomputer System

1.2.1. Z80 MU Board

The Z80 MU Board provides the CPU, 128K RAM Memory, 4K EPROM, and interface control to the disk, tape, serial and parallel devices.

The processor board has flat ribbon connectors to the following:

- o Five RS-232C Serial Interface Channels
- o Parallel Printer Interface - Centronics Compatible
- o Disk Interface - IMI Controller Bus
- o Expansion Memory

Two other connectors are to monitor the AC voltage level and DC power source.

During system initialization, either from power-up or reset, the lower 4K is mapped to the EPROM which runs a system diagnostic and provides a primary bootstrap to either disk or tape.

1.2.2. Z80 MU I/O Board

Located at the rear of the C5001/MU are the interface connections for external devices. The console is connected to J101 and is buffered on the processor board. All other terminal connectors J103 thru J106 are buffered on this board. The MODEM connector (J102) is the same serial channel as Terminal 2 (J103), only one of these connectors can be used at a time. J107 is the PARALLEL PORT for a parallel printer and is buffered on the processor board. The DISK EXPANSION is an extension of the IMI controller bus from the processor board.

TO BE SUPPLIED

Figure 1-2 C5001/MU Microcomputer System (Subassembly Locations)

1.2.3. C5000 Controller Board

The C5000 controller board is mounted on the bottom of the logic tray. This board has the capacity to handle two IMI 5-1/4 inch Winchester drives.

1.2.4. Z80 MU Memory Board (optional memory expansion)

The Z80 MU memory board provides a C5001/MU system with another 128K of memory with parity.

1.2.5. D.C. Power Supply

The d.c. power is supplied by a switching power supply mounted in the base of the unit, reference Figure 1-2. This supply provides the following voltage outputs.

- o +5 volts
- o -5 volts
- o +12 volts
- o -12 volts
- o +24 volts
- o -24 volts

All d.c. voltage outputs are protected against overload conditions. All outputs, except the -5V output, are protected by a "crow bar" circuit, the -5V output is fused by a pico-fuse for protection.

1.2.6. Fixed "Winchester" Disk Drive

The mass storage device for the C5001/MU Microcomputer System is a fixed disk drive using the "Winchester" technology. This completely sealed unit provides a compact, highly reliable mass storage device having a storage capacity of 6 to 40 megabytes.

This unit is located in the base of the C5001/MU System, left-hand side (reference Figure 1-2). Complete specifications for the disk unit may be found in Appendix A - Disk Drive Specifications.

1.2.7. Magnetic Cartridge Tape Transport

A 6400 bpi Cartridge Magnetic Tape Drive is provided by the system to allow the user to load from, or to write programs on removable storage media. The drive records information on, or reads information from, a magnetic tape cartridge built in conformance with ANSI Standard X3.55 - 1977 Specifications. Up to 17.2 megabytes of data (unformatted) may be stored on a 450 foot tape. The recording format is four track serial and the data transfer rate in both read and write modes is 192,000 bits per second.

This unit is located in the base of the C5001/MU System and access to the drive for mounting tape cartridges is provided via an aperture on the front of the system, reference Figures 1-1 and 1-2. Complete specifications for the drive are provided in Appendix B - Magnetic Cartridge Tape Drive Specifications.

2.1. GENERAL INFORMATION

The C5001/MU microcomputer system has minimal external controls and indicators, internally there are switches, indicators and jumper plugs on the processor board and a jumper plug on the I/O board. These switches and jumper plugs are set at the time of installation and are not usually changed.

2.2. EXTERNAL CONTROLS AND INDICATORS

There are only two external controls on the C5001/MU Microcomputer System; the power switch and the RESET switch. An incandescent indicator is also provided which provides a visual indication of the power ON state of the system.

Power On/Off (keyswitch):

This switch, located on the front of the unit, is a two position locking keyswitch which is used to apply (On) or remove (Off) a.c. power to the internal subassemblies. The key may be removed when the key is in either the On or Off positions. The initiation of the power-on state causes a general system reset operation.

RESET Switch (push button, momentary):

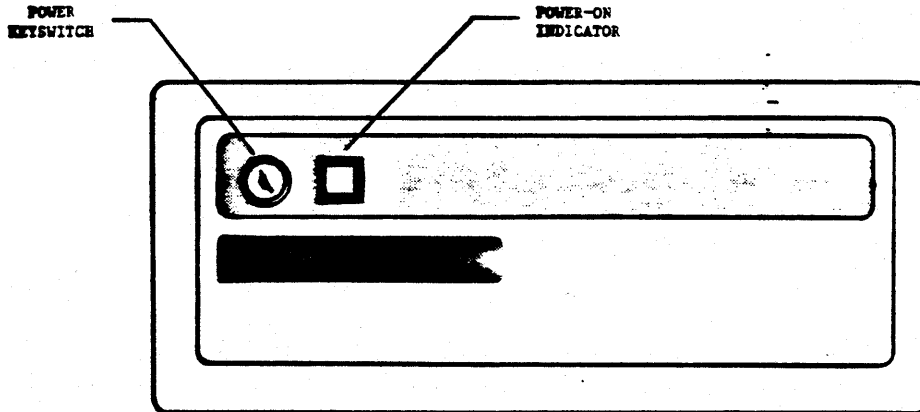
This switch, located on the rear of the unit, is used to initiate a general system reset operation. Once the RESET switch is pressed the general system reset is generated and program control is transferred to the 4k byte EPROM. The Z80 Processor Board will enter Self Test Mode and when this operation successfully completes, the operator is given control to boot from disk or tape.

CAUTION

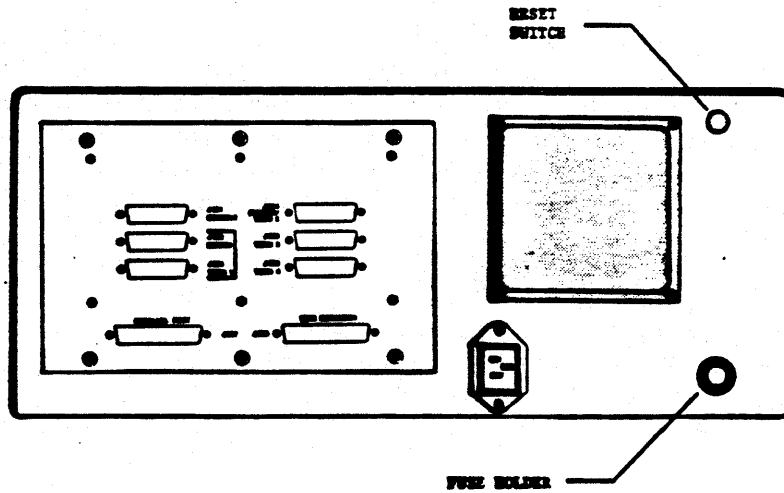
Depressing the RESET switch while the operating system is running can have detrimental effects on the file system. Reference Section 5 - Operation.

Power On Indicator (incandescent):

A power ON indicator is provided on the front of the unit, adjacent to the power On/Off key switch. This indicator will be illuminated when + 5 vdc is applied to the internal subassemblies of the system.



C8002 FRONT PANEL



C8002 REAR PANEL

Figure 2-1 External Controls and Indicators

2.3. INTERNAL CONTROLS AND INDICATORS

There is a set of switches, jumper connections and indicators on the processor board within the C5001/MU. There is also one jumper connection on the I/O board. The following subparagraphs provide a brief description of these controls and indicators, and their purpose. The configuration options are discussed in detail during the installation procedure described in Section 4 - Installation. The indicators are used for diagnostic purposes and are described in Section 6 - Maintenance.

2.3.1. Z80 Processor Board (Configuration)

The Z80 MU Board provides a 4-bit dip switch (SW1) which is used to select the baud rate for the terminal device connected to CONSOLE (J101).

There are three (3) jumper connectors, two for asynchronous or synchronous transmit and receive clock selection for the MODEM (J102) connector on the rear of the unit. The other jumper is to allow three or five serial ports in the interrupt chain - normally in the five port position.

In addition, there are four (4) light emitting diodes (LED1-4) which provide valuable diagnostic information during the Self Diagnostic Operations. These LEDs are not visible from the exterior of the machine and are only needed for use by maintenance personnel.

2.3.2. Z80 I/O Board (Configuration)

The Z80 MU I/O Board has one jumper connector and it is used when using a Texas Instruments printer on TERM 2 (J104).

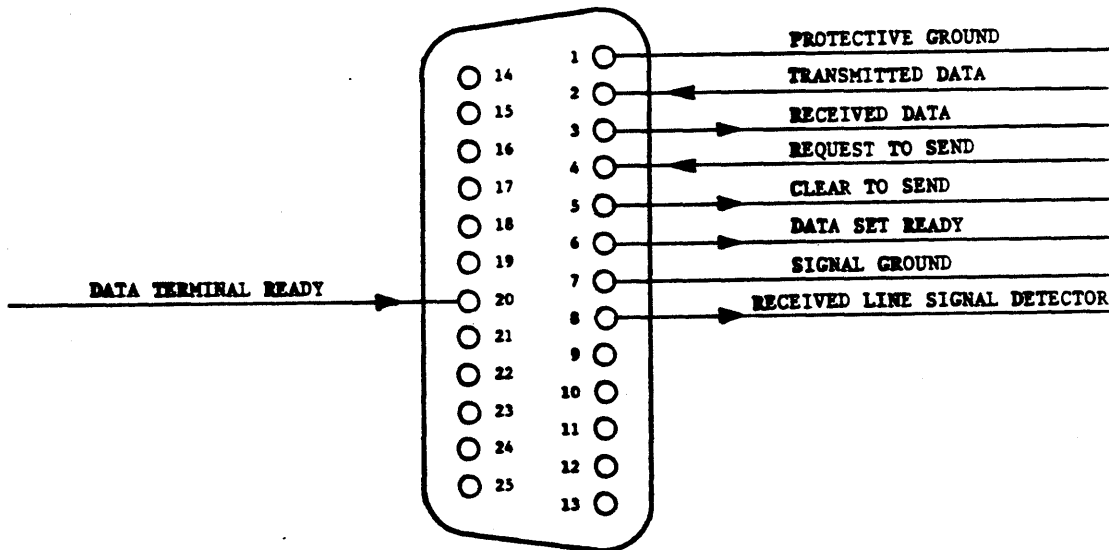
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3.1. GENERAL INFORMATION

This section describes the various input/output channels of the C5001/MU Microcomputer System, with discussion of the electrical and mechanical characteristics of each interface. It should be noted that all of the serial interface connections on the rear of the unit, except the CONSOLE (J101), are buffered on the Z80 MU I/O Board.

3.2. CONSOLE CONNECTOR (J101)

The CONSOLE connector (J101) provides a 25-pin, female D-Type connector, having EIA RS-232C interface characteristics (reference Figure 3-1). This connector has special significance to the C5001/MU System in that, it is the only connector that has hardware baud rate selection associated with it. This implies that the first terminal connected to the system MUST BE connected to CONSOLE (J101) and that the baud rate select switch (SW1), located on the Z80 MU Processor Board, must be properly configured, reference Section - 4, paragraph 4.4.2...



NOTE: Arrowheads indicate signal flow relative to C5001/MU

Figure 3-1 RS-232C Interface Connector

3.3. TERMINAL CONNECTORS (J1xx)

There are four (4) terminal connectors, designated TERM x, supplied on the rear of the C5001/MU System. These provide 25-pin, female D-Type connectors having EIA RS-232C interface characteristics (reference Figure 3-1). The connectors and associated terminal identity are listed below.

Table 3-1 Terminal Connectors

Identity	Connector	Terminal
Term 1	J103	2
Term 2	J104	3
Term 3	J105	4
Term 4	J106	5

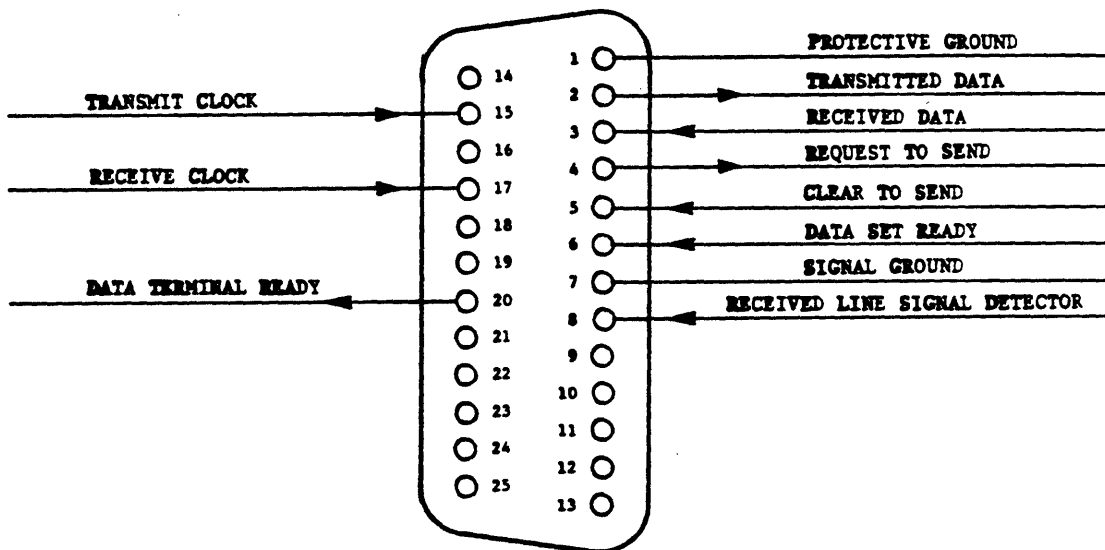
Note

Terminal 1 (TERM 1 - J103) may not be connected if a device is connected to MODEM (J102), reference paragraph 3.4..

3.4. MODEM CONNECTOR (J104)

A modem connector, MODEM - J102, provides a 25-pin, female D-Type connector having EIA RS-232C interface characteristics (reference Figure 3-2). This connector has two jumper connections associated with it that are located on the Z80 MU Processor Board. These jumpers, labeled A3, allow the selection of either asynchronous or synchronous transmit and receive clocks for the serial interface channel (reference Section 4, paragraph 4.4.3).

The signals associated with connectors J103 (TERM 2) and J104 (MODEM) are wire OR'd on the Z80 MU I/O Board, thus the connection of devices to either connector must be considered to be mutually exclusive.



NOTE: Arrowheads indicate signal flow relative to C5001/MU

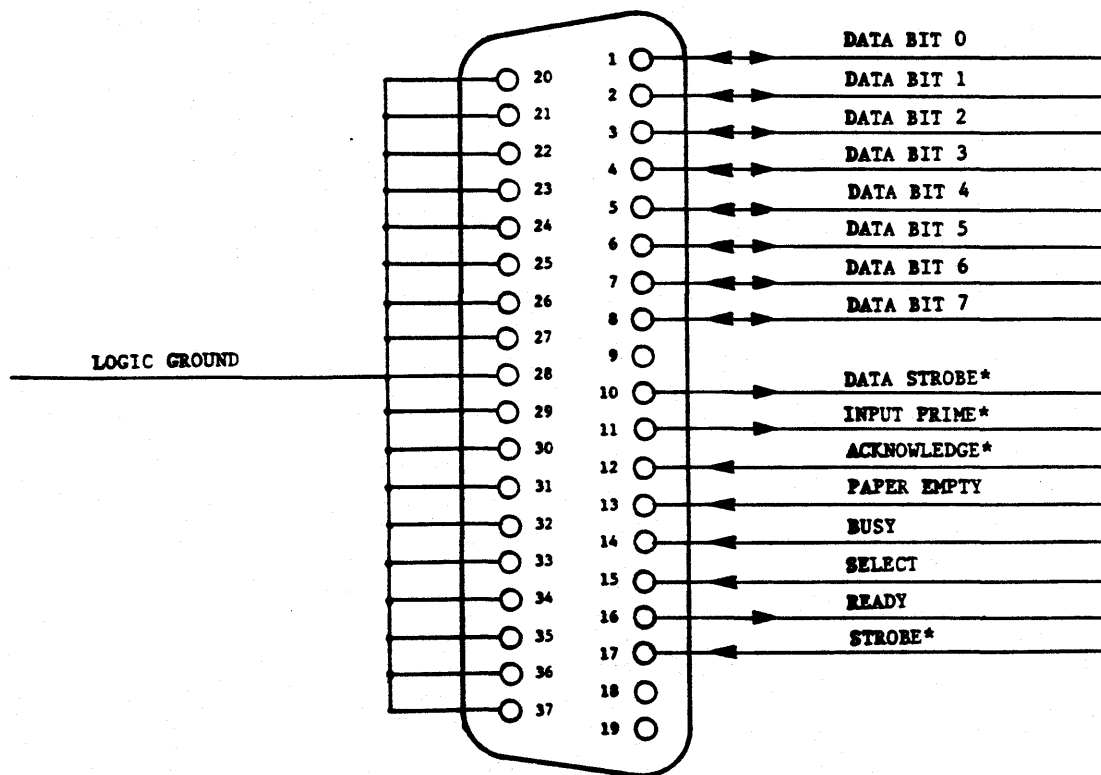
Figure 3-2 Modem Interface Connector

3.5. SERIAL PRINTER CONNECTOR (J105)

The serial printer connection, PRINTER - J104, provides a 25-pin, female D-Type connector having EIA RS-232C interface characteristics (reference Figure 3-1). Only TI printers are mandator to use this connector, other printers that use straight RS-232C pinouts may use any terminal connector (J103-J106). Reference Section 4, paragraph 5 on the use of TI printers on the ONYX C5001/MU.

3.6. PARALLEL PORT CONNECTOR (J106)

A parallel port connection is provided by connector PARALLEL PORT - J107, reference Figure 3-3. This 37-pin, female D-Type connector provides a Centronics parallel handshake interface characteristics and is designed to allow connection of printer devices that are equipped with the aforementioned interface option. This will allow a high speed output device to be utilized for hard copy output from the C5001/MU Microcomputer System. There are no jumpers or switches associated with this connector.

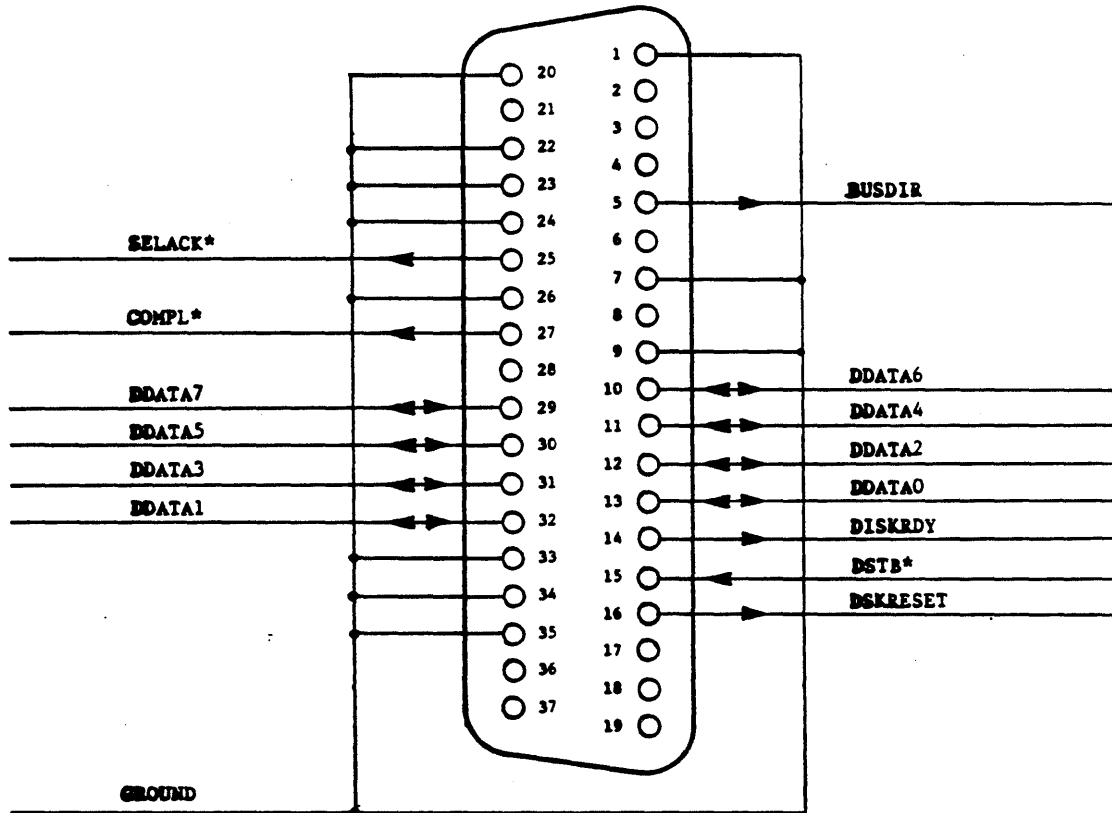


NOTE: Arrowheads indicate signal flow relative to C5001/MU

Figure 3-3 Parallel Printer Interface Connector

3.7. DISK EXPANSION CONNECTOR (J108)

A connector, labeled DISK EXPANSION - J108, is provided to allow the addition of Onyx C8201.C Auxiliary Disk Units to the C5001/MU System. This connection, a 37-pin, female D-Type connector, provides the necessary drive interface signals for the auxiliary disk unit., reference Figure 3-5.



NOTE: Arrowheads indicate signal flow relative to C5001/MU

Figure 3-5 Disk Expansion Interface Connector

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4.1. GENERAL INFORMATION

The C5001/MU Microcomputer System is a compact unit which may easily be installed. This section provides the information necessary to unpack, install and upgrade the system with minimum difficulty.

4.2. INSTALLATION PLANNING

Careful planning of the installation will minimize difficulties encountered in installation, operation and maintenance of the C5001/MU Microcomputer System, and associated peripheral devices. The following subparagraphs provide the information necessary to effectively plan the installation.

4.2.1. Environmental Considerations

The C5001/MU Microcomputer System is designed for the office environment. When the system shares a common environment with other units, environmental specifications must be determined by the unit having the most restrictive limits. The C5001/MU Microcomputer System will operate reliably if the limits shown in Table 4-1 are not exceeded.

4.2.2. Electrical Characteristics

The electrical requirements for the C5001/MU System are shown in Table 4-1. System performance can be affected by noise and/or transients entering the system on the primary power input; thus, one or more of the following noise isolation techniques should be employed.

- a. Power line shielding may be utilized by enclosing the input power lines in rigid conduit or metallic shielding, which is connected to earth ground.
- b. Line filters may be used to reduce the amplitude of transients on the input power lines.
- c. An isolation transformer, fed by the highest available primary source may be utilized. The transformer should have taps to permit adjustment for load and line variations. The transformer must also meet the starting and operating surge requirements for the unit(s) with which it is used.

4.2.2.1. Grounding Considerations

The proper grounding of the C5001/MU System is extremely important. Inadequate grounding often causes intermittent problems which are extremely difficult to isolate and are detrimental to system performance. All Onyx machines are equipped with machine power cables containing an insulated equipment ground wire (green or green with one

or more yellow stripes), which is identical in size and insulation to the grounded and ungrounded supply conductors. This conductor connects machine frame ground to a pin on the input power connector.

WARNING

An insulated grounding conductor identical in size and insulation to the grounded and ungrounded branch-circuit supply conductors, except that it is green or green with one or more yellow stripes, is to be installed as part of the branch-circuit that supplies the unit(s). This conductor must be connected at the service equipment. Conduit **MUST NOT** be used as the only grounding medium.

4.2.2.2. Lightning Protection

It is recommended that the user install lightning protection devices on the secondary power source which is exposed, whenever:

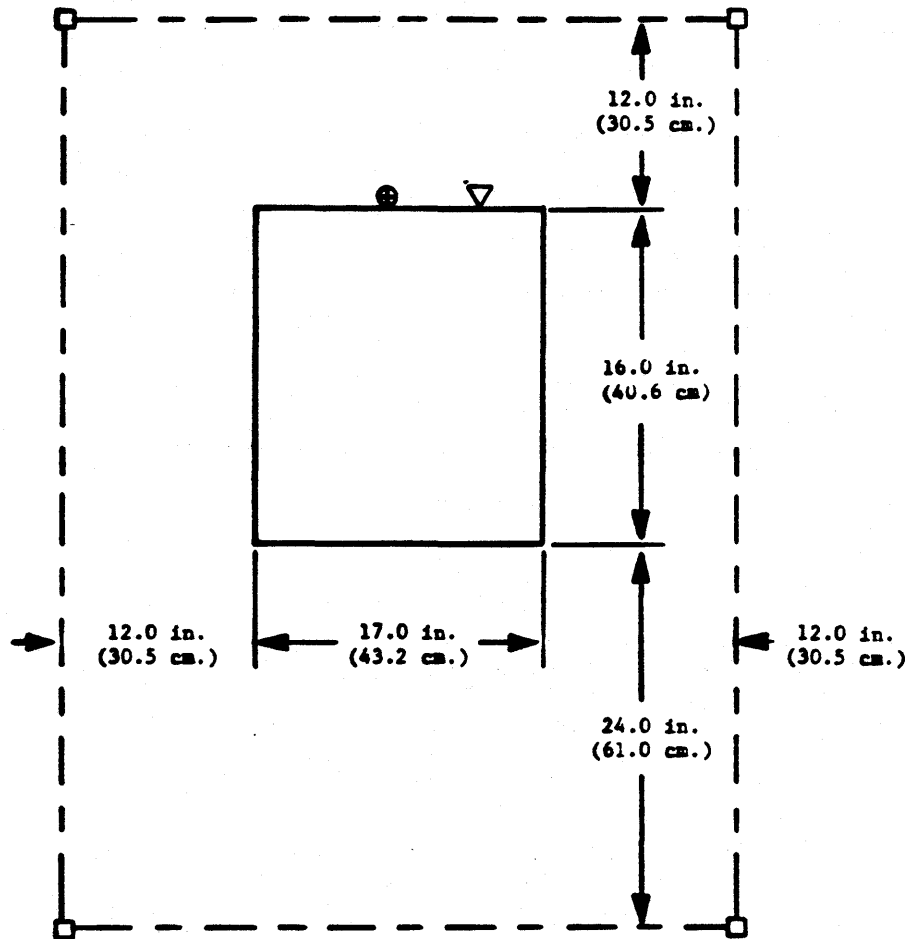
- a. Utility company installs lightning protectors on the primary circuit.
- b. Primary power is supplied by an overhead service.
- c. Area is subject to electrical storms.
- d. Area is subject to power surges.

4.2.3. Physical Considerations

The exact physical specifications for the C5001/MU Microcomputer System are shown in Table 4-1. Figure 4-1 provides a diagram showing the unit as well as the recommended service clearances that are required for performing corrective maintenance.

Table 4-1 C5001/MU Microcomputer System - Specifications

PHYSICAL SPECIFICATIONS				
Dimensions	Width 17.0 in (43.2 cm)	Depth 16.0 in (40.6 cm)	Height 8.0 in (20.3 cm)	
Service Clearances	Front 24.0 in (61.0 cm)	Rear 12.0 in (30.5 cm)	Left 12.0 in (30.5 cm)	Right 12.0 in (30.5 cm)
Maximum Weight	65 lbs (29.5 kg)			
Heat Output/Hour	1962 BTU (494 kcal)			
ELECTRICAL SPECIFICATIONS				
		60 Hz	50 Hz	
Phase		1	1	
Voltage (+/- 10%)		115V	230V	
Maximum Load Current		5A	2.5A	
Kilovolt Amperes		.575 kVA		
Power Cable Length	7.0 ft.(2.13 m)			
ENVIRONMENTAL SPECIFICATIONS				
OPERATING:				
Temperature	50 to 95 degrees F (10 to 35 degrees C)			
Relative Humidity	20 to 80% (no condensation)			
STORAGE:				
Temperature	-40 to 140 degrees F (-40 to 60 degrees C)			
Relative Humidity	10 to 90% (no condensation)			
Altitude	-1000 to 10,000 ft. (above sea level)			



FRONT

LEGEND :

- - - - □ Service Clearance Boundary
- A.C. Power Connection
- ▽ Signal Cable Connections

Figure 4-1 C5001/MU Microcomputer System - Physical Planning

4.3. TOOLS AND TEST EQUIPMENT

The following list of tools and test equipment will be required to assist in the installation and checkout of the C5001/MU Microcomputer System.

- o 1/4 inch nut driver
- o Small straight blade screw driver
- o Phillips head screw driver
- o A.C. Voltmeter (range - 0 to 400 volts)

4.4. UNPACKING AND ASSEMBLY

The C5001/MU Microcomputer System is shipped in a single, cardboard container that is provided with special foam packing material. It is recommended that this container be saved for use, in the event the system must again be transported. After opening the carton(s) the following items should be found.

- o C5001/MU MICROCOMPUTER SYSTEM:
 - A.C. Power Cable
 - Spare Line Fuse
 - System Keys (2 ea.)
- o SOFTWARE:
 - Software Distribution Tape Cartridge
 - Optional Language Product Tape (e.g. RM COBOL)
- o SOFTWARE DOCUMENTATION:
 - Software Release Notice(s)
 - Software Manuals (1 set)
 - Optional Software Manual(s)
- o HARDWARE DOCUMENTATION:
 - C5001/MU User's Manual

TO BE SUPPLIED

Figure 4-2 C500/MU Subassembly Locations

4.4.1. Unpacking Instructions

The following procedure is recommended for unpacking the C5001/MU System from its shipping container. Care should be exercised in opening the containers so that they may be reused at a later date for transportation.

- | Step | Procedure |
|------|--|
| 1. | Before opening the shipping container(s) inspect for damage. If the damaged contact the freight forwarder before proceeding further to resolve any insurance claims. |
| 2. | Carefully open shipping container, housing the C8002 System, and remove the system, keys, power cable and any other items. |
| 3. | Save all packing material and the container for future use. |
| 4. | Remove plastic cover from the system and save with materials from previous step. |
| 5. | Inspect the exterior of the unit for signs of damage. |
| 6. | The unit may now be moved to an area suitable to proceed with the checkout. |

4.4.2. Assembly Instructions

The C5001/MU Microcomputer System is a single, self-contained unit and therefore requires no assembly. Details regarding cable connections, installation of options and installation of the various system I/O devices are provided in subsequent paragraphs within this section.

4.5. PRE-POWER CHECKS

The following procedures (subparagraphs) provide detailed instructions necessary to install the C5001/MU Microcomputer System.

CAUTION

It is MANDATORY that the following procedures are performed prior to connecting a.c. power to the C5001/MU System.

Before proceeding further the user should identify the major subassemblies and their location within the C5001/MU Microcomputer System. These subassemblies are depicted in Figure 4-2.

4.5.1. Console Baud Rate Selection

A single 4-bit dip switch (SW1), located on the Z80 MU Processor Board, provides baud rate selection for the CONSOLE connector (J101). Three of the four bits (bit 2 - 4) are used for baud rate selection.

- | Step | Procedure |
|------|--|
| 1. | Remove the eight (8) screws which secure the top cover to the system and remove the cover. |
| 2. | Locate the Z80 MU Processor Board, use Figure 4-2 as a reference. |
| 3. | Locate the 4-bit dip switch (SW1), this may be found near connector J6. |
| 3. | Set the baud rate switches (bits 2 - 4) to the desired value shown in Table 4-2. |

Table 4-2 Console Baud Rate Select

SW1 (bit)				Baud
1	2	3	4	Rate
	on	on	on	300
	on	on	off	600
	on	off	on	1200
	on	off	off	2400
	off	on	on	4800
	off	on	off	9600
	off	off	on	19200
	off	off	off	38400

4.5.2. Modem and Interface Clock Selection

There are two (2) jumper connections, located on the Z80 MU Processor Board, that are used to select asynchronous or synchronous clocking for the transmit and receive clock inputs for the MODEM (J102) interface. These jumper connections are configured at the factory for (internal) clocking. To alter this setting perform the following procedure.

- | Step | Procedure |
|------|--|
| 1. | Locate the Z80 MU Processor Board, reference Figure 4-2. |
| 2. | Locate the jumper connections E1 and E2, these are found directly above connector J2 at location H3. |
| 3. | Using Figure 4-3 as a reference, configure the jumper connections to the desired position. |

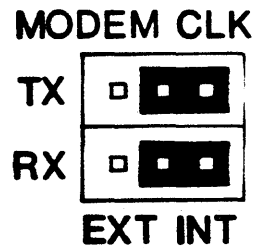


Figure 4-3 Modem and RS-422 Interface Clock Selection

4.5.3. A.C. Power Checks

Prior to connecting the system to the primary a.c. power source a check must be made to insure that the proper voltage and grounding are provided. It is recommended that this check be performed using an A.C. Voltmeter having the required scale for reading either 115 vac or 230 vac.

Voltage Checks:

Measure between the a.c. ungrounded supply conductor (hot) and the a.c. grounded supply conductor (return) and insure that the supply voltage is within the limits specified in Table 4-1.

CAUTION

If input supply voltage is not within the operating limits of the C5001/MU System, DO NOT connect the a.c. power source to the system until proper voltage is obtained.

Grounding Checks:

Measure between the a.c. grounded supply conductor (return) and the a.c. earth ground conductor (ground) to insure that there is no greater than 1 vac present.

WARNING

If voltage measured between a.c. return and a.c. ground is equal to the input supply voltage the service is ungrounded. DO NOT CONNECT C5001/MU System to this service until adequate grounding is provided.

CAUTION

If voltage measured between a.c. return and a.c. ground is less than the input supply voltage, but greater than 1 vac, the circuit may either have noise present or inadequate grounding. Either condition will have detrimental effects on the operation of the C5001/MU System.

4.5.4. Cable and Connector Checks

Before connecting a.c. power to the C5001/MU Microcomputer System, perform the following visual checks to insure all connectors are firmly seated.

- | Step | Procedure |
|------|--|
| 1. | Remove the two screws which secure the front edge of the logic card tray to the base of the system. These are located on the top left and right hand sides of the unit. |
| 2. | Tilt the logic tray upwards and towards the rear of the unit, reference Figure 1-2. |
| 3. | Inspect 25 pin signal cable connector and the 6-pin and 16-pin power connectors on the rear and the side of the magnetic cartridge tape transport, and insure they are firmly seated. |
| 4. | Inspect the 26 pin signal cable connector and the 6-pin d.c. power connector to the fixed disk drive, and insure they are firmly seated. Figure 1-2. |
| 5. | Inspect the 26-pin signal cables on the disk controller board, and insure they are firmly seated. Tilt the logic tray downwards to its original position and install the two screws removed in Step 3. |

After completing this procedure, the top cover may be placed on the unit and secured with the 8 screws removed in paragraph 4.5.2., Step 1.

4.5.5. Console Terminal Connection

After unpacking the terminal device and installing it according to the manufacturer's procedures, it may be connected to the CONSOLE connector (J101) on the rear of the C5001/MU System. The terminal device must be configured with following options.

- o Desired baud rate (300 - 38,400 baud) to match that set previously, reference paragraph 4.5.2..
- o No Parity.
- o One Start Bit and Two Stop Bits.

4.6. POWER-ON CHECKOUT

After completing all checks and procedures previously described in this section, the C5001/MU Microcomputer System may be connected to the a.c. input supply source so that power up operation may occur. The procedure for power up sequencing is provided in the following subparagraphs.

Perform the following procedure to connect and apply a.c. power to the C5001/MU Microcomputer System.

Step	Procedure
1.	Locate system keys and insert into a.c. power keyswitch on the front of the system.
2.	Insure the keyswitch is in the Off position.
3.	Connect the a.c. power cable supplied with the C5001/MU System to the unit and to primary a.c. power input.
4.	Apply power to the terminal device connected to the system's CONSOLE connector (J101).
5.	Turn the power keyswitch on the C5001/MU System to the On position. The power indicator should illuminate, the cooling fan should begin cycling and the fixed disk's spindle motor should also cycle up to speed. Proceed to Section 5 - Operation for instructions on loading and initializing the system software.

4.7. C8020 ADD-ON MEMORY INSTALLATION

An additional 128 Z80 MU Memory Board may be added to units shipped with 128K memory, but not to units shipped with 256K.

- | Step | Procedure |
|------|--|
| 1. | Unpack Z80 Memory Expansion Board and insure there is no physical damage. |
| 2. | Insure that there is a hardware kit containing screws, etc.. |
| 3. | Insure a.c. power is removed from the C5001/MU System. |
| 4. | Remove the top cover of the system, reference paragraph 6.5.2.. |
| 5. | Remove the screws, which secure the Z80 MU Board. |
| 6. | Insert standoffs, supplied in hardware kit, on top of existing screws. |
| 7. | Connect orange, 8-pin d.c. power connector to the Z80 MU Memory Board, and align board over the standoffs installed in step 6. |
| 8. | Secure the memory board in place by using screws removed in step 5 on the front of the board, and 1/2" standoffs in the rear of the board. |
| 9. | Connect the two 34-pin connectors to the Z80 MU Memory Board. |
| 10. | Replace top cover removed in step 2. |
| 11. | Apply a.c. power to the C5001/MU System, removed in step 3. |

4.8. C8201-C AUXILIARY DISK UNIT INSTALLATION

The Model C8201-C Auxiliary Disk Unit is available in 10, 18 and 40 megabyte configurations, and in both 50 and 60 Hz versions. For the C5001/MU System these options utilize the IMI 7700-C Series Drives. This means that other units for ONYX C8001 or C8002 Systems may not be compatible with the C5001/MU System. The following subparagraphs describe the installation of the Model C8201-C, the procedure is divided into the following:

- o Unpacking Procedures
- o Signal Cable Connection and Power-Up
- o Modification of Physical Drive Address

4.8.1. Unpacking Procedures

The Model C8201-C Auxiliary Disk Unit is shipped in the same type of container as the C5001/MU Microcomputer System, all necessary hardware, cables and system keys are included. The following procedure describes the unpacking procedure.

- | Step | Procedure |
|------|--|
| 1. | Insure adequate a.c. power input is provided for connection to the C8201-C, reference paragraph 4.5.2. and all subparagraphs. |
| 2. | Unpack C8201-C and insure that there is no physical damage, remove from shipping container, save container and prepare for installation. |
| 3. | After the C8201-C is transported to the installation site, the disk carriage may be unlocked, reference paragraph 4.5.1.. |
| 4. | If the C8201-C is to be installed as drive no. 2 or drive no. 3, proceed to paragraph 4.8.4., otherwise proceed to the next paragraph, 4.8.2.. |

4.8.2. Signal Cable Connection and Power-Up

Connect the signal cable supplied with the C8201-C between the DISK EXPANSION - INPUT connector and the C5001/MU System DISK EXPANSION connector. If more than one C8201-C is used connections are made between the DISK EXPANSION - OUTPUT of one C8201-C to the DISK EXPANSION - INPUT of the next physical drive.

- | Step | Procedure |
|------|---|
| 1. | Connect signal cable, supplied with C8201-C, to appropriate connector on rear of C5001/MU System or existing C8201-C, and the DISK EXPANSION - INPUT connector of the new C8201-C unit. |
| 2. | Insure that the Power keyswitch of the C8201-C is in the Off position and connect the a.c. power cable of the C8201-C to the a.c. input source. |
| 3. | Turn the Power keyswitch to the On position, the cooling fan and disk spindle motor should cycle; and the power indicator on the C8201-C should illuminate. |
| 4. | Reference Section 5 - Operation for instructions on software configuration and commands to utilize the additional disk. |

4.8.3. Modification of Physical Drive Address

Every Model C8201-C shipped from the factory is configured as physical address 01 based on the assumption that the drive is the first and only expansion drive that will be connected to the C5001/MU System. If the drive is the second or third expansion drive it will be necessary to remove the IMI Disk Drive from the enclosure and reconfigure the address switches.

- | Step | Procedure |
|------|--|
| 1. | Remove the IMI Disk Drive from the C8201-C Unit, reference Section 6, paragraph 6.4.10.(Removal). |
| 2. | Place the disk unit on its top so that bottom of the drive can be accessed. |
| 3. | Newer versions of the IMI Disk Drive will have the 8-bit dip switch for physical address selection accessible through a rectangular hole in the base of the drive, reference Figure 4-4. |

Older units must have the bottom plate removed in order to access the switch. This is accomplished by removal of the six screws which secure the base to the sides of the drive, reference Figure 4-7 for switch location.

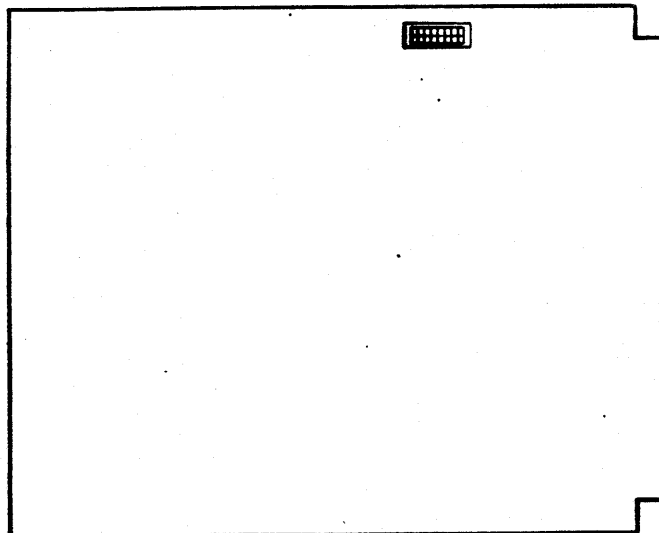


Figure 4-4 Address Select Switch Access (New Units)

4. Select the appropriate physical drive address, reference Table 4-5, using the 8-bit dip switch. Insure you have located the proper switch for drive addressing, the other 5 switches must be left as is.

Table 4-5 Unit Address Selection

Unit Address Switch			Drive Address
Bit 6	Bit 7	Bit 8	
on	on	on	0
on	on	off	1
on	off	on	2
on	off	off	3

5. Replace bottom cover on IMI Disk Drive, if removed in step 3.
6. Install the drive in the C8201-C chassis, reference paragraph 6.4.10 (Replacement), only perform steps 4 - 8, and then perform the procedure described in paragraph 4.8.2..

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5.1. GENERAL INFORMATION

This section provides information on general system practices, initial software configuration, boot-straps, system shut-down procedures, and what to do when the system crashes. It is not intended to be used as an operator's guide or a system reference manual, but as a tool to get started. Refer to the CP/M or OASIS operating system reference manual(s) for details on their usage. For details on the utilities and implementation on the C5001/MU refer to the appropriate user guide.

CP/M

- AN INTRODUCTION TO THE CP/M FEATURES AND FACILITIES
- CP/M 2.2 USER'S GUIDE
- CP/M 2.2 INTERFACE GUIDE
- CP/M DYNAMIC DEBUGGING TOOL (DDT) USER'S GUIDE
- CP/M ASSEMBLER (ASM) USER'S GUIDE
- ED: A CONTEXT EDITOR FOR THE CP/M DISK SYSTEM USER'S GUIDE
- CP/M 2.2 ALTERATION GUIDE
- CP/M 2.2.1 on the ONYX C8001 USER GUIDE & UTILITY PROGRAM REFERENCE MANUAL
- MP/M for the Onyx C8001 128/256K

OASIS

- OASIS REFERENCE MANUAL
- OASIS ON THE ONYX

5.2. INITIALIZATION MICROPROGRAM

The C5001/MU system runs a self-test program from EPROM whenever the system is powered-up or the reset button is pressed. This test runs to completion before the operator is able to perform any function. Once the self-test completes, a variety of boot options exist. A boot from either a Software Distribution Tape (SDT), a Diagnostic Tape, or from disk, either the main disk or alternate disks.

5.2.1. Self-Test

The tests performed by the initialization microprogram is not intended to be an exhaustive system diagnostic but rather a quick check for the functionality of the major system components. Further testing is provided by the system exerciser utility on the SDT or from a Diagnostic Tape. If this test fails, the test is halted with the reason is given by the status of three LEDs on the processor board (see Table 5-1 Self-Test Decoding). At this time, a carriage return will proceed with the test. Although a successful boot may be accomplished through repeated carriage returns, the system should be treated as a marginal unit until the self-test can run through completion without errors.

Table 5-1 Self-Test Decoding

Sequence	LEDs			Test	Notes
	1	2	3		
1	1	1	1	EPROM checksum	Indicates a problem processor, EPROM or BUS.
2	0	1	1	RAM banks 1,2,3	Failure in the upper upper three banks of RAM.
3	1	0	1	RAM bank 0	Failure in bank 0.
4	0	0	1	Memory Parity	Parity bit error.
5	1	1	0	Tape	The tape drive is not ready.
6	0	1	0	Disk	The disk dis not rezero or a test and sector could not be read.
7	0	0	0	Complete	Self-Test is completed.

When the self-test starts the following message is printed on the console device.

C8001/MU SELF TEST

Upon completion of the Self-Test, the display will show:

C8001/MU SELF TEST COMPLETE

*

The operator is now able to boot from tape or disk.

5.3. TAPE BOOT

A bootable tape is one that has a program on it (bootstrap) that has the capability of reading other programs from tape that can perform some functions. e.g. run diagnostics, recreate the system disk, etc. To boot from tape, enter a <t> or <T> from the microprogram prompt "**". Each type of tape will have their own unique options. Discussed below is the OASIS SDT.

5.3.1. OASIS Software Distribution Tape (SDT)

The SDT contains all the necessary files to run the OASIS operating system on the C5001/MU. Any special programs or languages are supplied on a Language Product Tape (LPT).

The OASIS SDT is recognized by the following label:

```
SOFTWARE DISTRIBUTION TAPE
MOASIS REV. 5.5 06/01/81
C5001/MU S/N: _____
*** LICENSED USE ONLY ***
```

The revision number and date will change with each new release.

After the initial program has been loaded the following menu is displayed:

1. RUN SYSTEM EXERCISER UTILITY
2. RECREATE SYSTEM DISK
3. DISPLAY DELIVERED SOFTWARE DIRECTORY

SELECT PROGRAM: _

5.3.1.1. RUN SYSTEM EXERCISER UTILITY

5.3.1.2. RECREATE SYSTEM DISK

This option is selected by entering a <2><CR>, the following message will appear:

WARNING: FORMATTING WILL DESTROY THE DISK CONTENTS.
HIT "RETURN" KEY TO CONTINUE ANYTHING ELSE TO ABORT THIS
FUNCTION.

Enter a <CR> to continue this operation.

The first thing that this program does is try to format the disk. All data fields and sector address information will be rewritten if switch 4 on the disk controller board is closed - in the format-enable position. This is not the normal position. See the maintenance section for details on the use of the format-enable switch. The disk is then interrogated for sectors that have been spared to check their integrity. While this process is taking place the following message is printed.

```
formatting drive 0 (9)
track skip list:
original configuration byte is 0025
new configuration byte is loaded into disk

0      bad sectors encountered
```

When the "S" drive has been restored to the original configuration as shipped from the factory, the following message is displayed.

SYSTEM DISK RECREATED SUCCESSFULLY

1. RUN SYSTEM EXERCISER UTILITY
2. RECREATE SYSTEM DISK
3. DISPLAY DELIVERED SOFTWARE DIRECTORY

SELECT PROGRAM: _

Press the reset button on the back of the machine (it is detrimental to the system to reset the system by cycling power). When the self-test is complete, a boot from disk is accomplished by pressing a <CR> and the OASIS operating system is loaded into memory and given control. For further information on booting from disk see section *.*.*.

5.3.1.3. DISPLAY DELIVERED SOFTWARE DIRECTORY

Enter a <3><CR> to display the software revision and the software serial number on this tape.

5.4. DISK BOOT

The disk in the C5001/MU is divided into two physical devices, device 1 and 2. A normal boot is from device 1, while an alternate (reverse) boot is from device 2. Device 1, the normal "S" drive has a capacity of 1000K bytes and 208 files, while device 2, the normal "A" drive has a capacity of 4,432K bytes and 1,024 files. The purpose of alternate

boots is in case device 1 gets corrupted, an alternate boot will allow access to the system and possibly restoring device 1 without recreating the system and possibly losing unrecoverable data. Normally, device 1 is associated with the logical drive "S", whereas an alternate boot will make the "S" drive attached to device 2. A normal boot is accomplished by entering a carriage return <CR> at the microprogram prompt "*". To reverse boot enter <a>< ><1> or <A>< ><1>.

Normal boot
* <CR>

Reverse boot
*a 1

The status of the operating system will be the same as when the "SYSGEN" was last performed, i.e. the mapping of logical to physical devices, the switch settings of the "SET" command and whether the accounting feature was initialized. This is the case for each device that the boot is from. The first time an alternate boot is performed, for example, there isn't any "A" drive because it hasn't been attached before.

5.5. INITIAL CONDITIONS

There are several initial conditions that are user-configurable and may need changing depending on the requirements of each installation. These are all preselected at the factory to be common at the time of shipment and on the SDT. The disk is divided into "A" and "S" logical disks. The "A" disk has a capacity of 4,432 kilobytes of data and 1024 files. The "S" disk has a capacity of 1,000 kilobytes of data and 208 files. After loading the SDT there is 3,638 kilobytes of data space available on the "A" disk and 232 kilobytes available on the "S" disk. There are 167 files on both the "A" and the "S" disks. These are the only disks that come attached, if the system has add-on disks, these will need to be sysgened into the configuration status.

The console is set for CLASS 4 at 9600 baud. To change this attachment refernce chapter 12 of the OASIS REFERENCE MANUAL.

Memory is predefined at 16K common banks. Table 5-2 shows the bank sizes for the different memory configurations. Each bank may be split into partitions for different users or tasks. The time slice for each partition is set to 10-msec. Both the bank size and the time slice are SETable switches.

Table 5-2 bank sizes

	128K System		256K System	
16K Common Bank Size	NUCLEUS	20,654	NUCLEUS	20,654
	Bank #0	44,882	Bank #0	44,882
	Bank #1	44,882	Bank #1	44,882
	Bank #2	12,114	Bank #2	44,882
			Bank #3	44,882
			Bank #4	44,882
32K Common Bank Size	NUCLEUS	20,654	NUCLEUS	20,654
	Bank #0	44,882	Bank #0	44,882
	Bank #1	32,768	Bank #1	32,768
	Bank #2	32,768	Bank #2	32,768
			Bank #3	32,768
			Bank #4	32,768
		Bank #5	32,768	
		Bank #6	32,768	
48K Common Bank Size	NUCLEUS	20,654	NUCLEUS	20,654
	Bank #0	44,882	Bank #0	44,882
	Bank #1	16,384	Bank #1	16,384
	Bank #2	16,384	Bank #2	16,384
	Bank #3	16,384	Bank #3	16,384
	Bank #4	16,384	Bank #4	16,384

From these available memory sizes, the top portion is used by device drivers. The more devices attached, the less memory is available. Table 5-3 shows how much memory is used by each device.

Table 5-3 Device Memory Usage

DEVICE	MEMORY CONSUMED (in decimal)
CONSOLE	869
SERIAL PRINTER	628 (each)
PARALLEL PRINTER	62
ASYNC COMM1	628
SYNC COMM1	594

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6.1. GENERAL INFORMATION

This section provides the necessary preventive and corrective maintenance procedures for the C5001/MU Microcomputer System. The basic maintenance philosophy is to minimize the amount of preventive maintenance and the amount of "down time", or mean time to repair (MTTR), by isolating failures to a specific subassembly and replacing it with a spare. The following paragraphs are provided to assist the user in achieving that end.

The philosophy is based on the premise that "known good" spare units are available to accomplish the exchange procedure, spare units are available from ONYX Systems as part of the OEM Spares Program. When spare subassemblies are received, the user should inspect, configure and checkout the assemblies to insure that they are functional after shipment. This practice not only insures that the spares are indeed functional, but it also insures that any failure or damage is detected within the 90 day warranty period.

6.1.1. Safety Precautions

Personal safety cannot be over emphasized. To insure your own safety, as well as that of others, observe safety precautions for electronic equipment at all times. The following symbols are used in the text to alert the user to procedures and/or conditions which may present a hazard to the user or the equipment.

CAUTION

This symbol denotes a condition or procedure which may result in damage to the equipment.

WARNING

This symbol denotes a condition or procedure which may result in personal injury or loss of life.

6.1.2. Tools and Equipment

The following list of tools and equipment is recommended for performing level 1 maintenance on the C5001/MU Microcomputer System and C8201-C Auxiliary Disk Unit.

Table 6-1 Tools and Equipment

Item	Description	Qty	Mfgr
1	1/4 in. hex, nut driver	1	Xcelite
2	# 2 Phillips Screwdriver, 4 in. blade	1	Xcelite
3	Straight Blade Screwdriver, 4 in. blade	1	Xcelite
4	Straight Blade Screwdriver, 2 in. blade	1	Xcelite
5	Freon Solvent Cleaner (TX 106)	1	Texwipe
6	Foam Cleaning Swabs (TX700)	100	Texwipe

6.1.3. Reference Documents

The following list of related publications may be referenced from the text contained in subsequent paragraphs and may serve to enhance or clarify specific text passages.

- o ONYX C5001/MU Hardware User's Manual
- o IMI 7700 Series Controller Option User's Manual
- o DEI Series CMTD-3400S2 6400 BPI High Density, Cartridge Magnetic Tape Drive, Operation and Maintenance Manual

6.2. PREVENTIVE MAINTENANCE

The C5001/MU Microcomputer System is designed to minimize preventive maintenance activity. This activity is limited to general cleaning of the system's exterior and cleaning of the cartridge magnetic tape transport.

6.2.1. General Cleaning

The exterior of the C5001/MU Microcomputer System should be periodically cleaned to remove accumulated dust and dirt from the front of the unit and from the screen which protects the air intake on the rear of the unit. The frequency of cleaning is determined by the environmental conditions, but as a general rule this should be performed every 90 days.

Cleaning of the unit should be performed using a soft cloth and a mild, commercially available detergent. The air intake screen should be cleaned to remove any accumulated dust or foreign matter which will restrict air flow to the system.

6.2.2. Tape Transport Cleaning

The magnetic cartridge tape transport requires scheduled maintenance to insure contaminants are removed from the read/write heads, capstan drive and tape cleaner. If the tape transport is in regular use the transport must be cleaned on a daily basis.

MAGNETIC HEAD: The magnetic head should be cleaned daily if the drive is in regular use. Dirty heads may cause data dropouts during read and write operations. Use a non-residue, non-corrosive cleaning agent, such as duPont Freon TF or isopropyl alcohol, and a foam-tipped swab to clean the head assembly. Be sure to wipe up any excess and allow the heads to dry prior to operating the drive.

CAUTION

Spray type head cleaners are not recommended because overspray may contaminate the motor bearings. Also, never clean the head with hard objects. This will result in permanent head damage.

TAPE CLEANER: The tape cleaner removes loose tape oxide and other foreign material from the tape before it contacts the head. This foreign material accumulates in and around the tape cleaner and must be removed to insure that the tape cleaner will work effectively. The tape cleaner should be cleaned on the same schedule as the head.

To clean, insert a folded sheet of paper in the bottom of the cleaning slot for the cleaner. Slide the paper up, lifting and foreign material from the cleaner. A soft brush, or compressed air may be used to remove the foreign material from the area around the tape cleaner and head assembly. Alternately, the tape cleaner may be cleaned using the same materials used to clean the head.

CAUTION

Do not use hard objects to clean the tape cleaner! If the tape cleaner should become chipped, it will scratch the tape surface, resulting in lost data and/or permanent tape damage.

MOTOR CAPSTAN: The drive capstan is composed of hard polyurethane and must be cleaned after foreign material has built up on its surface. Clean, using isopropyl alcohol and a foam-tipped swab. The cleaning schedule is the same as for the head and tape cleaner.

CAUTION

Do not allow the cleaning solvent to contaminate the motor drive bearings!

6.3. ADJUSTMENT PROCEDURES

The C5001/MU Microcomputer System does not require periodic adjustment as a part of scheduled maintenance activity. All electromechanical subassemblies such as the fixed disk and magnetic cartridge tape transport are set at the factory and do not require adjustment in the field. If problems do occur with either of these units they should be replaced with the spare unit(s) and the faulty unit(s) should be returned to ONYX Systems for repair and/or alignment.

6.4. REMOVAL AND REPLACEMENT

The following subparagraphs provide details, in the form of step-by-step procedures, regarding the removal and replacement of all subassemblies in the C5001/MU Microcomputer System.

WARNING

Before removing or replacing any subassembly in the C5001/MU System, insure that all a.c. input voltage is removed. Turn the power keyswitch to the Off position and disconnect the a.c. power cable from the rear of the unit.

6.4.1. Cover Removal and Replacement

The top cover of the C5001/MU System is secured to the base using eight (8) 6-32 x 3/8 phillips head screws, four (4) located on each side of the unit.

Removal: [1] Insure a.c. power is Off.

[2] Using a phillips screwdriver, loosen the screws which hold the top cover in place.

[3] Tilt the cover toward the rear of the unit and lift to remove.

Replacement: [1] Carefully place the rear of the top cover over the rear of the unit and lower the front edge until it is in place.

[2] Align the holes in the cover with the ones in the base and insert the 8 screws to secure the cover.

[3] Apply a.c. power to the system.

6.4.2. Front Panel Removal and Replacement

The plastic front panel is secured to the base of the system using five (5) quick release plastic fasteners.

Removal: [1] Using a straight blade screwdriver, pry the front panel from the base of the system.

Replacement: [1] Align the front panel so that the opening for the tape cartridge matches the opening in the base of the unit.

[2] Press the front panel over each plastic fastener until they snap into place.

6.4.3. Power Indicator Replacement

The power indicator, located on the front of the unit, contains an incandescent lamp which may require periodic replacement.

Removal: [1] Insure a.c. power is Off.

[2] Remove the front panel of the unit, reference preceding paragraph.

[3] Grasp the plastic lens cap of the power indicator and pull the cap from the plastic holder.

[4] The 5 volt lamp is located in the stem of the plastic lens cap, remove it.

Replacement: [1] Insert new incandescent, 5 volt lamp into lens cap.

[2] Insert lens cap into plastic holder and snap in place.

[3] Replace front panel, reference preceding paragraph.

[4] Apply a.c. power to the system.

6.4.4. A.C. Line Fuse Replacement

The a.c. line fuse is located at the rear of the unit, lower right corner. This fuse must be replaced with the same value and rating as listed on the label near the fuse holder. This value is 6 1/4A for 120V systems, or 3A for 240V systems.

Removal: [1] Insure a.c. power is Off and that the a.c. power cable is disconnected from the rear of the system.

[2] Grasp the fuse holder cap, push the cap towards the unit and turn 1/4 turn counter clockwise.

[3] The cap should unlock and can be removed from the holder.

[4] Remove the fuse from the cap.

Replacement: [1] Insert fuse into fuse cap, previously removed.

[2] Guide fuse into fuse holder and turn cap to align with keys in the fuse holder.

[3] Press the fuse cap into the holder and turn 1/4 turn clockwise until the cap locks in place.

[4] Connect a.c. power cable to the rear of the system, and apply power.

6.4.5. Z80 MU Expansion Memory Board Replacement

The standard C5001/MU System may be configured with an additional 128K byte memory board.

- Removal:**
- [1] Insure that a.c. power is Off, and a.c. power cable is removed.
 - [2] Remove the top cover of the system, reference paragraph 6.4.1..
 - [3] Locate the Z80 MU Memory Board, reference Figure 4-2.
 - [4] Disconnect both 34-pin quick release connectors by moving the ejectors outward.
 - [5] Using a 1/4 in. nutdriver, remove the six nuts which secure the board, or phillips screwdriver to remove the screws.
 - [6] Carefully, lift the board from the standoff supports and once it is clear, disconnect the orange 8-pin d.c. power connector.
- Replacement:**
- [1] Install the memory board in the desired location by reversing the order of steps 4 - 6 above.
 - [2] Replace the top cover, removed in step 2 of Removal.
 - [3] Connect a.c. power cable and apply a.c. power to the system.

6.4.6. Z80 Processor Board Replacement

The Z80 Processor Board is located on top of the logic tray, under the expansion memory board if installed. The following procedure describes the removal and replacement of the Z80 Processor Board.

Removal: [1] Insure a.c. power is Off, and the a.c. power cable is removed.

[2] Remove the top cover of the system, reference paragraph 6.4.1..

[3] Locate Z80 Processor Board, reference Figure 4-2.

[4] Remove the Z80 MU Expansion Memory Board if installed, reference paragraph 6.4.5.

[5] Disconnect the four flat cable connectors from the board by grasping the connector, NOT the cable, and pulling outward.

[6] Using a 1/4 in. nutdriver, remove the six nuts which secure the board.

[7] Carefully, lift the board from the mounting screws and once it is clear, disconnect the orange 8-pin d.c. power connector and the red 8-pin signal connector.

Replacement: [1] Insure that the switch setting for baud rate is configured correctly, reference paragraph 4.5.4..

[2] Perform steps 4 - 7 in the reverse order to install the Z80 Processor Board.

[3] Replace Z80 MU Expansion Memory Board, removed in step 4 of Removal.

[4] Replace the top cover of the system, removed in step 2 of Removal.

[5] Connect a.c. power cable and apply a.c. power to the system.

6.4.7. Z80 MU I/O Board Replacement

The Z80 MU I/O Board is mounted on the rear connector panel, which in turn is secured to the rear of the base using six 6-32 x 1/4 phillips head screws. The complete subassembly must be removed from the unit before the Z8000 I/O Board can be replaced.

Removal: [1] Insure a.c. power is Off, and a.c. power cable is disconnected.

[2] Remove top cover from the system, reference paragraph 6.4.1..

[3] Remove the two phillips head screws which secure the logic tray to the front of the system, this is so it may be tilted upward in subsequent steps.

[4] Remove the six phillips screws which secure the I/O Connector Panel to the rear of the system.

[5] Carefully, lift the I/O Connector Panel upward between the logic tray and the rear of the chassis. You may have to tilt the logic tray in order to obtain enough clearance.

[6] The I/O Connector Panel should now be clear, but the connectors are still in place.

[7] Disconnect the two 50-pin quick release connectors by moving the ejector tabs outward.

[8] Remove the six phillips screws which secure the Z80 MU I/O Board to the I/O Connector Panel.

Replacement: [1] Replace Z80 MU I/O Board and mount to I/O Connector Panel using the six screws removed in step 8 above.

[2] Reverse steps 3 - 7 above, to install I/O Connector Panel.

[3] Replace cover, removed in step 2 above.

[4] Connect a.c. power cable and apply a.c. power to the system.

6.4.8. Cartridge Tape Transport Replacement

The magnetic cartridge tape transport is located in the front of the system base on the left side, reference Figure 4-2. It is secured to the front of the base using four (4) 8-32 x 3/8 inch screws. The following procedure describes the removal and replacement of the transport.

- Removal:
- [1] Insure a.c. power is removed from the system.
 - [2] Remove top cover of system, reference paragraph 6.4.1..
 - [3] Remove front panel from system, reference paragraph 6.4.2..
 - [4] Locate the four screws which secure the transport to the front of the chassis. These screws are directly below the cartridge opening, two screws are located on each side of the opening.
 - [5] Remove the screws which secure the transport to the chassis.
 - [6] Remove the two screws which secure the logic tray to the front of the chassis so that it may be tilted upward to access the transport.
 - [7] Using your hands, lift the transport upward until it is almost touching the keyswitch and power indicator. Tilt the transport so that the right side, the one with the protruding heat sink, clears the d.c. power supply and carefully lift the transport over the d.c. power supply.
 - [8] Rest the transport on the d.c. power supply cover and remove the three cables.
- Replacement:
- [1] Connect the three cables to the transport. These cables are keyed to insure proper orientation.
 - [2] Install the transport in the chassis by reversing steps 4 - 7.
 - [3] Install top cover, reference paragraph 6.4.1..
 - [4] Install front panel, reference paragraph 6.4.2..
 - [5] Apply a.c. power to the system.

6.4.9. Fixed Disk Replacement

The fixed "Winchester" disk drive is located in the chassis on the left side of the unit, reference Figure 4-2. It is secured to the chassis by four (4) 10-32 x 3/8 inch screws on the bottom of the unit.

- Removal:
- [1] Insure a.c. power to the system is removed.
 - [2] Remove top cover of system, reference paragraph 6.4.1..
 - [3] Turn the system on its side, the side nearest the disk drive.
 - [4] Remove the four screws from the chassis which secures the disk drive.
 - [5] Carefully, return the system to its normal position.
 - [6] Remove the screws which secure the logic tray to the front of the system, and lift the tray upward to gain access to the disk drive.
 - [7] As the disk is removed, disconnect the 26-pin flat signal cable which connects to the controller card and disconnect te 6-pin power cable from the drive.

Replacement: [1] Lift the logic tray upward to gain access to the chassis.

[2] While placing the disk in the chassis, connect the 26-pin flat signal cable and the 6-pin power cable to the drive. Align the mounting holes in the drive with the holes in the chassis.

[3] Secure the disk drive to the chassis using the four screws removed in step 4 above.

[4] Restore the logic tray to its normal position and secure it using the two screws removed in step three of Removal.

[5] Replace the top cover, reference paragraph 6.4.1..

[6] Connect a.c. power to the system.

6.4.10. D.C. Power Supply Replacement

The D.C. Power Supply is located in the chassis, reference Figure 4-2. To replace the supply the protective cover must be removed, all wires disconnected from the terminal block and then the supply may be removed from the system. The following procedure describes the removal and replacement of the D.C. Power Supply.

WARNING

All a.c. input power to the C5001/MU System **MUST** be removed (disconnected) prior to removal of the D.C. Power Supply.

- Removal:
- [1] Insure that the a.c. power cable is disconnected from the C5001/MU System.
 - [2] Remove top cover of system, reference paragraph 6.4.1..
 - [3] Remove the two screws which secure the logic tray to the front of the chassis, and tilt the tray upward to gain access to the power supply.
 - [4] Release the six cable clamps which secure the power cables to the top of the D.C. Power Supply, and move the cables to the side.
 - [5] Using a phillips screwdriver, remove the six screws which secure the protective cover to the D.C. Power Supply.
 - [6] Lift and remove the protective cover from the D.C. Power Supply.
 - [7] Using a flat blade screwdriver, remove the 2 screws (TBl-1 and TBl-2) which secure the power supply cable harness to the terminal block of the supply.
 - [8] Remove all external wiring, connected to the terminal block TBl, by pulling the slip-on connectors from the male connectors.

TO BE SUPPLIED

Figure 6-1 D.C. Power Cable Connections

Removal: (Continued)

[9] Return the logic tray to its normal position, and turn the system on its side, the side nearest the D.C. Power Supply.

[10] Locate the six screws which secure the D.C. Power Supply to the system base, and remove them.

[11] Return the system to its normal position, lift the logic tray and remove the D.C. Power Supply from the chassis.

[12] Replace any screws, previously removed in step 7 from the terminal block.

[13] Secure the protective cover, removed in step 5, using the six screws.

Replacement: [1] Reverse procedure steps 3 - 13, previously described under Removal.

[2] Replace top cover, removed in step 2 above.

[3] Connect a.c. power to the system and turn power On.

6.5. QUICK REFERENCE TROUBLESHOOTING

The following subparagraphs provide a quick reference for isolating common problems which may be encountered with the C5001/MU Microcomputer System and associated peripheral devices.

6.5.1. Power-On Problems

The power indicator should illuminate whenever power is applied to the system and the power keyswitch is in the On position. It is important to note that the indicator is driven from the +5V d.c. power supply, not a.c.. When the system is powered up the cooling fan will cycle if a.c. power is applied, and the disk unit will cycle if d.c. power is applied. The nature of the the d.c. power supply design will allow the following to occur:

- o All d.c. voltages will be "crowbarred" if an overload occurs.

Table 6-2 Power-On Failures

Symptom	Possible Causes	Solutions	
Power Indicator Off	Keyswitch Not On	Turn Keyswitch On	
	Bad Indicator Lamp	Replace Indicator Lamp	
	Line Fuse Blown	Replace Line Fuse	
	No A.C. Power Source		Locate New Power Source
			Check A.C. Power Cable Connection
	Bad D.C. Power Supply	Replace D.C. Power Supply	

6.5.2. Terminal Malfunctions

The majority of problems encountered with the terminal devices occurs during installation, primarily with configuration of options and signal cables. All interface connections between the C5001/MU System and external devices are described in Section 3 - I/O Interface. Details regarding terminal options may be found in Section 4 - Installation, paragraphs 4.5.2., 4.5.4. and 4.5.8.. Table 6-3 will provide general troubleshooting information for all terminal devices.

Table 6-3 Terminal Failures

Symptom	Possible Causes	Solutions
No Data Displayed	Terminal Power Off	Check Power Cable
		Check Terminal's Fuse
		Check Power Switch
	Incorrect Options Selected	Check Baud Rate
		Check Number of Start/Stop Bits
		Check Parity
	Signal Cable Disconnected	Connect Signal Cable
Brightness Too Low	Adjust Brightness	
Terminal "Off-Line"	Place Terminal On-Line	
Data Garbled	Incorrect Options	Check Baud Rate, Parity or Start/Stop Bits
		Wrong Pinouts in Signal Cable

FIXED "WINCHESTER" DISK DRIVE SPECIFICATIONS

PHYSICAL CHARACTERISTICS

Height	3.25 inches (8.26 cm)
Width	5.75 inches (14.61 cm)
Depth	6.0 inches (20.32 cm)
Weight	5 lbs. (2.27 kg)

ENVIRONMENTAL CHARACTERISTICS

OPERATING:

Temperature	50 to 113 degrees F (10 to 45 degrees C)
Temperature Variation	18 degrees F/hr (10 degrees C)
Relative Humidity (No condensatin)	10% to 80%
Maximum Altitude	10,000 ft. above sea level (3050 m)
Vibration	0.1 G (5 CPS linear increase to 100 CPS)

NON-OPERATING:

Temperature	-40 to 140 degrees F (-40 to 60 degrees C)
Relative Humidity (no Condensation)	10% to 90%
Vibration	1.0 G (2 CPS linear increase to 100 CPS)
Shock	5.0 G for 5 ms. duration

OPERATIONAL CHARACTERISTICS

	6 Mybte -----
Number of Disks	2
Number of Data Surfaces	4
Number of Tracks per surface	140
Bytes per Track (Unformatted)	12,000
bytes per Cylinder (Unformatted)	36,000
Number of Data Cylinders	140
Bytes per Drive (Unformatted)	6.72
Track Density	200 TPI
Bit Density	8,800 BPI
Rotational Speed (+/- 3%)	4,800 RPM
Average Latency	6.25 ms
Maximum Single Track Access Time	3 ms
Average Access Time	125 ms
Maximum Access Time	240 ms
Data Transfer Rate	960
Recording Method	MFM
Heads per Surface	1
Servo Head	1
Start Time	25 sec
Stop Time	15 sec

CARTRIDGE MAGNETIC TAPE DRIVE SPECIFICATIONS

PHYSICAL CHARACTERISTICS

Height	4.25 inches (10.8 cm)
Width	6.96 inches (17.6 cm)
Depth	7.75 inches (19.7 cm)
Weight	4.0 lbs. (1.8 kg)

ENVIRONMENTAL CHARACTERISTICS

OPERATING:

Temperature	41 to 113 degrees F (5 to 45 degrees C)
Relative Humidity (No condensation)	20% to 80%

NON-OPERATING:

Temperature	-30 to 140 degrees F (-30 to 60 degrees C)
Relative Humidity (No Condensation)	20% to 80%

OPERATIONAL CHARACTERISTICS

Cartridge Type	ANSI X3.55-1977 (300 or 450 ft. tape length)
Recording Density	6400 bpi
Recording Mode	4-Track Serial
Head Type	Dual Gap, Read-While-Write with Separate Erase
Tape Cleaner	Integral
Operating Speed	30 ips Write, Bidirectional Read 90 ips Bidirectional Search and Rewind
Transfer Rate	192,000 Bits/Sec
Start/Stop Time	At 30 ips: 25/26 ms At 90 ips: 71/74 ms
Nominal Start/Stop Distance	At 30 ips: 0.30/0.41 inches At 90 ips: 2.97/3.42 inches
Instantaneous Speed Variation	+/- 3% (Drive only, +/- 7% cartridge inclusive)
Long Term Speed Variation	+/- 2% (Drive only, +/- 3% cartridge inclusive)

ERATTA for MU user guide SECTION 5

5.2.1. Self-Test

There is another self test. Failure of this test is indicated in the leds by 001. The test is a dma test.

The Prom message is now:

```
ONYX MU self test ver. 1.0
```

5.3.1.2. RECREATE SYSTEM DISK

The internal operation during a format has changed. The spare sector information from previous system operation is maintained. During a successful format the system will print:

```
**** write pass ****  
    <cylinder number>  
**** read pass ****  
    <cylinder number>  
**** configuring ****
```

5.4 DISK BOOT

The disk boot capability has been expanded. It is now possible to boot off of any logical drive. The new prom command is 'p'.

The 'p' command is used to select which OASIS logical drive should be booted as the SYSTEM drive. When the 'p' is entered the prom prompts for

parameter:

At this point the logical drive number should be entered. (S = 0, A = 1, ...)

So to boot off logical drive 1 (normally the A drive) type 'p' and then '1'. You are now back at the prom monitor. A CR can now be entered to complete the boot. In summary, 'p' '1' CR, will boot the normal A drive as the system drive.

Table 5-2 bank sizes

The size of the NUCLEUS is now 19,246.
The size of Band #0 is 46,290.

Table 5-3 Device Memory Usage

The size of the TAPE drive is 4,200 bytes.