## **User's Guide**

## I<sup>2</sup>C Bus / SMBus Monitor and I<sup>2</sup>C/SMBus Software Analyzer

Version 1.6





Micro Computer Control Corporation www.mcc-us.com

# This user's guide is for use with MCC's I<sup>2</sup>C/SMBus Monitor (#MIIC-101), and I<sup>2</sup>C/SMBus Analyzer Software (#SMB-SW)

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#### LIMITED WARRANTY

Micro Computer Control (MCC) Corporation warrants this products against defects in materials and workmanship for a period of ninety (90) days from the original date of purchase.

This limited warranty is not applicable to:

- 1) Normal wear and tear;
- 2) Abuse, unreasonable use, mistreatment or neglect;
- Damage caused by the equipment or system with which the product is used; or
- 4) Damage caused by modification or repair not authorized by MCC.

#### THIS WARRANTY IS EXTENDED TO THE ORIGINAL PURCHASER ONLY AND IS IN LIEU OF ALL OTHER WARRANTIES, INCLUDING IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

In no event will MCC be liable for any incidental or consequential damages.

During the warranty period, MCC will repair, replace or refund the purchase price of any product found defective at its option. Returned items require an RMA (Return Material Authorization) issued by MCC, must be carefully packaged, insured for the full replacement value, with shipping charges prepaid, before the return will be accepted.

## System Requirements (Remote Mode Only)

The I<sup>2</sup>C/SMBus Monitor can be used in stand-alone mode or host computer controlled remote mode. To use the I<sup>2</sup>C/SMBus Monitor in remote mode with the I<sup>2</sup>C/SMBus Analyzer Software, your PC must meet the following requirements:

IBM PC or 100% compatible System.
4MB of RAM.
1 MB Free Hard Disk Space.
Microsoft Windows 3.1, 3.11, 95, 98, NT or above.
Mouse.
VGA or Better Monitor.
1 Free RS-232 Serial Port (COM1,2,3,4).

## **System Components**

The I<sup>2</sup>C/SMBus Monitor package includes the following components:

- 1. I<sup>2</sup>C/SMBus Monitor (#MIIC-101)
- 2. I<sup>2</sup>C Bus Clip Lead Cable, 2Ft. (#CABCL).
- 3. I<sup>2</sup>C Interface Cable, 4Ft. (#CAB4).
- 4. RS-232 Serial Cable, 7Ft. with DB-25 adapter (#MEE-PS).
- 5. Wall Transformer (depending on power configuration selected, see next pg).
- 6. User's Guide.
- I<sup>2</sup>C/SMBus Analyzer Software (#SMB-SW) for remote usage, (included with MIIC-101K only)

#### **Power Configurations**

Standard (#MIIC-101)	120 VAC 60Hz 6W to 5VDC 300mA Regulated, USA Plug.
European (#MIIC-101E)	220V~50Hz 5W to 5V 300mA Regulated, European Plug.
International (#MIIC-101I)	120 VAC 60Hz 6W to 5VDC 300mA Regulated, USA Plug, 220/240VAC, 50-60Hz, up to 50 Watts Converter, and International Adapter Set.

## **Optional Add-On Parts**

- 1. I<sup>2</sup>C/SMBus Analyzer Software (#SMB-SW).
- 2. I<sup>2</sup>C Interface Cable, 8Ft. (#CAB8).
- 3. I<sup>2</sup>C Interface Cable, 16Ft. (#CAB16).
- 4. I<sup>2</sup>C Bus Clip Lead Cable, 2Ft. (#CABCL).





#### I<sup>2</sup>C Bus / SMBus Monitor

The **I**<sup>2</sup>**C Bus / SMBus Monitor** is a Troubleshooting Tool for the Inter-Integrated Circuit (**I**<sup>2</sup>**C**) Bus developed by Philips Semiconductors and the System Management Bus **(SMBus)** developed by Intel Corporation. When connected to an I<sup>2</sup>C Bus or SMBus network, the I<sup>2</sup>C Bus / SMBus Monitor can capture and display bus message activity.

The I<sup>2</sup>C Bus / SMBus Monitor can operate in two modes, stand-alone and remote. In *stand-alone mode*, the built-in display and keypad supports the capture and display of bus messages. In *remote mode*, the monitor is controlled by a host computer via an RS-232 serial communications port.

For remote mode operation, MCC offers an optional Windows-based I<sup>2</sup>C Bus / SMBus Analyzer software (#SMB-SW) to provide remote control of the monitor from a PC. This software allows bus message data to be captured, logged, filtered, displayed, and analyzed using one of several built-in protocol parsers, including the display of Smart Battery System (SBS) messages in engineering units.

In addition to MCC's standard software, a customer may also develop custom software to meet special processing requirements. Custom software can control, collect, and upload bus message data to a host system. This provides a powerful tool for integrating the monitor into an automatic manufacturing-test environment. Remote control is accomplished via a series of ASCII text commands. A description of the monitor command set is provided in the Application Program Interface section of this manual.

The complete I<sup>2</sup>C Bus / SMBus Monitor package consists of a hand-held unit, connecting clip-lead and interface cables, power supply, and optional Windows-based analyzer software.

#### **Product Features**

- ► I<sup>2</sup>C Bus and SMBus Compatible.
- Captures bus traffic to 100kHz with minimal clock-stretching requirements.
- Compatible with 3.3 to 5 volt bus logic.
- Trace Buffer stores up to 2700 messages. Unlimited when operated in remote mode.
- Stand-Alone and Remote Operating Modes.
- RS-232 Port supports Host Computer communication.
- Optional software integrates monitor and PC resources.

## Input / Output Ports

The **I**<sup>2</sup>**CBus/SMBus Monitor** includes three I/O ports (**Bus**, **COM**, and **TRIG** ) for connecting the unit to the network under test and an optional host computer system.

This section provides a general description of these I/O ports. For specific port use, see th "Installation" section of this guide.

#### I<sup>2</sup>C Bus / SMBus Port

The monitor provides a Molex Semicon connector (**BUS**) for connecting to the I<sup>2</sup>C Bus or SMBus.



4321

<u>Pin</u>	<u>Signal</u>	<b>Description</b>
1	GND	Ground Line
2	SDA	Data Line
3	V	Bus +5V (Optional)
4	SCL	Clock Line

A clip lead cable (#CABCL), included with the unit, provides connection to the system under test. The Bus +5v line is used to optionally supply or source power from the target system. See the Power Supply Section for information on the use of this line. An RS-232 serial port connector (**COM**) and cable provides connection to an optional Host system. This port provides remote unit control and data uploading capabilities.



<u>Pin</u>	<u>Signal</u>	Description
1	CTS	Clear To Send (Host > Monitor) (Optional)
2	ТΧ	Data (Monitor > Host)
3	GND	Ground Line
4	RX	Data (Host > Monitor)

A serial port cable with DB-25 and DB-9 adapter, included with the unit, provides connection to the RS-232 serial communications port on an optional Host system.

## **External Trigger Port**

An External Trigger port connector (**TRIG**) and clip lead provides Trace synchronization with external signals. The trigger is activated on a high to low signal transition.

#### **Connecting a Power Source**

The I<sup>2</sup>C Bus/SMBus Monitor can be powered from either internal or external power sources.

#### **Internal Battery Power**

An internal 9V battery provides unit power when the power switch is in the **ON** position. This power source allows the unit to operate stand-alone, or when another power source is unavailable.

#### **External Power**

When the power switch is in the **EXT**ernal position, the unit can be powered from:

- 1. The BUS +5V (V) Input line.
- 2. A regulated +5V wall power supply (Digi-Key #T309-ND or CUI/Stack # DPR050030-P6) through the external power jack (+5V).

#### ~ ~ ~ ~ **CAUTION** ~ ~ ~ ~

Powering the monitor from its +5V external power jack applies power to the BUS +5V (V) line. The BUS V line should only be connected to the system under test if: a) You are powering the monitor from the target system; or, b) You are powering the target system from the monitor. **DO NOT CONNECT BOTH THE WALL POWER AND TARGET POWER SUPPLIES TOGETHER.** 

### Connecting to an I<sup>2</sup>C Bus / SMBus

The unit provides a test clip lead cable for connection to an I<sup>2</sup>C Bus or SMBus under test. On the monitor, the test clip cable connects to the Molex Semicon modular connector marked **BUS**.

Test clips are provided for:

<u>Clip ID</u>	<u>Signal</u>	<b>Description</b>
G	GND	Ground Line
D	SDA	I <sup>2</sup> C/SMBus Data Line
V	V	+5V (Optional)
С	SCL	I <sup>2</sup> C/SMBus Clock Line

For information on using the +5v option, see the "Power Supply Section" of this guide.

### **Connecting the External Trigger**

The monitor provides External Triggering for Trace synchronization with external events. Trace synchronization allows bus traffic to be collected immediately before or after an electronic event.

A High-to-Low transition on the External Trigger port can be used to start a PRE-TRIG trace, or stop a POST-TRIG trace. See the Trace Mode section of this guide for trace synchronization details.

## **Connecting the Serial Cable (optional)**

The Serial Cable provides the connection between the monitor and an optional Host system. On monitor, the Serial Cable connects to the modular RJ-45 connector marker **COM**. On the Host system, the cable connects to a standard RS-232 serial communications port. Both DB-25 and DB-9 connectors are supported.

When using a Host computer, data terminal, or terminal emulator program to access the monitor via its RS-232 port, communication parameters must be properly set before communicating can begin.

The monitor operates with the following Serial Link communication parameters:

Baud Rate	* 19.2K or 57.6K
Parity	None
Data Bits	8
Stop Bits	1 or 2

\* The monitor defaults to 19.2K baud at power up. See the Serial Command section for more information on switching to baud rates.

The monitor's serial port is configured as a Data Communications Equipment (DCE) device, thus permitting direct connection to a PC's standard RS-232 serial communications port. In this configuration, only three (3) wires (TX, RX, and GND) are required to establish serial communication. An optional fourth handshaking wire may be used to establish hardware flow control.

DB-25 Pin Assignments		
Pin	Name	Description
2	ТХ	Transmit Data to Monitor
3	RX	Receive Data from Monitor
4	RTS	Request to Send to Monitor (Optional)
7	GND	Signal Ground

DB-9 Pin Assignments		
Pin	Name	Description
2	RX	Receive Data from Monitor
3	ТХ	Transmit Data to Monitor
5	GND	Signal Ground
7	RTS	Request to Send to Monitor (Optional)

## **Operating Modes**

The I<sup>2</sup>C Bus / SMBus Monitor can operate in two modes, stand-alone and remote. In *stand-alone mode*, the built-in display and keypad supports the capture and display of bus data. In *remote mode*, the monitor is controlled by a host computer via an RS-232 serial communications port.

### **Stand-Alone Operation**

#### **Quick Start**

- 1. Connect monitor to the target bus.
- 2. Turn monitor power to **ON** or **EXT**.
- 3. Select address mode **ALL** or **SELECT**.
- 4. Press **PRE** or **POST-TRIG** Trace button to begin data capture. PRE-TRIG waits for TRIG↓ line low or repeat PRE-TRIG button press.
- 5. Press VIEW-DATA button to end capture and enable BYTE, MSG, and BUFFER display scroll buttons.

When using the I<sup>2</sup>C Bus/SMBus Monitor stand-alone, the unit performs data collection and display using eight (8) operating modes. These modes include:

Operation	Description
Address Selection	Select slave address to monitor
View Status	View bus signal logic levels
Trace	Capture bus message data
View Data	View captured bus data
Remote	Capture/Transmit bus data
Simulation	Simulate bus message data

#### Address Select Mode

Address Select Mode is used to select the bus slave address or addresses the unit will monitor.

Address Select Mode is entered by pressing the **MONITOR-SELECT** or **MONITOR-ALL** key on the unit's front panel.

The MONITOR-SELECT key is used to specify a single bus slave address to monitor. The first time this key is pressed, the unit will display the current selected slave address. Subsequent key presses will step the unit through all possible slave addresses.

Pressing the MONITOR-ALL key instructs the unit to collect bus traffic to all slave addresses.

Pressing any other mode select key terminates Address Select Mode with the displayed address selected.

Slave address selection may also be set with the Select Address Serial command. For more information see the Serial Command section in this guide.

### **View Status Mode**

View Status Mode displays bus and TRIG line levels.

View Status Mode is entered by pressing the **VIEW-STATUS** key on the unit's front panel.

In View Status Mode, the unit displays the following line levels ("0" for < 0.5V, "1" for > 2.5V):

- A.bV Bus +5V Line
- SCL Clock
- SDA Data
- TRIG Trace Trigger Input

Selecting any other operating mode terminates View Status Mode.

#### **Trace Mode**

In Trace Mode, the unit collects and stores all or selected bus traffic with PRE or POST Trace triggering.

Trace Mode is entered by pressing the **PRE-TRIG** or **POST-TRIG** key on the unit's front panel. All previously collected data is erased from the monitor's internal storage. Bus traffic to one or all slave devices is collected in accordance with the current Address Select Mode defined above.

Pressing the PRE-TRIG key instructs the unit to start collecting bus traffic upon receiving a trigger signal. Pressing the PRE-TRIG key again, or a High-to Low transition on the External Trigger line will trigger data collection. Once started, PRE-TRIG data collection continues until the monitor's internal trace buffer is full, or another operating mode is selected.

Pressing the POST-TRIG key instructs the unit to start collecting bus traffic immediately. Once started, POST-TRIG data collection continues until a High-to-Low transition is detected on the External Trigger line, or another operating mode is selected. Once the trace buffer is full, POST-TRIG tracing continues collecting data by overwriting the oldest stored data with the newest.

Selecting any other operating mode terminates Trace Mode.

## View Data Mode

View Data Mode displays data captured during the last trace of bus activity. Displayed information includes:

- Number of Messages : Bytes Captured
- Start/Stop Events
- Message Number and Message Byte Number
- Message Destination Slave Address
- Read/Write Requests

- Acknowledgments and Negative-Acknowledgments
- Transmitted Data in Hex and ASCII
- View Data supports forward and reverse scrolling of captured data bytes or messages.

View Data key/actions include:

<u>Key</u>	Action
BYTE-UP BYTE-DOWN MSG-UP MSG-DOWN BUFFER-UP BUFFER-DOWN	<ul> <li>Move Backward one byte.</li> <li>Move forward one byte.</li> <li>Move Backward one message.</li> <li>Move Forward one message.</li> <li>Move to Start of buffer.</li> <li>Move to End of buffer.</li> </ul>

The monitor uses the following display syntax:

<u>I<sup>2</sup>C Event</u>	<u>Display</u>
Start of Buffer	[- START OF TRACE -]
Start Read w/Ack Data w/Ack Stop Condition	[MMMM:START AA RA] [MMMM:NNN DD 'C 'A] [MMMM:STOP ]
End of Buffer	[ END OF TRACE ]
where:	
MMMM NNN AA DD C R/W N/A	<ul> <li>Trace Message Number</li> <li>Message Byte Number</li> <li>Device Address</li> <li>Data in Hexadecimal Format</li> <li>Data in ASCII Format</li> <li>Read or Write Request</li> <li>Receiver Non/Acknowledgment</li> </ul>

Selecting any other operating mode terminates View Data Mode.

#### **Remote Mode**

In Remote Mode, the unit is controlled by a Host computer system via its serial port. Bus traffic can be collected or uploaded to the Host system for storage and further analysis.

Remote Mode is entered when the unit receives a **Serial Command** at its serial port.

The monitor responds to a variety of Serial Commands including:

- Baud Rate Select
- ASCII or Binary Remote Upload Select
- Slave Address Select
- Dump Trace Buffer
- Remote Trace
- Help

For more information see the Application Program Interface section in this guide.

Selecting any other operation mode terminates Remote Mode.

### **Bus Simulation Mode**

In Bus Simulation Mode, the monitor simulates I<sup>2</sup>C Bus traffic without a bus connection. Emulation provides a learning and testing platform without the need for a working bus.

Bus simulation is enabled by pressing the **BUFFER-UP** key on the unit's front panel during the power-up sequence. Once enabled, bus simulation remains in effect until the next unit power-up cycle.

During Trace operations, bus simulation repetitively generates the following three bus messages:

 10234836536C36C36F500
 - Start 02, W, A, "Hello", Stop

 10435736F37236C364500
 - Start 04, W, A, "World", Stop

 2FF500
 - Start FE, R, N, Stop

See ASCII Remote Select Serial command for details on ASCII format.

Bus simulation can also be enabled with the Bus Simulation Enable Serial command. For more information see the Serial Command section in this guide.

#### **Remote Operation**

In *remote mode*, the monitor is controlled by a host computer via an RS-232 serial communications port. In this mode, bus traffic can be collected or uploaded to the Host system for storage and further analysis.

For remote mode operations, MCC offers Windows-based **I**<sup>2</sup>**C Bus / SMBus Analyzer** software to provide remote control of the monitor. This software, described below, can be purchased with the monitor in kit form (#MIIC-101K), or the software can be separately purchased (#SMB-SW).

A customer may also develop custom software to meet special processing requirements. Remote control is accomplished via a series of ASCII text commands. A description of the monitor command set is provided in Appendix C.

## I<sup>2</sup>C Bus / SMBus Analyzer Software

## **Quick Start**

- 1. Install analyzer software.
- 2. Connect monitor to the target bus.
- 3. Connect monitor to host PC COM port.
- 4. Turn monitor power to **ON** or **EXT**.
- 5. Select **COM** port connected to bus monitor.
- 6. Select bus slave addresses to monitor.
- 7. Click Trace button.

The I<sup>2</sup>C/SMBus Analyzer Software provides real-time capture and onscreen display of live or previously recorded I<sup>2</sup>C or SMBus messages. It is designed to work with the I<sup>2</sup>C Bus / SMBus Monitor (#MIIC-101). The software also provides filtering of displayed messages by device slave address, and provides a global display of bus activity over all 7-bit slave addresses.

	Slave Address Map 🔀
	Address [Assignment]: F8
	00 10 20 30 40 50 60 70 80 90 A0 B0 C0 D0 E0 F0
W IZC Bus/SMBus Analyzer [File: SBS.IZC]	
Eile Addr <u>M</u> ap Com <u>P</u> orts Mode <u>S</u> elect Log <u>H</u> elp	
Msg 1618 [Start]#16[W]00 [Start]#16[R	
Msg 1619 [Start]#16[W]01 [Start]#16[R	08 / / / / / / / / / / / / / / / /
Msg 1620 [Start]#16[W]02 [Start]#16[R	
Msg 1621 [Start]#16[W]03 [Start]#16[R	
Msg 1622 [Start]#16[W]04 [Start]#16[R	
Msg 1623 [Start]#16[W]05 [Start]#16[R	Asting Claus Address
Msg 1624 [Start]#16[W]06 [Start]#16[R	Active Stave Address
Msg 1625 [Start]#16[W]07 [Start]#16[R	lai aafulfacahl
Msg 1626 [Start]#16[W]08 [Start]#16[R	]28 01[N][Stop]
Msg 1627 [Start]#16[W]09 [Start]#16[R	]E0 2E[N][Stop]
Msg 1628 [Start]#16[W]0A [Start]#16[R	]00 00[N][Stop]
Msg 1629 [Start]#16[W]0B [Start]#16[R	]00 00[N][Stop]
Msg 1630 [Start]#16[W]0C [Start]#16[R	]01 00[N][Stop]
Msg 1631 [Start]#16[W]0D [Start]#16[R	]32 00[N][Stop]
Msg 1632 [Start]#16[W]0E [Start]#16[R	]32 00[N][Stop]
Msg 1633 [Start]#16[W]0F [Start]#16[R	]E8 03[N][Stop]
Display [Options]	
	Log: Closed
🗌 Ack 🔽 Nak 📀 Hex 🔿 F	Raw Trace Halt Clear

### Software Installation

For Windows 95 and above:

- 1. Insert software distribution diskette into floppy drive.
- 2. Select Start|Run. Type "a:setup".
- 3. Follow instructions on screen.

For Windows 3.x or NT 3.51:

- 1. Insert software distribution diskette into floppy drive.
- 2. Select File|Run. Type "a:setup".
- 3. Follow instructions on screen.

## **Equipment Setup**

- 1. Connect monitor to a PC COM port COM:1, 2, 3 or 4.
- 2. Connect monitor to the target  $I^2C$  Bus using the clip lead cable.
- 3. Turn monitor power ON.

**NOTE**: Previously collected raw (\*.i2c) files may be analyzed off-line. Several such file are automatically installed during product installation. See the File|Load feature below.

## **Starting The Program**

For Windows 95 and above:

- 1. From Start Menu, select Programs I2C Bus\_SMBus Analyzer.
- 2. Click on I2C Bus\_SMBus Analyzer.

For Windows 3.x or NT 3.51:

- 1. From Program Manager double click on the I2C Bus\_SMBus Analyzer Program Group.
- 2. Double click on I2C Bus\_SMBus Analyzer Program Item.

The I<sup>2</sup>C/SMBus Analyzer Software can display real-time or previously recorded bus data. To display live data, select the COM port connected to the Bus Monitor, then click on the Trace Button. To display previously recorded log file data, click File|Load and select a raw I2C (\*.i2c) log file. Several sample log files are automatically installed in the software default folder (sub-directory) during software installation.

### **Program Controls:**

I<sup>2</sup>C/SMBus Analyzer Software program controls consists of onscreen buttons, check boxes, grid controls, menu items, and dialog boxes. This section describes these controls and explains how to use these controls to capture and display bus message data.

#### **Button Controls:**

**Trace** - This button is available when the ModeSelect|Remote Trace menu item is selected. Clicking this button puts the monitor into remote trace mode, and will display real time data captured from the bus. Message data is displayed according to the current slave addresses, display options, and data protocol selected.



**Dump** - This button is available when the ModeSelect|Dump Buffer menu item is selected. Clicking this button puts the monitor into dump mode, and will display previously recorded data captured from the bus that is held in the monitor's internal buffer. Message data is displayed according to the current slave addresses, display options, and data protocol selected.

□Display [Options] □ Start □ Stop □ B/₩	Data Protocol	C SBS		Log: Close	d
CACK Nak	• Hex	C Ra <del>w</del>	Dump	Halt	Clear

**More** - This button is available when the File|Load menu item is selected, and message display area is full. Clicking this button reads and displays additional previously recorded log file data. Message data is displayed according to the current slave addresses, display options, and data protocol selected.

Halt - Stop the display of data.

Clear - Clear the display area.

#### **Check Box Controls:**

Display [Options] ☐ Start ☐ Stop ☐ R/₩	C ASCII/Hex	C SBS	L	og: Closed	d
Ack Nak	⊙ Hex	C Raw	Trace	Halt	Clear

Display [Options] - Display Control

These check boxes control the display of Start, Stop, Ack, Nak and R/W events within an I<sup>2</sup>C or SMBus message.

Data Protocol - Select Data Display Protocol

ASCII/Hex Printable ASCII or Hexadecimal

- Hex Hexadecimal
- SBS System Management Bus

Raw Raw data received from monitor

#### Grid Control:

AddrMap Grid - Select Slave Addresses to Display



Select slave addresses to display and monitor address traffic. Click on grid cells to Enable (checked) or Disabled (x) slave address for display. Enabled addresses show bus message activity with a red dot. Selecting a grid cell clears traffic indicator.

#### Menu Controls:

#### File|Load - Load a File

Load a previously stored file for processing or display. The software can read/process/display log files (\*.i2c) previously collected from the monitor, or can read/display any ASCII text (\*.txt) file. Message data is displayed according to the current slave addresses, display options, and data protocol selected. ASCII text files are simply displayed.

#### File|Save As - Save Data to File

Save the currently displayed data to a file. Up to 32K characters currently displayed can be saved in a log file (\*.i2c) or ASCII text (\*.txt) file. Saved files can be redisplayed using the File|Load menu item.

#### File|Print Setup - Setup printer.

#### File|Print - Print Displayed Data

Print the currently display data. Up to 32K characters currently displayed are printed.

File|Font Select - Select display font and size.

#### File|Save Setup - Save Setup Parameters

The following program parameters are saved to the file I2C.INI. These parameters are automatically loaded the next time the program is started. ComPort Number Display Options Protocol Selection Font Selection Hints On/Off Selection

AddrMap - Display Address Map Grid

See the AddrMap control definition above.

ComPorts - Select Com Port

Select monitor connected com port and baud rate.

**NOTE**: The monitor defaults to 19200 baud at power up. Faster baud rates can cause loss of data on some PCs.

#### ModeSelect|Remote Trace - Select Monitor Remote Mode

Bus messages captured by the monitor are uploaded for display.

ModeSelect|Dump Buffer - Select Monitor Dump Mode

Previously captured bus messages held in the monitor's internal buffer are uploaded for displayed.

#### ModeSelect|Message Display - Select Message Mode

Bus messages are displayed upon receiving STOP at end of message. This is the default mode and provides fast display of message data.

#### ModeSelect|Byte Display - Select Byte Mode

Bus messages are displayed upon receiving each byte of message data. This mode can display partial or incomplete message data when a complete message is not being transmitted (i.e. missing STOP).

**ModeSelect|Show Hints** - Enables Program Controls hint display.

Log - Log File Control

Open/close log file (\*.i2c) of data received from monitor. Log files can later be read/processed with the File|Open menu item.

X		Open Log File
	Directories:	File Name: (*.i2c)
	🗁 c:\	
	🗁 smb-sw	
		ab.i2c
		smb.i2c
	X Cancel	🗸 ок
	🗙 Cancel	🗸 ок

Help|ReadMe - Display technical notes

#### Help|Revision Report - Display revision report

**Help|About -** Display software information This section is a description for programmers writing custom applications.

## **Application Program Interface**

The Host System Interface provides RS-232 port access to monitor data capture functions. The monitor provides the following Serial Commands to assist in bus traffic collection:

19.2K Baud Select 1
57.6K Baud Select 5
ASCII Remote Select A
Binary Remote SelectB
CTS/RTS Handshaking C
Dump Trace Buffer D
Enable Bus Simulation E
Remote Trace
Select Address
Test System T
Escape <esc></esc>
Screen Pause
Screen Resume
?Help ?

The following sections give details on the syntax and operation of these commands.

#### **Command Syntax**

Serial commands consist of a single character command key possibly followed by command parameters and terminated with the <Enter> key.

() Optional parameters.

- [] Numeric parameters. All such parameters are specified in hexadecimal <u>without</u> a radix specifier. Example OO to FF.
  - Alternate selection. Only one of the alternate selections is permitted.

<> Control keys.

#### **Baud Rate Select**

**Syntax:** 1 (9200) | 5(7600)

#### **Description:**

The Baud Rate Select command sets the units serial port to 19.2K or 57.6K baud. The unit defaults to 19.2K baud at power-up.

Executing a Remote Trace on high volumes of bus traffic at 19.2K baud may cause loss of data on buffer overflows. Buffer overflows are marked in the data stream with the "???" string.

When executing a Remote Trace at 57.6K baud, the HOST system may lose data on character overwrites. Character overwrite detection is a function of your terminal emulation program.

#### Note

Immediately after issuing a Baud Rate Select command, the Host system serial port must also change to the matching baud rate.

**Example:** 5 <Enter> - 57.6K baud selected. 1 <Enter> - 19.2K baud selected.

#### **ASCII Remote Select**

#### Syntax: A

#### **Description:**

The ASCII Remote Select command configures Remote Trace data to be sent to the serial port in printable ASCII format. At power-up, ASCII Remote is the default transfer mode.

When ASCII Remote in enabled, data is transferred in three-character ASCII sets. The first character specifies the data type, and is followed by a two character slave address or data.

When executing a Remote Trace, data is sent to the serial port in the following ASCII format:

TAATHH ...THH<CR><LF>

where:

T - Type

- 1 Start with Acknowledgment.
- 2 Start without Acknowledgment.
- 3 Data with Acknowledgment.
- 4 Data without Acknowledgment.
- 5 Stop
- AA 8-bit Slave Address (00...FFH).
- HH 8-bit Data (00...FFH).

Example: A<Enter> R<Enter>

150320...323500<CR><LF>

where:

1 - Start with Acknowledgment.

- 50 Slave Address 50H.
- 3 Data with Acknowledgment.
- 20 Data 20H.
- . 2 Dete mith A due and down and
- 3 Data with Acknowledgment.
- 23 Data 23H.
- 5 Stop.
- 00 Always 00.

In the above example, a single bus message is uploaded to the Host system in ASCII format during a Remote Trace.

#### **Binary Remote Select**

#### Syntax: B

#### **Description:**

The Binary Remote Select command configures Remote Trace data to be sent to the serial port in Binary format.

When Binary Remote is enabled, data is transferred in two-byte binary sets. The first byte specifies the data type, and is followed by a slave address or data byte.

When executing a Remote Trace, data is sent to the serial port in the following Binary format:

TATH...TH<CR><LF>

where:

T - Type

- 1 Start with Acknowledgment
- 2 Start without Acknowledgment.
- 3 Data with Acknowledgment.
- 4 Data without Acknowledgment.
- 5 Stop.
- A 8-bit Slave Address (00...FFH).
- H 8-bit Data (00...FFH).

#### NOTE

The Binary format is reserved for future MCC product support.

#### Example: B<ENTER> R<ENTER>

150320...323500<CR><LF>

where:

- 1 Start with Acknowledgment.
- 50 Slave Address 50H.
  - 3 Data with Acknowledgment.
- 20 Data 20H.
- 3 Data with Acknowledgment.
- 23 Data 23H.
- 5 Stop.
- 00 Always 00.

In the above example, a single bus message is uploaded to the Host system in binary format during a Remote Trace.

#### **CTS/RTS Handshaking Command**

#### Syntax: C

#### **Description:**

The CTS/RTS Command is used to toggle Clear-to-Send / Request-to-Send Serial Link flow control. The power-up default condition is CTS/RTS Handshaking disabled.

When enabled, CTS/RTS Handshaking halts monitor serial port output when the Host RTS line is dis-asserted. This feature is useful in preventing serial link data overflow on the host system.

The monitor always supports X-ON/X-OFF Serial link flow control. Sending an X-OFF (Ctrl/S) character to the unit halts serial port output. Sending a subsequent X-ON (Ctrl/Q) character causes output to continue. This feature is useful during a Dump or Remote Trace to temporarily stop data scrolling.

Example: C<Enter> - CTS/RTS Handshaking Enabled

#### **Dump Trace Buffer**

Syntax: D

#### **Description:**

The Dump Trace Buffer command sends all bus data collected during the last PRE-TRIG or POST-TRIG Trace to the serial port. Buffered data is unaltered by this operation.

Data is sent to the serial port in ASCII format. See the ASCII Remote Select command for format details.

Dump Trace Buffer terminates upon exhausting the buffer, or upon receiving an Escape <ESC> character on the serial port.

Screen Pause <Ctrl-S> and Screen Resume <Ctrl-Q> are active.

#### Example: D<Enter>

In the above example, buffered bus messages are uploaded to the Host system in ASCII format during a Dump Trace Buffer operation. See the ASCII Remote Select command for format details.

#### **Enable Bus Simulation**

Syntax: E

#### **Description:**

The Enable Bus Simulation command causes the unit to emulate bus traffic without a bus connection. Emulation provides a learning and testing platform without the need for a working bus.

Bus simulation repetitively generates the following three messages:

10234836536C36C36F500	-	Start #2, "Hello", Stop
10435736F37236C364500	-	Start #4, "World", Stop
2FF500	-	Start #FFH, Stop

See ASCII Remote Select for details on ASCII format.

Once enabled, bus simulation remains in effect until the next unit power-up cycle.

Bus simulation can also be enabled by pressing the BUFFER-UP key during the unit power-up sequence.

**Example:** E<Enter> - Enable Simulation

**Remote Trace** 

Syntax: R

#### **Description:**

The Remote Trace command places the unit in POST-TRIG Trace Mode, and sends all bus traffic to the serial port.

During a Remote Trace, data in temporarily buffered in the unit, then sent to the serial port in the currently selected ASCII or Binary format. See the ASCII Remote Select or Binary Remote Select commands for data format details.

Remote Trace terminates upon receiving a High-to-Low transition on the External Trigger line or an Escape <Esc> character on the serial port.

Screen Pause <Ctrl-S> and Screen Resume <Ctrl-Q> are active.

Example: R<Enter> - Start Remote Trace

In the above example, bus messages are buffered and uploaded to the Host system in the selected ASCII or Binary format. See the ASCII Remote Select or

#### **Select Address**

Binary Remote Select commands for data format details.

Syntax: S(ALL | [Slave Address] )

#### **Description:**

The Select Address command is used to select the bus slave address or addresses the unit will monitor. During a PRE-TRIG, POST-TRIG, or Remote Trace, the unit will capture all messages sent to this address.

Entering parameter ALL instructs the unit to collect bus traffic to all slave addresses.

Entering a slave address parameter specifies a single bus address to monitor.

Slave address selection may also be set with the MONITOR-SELECT or MONITOR-ALL keys. For more information see the "Introduction" section in this guide.

**Example:** SALL<Enter> - Monitor ALL Slave addresses.

S50<Enter> - Monitor slave address 50H.

#### **Test System**

#### Syntax: T

#### **Description:**

The Test System command invokes manufacturing test functions. This command is reserved for MCC use only.

#### NOTE

The Test System command is reserved for MCC manufacturing and support use only.

Syntax: ?

#### **Description:**

The Help command displays the syntax for **Monitor** command set.

**Example:** ?<Enter> - display monitor Help Screen

## **Appendix A - Solving Problems**

#### **Solving Problems**

If you suspect a malfunctioning unit follow the steps described below <u>before</u> contacting MCC for additional assistance.

#### **Problem:**

Unit does not display the sign-on message on the internal LCD display at Power-up.

#### Solution:

- 1. Check the unit power supply. If the power switch is in the ON position, the unit is powered by the internal 9V battery. Check and replace a faulty battery.
- If the switch is in the EXTernal position, the unit can be powered by 5V ACCESS.bus power, the Test Cable A.bV external power lead, or an external 5V wall transformer. Check and replace any faulty power source.

#### **Problem:**

Unit does not display the sign-on message on the Serial Link at Power-up.

#### Solution:

- 1. Check the Serial Link at unit and Host system.
- 2. Confirm that the unit and Host system are communicating at the same baud rate and with the proper communication parameters.

#### **Problem:**

#### Unit does not collect bus traffic in Trace Mode.

#### Solution:

- 1. Check cable connections at the unit and bus. When using the Test Cable, confirm SCL, SDA, and GND clip leads are connected to appropriate bus lines.
- 2. Check Selected Address. If a single bus address is specified, only messages directed to that address will be collected. Confirm presence of bus traffic by monitoring all bus addresses.
- 3. When using the External Trigger Port, the unit will wait for a trigger event. Check the TRIG input using Line Status Mode. A High-to Low transition, with minimum 2usec Low duration, is required to generate a trigger condition.

## **Appendix B - Operating Specifications**

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Operating Specifications					
Parameter	Min	Тур	Max	Unit	
Temperature Range					
Operating Temperature Storage Temperature	0 -25		+50° +70°	C C	
<b>D.C.</b> Characteristics					
External Power Input Current Internal Battery	-5%	5 20 9	$+5\% \\ 40$	V mA V	
<u>SDA and SCL (I<sup>2</sup>C Signals)</u> Input Low Voltage Input High Voltage Input Leakage Current	05 +3.5		+1.5 -5.5 +-20	V V uA	
Input Capacitance w/o Test Cable with Test Cable		20 60		pF pF	
<u>Trigger Input</u> Input Low Voltage Input High Voltage Input Current	-0.5 +1.9		$^{+0.9}_{+5.5}$ 100	V V uA	
Input Capacitance	20		60	pF	

## **Appendix C - Serial Port Commands**

#### **Serial Port Commands**

Command	Syntax	Description
Baud Rate Select	1 <cr> 5<cr></cr></cr>	19.2K baud select 57.6K baud select
ASCII Protocol Select	A <cr></cr>	Configure Remote Trace to send trace data in ASCII format.
Binary Protocol Select	B <cr></cr>	Configure Remote Trace to send trace data in binary format.
CTS/RTS Flow Control	C <cr></cr>	Toggle Clear To Send (CTS) / Request To Send (RTS) RS-232 port flow control.
Dump Trace Buffer	D <cr></cr>	Dump pre-recorded message trace data in ASCII format.
Enable Simulation	E <cr></cr>	Simulate bus message traffic without a bus connection.

Remote Trace	R <cr></cr>	Place monitor in POST-TRIG trace mode and sends all captured bus traffic to the serial port in the current selected format (ASCII or Binary).
Slave Address Select	SALL <cr> Sxx<cr></cr></cr>	Monitor all Monitor single slave address
System Test	T <cr></cr>	Enter test mode
?Help	? <cr></cr>	Display monitor help