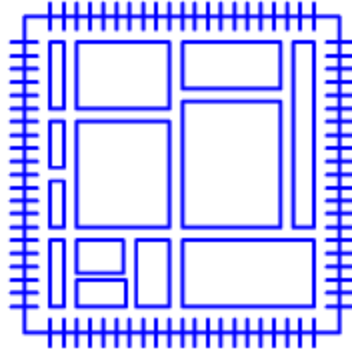


# Vetronix Research Corporation



User Manual

## MBDS-EX-2

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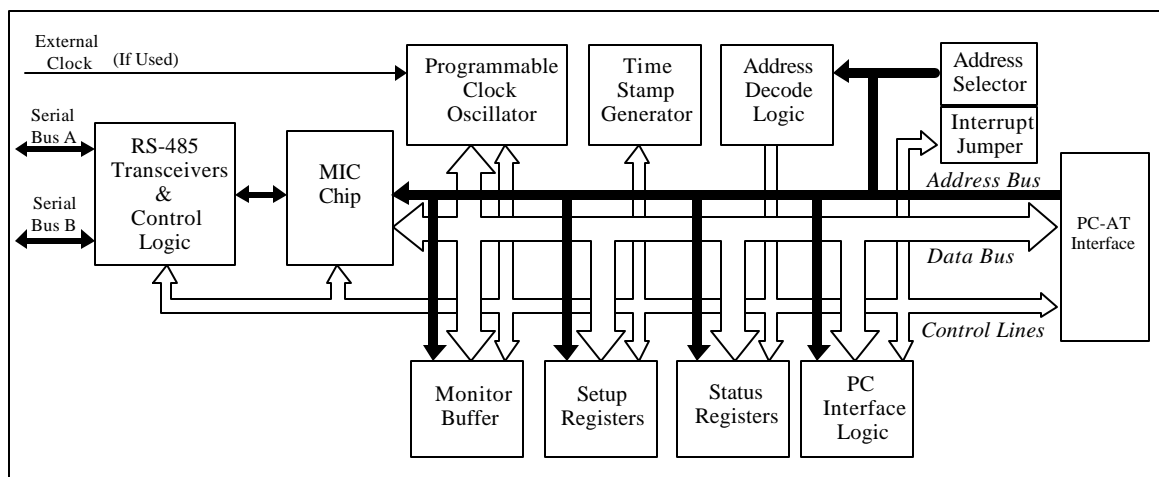
## 1.0 INTRODUCTION & INSTALLATION

### Features

- *Simulates, Tests, and Verifies the MIC Bus Protocol*
- *Aides Hardware and Software Integration Efforts*
- *Operates as Bus Controller, Bus Monitor, or Remote Module*
- *Menu-driven User Interface*
- *Programmable Data Filters and Triggers in Monitor Mode*
- *On-board Data Monitor and Time-Stamp Buffers*
- *Dual Bus Operation (EIA RS-485 Electrical Characteristics)*
- *Error Injection and Detection Capabilities*

### Overview

The MBDS-EX-2 is a serial data bus development and analysis system designed specifically for the communications protocol of the MIC. The MBDS-EX-2 is a full size PC-AT printed circuit card and software which, when configured with a PC-AT compatible, can be used to aid in remote module design, application software development, systems integration, and system verification for applications using the MIC Bus architecture. A user-friendly, menu-driven software interface allows the operator to use the MBDS-EX-2 as a bus controller, bus monitor, or remote module. The MBDS-EX-2 is capable of implementing the full MIC protocol and contains diagnostics functions to test MIC Bus networks using RS-485 transceivers.



## MBDS-EX-2 Block Diagram

## 1.1 Hardware Requirements

The MBDS-EX-2 circuit card and software run in IBM and compatible personal computer AT systems. Considering the high speed and high volume requirements of many MIC Bus applications, the hardware shown in the following table is required as a minimum. Increased processor speed, memory, or hard disk may provide improvements to the processing and storage capabilities of the applications software.

### Hardware Requirements

<b>HOST COMPUTER:</b>	IBM PC-AT compatible.
<b>RECOMMENDED PROCESSOR:</b>	80386SX, 80386, 80486, or Pentium at 20 MHz minimum
<b>FLOPPY DRIVE:</b>	1.4 Mega Bytes minimum; 3.5 inch format
<b>EXPANSION SLOT:</b>	One full size PC-AT compatible expansion ISA card slot
<b>DISPLAY:</b>	VGA recommended
<b>OPERATING SYSTEM:</b>	DOS 4.01 or later

## 1.2 Memory Map Starting Address

The MBDS-EX-2 is memory mapped to the host processor. The starting address of the memory used can be set in increments of 4000 hex from C0000 to FC000 by adjusting the on-board selector switch. The installer should determine a memory starting address that does not conflict with other application which may be run on the host computer. The memory map starting address selector should be set according to the table shown on the next page prior to installing the card in the host computer. Include on the provided diskette is a program entitled MEMCHK.EXE that will determine all possibilities for a starting memory address. All MBDS-EX-2 cards delivered by Vetronix are preset to address C8000.

## 1.3 Hardware Interrupts

The MBDS-EX-2 software uses one PC-AT hardware interrupt. The installer should determine an interrupt that will not conflict with other applications that may be running concurrently with the MBDS-EX-2 application software. Interrupts 5, 7, 10, or 11 can be selected by placing the corresponding jumper shunt on the interrupt jumper header. The on-board interrupt jumper should be set prior to installing the card in the host computer.

ADDRESS SELECTION	
Selector Setting	Starting Address Hex
0	C0000
1	C4000
2	C8000
3	CC000
4	D0000
5	D4000
6	D8000
7	DC000
8	E0000
9	E4000
A	E8000
B	EC000
C	F0000
D	F4000
E	F8000
F	FC000

INTERRUPT SELECTION	
Jumper Position	Hardware Interrupt
1	IRQ5
2	IRQ7
3	IRQ10
4	IRQ11

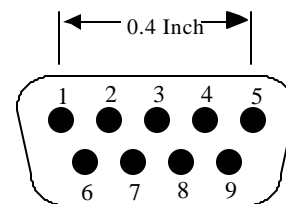
**INSTALLATION NOTES:**

1. Memory address selector controls addresses A14 through A17.
2. Address selector is set to setting 2 (C8000) before shipment.
3. Only one interrupt jumper should be used.
4. IRQ5 is set before shipment.

## 1.4 Serial Data Bus Connector

The MBDS-EX-2 circuit card bracket holds a standard Amp 747250-30, 9-pin, male, D-subminiature connector which provides the interface to the serial MIC Bus. The pinout of this connector is shown below.

SERIAL BUS INTERFACE CONNECTOR		
Pin Number	In/Out	Signal Description
1	In/Out	Bus-A Hi
2		5V Ground
3	In/Out	Bus-B Hi
4		5V Ground
5	In	External Clock
6	In/Out	Bus-A Lo
7	Out	+5 VDC, 250mA max
8	In/Out	Bus-B Lo
9	In/Out	Clock Ground/5VGND
Case		Host Chassis Ground



**AMP 747250-30  
9-Pin Male D-Sub**

**CONNECTOR NOTES:**

1. Bus-A and Bus-B should connect to the bus network with 120 twisted and shielded wire pairs.
2. The external clock is only required if not using the internal 16 Mhz oscillator. The external clock should be 0 to 5VDC and have as near a 50% duty cycle as practical.
3. The external clock ground should be connected to pin 9.

## 1.5 Software

The MBDS software requires the Microsoft MS-DOS or IBM PC-DOS, version 4.01 or later operating system for execution. There is no software protection or security devices on the MBDS product diskettes. The system installer should create master disk backups for all product diskettes included in the documentation package.

The MBDS source code can be made available to users for use within application specific programs. See Appendix A for additional information about provided software and source code.

## 1.6 Software Installation

The MBDS software can be interactively installed using the INSTALL program. The MBDS diskette labeled *Disk 1* includes an installation program named INSTALL.EXE. This program automatically installs the MBDS software onto the host computers' hard disk. Multiple software installations can be made on multiple computers even if the MBDS-EX-2 card is not installed.

To install the MBDS software, first make a directory (ex. MBDS) to contain all of the MBDS software files. Then insert the diskette labeled *Disk 1* into the source floppy disk drive and type:

```
{source drive}:INSTALL <enter>
```

The installation program executes and will prompt the user as required. Each prompt must be answered before the installation sequence will continue. The installation sequence can be terminated by pressing CTRL-C. This sequence should be repeated until all product disks have been installed.

After completion of the installation sequence the host computer will have a current path at \MBDS>. A file named MBDS.CFG should be located in the MBDS directory. This file should contain the correct memory map starting address, the interrupt number, and ramdrive location. If either parameter is not consistent with the card's settings the MBDS.CFG file should be corrected.

```
MBDS.CFG file example:  ADDRESS C8000
                        INTERRUPT 5
                        RAMDRIVE E
```

Before running the MBDS-EX-2 software it is strongly recommended that the DOS device driver ANSI.SYS be loaded on your computer. Editing your config.sys file to include the following line will activate the ANSI.SYS device driver on power up:

```
DEVICE=C:\DOS\ANSI.SYS
```

The MBDS-EX-2 application is invoked by typing MBDS <enter> at the \MBDS directory.

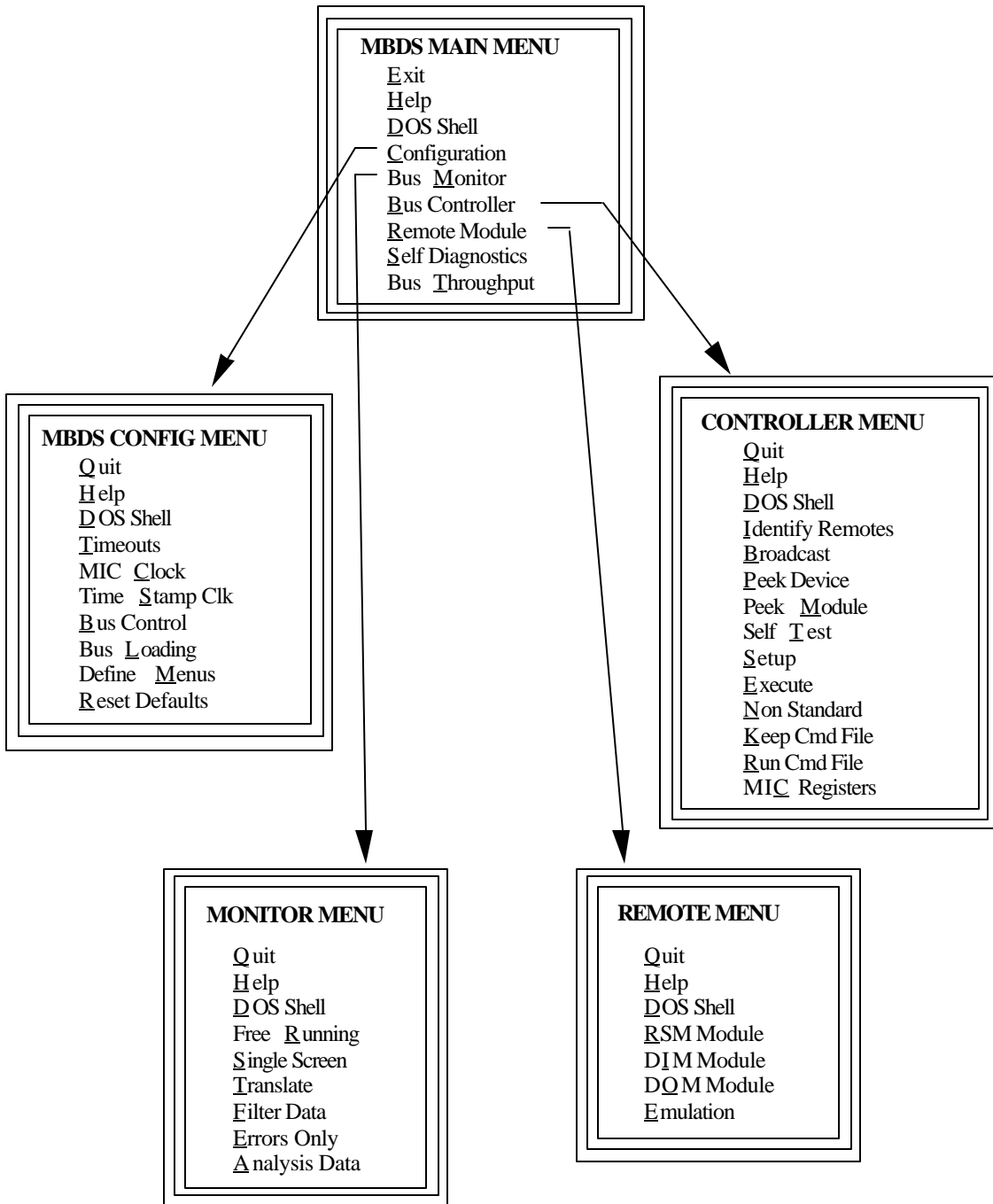
```
{host drive}:\MBDS>MBDS <enter>
```

The initial MBDS application screen should appear. If this screen appears the user may proceed through the application menus as described in the following sections. If the MBDS screen does not appear the INSTALL routine can be repeated. If after trying the INSTALL program again the MBDS application screen does not appear, please contact Vetronix for assistance.

## 2.0 START-UP INSTRUCTIONS

**While using the MBDS-EX-2 it may be helpful to refer to the MIC BUS REFERENCE MANUAL for detailed protocol and applications information.**

1. The MBDS application may be invoked by typing MBDS at the \MBDS directory followed by pressing <Enter>. The initial MBDS application screen should appear, including the Vetronix logo and copyright information. If this screen appears, then the user may proceed through the application menus as described in the following chapters. If the MBDS screen does not appear, then the INSTALL routine should be repeated. If, after trying the INSTALL program again, the MBDS application screen does not appear, please contact Vetronix for assistance. Otherwise, press any key to continue with the program.
2. An MBDS.CFG file is searched for and its contents displayed. If the warning message "Possible MEMORY ACCESS problem" appears on the screen, and the MBDS card is installed, do not continue. Verify that the MBDS.CFG file and MBDS card settings match each other (refer to paragraph 1.6). Power down or reset the system and return to step #1, or the software installation sequence if necessary, as outlined in chapter one. Otherwise continue by pressing any key.
3. The MBDS Main menu will appear. To operate in the MBDS environment, please note the following information:
  - To select a desired function, use the cursor keys with a return, or, press the highlighted letter (the hotkey) of the corresponding selection.
  - For questions that require a simple "y"/"n" response, characters entered other than 'y' and 'n' are treated as a "n" by default.
  - Pressing the <Esc> key will cancel any menu selection.
  - Throughout the MBDS program, several values will be input by the user. These numbers may be entered in decimal, octal (Onum), or hexadecimal (Oxnum) format, and must remain within the specified range. If the number entered is not within this range, or an unmatched character is entered, nothing will happen.



**Figure 1 Menu Distribution**



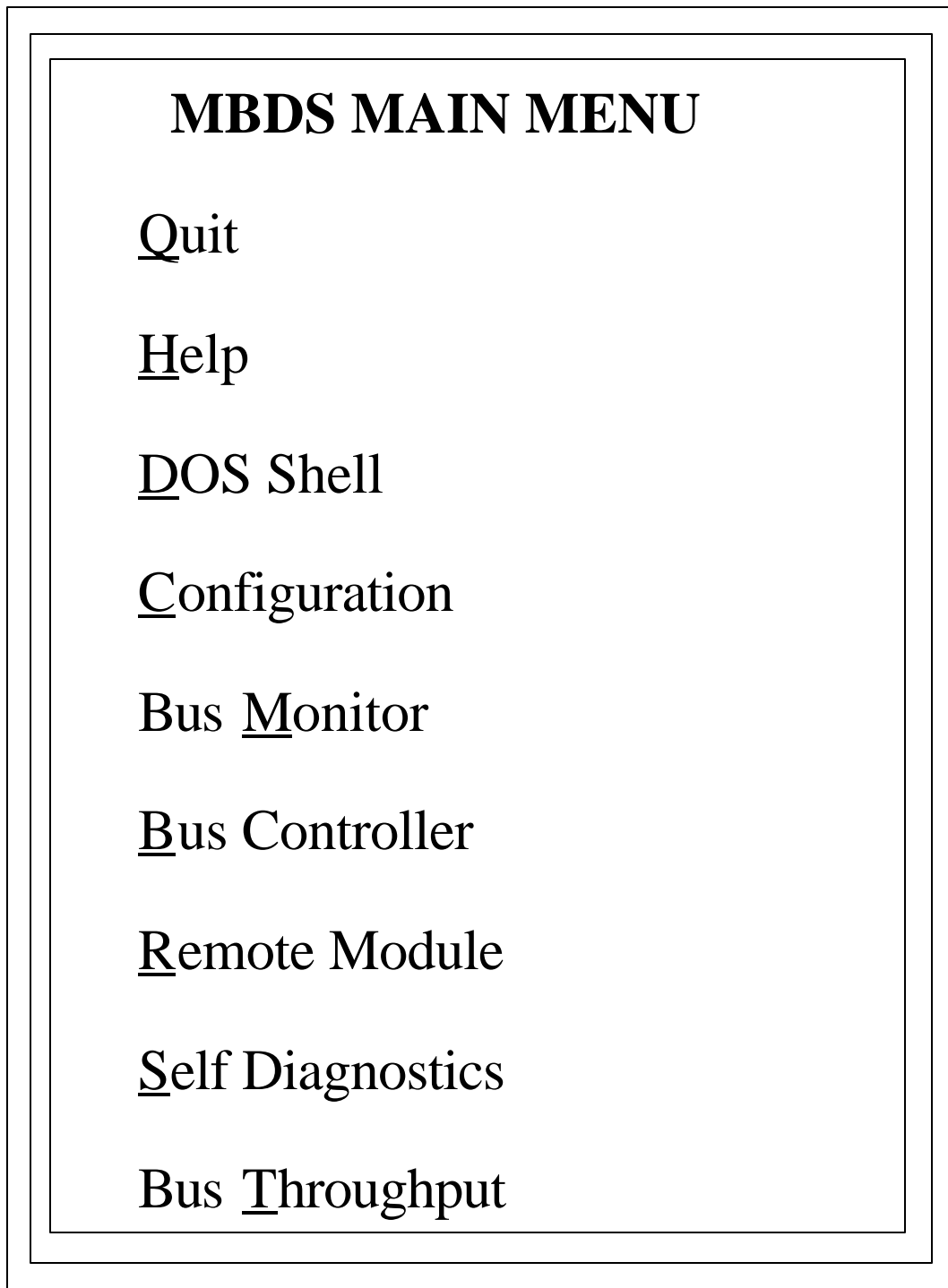


Figure 2 MBDS Main Menu

3.0

MBDS MAIN MENU

This menu forms the root of all operations on the MBDS.

- 3.1 **Exit:** Exits the MBDS program completely.
- 3.2 **Help:** Lists the MBDS Main Menu testing selections with a brief explanation. To return to the main menu, press any key.
- 3.3 **DOS Shell:** Returns user to a DOS prompt allowing commands such as copy, print, and other operations to be performed. Type EXIT to return to the MBDS.
- 3.4 **Configuration:** Provides the user with the flexibility and control to manipulate several parameters that configure the MBDS-EX-2 card for application specific requirements. See Chapter 4 to learn of configuration options.
- 3.5 **Bus Monitor:** Configures the MBDS-EX AT card to operate as a MIC Bus controller that is capable of monitoring and storing MIC Bus data in its on-board memory. Allows programmable and data filtering and triggering, as well as convenient display formats that simplify analysis. See chapter 5 for complete descriptions of all monitor capabilities.
- 3.6 **Bus Controller:** Programs the MBDS-EX card to act as the bus controller. In this mode, the user establishes communications with all remote modules, and initiates all commands. Commands may be entered interactively, or through input files. The user may also generate a limited set of application specific protocol for customized testing. Refer to chapter 6, and the MIC BUS REFERENCE MANUAL\* for more detailed information.
- 3.7 **Remote Module:** Configures the MBDS-EX-2 to act as various remote modules and calculates their responses for numerous devices. Note that each remote module may be configured to operate in separate modes of operation at one time depending on the needs of the application. In addition, one MBDS-EX-2 card is capable of emulating up to 64 individual bus remote modules for testing purposes. See chapter 7, as well as the MIC BUS REFERENCE MANUAL\*\* for further information on remote emulation.
- 3.8 **Self Diagnostic:** Tests the MBDS-EX-2 hardware to determine if any service is required.

---

\* The MIC BUS REFERENCE MANUAL provides complete information on the MIC communications protocol format, and may be of assistance when creating customized commands.

\*\* The MIC BUS REFERENCE MANUAL fully describes each of the modes of operation, and their related applications. Examining this material may help the user to simulate the necessary remote modules.

At this point the system will ask:

```
Do you wish to continue [y/n] ?
```

If your response is “n”, you will return to the MBDS Main Menu .

If you continue, a list will notify you of the self diagnostic responses. The following tests are performed:

```
AT Interface Logic Test
Address Decode Logic Test
Reset Logic Test
Clock Generation Logic Test
MIC Logic Test
Interrupt Logic Test
Serial Bus Control Logic Test
Time Stamp Logic Test
```

If all of the messages are PASSED, press any key to continue. If any of the diagnostic messages are FAILED, carefully check the MBDS-EX-2 AT bus connections before continuing. Again, strike any key to return to the main menu.

***Warning:***

An active MIC Bus connected to the MBDS-EX-2 during self diagnostics can cause invalid errors to be detected. To eliminate this problem, disconnect the MIC Bus or be sure the bus has no data traffic before initiating self diagnostics.

- 3.9 Bus Throughput: Calculates the MIC Bus data traffic utilization. This feature is a monitoring tool that allows the user to view the level of bus activity in bits per second during communication between separate bus modules.

**MBDS CONFIG MENU**QuitHelpDOS ShellTimeoutsMIC ClockTime Stamp ClkBus ControlBus LoadingDefine MenusReset Defaults

**Figure 3 MBDS Configuration Menu**

CURRENT CONFIGURATION	
Bus Timeout	: 491.280 mS (7ff0 hex)
No Command Timeout	: 1.500 mS (0064 hex)
No response Timeout	: 15.330 mS (03fe hex)
Interrupt Timeout	: 15.345 mS (03ff hex)
MBDS MIC Clock	: 16.0 MHz
Time Stamp Clock	: 1000.0 KHz (1uS)
Serial Bus A	: Enabled
Serial Bus B	: Enabled
Serial Bus A Loading	: Disabled
Serial Bus B Loading	: Disabled
Menu Definition File	: None

**Figure 4 Configuration Defaults**

## 4.0 MBDS CONFIGURATION

When in this menu, the default values of the current configurations (see Figure 4) are immediately displayed. This menu allows the value or condition of each of its parameters to be altered. Any changes made to the items in the MBDS Configuration Menu will update the current configuration table. Refer to the MIC BUS REFERENCE MANUAL for more details on MIC configurations.

- 4.1 **Quit:** Returns the user to the Main Menu.
- 4.2 **Help:** Shows the options of the MIC Config Menu with a single remark regarding its operation. Press any key to return to the MIC Config Menu.
- 4.3 **DOS Shell:** Returns user to a DOS prompt allowing commands such as copy, print, and other operations to be performed. Type EXIT to return to the MBDS.
- 4.4 **Timeouts:** Allows the user to adjust the MIC's timeout parameters. The MBDS-EX-2 defaults to timeout values that do not allow the MBDS-EX-2 to reach a bus timeout condition. Each of these registers are "write only" registers. Refer to the MIC BUS REFERENCE MANUAL for more details on the following MIC timeout constant registers.

```
(0) Exit
(1) Bus Timeout Constant
(2) No Command Timeout
(3) No Response Timeout
(4) Interrupt Acknowledge Timeout
```

```
Enter Choice [0-4]:
```

After entering a timeout selection, options 1 thru 4 will be updated and will remain on the screen. Therefore, you may continue altering the other timeout constants or return to the MBDS Config Menu by selection option 0.

(0) Exits the time-out option and returns to the MBDS Config Menu.

(1) The Bus Timeout Constant (BTC) is used to determine MIC Bus control and the device which is initiating the MIC Bus activity.

```
Enter BTC [0.015mS-491.50mS]:
```

(2) The No Command Time-out Constant (NCTC).

```
Enter NCTC [0.015mS-983.025mS]:
```

- (3) A No Response Time-out Constant (NRTC) is the amount of time the bus controller waits before considering that a response has not been received.

```
Enter NRTC [0.015mS-15.345mS]:
```

- (4) An Interrupt Acknowledge Timeout Constant (IATC) is used to indicate when the microprocessor fails to respond to an interrupt signal.

```
Enter IATC [0.015mS-15.345mS]:
```

- 4.5 **MIC Clock:** Although its internal default value is 16Mhz, an external clock may be connected to the 9-pin end plate connector.

```
(0) Internal 16 MHz
(1) External CLK
Enter Choice [0-1]:
```

- (0) The internal 16MHz clock will be used.

- (1) Uses an external clock. If this option is selected and the clock does not exist, the system may shut down and require rebooting. The external clock defines the frequency/time of the MIC Clock

```
Enter frequency [MHz]:
```

- 4.6 **Time Stamp Clk:** Sets the resolution of the time stamp generator on the MBDS-EX-2. Since the selections appear as frequencies, the conversion  $T=1/f$  may be applied. The higher the frequency is set, the finer the resolution becomes. This clock may be set equivalent to the MIC clock, or altered to the option values which range from 1Khz to MHz. After reviewing the options,

```
Enter Choice [0-13]:
```

The user will then return to the MBDS Configuration Menu.

- 4.7 **Bus Control:** Allows the user to enable or disable Bus A and/or Bus B. By enabling a bus, data can be transmitted/received on that bus. Therefore, disabling a bus creates an inactive or nonfunctional bus.

```
(0) Exit
(1) Disable Bus A
(2) Disable Bus B
```

```
Enter Choice [0-2]:
```

After making this selection, options 1 and 2 will be updated and will remain on the screen. Therefore, you may continue making selections or return to the MBDS Config Menu.

- 4.8 **Bus Loading:** Permits the operator to load or unload Bus A and/or Bus B. This process does not control data on a bus, but rather controls its wave form. The bus loading function switches an RC (47pF, 54ohm) network across the bus to simulate a fully loaded RS-485 bus. To operate the loads,

```
(0) Exit
(1) Load Bus A
(2) Load Bus B
```

Enter Choice [0-2]:

After making this selection, options 1 and 2 will be updated and will remain on the screen. Therefore, you may continue making selections or return to the MIC Config Menu.

- 4.9 **Define Menus:** This option provides the user with the freedom to customize the names of any bus controllers, alternate controllers, or remote modules connected on the MIC Bus. Once selected, the following prompt requesting a filename appears:

MENU Definition file:

This file provides a more user-friendly program when executing bus commands. An ASCII file can be used to assign module and device addresses with meaningful names or identifications, instead of using binary data. When simulating, a virtual window permits the user to choose the module and device names to be examined rather than requiring the user to remember the actual addresses. Therefore, the Module Address and Device Address are no longer input, but rather are selected directly from the virtual window. Once a file name is entered, the user is returned to the MBDS Config Menu.

The menu definition file must be generated by the user and stored on the disk using the format shown in the following example:

```
6      -1    Headlight assembly
6      0     Left headlight
6      1     Right headlight
6      2     Left blinkers
6      3     Right blinkers
7      -1    Dashboard assembly
7      0     Dash brightness
7      1     Fuel level
```

7	2	Oil level
7	3	Speedometer
7	4	Temperature

The first column represents the module address. The second column represents the device address except where a -1 is used to indicate that it is a module name. The third column is the actual description that will be used in the menu selections. These descriptions should be kept to a maximum of 20 characters each. In the above example, the right headlight is located at module address 6, device address 1.

- 4.10 **Reset Defaults:** Automatically returns all configurations within the MIC Configuration Menu to its default values, enabling the buses and removing any loads applied. Refer to Figure 4 for default settings.

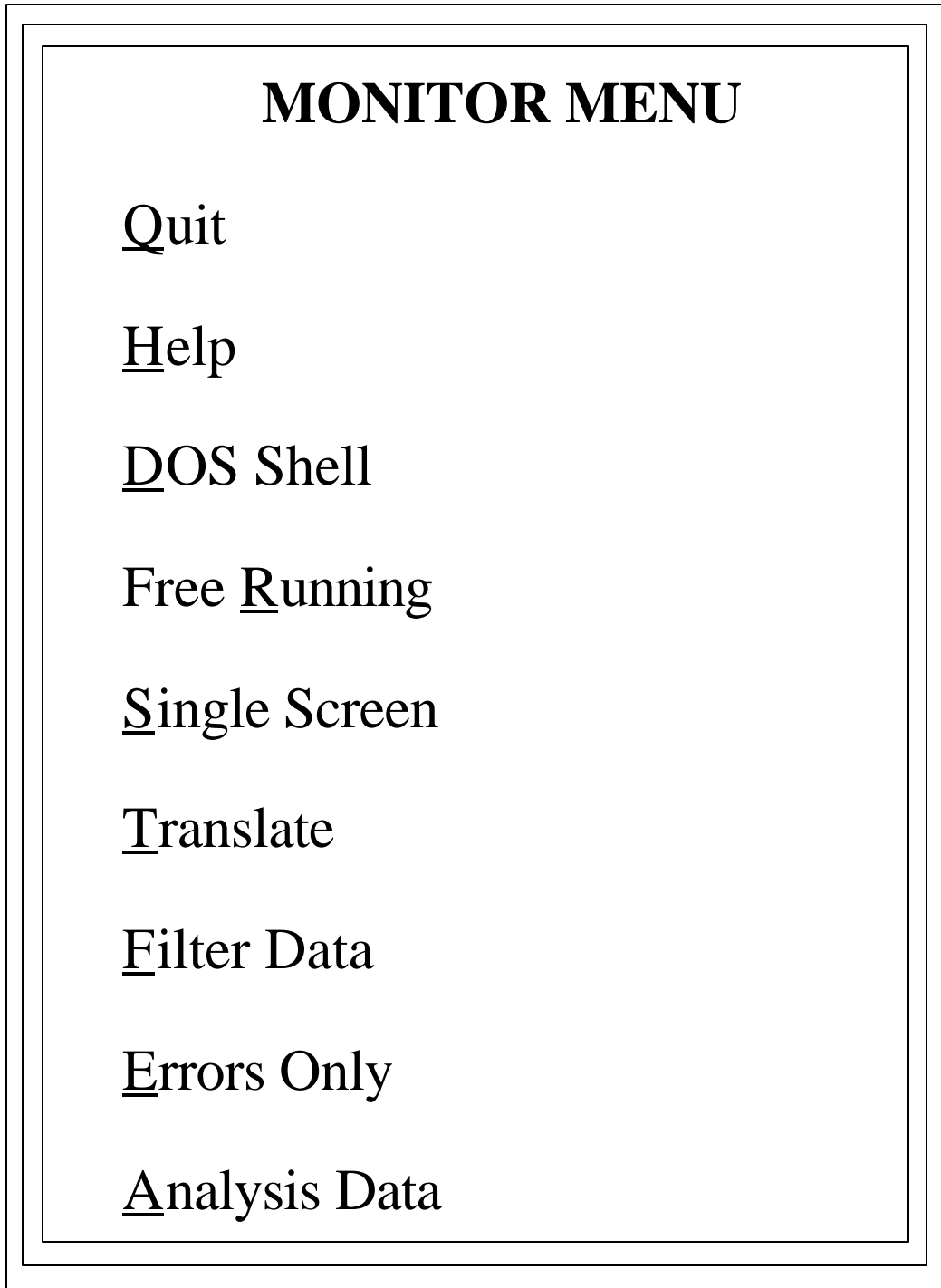


Figure 5 Monitor Menu

## 5.0 BUS MONITOR

The MBDS has the ability to monitor the MIC Bus and to store any bus data within on-board memory. The Bus Monitor Mode has several programmable options for management and manipulation of the data that it receives from the MIC Bus. Selective data filtering is one of the features which can be used to receive and store only pertinent data packets or messages. Received data can be displayed on the screen, saved to host memory, and printed in various formats. Data location and system-level event reconstruction are aided by the inclusion of a programmable on-board 32-bit time-stamp generator. Various log files may also be kept to identify invalid messages or subsystem status. This testing can be accomplished through several different modes as described below.

- 5.1 **Quit:** Returns the user to the Main Menu.
- 5.2 **Help:** Displays the options of the Monitor Menu with a single brief remark regarding each operation. Press any key to continue. The system will return to the Monitor Menu.
- 5.3 **DOS Shell:** Returns the user to a DOS prompt on the host drive. Type EXIT to return to the MBDS.
- 5.4 **Free Running:** The free running monitor mode acquires all the data from the MIC Bus and displays it in hex on the screen in a scrolling fashion. The following options appear:
  - (0) Exit
  - (1) Monitor to screen
  - (2) Monitor to disk

```
Enter choice [0-2]:
```

(0) Exits the free running option and returns to the Monitor Menu.

(1) Monitor to the screen displays the MIC Bus data onto the screen. A sub-menu appears, providing the user with the following options:

```
Monitor I'm Alive Messages?  
(0) No  
(1) Yes  
(2) Yes [Reduced]
```

```
Enter choice [0-2]:
```

The reduced option will only display the first I'm Alive message detected after an intermessage gap. After a selection is made, the Monitor Mode is immediately enabled. Press the <Esc> key to exit active monitor.

(2) Monitor to disk saves MIC Bus data to a disk. The following prompt appears:

```
Enter Limit in Mega Bytes [1-500]:  
Monitor I'm Alive Messages?  
(0) No  
(1) Yes
```

```
Enter choice [0-1]:
```

- (0) Monitor to disk begins. Press the <Esc> key to exit active monitor.
- (1) This response is followed by a request for the destination file path name. Note that this path is essential for proper operation, and, if not entered, the system may fail. The Free Running Monitor Mode is engaged after a file path name is defined. Press the <Esc> key to exit active monitor.

- 5.5 **Single Screen:** The single screen monitor mode gathers the data from the MIC Bus and transfers it to the screen, one screen at a time (192 32-bit messages maximum). The pause between each screen permits the user to closely observe the information. As in the Free Running monitor mode, the following prompt appears:

```
Monitor I'm Alive Messages?  
(0) No  
(1) Yes  
(2) Yes [Reduced]
```

```
Enter choice [0-2]:
```

The reduced option will only display the first I'm Alive message detected after an intermessage gap. Following this response the Single Screen Monitor Mode is immediately engaged. Press the <Esc> key to exit active monitor.

- 5.6 **Translate:** This option allows the user to view all bus data in a structured, ASCII format. Two options are presented, allowing the user to choose the amount of information displayed:

```
(0) Monitor with msg decode  
(1) Filtered monitor w/ msg decode
```

The first of these options will pass all bus information to the monitor screen, while the second allows the user to filter out unwanted data by capturing only messages containing the user-specified module and device addresses.

- (0) The user will be requested to enter the message limit:

```
Enter Message Limit in Thousands [1-32] :
```

This will restrict the number of bus commands that will be recorded in the storage buffer (a maximum of 32,000). Once this user-defined limit is reached, all information will be available on the monitor screen for user analysis.

Next, a request for a trigger is presented.

```
Set TRIGGER [y/n]?
```

If the user refuses this offer, then the Monitor Mode is immediately engaged. Otherwise, this option will provide flexibility for the user when viewing data from the bus. To set the trigger, the user simply enters the bit pattern (of a 32-bit word) in hexadecimal notation. Once entered, the monitor will know to capture messages only with the designated bit pattern.

Following the trigger is a request for a mask:

```
Set MASK value [y/n]?
```

This simply allows the user to define certain bits that may be considered “don't cares” in each word. These irrelevant bits are “masked” by entering the corresponding hexadecimal number which, when converted to binary format, places a zero in the sequence where a bit in the received message is to be neglected.

For example, to monitor module address 21, device address 1 only set:

```
Trigger 01010 0100 0010 0000 0000 0000 0000 0000
Mask      11111 1111 1110 0000 0000 0000 0000 0000
Data Checked 01010 0100 001x xxxx xxxx xxxx xxxx
```

To conclude the procedure, the trigger point must be defined. Five choices are available to provide enough freedom to analyze the stream of data before and/or after the individual data of interest. The following appears:

```
Select trigger point:
(0) Beginning
(1) 1/4
(2) 1/2
(3) 3/4
(4) End
```

```
Enter choice [0-4]:
```

- (1) With the filter monitor with message decode option the user must first designate the module and device addresses that will be captured. Then, as before, a message limit is requested, followed by a trigger and mask request, concluding with a trigger point.

Note that all information will be directed to the screen. At the bottom left of the monitor mode screen, a message indicating the recording status is present. When viewing the translated data, use of the directional arrows is required. There are two possible methods of viewing a particular data line, or group of data lines: Either the up/down arrows may be utilized; or the left/right arrows. The former of these choices simply allows the user to scroll up or down, incrementing or decrementing the data in blocks that are determined by the length of the screen. The latter of these options allows for a faster method of searching. By depressing either of these keys, the user will be prompted to enter the data line number that is of interest. In this way, the user may bypass any scrolling, and will save time. This is especially useful for very large files.

- 5.7 **Filter Data:** The filter data mode is conducted in a free running manner and will capture only messages containing the specified module and device addresses. The system will present the following list:

```
(0)  Exit
(1)  Filter device to screen
(2)  Filter module to screen
(3)  Filter device to disk
(4)  Filter module to disk
```

```
Enter Choice [0-4]:
```

```
Enter Module Address [0-63]:
```

```
Enter Device Address [0-31]:
```

Since up to four filters may be added, the system will ask:

```
Enter another filter [y/n] ?
```

If a response of “y” is issued, the above process is repeated. A “n” response will continue in the filtering monitor mode. If option 3 or 4 is selected the system will ask for the file location. The path can either be to a RAM disk or a hard disk.

```
Enter Path name:
```

At this point the testing data will appear in hex code only. See Analysis Data options to convert saved binary data to ASCII. To exit this mode, press <Esc>. The system will then ask:

```
Continue in filtering monitor mode [y/n] ?
```

Input accordingly. A response of “y” continues in the active mode, while a response of “n” returns the system to the MBDS Main Menu.

- 5.8 **Errors Only:** This mode compares the command and response to verify that each message is being translated properly. Any commands without responses or attention responses detected on the MIC Bus will be captured. The data will be displayed on the screen in a translated ASCII format. Again, the arrow keys should be used to search through the output file.

```
(0) Ignore messages from module 0 & 32  
(1) Specify different modules to ignore
```

(0) Ignores messages from modules 0 & 32 while proceeding immediately into error monitor mode. To terminate the Errors Only monitor mode, simply press the <Esc> key as indicated in the bottom left corner of the monitor screen.

(1) The specify different modules to ignore option requires the user to respond to the following prompts:

```
Enter Module Address [0-63]:
```

After a response is received, error monitor mode is entered. To terminate the Errors Only monitor mode, simply press the <Esc> key .

- 5.9 **Analysis Data:** All saved data is binary encoded in order to meet the systems timing requirements and therefore must be converted to ASCII before reviewing or printing. Selecting this option will enable the user to translate recorded input files (in binary) into output files (in ASCII) that may either be saved to the hard disk, or directed to the monitor screen. This conversion process calculates the elapse and delta of the time-stamp and decomposes words including the Module Address, Device Address, data field information, and the function type. The result is a readable output file that will make data analysis much easier. Four options appear on the Analysis Data sub-menu:

```
(0) Bus messages to ASCII file  
(1) Bus msg to filtered ASCII file  
(2) View recorded bus messages  
(3) View filtered bus messages
```

(0) The bus messages to ASCII file option requires that both an input and output file must be specified. Note that the output file name must be different than the input file name. If these names are identical the system will fail. The user will be prompted to

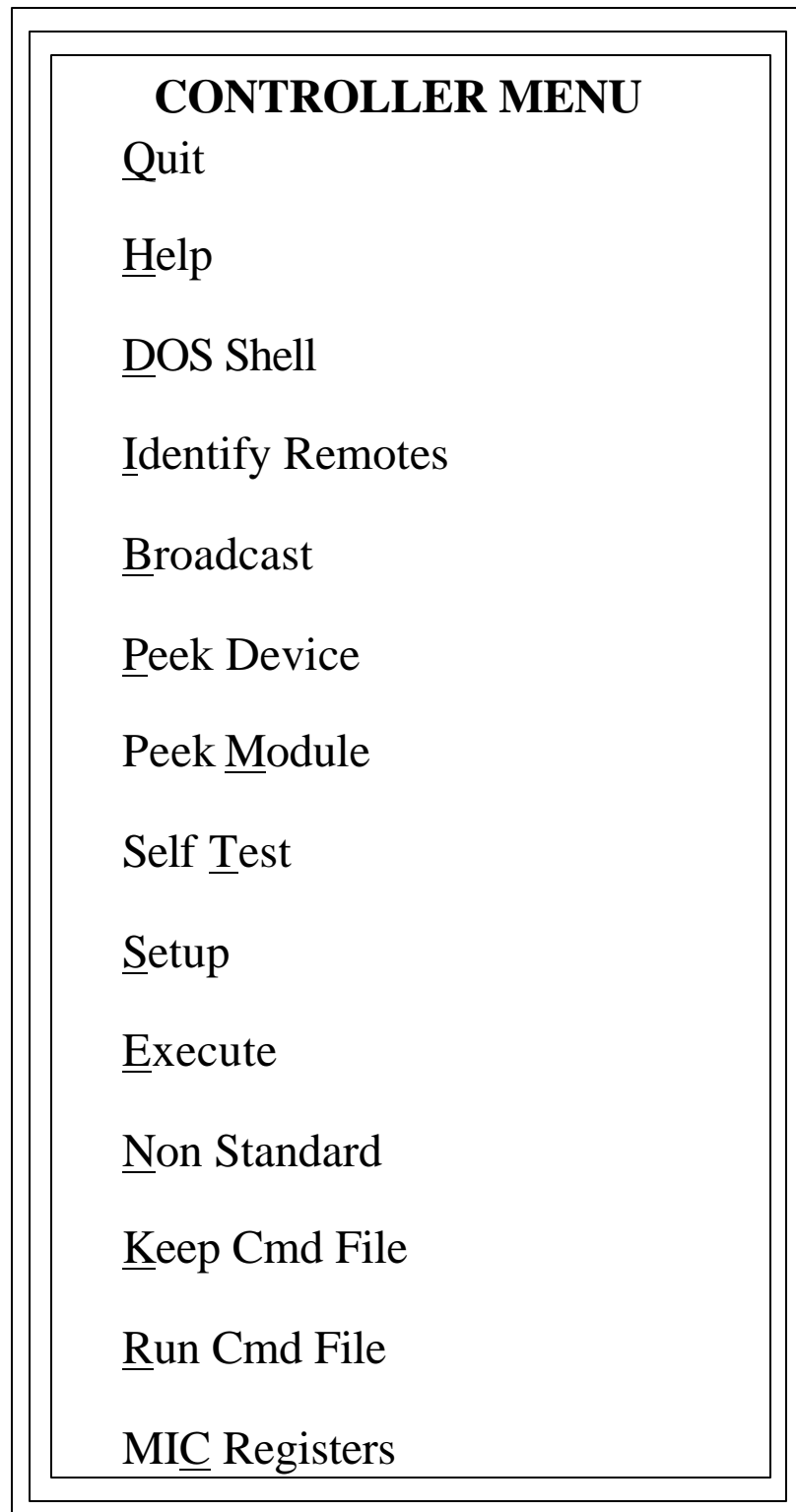
enter the corresponding input file name and location, as well as the output file name and destination.

- (1) With the Bus message to filtered ASCII file, the following additional prompts will appear:

```
Enter Module Address [0-63]:  
Enter Device Address [0-31]:
```

Enter accordingly. The conversion process will be completed in a short amount of time.

- (2) and (3) The recorded or filtered bus messages output will be directed to the monitor screen, and hence only an input file is necessary. Again, the choice of full or filtered output is provided. These options are available so that the user may quickly view output files, without the need for exiting to DOS, or using the DOS shell from the MBDS program. In addition, the function code column of the output file has a defined format to enhance readability: All command codes are left-justified, while all response codes are right-justified, and all reserved codes are center-justified.



**Figure 6 Controller Menu**

## 6.0 BUS CONTROLLER

The MBDS-EX-2 operates as the bus controller for a MIC Bus network when set to the Bus Controller Mode. The MBDS-EX-2 can be connected to one or more modules via the redundant serial data bus and is capable of transmitting commands, monitoring responses, logging bus messages, and displaying the bus activity. The menu-driven interface allows the operator to easily generate, save, and run application dependent bus routines. The Bus Controller menu permits the user to select the testing methods and parameters for the bus controller mode.

- 6.1 **Quit:** Returns the user to the MBDS Main Menu.
- 6.2 **Help:** Notes the Controller Menu testing options and a general statement of its function. Press any key to continue. The system will return to the Controller Menu.
- 6.3 **DOS Shell:** Returns user to a DOS prompt allowing commands such as copy, print, and other operations to be performed. Type EXIT to return to the MBDS.
- 6.4 **Identify Remotes:** Allows the user to identify all of the remote modules connected to the bus. This option should be used prior to preparing data for command operations. After viewing, press any key to continue. The system will then return to the Controller Menu.
- 6.5 **Broadcast:** Instructs a Remote Switching Module to turn ON or OFF all 32 devices assigned to that module. This command is only valid for remote modules using the MIC's Remote Switch Mode. No response is associated with the Broadcast Command. A warning will appear to notify the user of this operation. The system will then ask:

Do you wish to continue [y/n] ?

Input accordingly. If your response is "n", the system will return to the Controller Menu. Otherwise, the options controlling the command will appear.

Specify the method of broadcast desired.

- (0) Module ON
- (1) Module OFF

Enter Choice [0-1]:

(0) Module ON instructs an individual remote module to perform a broadcast ON.

Enter Module Address [0-63]:

After entering the desired option the system will respond:

```
Begin test [y/n] ?
```

Regardless of your answer, the system will ask:

```
Save command [y/n] ?
```

Input accordingly. A "n" response to both of these questions will return the system to the Controller Menu. A "y" response requires a file name to be entered or if a command file is currently open the command will be appended to that file. The next prompt allows for the option of adding a time delay in the command file between the previously save command and the command that may be saved next.

```
Enter File Name:
```

```
Add time delays [y/n]?
```

```
Enter Time [0-0x7FFF] msec:
```

(1) Module OFF instructs an individual remote module to perform a broadcast OFF.

```
Enter Module Address [0-63]:
```

After entering the desired option the system will respond:

```
Begin test [y/n] ?
```

Input accordingly. Regardless of your answer, the system will ask:

```
Save command [y/n] ?
```

Again, input accordingly. A "n" response to both of these questions will return the system to the Controller Menu. A "y" response requires a file name to be entered or if a command file is currently open the command will be appended to that file. The next prompt allows for the option of adding a time delay in the command file between the previously save command and the command that may be saved next.

6.6 **Peek Device:** Requests data from single device address or multiple device addresses within a particular remote module. To specify this function's characteristics,

```
Enter Choice [0-4]:
```

- (0) Peek Single Device transmits a peek single device command to the specified device and module.
- (1) The Continuous Peek Device operation repetitively transmits Peek Single Device commands to all 32 devices pertaining to the specified module.
- (2) The Peek Multiple Device requires the specified remote module to transmit up to 32 peek device responses.
- (3) Peek Multiple Device RSM/DIM functions in the same manner as the Peek Multiple Device but it returns multiple DIM data only.
- (4) The Peek Single Device RSM/DIM operates the same as the Peek Single Device but it returns DIM data only.

Regardless of your selection,

```
Enter Module Address [0-63]:
```

The single device condition also requires the Device Address to be assigned.

```
Enter Device Address [0-31]:
```

After entering the appropriate Module and Device locations, the system allows the user to select the method of transmission for the command.

```
Enter Choice [0-5]:
```

- (0) Transmit on Buses A and B: sends all data on both buses.
- (1) Transmit on Bus A only: sends all data exclusively on Bus A.
- (2) Transmit on Bus B only: sends all data exclusively on Bus B.
- (3) Manchester Error on A: will cause the command transmission to contain a temporary Manchester error on bus A only. Valid Manchester code will then resume.
- (4) Manchester Error on B: will cause the command transmission to contain a temporary Manchester error on bus B only. Valid Manchester code will then resume.

- (5) Manchester Error on A and B: will cause the command transmission to contain a temporary Manchester error on both busses. Valid Manchester code will then resume.

The system will then ask:

```
Begin test [y/n]?
```

Input accordingly. A 'y' response will enable the response of the specified remote module to be observed on the screen. If no errors are detected, the status is transmitted by a Peek Device Normal Response. Two beeps will sound to represent a no response, while three beeps represents a bad response. Regardless to the response, the system will ask:

```
Save command [y/n]?
```

Again, input accordingly. A "n" response to both of these questions will return the system to the Controller Menu. A "y" response requires a file name to be entered or if a command file is currently open the command will be appended to that file. The next prompt allows for the option of adding a time delay in the command file between the previously save command and the command that may be saved next.

- 6.7 Peek Module: Checks the status of any remote module. The data obtained here includes the results of self-test and other information regarding the system built-in test. This command is applicable for all remote modules. Specify the module to be tested,

```
Enter Module Address [0-63]:
```

The system allows the user to select the method of transmission for the command.

```
Enter Choice [0-5]:
```

- (0) Transmit on Buses A and B: sends all data on both busses.
- (1) Transmit on Bus A only: sends all data exclusively on Bus A.

- (2) Transmit on Bus B only: sends all data exclusively on Bus B.
- (3) Manchester Error on A: will cause the command transmission to contain a temporary Manchester error on bus A only. Valid Manchester code will then resume.
- (4) Manchester Error on B: will cause the command transmission to contain a temporary Manchester error on bus B only. Valid Manchester code will then resume.
- (5) Manchester Error on A and B: will cause the command transmission to contain a temporary Manchester error on both busses. Valid Manchester code will then resume.

Begin test [y/n] ?

Input accordingly. A 'y' response will enable the response of the specified remote module to be observed on the screen. If no errors are detected, the status is transmitted by a Peek Module Normal Response. Two beeps will sound to represent a no response, while three beeps represents a bad response. Regardless to the response, the system will ask:

Save command [y/n] ?

Again, input accordingly. A "n" response to both of these questions will return the system to the Controller Menu. A "y" response requires a file name to be entered or if a command file is currently open the command will be appended to that file. The next prompt allows for the option of adding a time delay in the command file between the previously save command and the command that may be saved next.

- 6.8 **Self Test:** Instructs a remote module to run its self test routine. This command is valid for all remote modules. If the Identify Remote option is executed prior to the Setup command the validation code will not be requested.

Enter Module Address [0-63]:

Validation Codes: 0x333 RSM  
 0x555 DIM  
 0x777 DOM

Enter Validation Code:

The system allows the user to select the method of transmission for the command:

- (0) Transmit on Buses A and B: sends all data on both buses.
- (1) Transmit on Bus A only: sends all data exclusively on Bus A.
- (2) Transmit on Bus B only: sends all data exclusively on Bus B.
- (3) Manchester Error on A: will cause the command transmission to contain a temporary Manchester error on bus A only. Valid Manchester code will then resume.
- (4) Manchester Error on B: will cause the command transmission to contain a temporary Manchester error on bus B only. Valid Manchester code will then resume.
- (5) Manchester Error on A and B: will cause the command transmission to contain a temporary Manchester error on both busses. Valid Manchester code will then resume.

The system will respond by asking:

Begin test [y/n]

To begin the test, input accordingly. A 'y' response will enable the status of the specified remote module to be observed on the screen. A single beep will sound if an attention response is received. Two beeps will sound to verify a no response, while three beeps represent a bad response. If this results, press any key to continue. The system will return to the Controller Menu. If a match occurs, and thus no errors are found, a Self Test Normal Response is received. Press <Esc> to terminate the testing screen. Regardless to the answer of the previous question, the system will ask:

Save command [y/n]?

Again, input accordingly. A "n" response to both of these questions will return the system to the Controller Menu. A "y" response requires a file name to be entered or if a command file is currently open the command will be appended to that file. The next prompt allows for the option of adding a time delay in the command file between the previously save command and the command that may be saved next.

- 6.9 Setup: Operates during bus initialization to transmit the original setup parameters to any specified remote module. First, the module must be specified,

Enter Module Address [0-63]:

If the "Identify Remotes" command has not previously located the selected module, six options followed by brief prompts, will be presented.

- (0) RSM Setup, Enter Valid Lag Constant [0-0x7FF]:
- (1) DIM Setup, Enter Number of Devices [0-31]:
- (2) DOM Setup, Enter Number of Devices [0-31]:
- (3) First RSM/DIM Setup, Enter Valid Lag Constant [0-0x7FF]:

This is followed by a request to format the communications protocol:

Set Peek Combination mode [y/n]?

A 'y' will set the Peek Device format to 2-bit Status/13-bit Data.

- (4) Second RSM/DIM Setup, Enter Number of Devices [0-31]:

Again, this is followed by a request to format the communications protocol, in which the same results apply as stated above:

Set Peek Combination mode [y/n]?

- (5) General Setup, Enter Setup Data [0-0xFFFF]:

The system allows the user to select the method of transmission for the command:

- (0) Transmit on Buses A and B: sends all data on both buses.
- (1) Transmit on Bus A only: sends all data exclusively on Bus A.
- (2) Transmit on Bus B only: sends all data exclusively on Bus B.

- (3) Manchester Error on A: will cause the command transmission to contain a temporary Manchester error on bus A only. Valid Manchester code will then resume.
- (4) Manchester Error on B: will cause the command transmission to contain a temporary Manchester error on bus B only. Valid Manchester code will then resume.
- (5) Manchester Error on A and B: will cause the command transmission to contain a temporary Manchester error on both busses. Valid Manchester code will then resume.

The system will respond by asking:

```
Begin test [y/n]?
```

Input accordingly. A 'y' response will enable the response of the specified remote module to be observed on the screen. If no errors are detected, the status is transmitted by a Setup Normal Response. Two beeps will sound to represent a no response, while three beeps represents a bad response. Regardless to the response, the system will ask:

```
Save command [y/n]?
```

Again, input accordingly. A "n" response to both of these questions will return the system to the Controller Menu. A "y" response requires a file name to be entered or if a command file is currently open the command will be appended to that file. The next prompt allows for the option of adding a time delay in the command file between the previously save command and the command that may be saved next.

- 6.10 **Execute:** Transmits the execute command followed by up to 32 data words which translate to a "switch on" or "switch off" message for Remote Switching Modules. If the remote module is configured in the Data Output Mode the data words would contain 16-bit values. The module location and word count must be specified,

```
Enter Module Address [0-63]:
```

```
Enter Word Count [1-32]:
```

For each word the Device Address and its condition/data must be assigned.

```
Enter Device Address [0-31]:
```

```
Enter 1 for ON and 0 for OFF:
      or
Enter DOM Data [0-0xFFFF]:
```

The system allows the user to select the method of transmission for the command.

```
Enter Choice [0-5]:
```

- (0) Transmit on Buses A and B: sends all data on both buses.
- (1) Transmit on Bus A only: sends all data exclusively on Bus A.
- (2) Transmit on Bus B only: sends all data exclusively on Bus B.
- (3) Manchester Error on A: will cause the command transmission to contain a temporary Manchester error on bus A only. Valid Manchester code will then resume.
- (4) Manchester Error on B: will cause the command transmission to contain a temporary Manchester error on bus B only. Valid Manchester code will then resume.
- (5) Manchester Error on A and B: will cause the command transmission to contain a temporary Manchester error on both busses. Valid Manchester code will then resume.
- (6) Word Count Error: will cause the command transmission to include an extra data word.

The system will respond by asking:

```
Begin test [y/n] ?
```

Input accordingly. A “y” response will cause the execute command to be transmitted to the specified remote module and will enable the response of the remote module to be observed. A single beep will sound if an attention response is received. If no response is received, two beeps will sound. For a bad response three beeps will sound. If this occurs, press any key to return to the Controller Menu. If no errors are detected the response data will appear on the screen. Press any key to terminate the process. Regardless to the response of the here, the system will ask:

```
Save command [y/n] ?
```

Again, input accordingly. A "n" response to both of these questions will return the system to the Controller Menu. A "y" response requires a file name to be entered or if a command file is currently open the command will be appended to that file. The next prompt allows for the option of adding a time delay in the command file between the previously save command and the command that may be saved next.

- 6.11 **Non Standard:** This option allows for the generation and testing of any custom communications protocol that the user may have created for application specific purposes.
- 6.12 **Keep Cmd File:** Saves an open command file to the hard drive. The Keep Command responds with one of two messages; file saved or nothing saved. Press any key to return to the Controller Menu.
- 6.13 **Run Cmd File:** Command files are ASCII files which contain 1 or more MIC Bus commands that can be executed using Run Cmd File. Command files can be generated by stepping through the various menu selections and saving the selected commands to a file. Delays can be placed in the command file after any MIC Bus command. Command files can also easily be generated using standard ASCII editors.

An example command file is as follows::

```
5405 0777 < Selftest Command to Module 21
x           < Transmit type, x=TX previous data on Bus A and Bus B
0000 0005 < 5 millisecond delay
u           < Indicates previous data field is delay, 1 millisecond per bit
5403 0000 < Peek Module Command to Module 21
a           < Transmit type, a=TX previous data on Bus A only
5402 0777 < Execute Command to Module 21, word count=1
545A 5555   < Data word
b           < Transmit type, b=TX previous data on Bus B only
/           < End of Command File Marker
```

Additional transmit types are:

```
w=transmit execute command with a word count error
k=insert Manchester error on Bus A command
l=insert Manchester error on Bus B command
m=insert Manchester error on Bus A and Bus B command
n=do not expect a response from command
p=transmit Multiple Peek command on Both Busses
q=transmit Multiple Peek command on Bus A
r=transmit Multiple Peek command on Bus B
```

Enter name of Command file:

If a file was never created under the specified Command file name the following message will appear:

```
File [file name] does not exist
```

If this results, press any key to continue. The system will return to the Controller Menu.

Otherwise, the number of iterations that the command file is to be run must be assigned,  
Number of loops or 0 for continuous:

If more than 1 iteration is selected, options for storing and viewing the responses from the command file are available:

- (0) Display response counts only
- (1) Store non normal responses to disk
- (2) Store all responses to disk
- (3) Display responses to screen

If either option 1 or 2 is selected an output file name and destination must be defined by the user otherwise all output will be directed to the monitor screen.

Enter Output File Name:

6.14 MIC Registers: This option allows the user to execute simple commands directly to the MIC on the MBDS expansion card. The following choices are available:

- (0) Exit
- (1) Write to TX Buffer
- (2) Write to SETUP Register
- (3) Read STATUS Register
- (4) Read RX Buffer

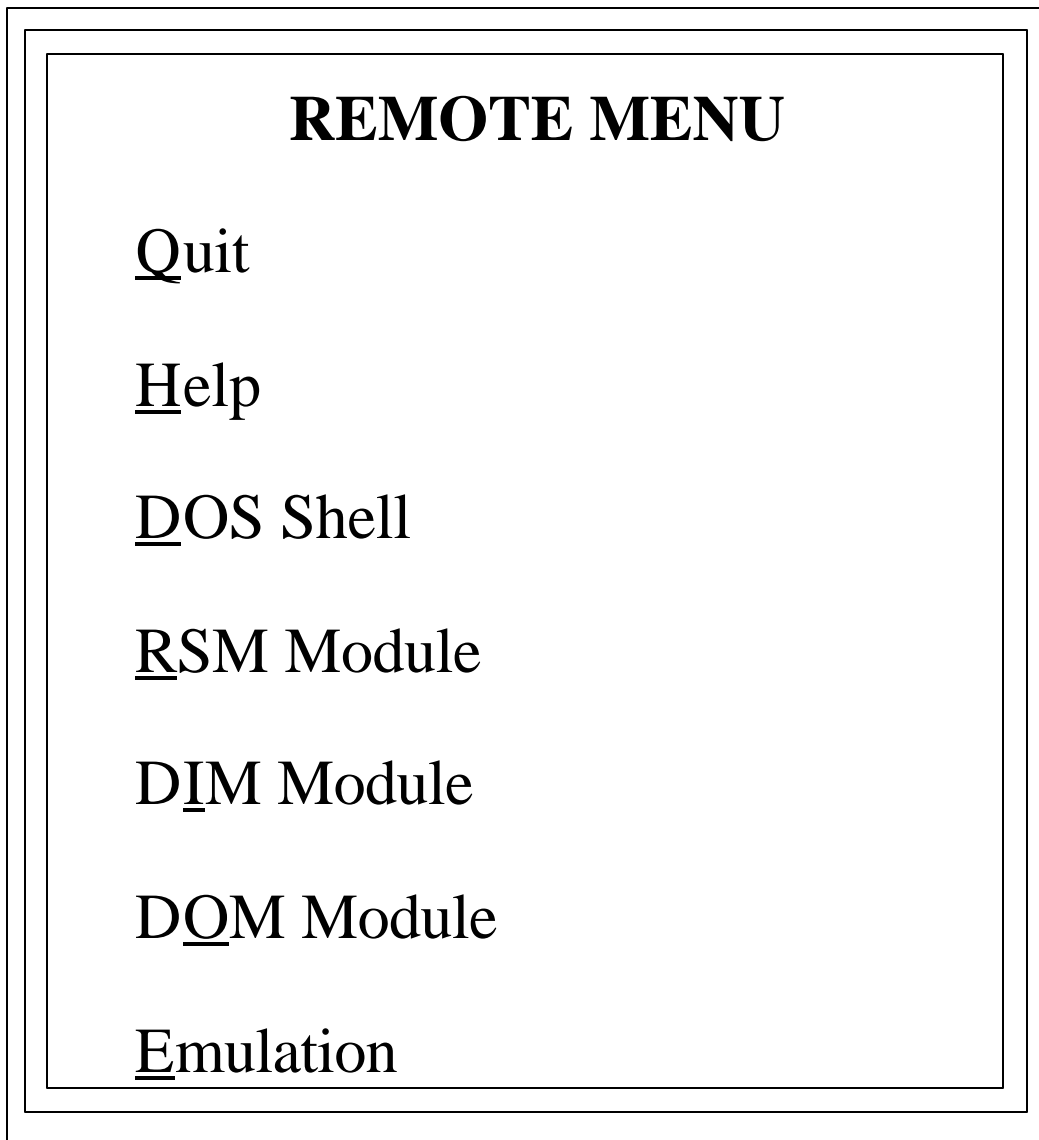


Figure 7 Remote Menu

## 7.0 REMOTE EMULATION

After being set to the Remote Module Mode, the MBDS-EX-2 can emulate various modules on the bus and is capable of responding to bus commands that are transmitted from the system bus controller or other MBDS. The MBDS-EX-2 is set into the selected remote mode of operation in order to provide the exact timing characteristics of responses from a single remote module. The emulation mode can emulate, with software, up to 64 remote module addresses. The emulation does not respond with the same response timing because of software overhead.

- 7.1 **Quit:** Returns the user to the MBDS Main Menu.
- 7.2 **Help:** Explains the options available in the Remote Menu. Press any key to continue working in the Remote Menu.
- 7.3 **DOS Shell:** Returns user to a DOS prompt allowing commands such as copy, print, and other operations to be performed. Type EXIT to return to the MBDS.
- 7.4 **RSM module:** The RSM module allows the user to interactively define a module's response. The defined responses can then be saved in a file for later use. The simple ASCII response definition files can also be created or edited using DOS commands. RSM output data is also captured and displayed on the screen.

The system is setup to provide the following default responses for the RSM status bits (MIC pins STAT[1:0]) depending on the condition of the corresponding MIC output control bit (MIC pins D[31:0]):

control bit ON - status=2  
control bit OFF - status=1

For example, if the MIC output data line D2 is HIGH, the MBDS-EX would respond to a peek device from device address 3 with the status value of 2. These default status values can be modified or each status can be define individually.

The system will ask:

Enter Module Address [0-63]:

Modify default ON/OFF status bits?

(0) No, (1) ON, (2) OFF

Enter Choice [0-2]:

(0) If the user chooses not to modify the default ON/OFF status bits, the system will then ask:

Do you wish to define RSM/DIM data?  
(0) No, (1) RSM, (2) DIM

Enter Choice [0-2]:

- (0) The system will display the current RSM and DIM response values for the specified module address. The MIC's address bus can be viewed in the upper left portion of the display as the MIC cycles through and loads the default status bits into its internal memory. The current RSM output (D31 to D0) is shown in the lower left portion of the display. The default values for each DIM device address are shown on the right side of the display. The DIM devices will be cycled through and loaded into the MIC if an appropriate setup command is received on the MIC Bus by the MBDS. See the MIC BUS REFERENCE MANUAL for RSM/DIM operation.
- (1) The system will allow the user to define response data (status bits) for each of the RSM device addresses. This data can be interactively defined or read from an existing definition file.

(0) Define data, (1) Read from file

Enter Choice [0-1]:

(0) is selected, the system will ask:

Enter Device Address [0-31]:

Enter Status Bits [0-3]:

After this information is compiled, the system will ask if more modules are to be defined.

More devices [y/n] ?

Input accordingly. A response of "y" will repeat this process, while a "n" response will simply continue. When all of the desired devices are defined, the system will ask:

Save definitions to a file [y/n] ?

Again, input accordingly. If the answer to this question is "y", the file name needs to be entered.

Enter File Name:

- (1) Reading the definition from a file requires the user to input the corresponding file name.

```
Enter File Name:
```

If no file is found, the following message will appear:

```
File doesn't exist!
```

- (2) The system will allow the user to define response data for each of the DIM device address. This data can be interactively defined or read from an existing definition file.

```
(0) Define data, (1) Read from file
```

```
Enter Choice [0-1]:
```

(0) is selected, the system will ask:

```
Enter Device Address [0-31]:
```

```
Enter DIM Data [0-0xFFFF]:
```

After this information is compiled, the system will ask if more modules are to be defined.

```
More devices [y/n] ?
```

Input accordingly. A response of “y” will repeat this process, while a “n” response will simply continue. When all of the desired devices are defined, the system will ask:

```
Save definitions to file [y/n] ?
```

Again, input accordingly. If the answer to this question is “y”, the file name needs to be entered.

```
Enter File Name:
```

- (1) Reading the definition from a file requires the user to input the corresponding file name.

```
Enter File Name:
```

If no file is found, the following message will appear:

```
File doesn't exist!
```

- (1) The system will allow the user to select the default value of the MIC's status bits when a corresponding control bit (ex. D0 for device address 0) is set high by a received MIC Bus command.

```
Enter ON Status Bits [0-3]:
```

- (2) The system will allow the user to select the default value of the MIC's status bits when a corresponding control bit (ex. D0 for device address 0) is set low by a received MIC Bus command.

```
Enter OFF Status Bits [0-3]:
```

- 7.5 **DIM module:** The DIM module option allows the user to interactively define a module's response. The defined responses can then be saved in a file for later use. The simple ASCII response definition files can also be created or edited using DOS commands.

The system will ask:

```
Enter Module Address [0-63]:
```

The system will then ask:

```
Do you wish to define DIM data?  
(0) No, (1) Yes
```

```
Enter Choice [0-1]:
```

- (0) The system will display the current DIM response data for the specified module address. The MIC's address bus can be viewed in the upper right portion of the display as the MIC cycles through and loads the default DIM device data into its internal memory. See the MIC BUS REFERENCE MANUAL for DIM operation.
- (1) The system will allow the user to define response data for each of the DIM device addresses. This data can be interactively defined or read from an existing definition file.

(0) Define data, (1) Read from file

Enter Choice [0-1]:

After this information is compiled, the system will ask if more modules are to be defined.

More devices [y/n] ?

Input accordingly. A response of "y" will repeat this process, while a "n" response will simply continue. When all of the desired devices are defined, the system will ask:

Save definitions to file [y/n] ?

Again, input accordingly. If the answer to this question is "y", the file name needs to be entered.

Enter File Name:

(1) Reading the definition from a file requires the user to input the corresponding file name.

Enter File Name:

If no file is found, the following message will appear:

File doesn't exist!

7.6 **DOM module:** The DOM module option allows the user to interactively define a module's response. The defined responses can then be saved in a file for later use. The simple ASCII response definition files can also be created or edited using DOS commands. DOM output data is also captured and displayed on the screen.

The system will ask:

Enter Module Address [0-63]:

The system allows the user to define the response data for all DIM device addresses. This data can either be user defined or can be the corresponding (ex. output data at address 2 = DIM device 2) output data from the DOM functions.

Which one to use for DIM data?

(0) DOM data, (1) User defined

Enter Choice [0-2]:

(0) The system will display the current DIM response values for the specified module address on the right portion of the display. The MIC's address bus can be viewed in the upper right portion of the display as the MIC cycles through and loads the

DIM device data into its internal memory. The current DOM output (D31 to D16) is shown in the left portion of the display. The DOM outputs will be updated when appropriate execute commands or selftest commands are received from the MIC Bus by the MBDS. See the MIC BUS REFERENCE MANUAL for DOM/DIM operation.

- (1) The system will allow the user to define response data for each of the DIM device addresses. This data can be interactively defined or read from an existing definition file.

```
(0) Define data, (1) Read from file
```

```
Enter Choice [0-1]:
```

- (0) The system will ask:

```
Enter Device Address [0-31]:
```

```
Enter DIM Data [0-0xFFFF]:
```

After this information is compiled, the system will ask if more modules are to be defined.

```
More devices [y/n] ?
```

Input accordingly. A response of “y” will repeat this process, while a “n” response will simply continue. When all of the desired devices are defined, the system will ask:

```
Save definitions to a file [y/n] ?
```

Again, input accordingly. If the answer to this question is “y”, the file name needs to be entered.

```
Enter File Name:
```

- (1) Reading the definition from a file requires the user to input the corresponding file name.

```
Enter File Name:
```

If no file is found, the following message will appear:

```
File doesn't exist!
```

- 7.7 **Emulation:** This option allows the user to emulate up to 64 remote module addresses using only one MBDS expansion card. The multiple module emulation is performed by the MBDS-EX-2 software and not by actual hardware. The response time of the emulated remote modules is longer than for actual hardware. The user is able to set each emulated remote to any of the remote module options, and may examine a simulated MBDS network system. In addition, the Emulation option provides the user with the opportunity to test any custom made communications protocol with the simulated modules. The user is restricted from using individual device addresses, and must use either all or none of the devices during each command. All responses must be interactively defined by the user, or, alternatively, through a pre-defined file. Thus, the following prompt appears:

```
(0) Define the response for each module
(1) Read definition from a file
```

(0) The system will ask:

```
Enter Module Address [0-63]:
Enter Device Address [0-31]:
```

After specifying the remote module location, the response type must be identified. In both cases (Normal and Attention), each response will be transmitted in response to a command with a matching module address. Enter accordingly.

The system will then ask the user to choose the command format:

```
(0) Setup response
(1) Multiple Peek response
(2) Execute response
(3) Peek Module response
(4) Peek Device response
(5) Self Test response
(6) Multiple Peek- RSM/DIM response
(7) Peek Device- RSM/DIM response
```

The data field must then be specified:

```
Enter data field [0-0xFFFF]:
```

After this information is compiled, the system will ask if more modules are to be defined. A response of 'y' will repeat this process, while a 'n' response will simply continue. Input as needed by following the above sequence. When all of the desired modules are identified, the system will ask:

```
Save definitions to file [y/n]?
```

Again, input accordingly. If the answer to this question is 'y', the file name needs to be entered.

Regardless of the preceding response, the programmed responses will appear on the screen. The MBDS will now answer with the programmed response to any command that is received with a matching module address. MBDS response transmissions are indicated in the upper right corner of the display. Press <Esc> to terminate the process. Then strike any key to return to the Remote Menu.

- (1) An input file must be located. Enter the proper file to be read. If a valid file is entered, then the system will continue normally, displaying the emulated remote configurations in the Remote Emulation window. If the input file is not located, then a warning message will appear. Press any key to re-type the file name.

## APPENDIX A: ADDITIONAL MBDS SOFTWARE COMMAND FILES

There are several executable files located on the installation diskette. The executable file MBDS.EXE is the file that contains all of the MBDS functions in a menu driven environment. There are 16 additional executable files that run at the DOS prompt without requiring the user to enter the main MBDS program. Note that these routines are hardcoded to run with IRQ5. Source code (written and verified in Microsoft Quick C version 2.0) for each of the 16 executable files is provided in the C directory for users who wish to modify and/or imbed these MBDS functions within custom application programs.

Below is a list of 7 commands that allow the user to directly access various MBDS and MIC registers. A brief description of each of these commands as well as the corresponding syntax format is also provided.

---

**INIT**                      Initialize MBDS-EX-2 Card and MIC Timeouts

INIT Segment\_Add(5 digit hex)

---

**WRITXBUF**                Write to MIC's Transmit Buffer

WRITXBUF Segment\_Add(5 digit hex) MSW(hex) LSW(hex)

---

**WRTSETUP**                Write to MIC's Setup Register

WRTSETUP Segment\_Add(5 digit hex) setup\_data(hex)

---

**RDRXBUFF**                Read the MIC's Receive Buffer

RDRXBUFF Segment\_Add(5 digit hex)

---

**TRANSMIT**                Transmit Data in TX Buffer on Serial Bus

TRANSMIT Segment\_Add(5 digit hex)

---

**TXMULTI**                Transmit Multiple Data words in TX Buffer, Set Bit 7 of Setup Register

TXMULTI Segment\_Add(5 digit hex)

---

**SEND**                      Transmit Data and Monitor Responses

SEND Segment\_Add(5 digit hex) MSW(hex) LSW(hex)

Segment\_Add (5 digit hex) = MBDS Memory Map Starting Address (ex: C8000)  
 Setup\_Data (5 digit hex) = Data to Write to MIC's Setup Register

MSW (4 digit hex) = Most significant word written to the MIC

LSW (4 digit hex) = Least significant word written to the MIC

Below is a brief description and the corresponding syntax format for the remaining 9 of the executable files. These files represent each command of the MIC's protocol. These commands will initialize the MBDS-EX-2 card, write to the set-up register, cause it to transmit the appropriate command on the serial MIC Bus, monitor the bus for responses, and display the corresponding responses on the screen or in a file. For a more detailed definition of the commands see the MIC Bus REFERENCE MANUAL. Note that the source code (written and verified in Microsoft Quick C version 2.0) for these files is also provided in the C directory.

---

**SETUP**                      Set-Up Command

SETUP Segment\_Add(5 digit hex) Module\_Address Set\_Data(4 digit hex)

---

**STEST**                      Self-Test Command

STEST Segment\_Add(5 digit hex) Module\_Address Val\_Code(3 digit hex)

---

**PKMODULE**                  Peek Module Command

PKMODULE Segment\_Add(5 digit hex) Module\_Address

---

**EXECUTE**                    Execute Command with a Single Data Word

EXECUTE Segment\_Add(hex) Module\_Address Device\_Address Data(Hex) Val\_Code(hex)

---

**PKDEVICE**                  Peek Single Device Command

PKDEVICE Segment\_Add(5 digit hex) Module\_Address Device\_Address

---

**PKDEVDIM**                  Peek Single RSM/DIM Data Device Command

PKDEVDIM Segment\_Add(5 digit hex) Module\_Address Device\_Address

---

**MULTIPKR**                  Peek Multiple Devices Command

MULTIPKR Segment\_Add(5 digit hex) Module\_Address Device\_cnt

---

**MULTIPKD**                  Peek Multiple RSM/DIM Data Device Command

MULTIPKD Segment\_Add(5 digit hex) Module\_Address Device\_cnt

---

**BDCAST**                      Broadcast Command (No response)

BDCAST Segment\_Add(5 digit hex) Module\_Address On:1/OFF:0

Segment\_Add (5 digit hex) = MBDS-EX-2 Memory Map Starting Address (ex: C8000)  
 Module\_Address = Module Address, 0 through 63  
 Device\_Address = Device Address, 0 through 31

Val\_Code (3 digit hex) = Validation Code, RSM=333 hex, DIM=555 hex, DOM=777 hex  
Device\_Cnt = Multiple Peek Device Count, 0 through 31

## APPENDIX B

### *MBDS SOFTWARE MEMORY MAP*

Addresses (SA19-SA0) C0000-FC03F Hex

Address Lines SA19-SA18 are High.

Address Lines SA17-SA14 are switch selectable.

Address Lines SA13-SA8 are all zero.

Address Lines

SA7 - - - - - SA0

Offset

0000 0000	00h	0	BTC MSW
0000 0010	02h	1	BTC LSW
0000 0100	04h	2	NCTC MSW
0000 0110	06h	3	NCTC LSW
0000 1000	08h	4	NRTC MSW
0000 1010	0Ah	5	NRTC LSW
0000 1100	0Ch	6	IATC MSW
0000 1110	0Eh	7	IATC LSW
0001 0000	10h	8	SET-UP REGISTER MSW
0001 0010	12h	9	SET-UP REGISTER LSW
0001 0100	14h (R)	10	STATUS REGISTER MSW
0001 0110	16h (R)	11	STATUS REGISTER LSW
0001 1000	18h	12	BASE VECTOR (RESERVED)
0001 1010	1Ah	13	BASE VECTOR
0001 1100	1Ch	14	TX BUFFER MSW
0001 1110	1Eh	15	TX BUFFER LSW
0010 0000	20h (R)	16	RX BUFFER MSW
0010 0010	22h (R)	17	RX BUFFER LSW
0010 0100	24h	18	MBDS CONFIGURATION REGISTER #1
0010 0110	26h	19	MBDS CONFIGURATION REGISTER #2
0010 1000	28h (R)	20	MBDS STATUS REGISTER #1
0010 1010	2Ah (R)	21	MBDS STATUS REGISTER #2
0010 1100	2Ch (R)	22	TIME STAMP MSW
0010 1110	2Eh (R)	23	TIME STAMP LSW
0011 0000	30h (R)	24	MIC R MSW
0011 0010	32h (R)	25	MIC RW LSW
	(W)		
0011 0100	34h	26	IACK
0011 0110	36h	27	SOFTWARE RESET
0011 1000	38h	28	MIC STATUS BITS

0011 1010	3Ah	29	SERIAL BUS SETUP
0011 1100	3Ch(R)	30	RX FIFO MSW
0011 1110	3Eh(R)	31	RX FIFO LSW

Note: All registers are Write Only unless indicated as a Read Only (R) register or a Read (R) Write (W) register.

**APPENDIX B**  
**MBDS SOFTWARE MEMORY MAP**

SA7 - SA0					
00h	BTC MSW				
02h	BTC LSW				
04h	NCTC MSW				
06h	NCTC LSW				
08h	NRTC MSW				
0Ah	NRTC LSW				
0Ch	IATC MSW				
0Eh	IATC LSW				
10h	SET-UP REGISTER MSW				
			D1 - Flip MSB		
			D0 - Reset Standby		
12h	SET-UP REGISTER LSW				
	D15 - Set in Standby		D7 - RX Multiple Responses		
	D14 - Sel MODAD Register		D6 - Clear Buffer		
	D13 - RX Multiple ModAdd		D5 - Monitor		
	D12 - Disable Alive RX		D4 - Broadcast		
	D11 - Incr. on Odd Add		D3 - Soft Reset		
	D10 - Disable Timeouts		D2 - Disable B		
	D9 - Int Mod Address Only		D1 - Disable A		
	D8 - Int Responses Only		D0 - TX		
14h (R)	STATUS REGISTER MSW				
	D15 -	D7 -	Mode1	Mode0	
	D14 -	D6 - Data In Buffer	0	0	PIM
	D13 -	D5 - Module Address 5	0	1	RSM
	D12 -	D4 - Module Address 4	1	0	DIM
	D11 -	D3 - Module Address 3	1	1	DOM
	D10 -	D2 - Module Address 2			
	D9 -	D1 - Module Address 1			
	D8 -	D0 - Module Address 0	Diag1	Diag0	
			0	0	Disabled
			0	1	Failed
16h (R)	STATUS REGISTER LSW				
	D15 - Mode1	D7 - Bad Man A	1	0	Passed
	D14 - Mode0	D6 - Bad Man B	1	1	In-Progress
	D13 - Diag1	D5 - Word Cnt Error			
	D12 - Diag0	D4 - Code Error	Vector1	Vector0	
	D11 - Vector1	D3 - Block Error	0	0	Normal
	D10 - Vector0	D2 - Peek Busy	0	1	Attention
D9 - Bad Par A		D1 - Standby	1	0	No Response
D8 - Bad Par B		D0 - Timeout Loaded	1	1	Bad Response
18h	BASE VECTOR (RESERVED)				
1Ah	BASE VECTOR				
	D15 -	D7 - Vector7			
	D14 -	D6 - Vector6			
	D13 - R MODAD5	D5 - Vector5			
	D12 - R MODAD4	D4 - Vector4			
	D11 - R MODAD3	D3 - Vector3			
	D10 - R MODAD2	D2 - Vector2			

	D9 - R MODAD1	D1 - Vector1
	D8 - R MODAD0	D0 - Vector0
1Ch	TX BUFFER MSW	
1Eh	TX BUFFER LSW	
20h (R)	RX BUFFER MSW	
22h (R)	RX BUFFER LSW	

## APPENDIX B

### MBDS SOFTWARE MEMORY MAP

SA7 - SA0			
24h	MBDS CONFIGURATION REGISTER #1		
	D15 - <i>SPARE</i>	D7 - Mode1	
	D14 - INT_FF	D6 - Mode0	
	D13 - INT_HF	D5 - MODAD5	all bits = 0 after power-up (hard reset)
	D12 - INT_DA	D4 - MODAD4	
	D11 - EN_INT	D3 - MODAD3	
	D10 - Check_TS	D2 - MODAD2	
	D9 - Monitor(use FIFO)	D1 - MODAD1	
	D8 - Remote	D0 - MODAD0	
26h	MBDS CONFIGURATION REGISTER #2		
	D7 - Clk_Sel1	Sel 0 (MIC Clock)      Sel 1 (TS Clock)	
	D6 - Clk_Sel0		
	D5 - TSP5	0 Internal 16 MHz      0 MIC Clock	
	D4 - TSP4	1 External Clock    1 PXO Clk	
	D3 - TSP3		
	D2 - TSP2		
	D1 - TSP1		
	D0 - TSP0	all bits = 0 after power-up or soft reset	
28h (R)	MBDS STATUS REGISTER #1		
	D15 - MODE1	D7 - DIM CYCLE	
	D14 - MODE0	D6 - MIC_W	
	D13 - DIAG	D5 - DIR DIAG	
	D12 - DOM_CYCLE	D4 - MA4	
	D11 - BUSY	D3 - MA3	0 Running ST or ST Disabled or ST Failed
	D10 - Full/	D2 - MA2	1 Self test passed
	D9 - HFull/	D1 - MA1	
	D8 - Data Available	D0 - MA0	
2Ah (R)	MBDS STATUS REGISTER #2		
	D7 - <i>not used</i>		
	D6 - <i>not used</i>		
	D5 - <i>not used</i>		
	D4 - <i>not used</i>		
	D3 - <i>not used</i>		
	D2 - <i>not used</i>		
	D1 - ST_TXB		
	D0 - ST_TXA		
2Ch (R)	TIME STAMP MSB		
2Eh (R)	TIME STAMP LSB		
30h (R)	MIC MSW		
32h (R)	MIC LSW		
	(W)		
34h	IACK		
36h	SOFTWARE RESET		
38h	MIC STATUS BITS		

		D1 - STAT1	
		D0 - STAT0	
3Ah	SERIAL BUS SETUP		
		D7 - F_BUS	
		D6 - F_TXEN	
		D5 - F_TXB	
		D4 - F_TXA	
		D3 - EN_B	1 = active, 0 = inactive
		D2 - EN_A	ex. EN_A = 1 = BUS A Enabled
		D1 - LOAD_B	all bits = 0 after power-up (hard reset)
		D0 - LOAD_A	
3Ch(R)	RX FIFO MSW		
3Eh(R)	RX FIFO LSW		