User's Guide

iPort/AFM™

RS-232 to I^{2}C Host Adapter with ASCII Fast Mode Interface

with iPort Utility Pack for Windows

MCC
Micro Computer Control
Small Area Network Specialists

www.mcc-us.com

Introduction

The MCC iPort/AFM (#MIIC-203) RS-232 to I^2C Host Adapter with ASCII Fast Mode Interface allows any PC, Host Computer, or Data Terminal with an RS-232 port to become an I^2C Master or Slave device, transmitting or receiving I^2C messages to one or more I^2C devices across an I^2C Bus.

This user's guide describes the installation and operation of the iPort/AFM (#MIIC-203) RS-232 to I^2C Host Adapter with ASCII Fast Mode Interface and iPort Utility Pack Software for Windows.

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Life Support Applications

MCC Products are not designed for use in life support appliances, devices, or systems where the malfunction of a MCC Product can reasonably be expected to result in a personal injury.

WARNING: This equipment can radiate levels of radio frequency energy that may cause interference to communications equipment. Operation of this equipment may cause interference with radio, television, or other communications equipment. The user is responsible for correcting such interference at the expense of the user.

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Part 1

Model MIIC-203

RS-232 to I^{2}C Host Adapter w/ASCII Fast Mode Interface

Model MIIC-203

RS-232 to I^{2}C Host Adapter

iPORT/AFM ™

w/ASCII Fast Mode Interface

Overview

The MCC iPort/AFM (#MIIC-203) RS-232 to I^{2}C Host Adapter with ASCII Fast Mode Interface allows any PC, Host Computer, or Data Terminal with an RS-232 port to become an I^{2}C Master or Slave device, transmitting or receiving I^{2}C messages to one or more I^{2}C devices across an I^{2}C Bus.

PRODUCT FEATURES

- **Turn *ANY* Computer's Serial Port into an I^{2}C Port.**
- **Supports Standard (100) and Fast (400) I^{2}C Bus Activity.**
- **High Performance Bus Co-Processor**
- **Maximum Bus Throughput with Low Overhead.**
- **19.2, 57.6, and 115.2 k selectable Baud Rates.**
- **Supports Bus Master and Slave, Transmit and Receive, and $\overline{\text{INT}}$ Signaling .**
- **Compatible with 3v to 5v I^{2}C at up to 400kbit/s.**
- **Compatible with iPort/AI applications.**

The iPort/AFM system consists of the following components:

1) iPort/AFM Adapter
This adapter plugs into an RS-232 Port on a host computer and generates I^{2}C Bus signals.

2) iPort Utility Pack Software
This software package, included with each iPort, includes the iPort Message Manager and Message Center applications to easily send and receive I^{2}C Bus messages.

3) Programmer's Reference
This section includes ASCII command interface definitions and example code to assist in developing a custom application for the iPort/AFM adapter.

Packing Slip

This package includes the following items:

- iPort/AFM (#MIIC-203) RS-232 to I^2C Host Adapter with ASCII Fast Mode Interface.
- 4 Foot I^2C Interface Cable. (#CAB4)
- 1Ft. /$\overline{\text{INT}}$-Trigger Cable (#AXM-12G)
- Serial Port Cable, 9F/25M, 1 Foot Long. (#C9F25M1)
- 1Ft. /$\overline{\text{INT}}$-Trigger Cable (#AXM-12G)
- iPort/AFM User's Guide.
- iPort Utility Pack for Windows Software.
- Power Supply
  Standard 120VAC, 60Hz, USA Plug (#MWT-5VA)
  European 220VAC, 50Hz, European Plug (#MWT-5VAE)
  International 120/220/240VAC, 50-60Hz, Int.Plug selection (#MWT-5VAI)

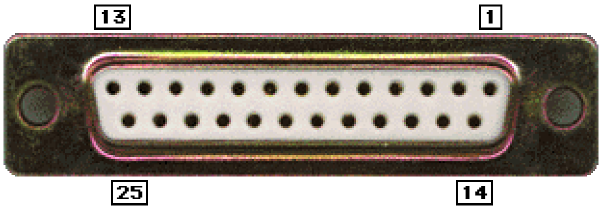
System Requirements

a. Host computer
b. 1 free RS-232 Serial Port

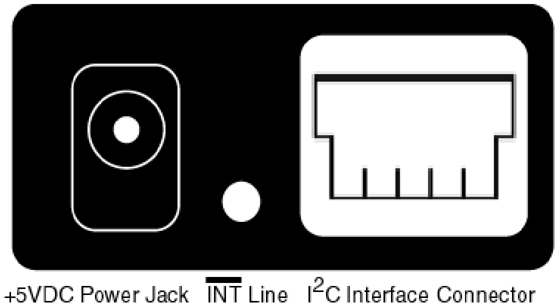
Interconnects

The I^2C Bus Host Adapter includes four interconnections:

1. RS-232 Serial Port Connector



RS-232 Serial Port Connector



This connector provides connection to the serial port on the PC. Use the #C9F25M1 cable to adapt the iPort to 9-pin serial ports.

DB-25 Serial Port Pinout

DB-25 Pin 2, Transmit Data from the Host Computer to the iPort
DB-25 Pin 3, Receive Data from the iPort to the Host Computer.
DB-25 Pin 4, Request to Send from the Host Computer to iPort.
DB-25 Pin 5, Clear to Send from the iPort to the Host Computer.
DB-25 Pin 7, Ground between Host Computer and iPort

DB-9 Serial Port Pinout

DB-9 Pin 3, Transmit Data from the Host Computer to the iPort
DB-9 Pin 2, Receive Data from the iPort to the Host Computer.
DB-9 Pin 7, Request to Send from the Host Computer to iPort.
DB-9 Pin 8, Clear to Send from the iPort to the Host Computer.
DB-9 Pin 5, Ground between Host Computer and iPort

Transmit Data, Receive Data, and Ground are required in all cases. Request to Send and Clear to Send are required if RTS/CTS communication handshaking protocol is selected. See the iPort/AFM Flow Control command.

Communication Handshaking Protocol

iPort/AFM implements either XON/XOFF (by default) or RTS/CTS flow control protocols. Either protocol can be selected with the iPort/AFM Flow Control command. Flow control is used by the iPort/AFM to limit character flow to and from the Host computer to avoid overflowing internal communication buffers and lost data.

Communication Parameters

19,200, 57.6k, or 115.2k Baud, No Parity, 8 Data Bits, 1 Stop Bit

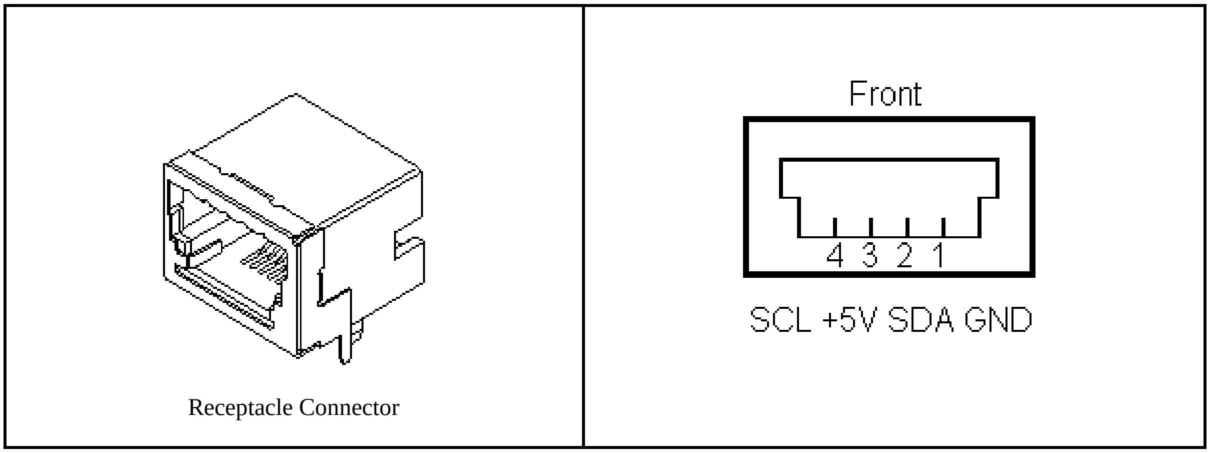
The default baud rate is 19,200 until the iPort/AFM receives a Baud Change command from the host computer.

2. +5VDC Power Jack

The iPort/AFM Host Adapter can be powered in one of two ways, from the power jack, or from the I^{2}C interface connector. If the unit is powered from the provided +5VDC Wall Transformer, approximately 250ma of regulated +5VDC is available at the I^{2}C interface connector to power external devices. If the iPort/AFM is powered from the I^{2}C connector, the unit requires 50ma of regulated +5VDC.

3. I^{2}C Interface Connector

The iPort/AFM Host Adapter includes a four wire, positive locking, modular connector (see Appendix A for more info on these parts) for interfacing to an external I^{2}C Bus. Lines provided include I^{2}C Clock (SCL), Data (SDA), Ground, and +5VDC.



Receptacle Connector

An I^{2}C Interface Cable (White=SCL, Red=+5VDC, Green=SDA, Black=Ground) is provided to connect to a external I^{2}C Bus. Since there is no standard I^{2}C Bus connector, you may want to cut off one end of the cable and add a connector compatible with your target system.

Additional I^{2}C Interface Cables (4 ft., 8ft., or 16 ft.) and above mentioned modular connectors are available from MCC. Clip Lead cables are also available. (see Appendix A)

4. $\overline{\text{INT}}$, Interrupt Signal Control

The iPort/AFM provides an open drain input/output ($\overline{\text{INT}}$) which can be connected to a corresponding pin on a master or slave. The $\overline{\text{INT}}$ Signal allows the iPort/AFM to participate in $\overline{\text{INT}}$ master and/or slave communications.

An interrupt output ($\overline{\text{INT}}$=low) is generated upon receiving an iNterrupt assert command from the host computer. Resetting and reactivating the interrupt signal is achieved when a release command is received from the host computer or data is read from or written to the iPort/AFM when addressed as an I^{2}C Bus slave.

Interrupt monitoring is enabled upon receiving an enable command from the host computer. Interrupt monitoring causes the iPort/AFM to send notification to the host computer when the $\overline{\text{INT}}$ signal changes state.

Hardware Configuration

Pull-up Resistors

The iPort/AFM Host Adapter includes a slide switch used to enable or disable internal 1.8K ohm Pull-Up resistors on the SCL, SDA, and $\overline{\text{INT}}$ lines. Every I^{2}C Bus system must have at least one Pull-Up on each line. Use this switch to configure the iPort/AFM appropriately for your system.

Connecting to a 3.3v System

1. Shut off iPort internal pull-ups. (See Pull-up Resistor section)
2. Use external pull-ups to 3.3 volts.

The iPort uses a 5 volt device. 3.3v is high enough for the iPort to see a Logical 1.

Connecting to an SMBus System

1. Shut off iPort internal pull-ups. (See Pull-up Resistor section)
2. Use external SMBus rated (approx. 15k ohm) pull-up resistors.

Hardware Set-Up

1. Attach your iPort/AFM (#MIIC-203) to an open ComPort on your computer. If your ComPort has a DB9 connector, use DB-9F to DB-25M Serial Port Adapter Cable included with your iPort/AFM to connect.

2. Connect the power supply provided or see Interconnect Section +5VDC Power Jack.

3. Connect I^{2}C Interface Cable to iPort/AFM and your I^{2}C device. If your device does not have the matching connector (#15830064) you can cut the end of the cable and attach the individual wires to your device or you can purchase our clip-lead cable(#CABCL).

4. Connect $\overline{\text{INT}}$ line if used.

Part 2

iPort Utility Pack for Windows

V5

iPort Utility Pack for Windows

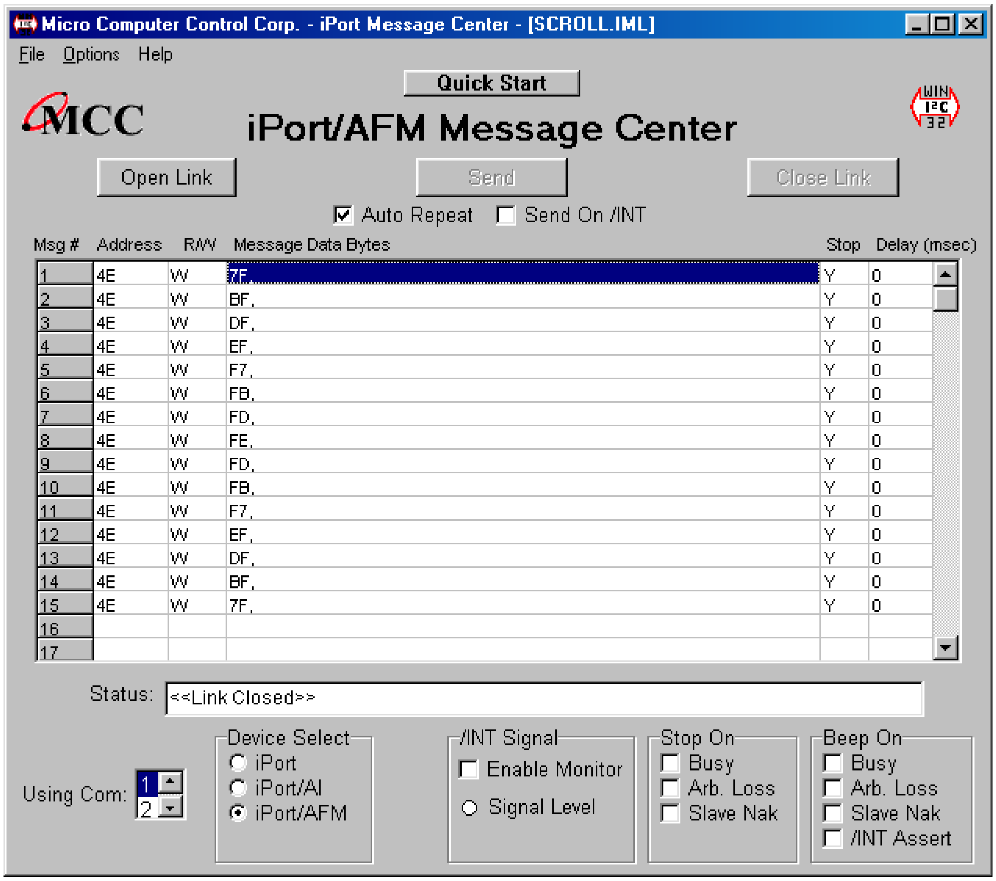
1. Introduction to Utility Pack

This product includes two (2) Windows applications (Message Manager and Message Center) that help a user get started sending and receiving I^{2}C Bus messages quickly.

iPort Message Center

The iPort Message Center operates with all versions of the iPort I^{2}C Bus Host Adapter. With this program you can create, save, and execute scripts of the following modes of I^{2}C Bus message activity:

- Master Transmit
- Master Receive



☑ Auto Repeat ☐ Send On /INT

Msg #	Address	R/W	Message Data Bytes	Stop	Delay (msec)
1	4E	W	7F,	Y	0
2	4E	W	BF,	Y	0
3	4E	W	DF,	Y	0
4	4E	W	EF,	Y	0
5	4E	W	F7,	Y	0
6	4E	W	FB,	Y	0
7	4E	W	FD,	Y	0
8	4E	W	FE,	Y	0
9	4E	W	FD,	Y	0
10	4E	W	FB,	Y	0
11	4E	W	F7,	Y	0
12	4E	W	EF,	Y	0
13	4E	W	DF,	Y	0
14	4E	W	BF,	Y	0
15	4E	W	7F,	Y	0
16					
17					

Status: <<Link Closed>>

Using Com: 1 2

Device Select
○ iPort
○ iPort/AI
● iPort/AFM

/INT Signal
☐ Enable Monitor
○ Signal Level

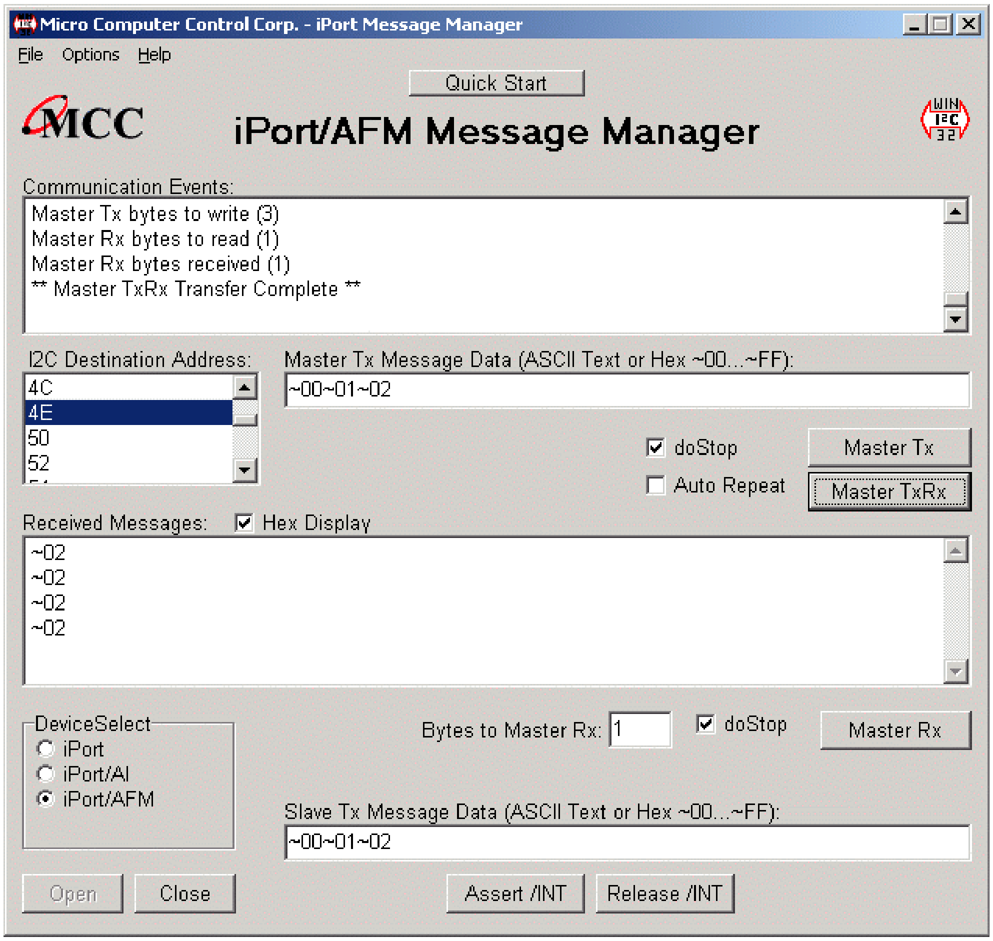
Stop On
☐ Busy
☐ Arb. Loss
☐ Slave Nak

Beep On
☐ Busy
☐ Arb. Loss
☐ Slave Nak
☐ /INT Assert

iPort Message Manager

The Message Manager operates with all versions of the iPort I^{2}C Bus Host Adapter. Using this program you can perform all four (4) modes of I^{2}C Bus messages activity, including:

- Master Transmit
- Master Receive
- Slave Transmit
- Slave Receive



Communication Events:

```
Master Tx bytes to write (3)
Master Rx bytes to read (1)
Master Rx bytes received (1)
** Master TxRx Transfer Complete **
```

I2C Destination Address: 4C, 4E (selected), 50, 52

Master Tx Message Data (ASCII Text or Hex ~00...~FF): ~00~01~02

☑ doStop

☐ Auto Repeat

Received Messages: ☑ Hex Display

```
~02
~02
~02
~02
```

DeviceSelect

○ iPort

○ iPort/AI

● iPort/AFM

Bytes to Master Rx: 1 ☑ doStop

Slave Tx Message Data (ASCII Text or Hex ~00...~FF): ~00~01~02

2. System Requirements

a. One of the following:

1. iPort (#MIIC-201) Windows to I^{2}C Bus Host Adapter.
2. iPort/AI (#MIIC-202) RS-232 to I^{2}C Bus Host Adapter with ASCII Interface
3. iPort/AFM (#MIIC-203) RS-232 to I^{2}C Bus Host Adapter with ASCII Fast Mode Interface.

b. Windows 95 or higher
c. 1 free RS-232 Serial Port.

3. Software Installation

Windows 95 and Above:

1. Insert software distribution diskette into floppy drive.

2. Select Start│Run. Type “A:SETUP.EXE”.

3. Follow instructions on screen.

iPort Message Center for Windows

Introduction to Message Center

The iPort Message Center supports I^2C Master Transmit and Receive activities for all versions of the iPort I^2C Bus Host Adapter. With this program you can create, save, and execute scripts of I^2C Master messages.

The MCC iPort Message Center Software, when used with an MCC iPort allows a PC to become an I^2C Master transmitter or receiving device, sending I^2C messages between the PC and one or more I^2C devices across an I^2C Bus.

The iPort Message Center is designed to be a simple application for experimenting with I^2C messages. It provides methods to:

1. Edit a list of I^2C Master Transmit or Receive Messages.

2. Save and/or Load a list of I^2C Master messages to/from disk.

3. Transmit the current list of I^2C Master messages, with the option to auto repeat upon completion, or send on $\overline{\text{INT}}$ assert (low). (iPort/AFM only)

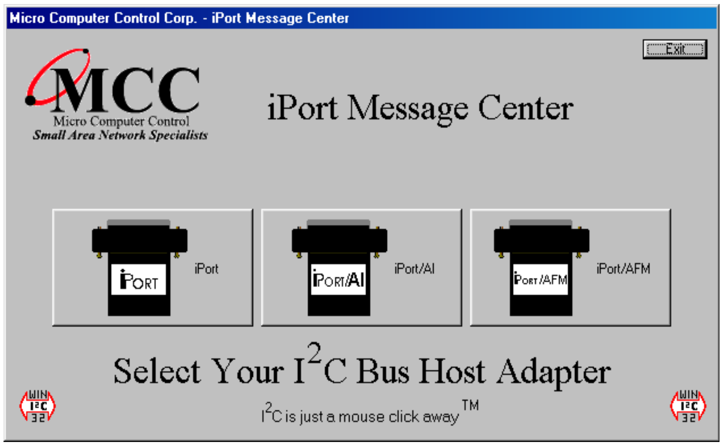
Each iPort Message Center I^2C message can include up to 32 bytes of 8-bit data, with an optional time delay at the completion of each message.

I^{2}C Message Operations

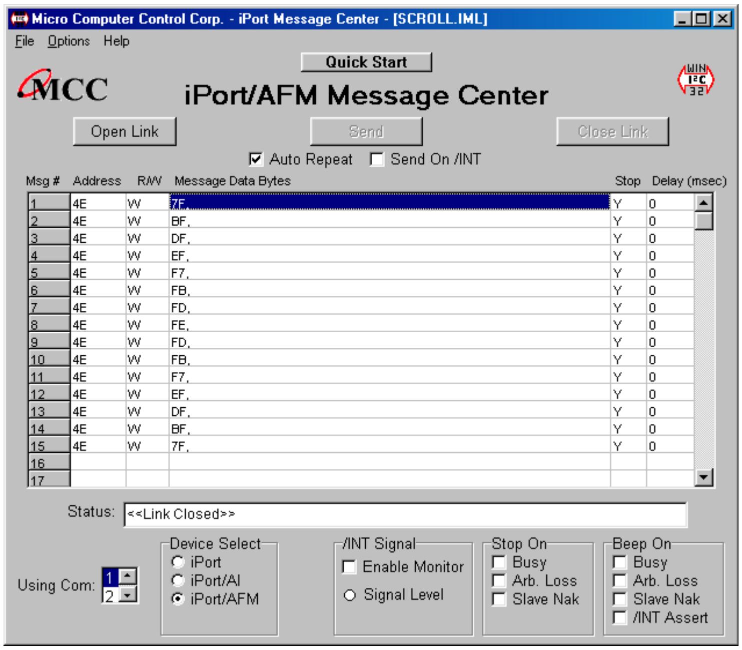
In order to communicate with another I^{2}C device, a user must take the following steps:

1. Start | Programs | iPort Utility Pack | iPort Message Center

2. Select which device you are operating with by choosing the corresponding image (Opening Screen), or the correct checkbox on the main application.


Micro Computer Control Corp. - iPort Message Center
Exit
MCC
Micro Computer Control
Small Area Network Specialists
iPort Message Center
iPort
iPort/AI
iPort/AFM
Select Your I^{2}C Bus Host Adapter
I^{2}C is just a mouse click away TM

Opening Screen



☑ Auto Repeat ☐ Send On /INT

Msg #	Address	R/W	Message Data Bytes	Stop	Delay (msec)
1	4E	W	7F,	Y	0
2	4E	W	BF,	Y	0
3	4E	W	DF,	Y	0
4	4E	W	EF,	Y	0
5	4E	W	F7,	Y	0
6	4E	W	FB,	Y	0
7	4E	W	FD,	Y	0
8	4E	W	FE,	Y	0
9	4E	W	FD,	Y	0
10	4E	W	FB,	Y	0
11	4E	W	F7,	Y	0
12	4E	W	EF,	Y	0
13	4E	W	DF,	Y	0
14	4E	W	BF,	Y	0
15	4E	W	7F,	Y	0
16					
17					

Status: <<Link Closed>>

Using Com: 1 / 2

Device Select: ○ iPort ○ iPort/AI ● iPort/AFM

/INT Signal: ☐ Enable Monitor ○ Signal Level

Stop On: ☐ Busy ☐ Arb. Loss ☐ Slave Nak

Beep On: ☐ Busy ☐ Arb. Loss ☐ Slave Nak ☐ /INT Assert

Main Application

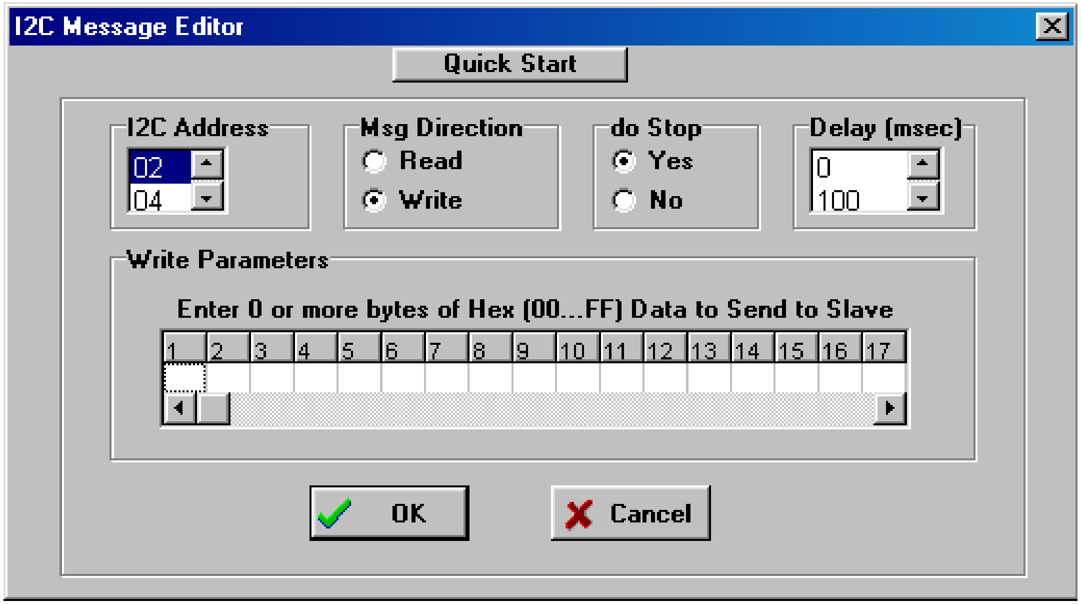
The Main Application screen is opened by selecting an image on the Opening Screen.

3. Select the PC ComPort where the iPort is connected to your computer.

4. Use the Options menu to override default Baud Rate and I^{2}C Bus Clock rate settings.

5. Establish a link to the iPort with the Open button. The iPort Message Center software sets the iPort's own I^{2}C Slave address to 0xFE.

6. To open an existing message list, click File|Open List on the menu bar. To enter or edit a message List, open the "I^{2}C Message Editor" screen, by double clicking on a message row in the spreadsheet.



I2C Address: 02
04

Msg Direction: ○ Read ● Write

do Stop: ● Yes ○ No

Delay (msec): 0
100

Write Parameters

Enter 0 or more bytes of Hex (00...FF) Data to Send to Slave

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17

Now you can:

a. Set the I^{2}C address (i.e. 4C, 4E, etc.)
b. Set Msg Direction (Read or Write)
c. Do stop (yes or no, Repeated starts)
d. Set time delay (delay in msec, controls speed of activity).
e. Write message data (from 00 to FF) or read count.
f. Click OK.

Repeat above steps for additional messages.

You can insert a new message between existing messages by clicking once on message below where you want to insert, press the “Insert” button on your keyboard, this will bring up the I^2C Message Editor screen, set all information and click OK.

7. On the main screen, click on Send to transmit the current list of I^2C Master messages, with the option to auto repeat upon completion, or send on $\overline{\text{INT}}$ assert (low).

Once the link has opened successfully, you are now an active I^2C node. Messages are entered into the message spreadsheet and are transmitted upon clicking the Send button. Data received as part of a Master Receive message replaces the 0xFF placeholders in the message spreadsheet control.

If you get a “Slave Not Acknowledging” message in the Communications Events window, this could mean you have the wrong address in the I^2C Destination Address, or the device is not answering to its address.

iPort Message Manager Software for Windows

Introduction to Message Manager

The MCC iPort Message Manager Software, when used in conjunction with an MCC iPort allows a PC to become an I^2C Master or Slave device, transmitting or receiving I^2C messages between the PC and one or more I^2C devices across an I^2C Bus.

The iPort Message Manager is designed to be a simple application for experimenting with I^2C messages. It provides methods to:

1. Set the device’s I^2C Slave address, General Call Enable, and other operating parameters.

2. Master Transmit ASCII text or Hex [~00...~FF] data to a specified I^2C Slave Receiver device.

3. Master Receive data from a specified I^2C Slave Transmitter device.

4. Perform Master Read after Write operation.

5. Slave Transmit data to a requesting I^2C Master Receive device.

6. Display Slave Receiver data.

7. Assert or release the $\overline{\text{INT}}$ signal (iPort/AFM only).

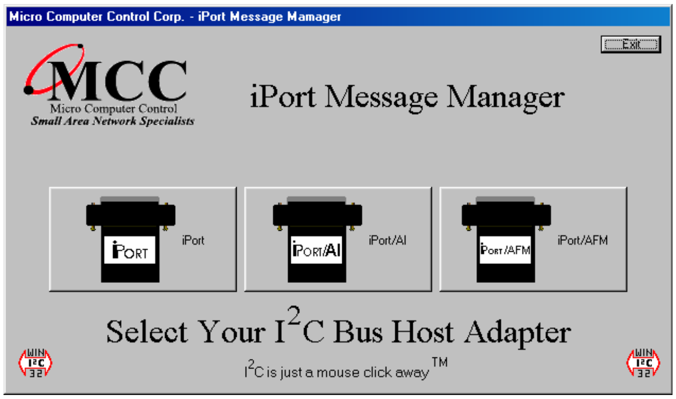
Each iPort Message Manager I^2C message can include up to 23 bytes of 8-bit ASCII binary data, although the iPort itself is capable of sending or receiving I^2C messages up to 64K bytes in length.

I^{2}C Message Operations

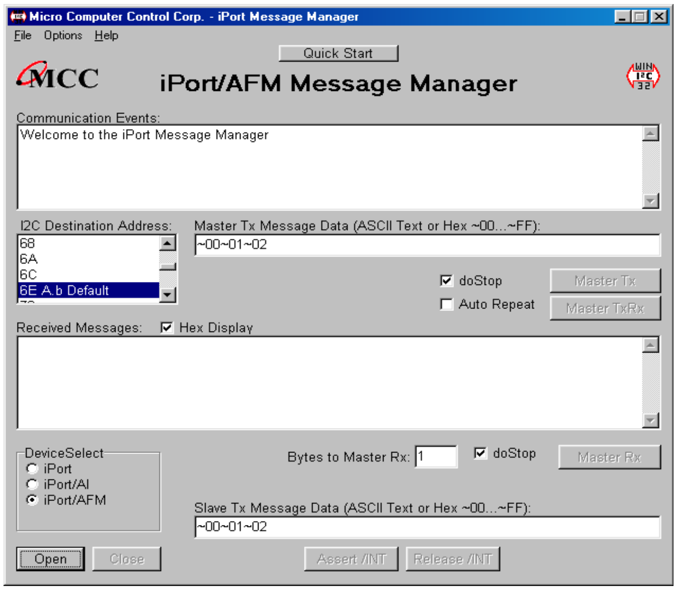
In order to communicate with another I^{2}C device, a user must take the following steps:

1. **Starting the program**:
   Start │Programs │iPort Utility Pack │ iPort Message Manager

2. **Select iPort Device**
   Select which device you are operating with by choosing the corresponding image (Opening Screen), or the correct checkbox on the main application.


Micro Computer Control Corp. - iPort Message Mamager
Exit
MCC
Micro Computer Control
Small Area Network Specialists
iPort Message Manager
iPort
iPort
iPort/AI
iPort/AI
iPort/AFM
iPort/AFM
Select Your I2C Bus Host Adapter
I2C is just a mouse click away TM
WIN I2C 32

Opening Screen



Communication Events:
Welcome to the iPort Message Manager

I2C Destination Address:
68
6A
6C
6E A.b Default

Master Tx Message Data (ASCII Text or Hex ~00...~FF):
~00~01~02

☑ doStop
☐ Auto Repeat

Received Messages: ☑ Hex Display

DeviceSelect
○ iPort
○ iPort/AI
● iPort/AFM

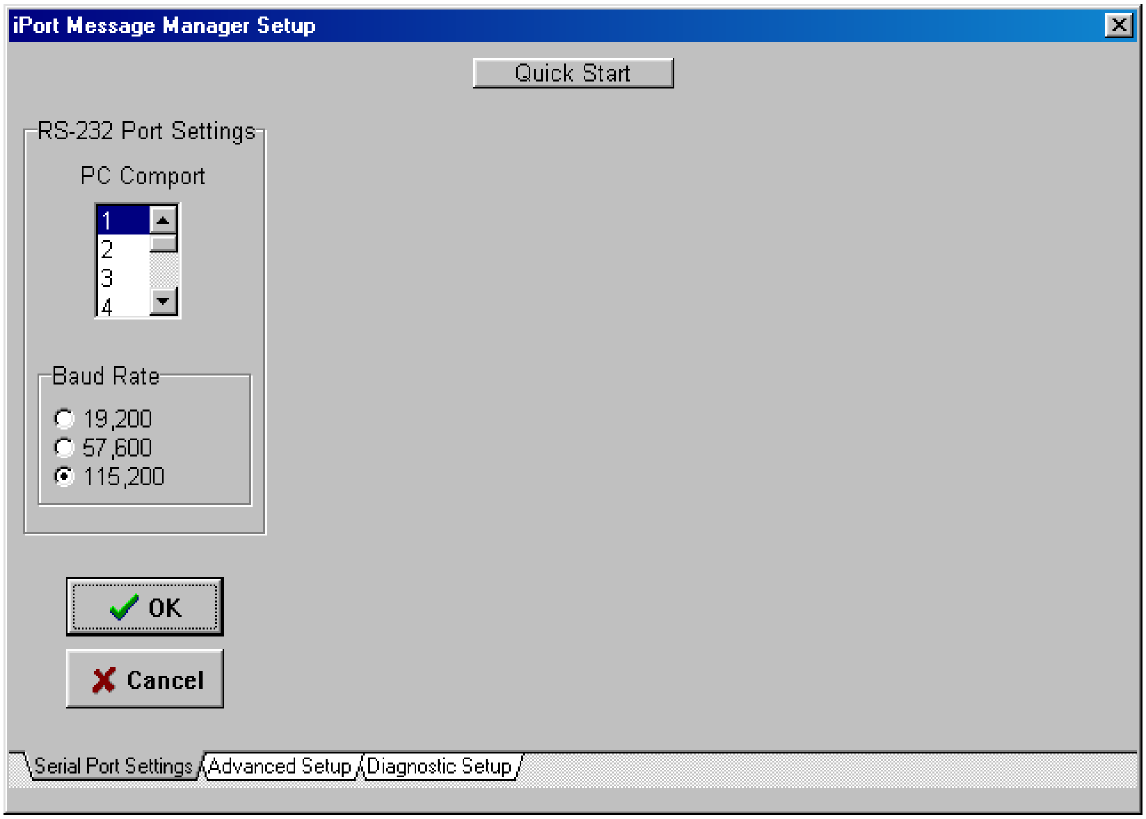
Bytes to Master Rx: 1
☑ doStop

Slave Tx Message Data (ASCII Text or Hex ~00...~FF):
~00~01~02

Main Application

The Main Application screen is opened by selecting an image on the Opening Screen.

3. **Establish iPort Link**
   On the Message Manager main screen, click the Open button to view the Set Up Screen. You now have three options of set-up for the Message Manager, Basic Set-up, Advanced Set-up, and Diagnostic Set-up.



RS-232 Port Settings

PC Comport: 1 (selected), 2, 3, 4

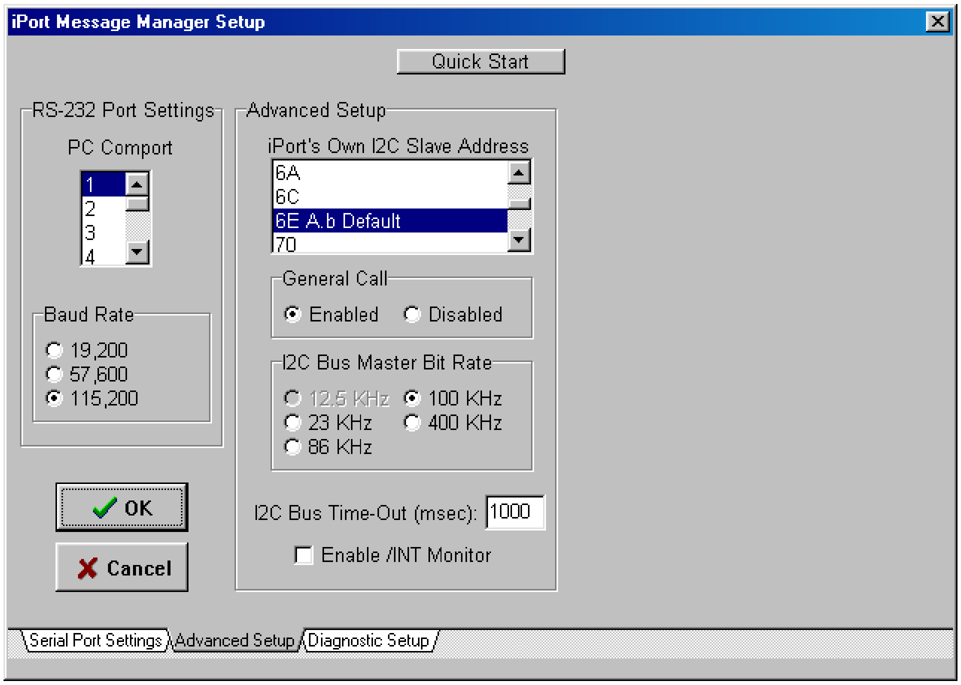
Baud Rate

○ 19,200
○ 57,600
● 115,200

Basic Set Up Screen

Basic Set-up

Select the PC ComPort attached to your iPort and the baud rate, then click OK. The Communications Events window on the Main Screen should report “I^{2}C Open Successful”. If this message does not appear, check the iPort connections and power.



RS-232 Port Settings

PC Comport: 1 (selected), 2, 3, 4

Baud Rate: ○ 19,200 ○ 57,600 ● 115,200

Advanced Setup

iPort's Own I2C Slave Address: 6A, 6C, 6E A.b Default (selected), 70

General Call: ● Enabled ○ Disabled

I2C Bus Master Bit Rate: ○ 12.5 KHz ● 100 KHz ○ 23 KHz ○ 400 KHz ○ 86 KHz

I2C Bus Time-Out (msec): 1000

□ Enable /INT Monitor

Advanced Set Up Screen

Advanced Set-up

On the Advanced Set-up screen you can set the following parameters:

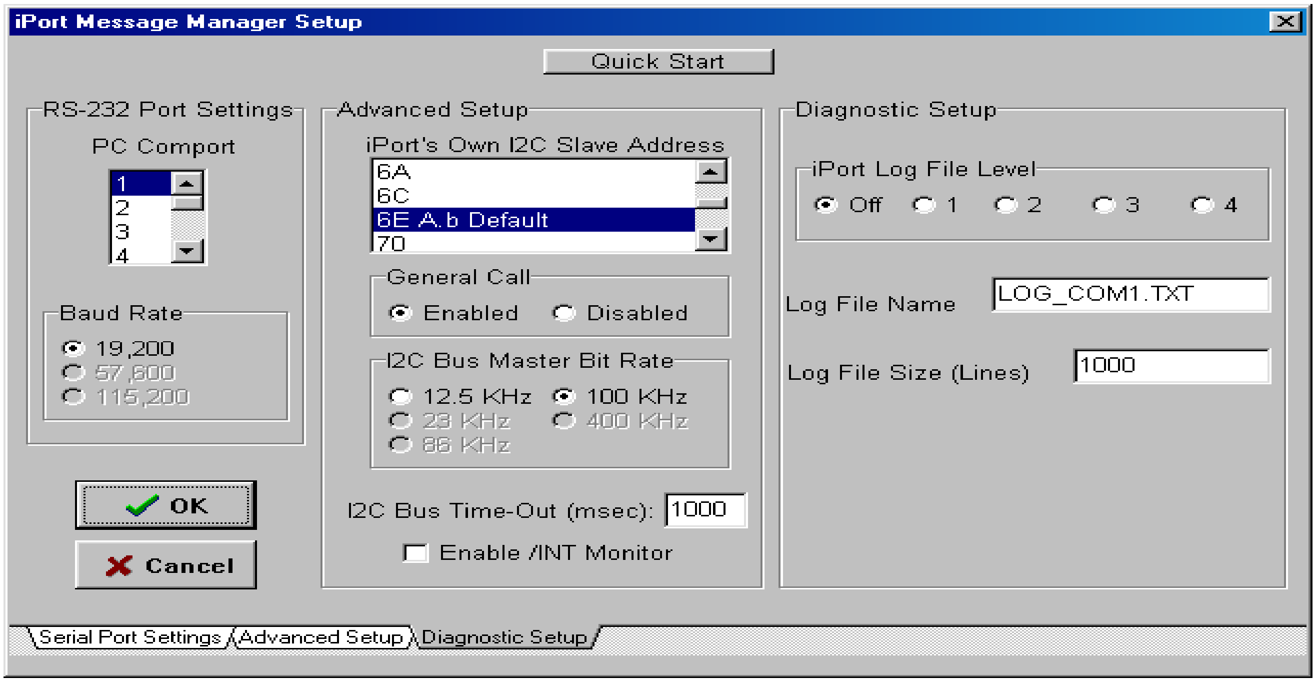
1. iPort I2C Slave Address
   Select iPort's I^2C slave address. iPort will acknowledge messages sent to this address.

2 .iPort General Call
   Enabled allows iPort to respond to the I^2C general call address (00). General call is used to broadcast an I^2C message to multiple devices.

3. I^2C Bus Master Bit Rate (iPort, iPort/AFM)
   The speed of the Bus will run. 100KHz is standard mode, 400kHz is fast mode. Use other rates if you are having trouble talking to a very slow slave device.

4. I^2C Bus TimeOut (Msec) (iPort, iPort/AFM)
   Control how long iPort will wait before reporting an I^2C Bus intra-message timeout. (0=None, 1...32767 msec)

5. Enable INT monitor (iPort/AFM only)
   Enables monitoring of the INT signal state. INT state changes are reported in the main screen Communications Events window.



RS-232 Port Settings

PC Comport: 1 (selected), 2, 3, 4

Baud Rate: ● 19,200 ○ 57,600 ○ 115,200

Advanced Setup

iPort's Own I2C Slave Address: 6A, 6C, 6E A.b Default (selected), 70

General Call: ● Enabled ○ Disabled

I2C Bus Master Bit Rate: ○ 12.5 KHz ● 100 KHz ○ 23 KHz ○ 400 KHz ○ 88 KHz

I2C Bus Time-Out (msec): 1000

□ Enable /INT Monitor

Diagnostic Setup

iPort Log File Level: ● Off ○ 1 ○ 2 ○ 3 ○ 4

Log File Name: LOG_COM1.TXT

Log File Size (Lines): 1000

Diagnostic Set Up Screen

Diagnostic Set-up (iPort Only)

On the Diagnostic Set-up screen you can set the following parameters:

1. iPort Log File Level
   Select iPort logging level.1 gives minimal info, 4 is verbose. Use the log file to troubleshoot communication problems.

2. Log File Name
   iPort log file name if enabled.

3. Log File Size (Lines)
   iPort log file length if enabled.

4. Set the Destination Slave Address

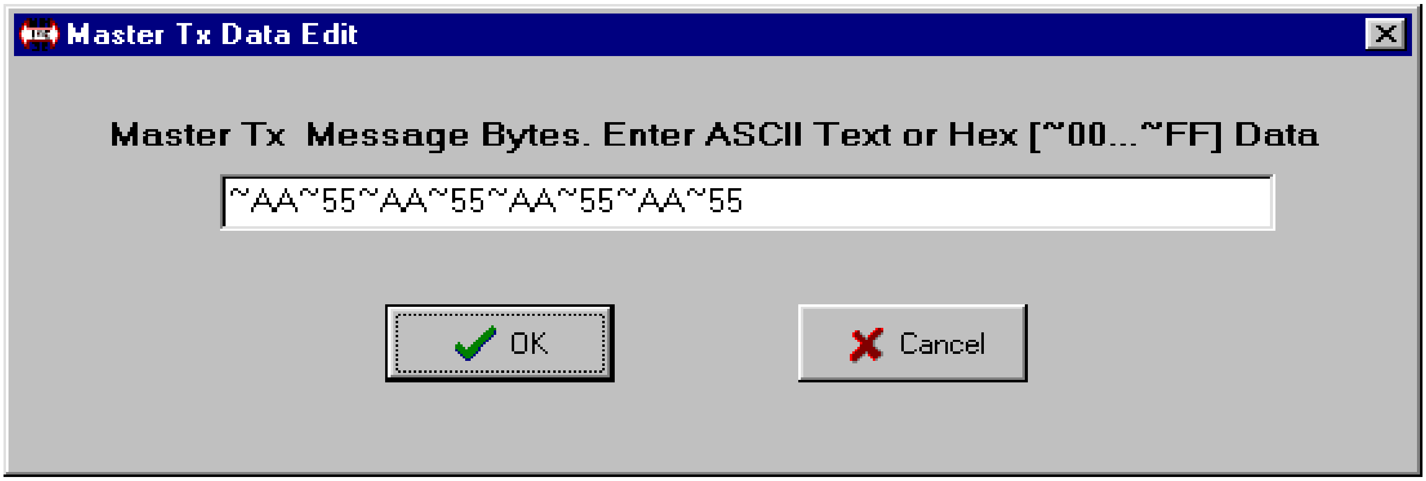
On the main screen, use the I^{2}C Destination Address list control to set the slave address of the device you want to communicate with.

Additional operating information is available by viewing the Status and Log File. (Option available only for the iPort).

Sending Messages

Master Operations

1. **To Master Transmit Data**
   On the main screen, set the Master Tx Message Bytes edit box to the data you want to send by single clicking on the box. For example: To send a 0x05(hexadecimal) to the device, enter ~05 in the edit box. Click Ok and then the Master TX button to send the message. The Communications Events window on the main screen should report “Master TX Complete”. If this message does not appear, check the slave device address, connections, and power.



Master Tx Data Edit

Master Tx Message Bytes. Enter ASCII Text or Hex [~00...~FF] Data

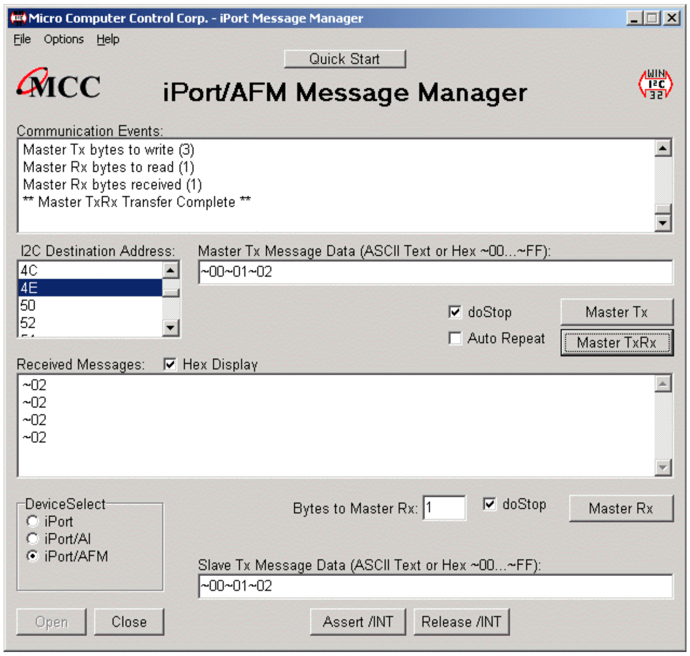
~AA~55~AA~55~AA~55~AA~55

Example: to send message 0x01, 0x02, 0x03, type in ~01~02~03.

You have the option to Auto Repeat a transmitted message upon completion by checking the Auto Repeat box. Also you may do a DoStop which will perform repeated starts automatically.

2. **To Master Receive Data**

On the main screen, use the I^{2}C Destination Address list control to set the slave address of the device you want to communicate with.



Communication Events:
```
Master Tx bytes to write (3)
Master Rx bytes to read (1)
Master Rx bytes received (1)
** Master TxRx Transfer Complete **
```

I2C Destination Address: 4C, 4E, 50, 52

Master Tx Message Data (ASCII Text or Hex ~00...~FF): ~00~01~02

☑ doStop

☐ Auto Repeat

Received Messages: ☑ Hex Display
```
~02
~02
~02
~02
```

DeviceSelect
○ iPort
○ iPort/AI
● iPort/AFM

Bytes to Master Rx: 1 ☑ doStop

Slave Tx Message Data (ASCII Text or Hex ~00...~FF): ~00~01~02

Main Application Screen

On the lower part of the main screen, set the Bytes to MasterRx edit box to the number of bytes you want to read. For example: Set this to 1 to read a single byte. Click on the Master RX button to receive the message. Data received from the slave is displayed in the Received Messages text box on the main screen. The Communications Events window should report “Master RX Transfer Complete”. If this message does not appear, check the slave device address, connections, and power.

If you get a “Slave Not Acknowledging” message in the Communications Events window, this could mean you have the wrong address in the I^{2}C Destination Address, or the device is not answering to its address.

You have the option to Auto Repeat a transmitted message upon completion by checking the Auto Repeat box. Also you may do a DoStop which will perform repeated starts automatically. Another option you have is to do “DoNak”, which allows you to Ack or Nak the last byte coming from a Slave Transmitter. Some Slave Transmitter Devices require a Nak on the final byte going across the bus. (Option only available for the windows iPort).

Slave Operations

To Slave Transmit a message:

Enter data to be transmitted in the Slave Tx Message Bytes control by single clicking. Binary data bytes are entered using a three character Hex-Equivalent format (~00 ... ~FF), you may also type in ASCII text. These bytes are automatically transmitted when a Slave Transmit Request is received from a Master device.

To Slave Receive a message:

Data bytes received from a Master Transmitter are automatically displayed in the Received Message window. Received binary data is displayed using a three character Hex-Equivalent format (~00 ... ~FF). By selecting the Hex-Display checkbox, the data is displayed as Hexadecimal data .

Uninstalling iPort Utility Pack

Click, Start | Programs | iPort Utility Pack | uninstall.

Follow the on screen instructions.

Part 3

Programmer’s Reference

ASCII Command Interface Definitions

V2

iPort/AFM
Quick Start

Follow these steps to start sending and receiving I^{2}C messages:

1. Install iPort/AFM as directed in the “Installation Instructions” section of this User’s Guide.
2. Use a terminal emulator program (like the Windows Terminal Program or Windows Hyperterminal) to get started. Remember to select the correct Com Port (COM1, COM2,…) and set the terminal emulator to 19200 Baud, 8 Data Bits, No Parity, and 1 Stop Bit.
3. Enter **//** to get an iPort/AFM Status Report. **Note**: All iPort/AFM commands are terminated with a Carriage Return character. On most terminal emulators press the Enter key.
4. Enter **/E1** to Enable the Echo/Prompt feature. This makes it easier for a person to interact with the iPort/AFM from a terminal.
5. Enter **/F0** or **/F1** to set iPort/AFM’s communications Flow Control to match your terminal.
6. Enter **/Ixx** (xx = 02…FE even) to set iPort/AFM’s Own I^{2}C Slave Address.
7. Enter **/O** to Open the iPort/AFM Connection. The iPort/AFM does not need to be connected to an I^{2}C Bus to open a connection.
8. Enter **/Dxx** (xx = 00…FE even) to select a Destination I^{2}C Slave Address.
9. Enter **/Ttext** (text = ASCII or Hex-Equivalent ~00…~FF) to Master Transmit a message to the current Destination I^{2}C Slave device.
10. Enter **/Rn** (n = 0…32767) to Master Read a message from the current Destination I^{2}C Slave device.

Syntax: [CR] = Carriage Return

The following sections provide detailed information on all **iPort/AFM** ASCII Commands and Prompts.

For the latest product information and application note
visit our web site at:

http://www.mcc-us.com

iPort/AFM
ASCII Text Interface Commands

Note: [CR] = Carriage Return Code or Enter Key.
Syntax: [Select], (Optional), xx = [00..FE], n = [0..32767]

Command	**Description**
Ctrl/R,Ctrl/R,Ctrl/R	**iPort/AFM Reset** This command resets the iPort/AFM to its default state.
//[CR]	**Status Display** Display iPort/AFM status information.
/B[0|1|2][CR]	**RS-232 Baud Rate Control** Set the RS-232 Baud rate (0 = 19.2, 1 = 57.6, 2 = 115.2 Baud)
/C[CR]	**Close I^{2}C Connection** Disconnect from the I^{2}C Bus.
/Dxx[CR]	**Set Destination I^{2}C Slave Address** Set the destination I^{2}C Slave Address for subsequent Master Transmit or Receive operations.
/E[0|1][CR]	**Echo/Prompt Control [0 = Disable, 1 = Enable]** Enable/Disable data entry echo and prompts.
/F[0|1][CR]	**Flow Control [0 = XON/XOFF, 1 = RTS/CTS]** Select serial communication handshaking protocol.
/G[0|1][CR]	**I^{2}C General Call Control [0 = Disable, 1 = Enable]** Enables/Disables iPort/AFM response to I^{2}C Bus General Call (00) messages.
/H[0|1][CR]	**Hex Only Display Control [0 = Disable, 1 = Enable]** Controls display format of received message data.
/Ixx[CR]	**Set iPort/AFM's Own I^{2}C Slave Address** Sets iPort/AFM's own I^{2}C Slave Address. iPort/AFM will respond to I^{2}C Bus messages sent to this address.
/K[0|1|2|3][CR]	**I^{2}C Bus Clock Rate Control** Set I^{2}C Bus Clock Rate Control (0=23, 1=86, 2=100, 3=400 KHz)
/M[CR]	**Command Menu Display** Display iPort/AFM's Command Menu

/N([0|1|A|R])[CR]	**iNterrupt Signal Monitor/Control/Status** Sets Monitor/Control/Status of INT line. [0 = Disable, 1 = Enable, A = Assert, R = Release/CR=Status]
/O[CR]	**Open I^{2}C Connection** Activates iPort/AFM as an I^{2}C device attached to the bus.
/(*)Rn[CR]	**Master Read Message** Read the specified number of data bytes from the current Destination I^{2}C Slave device. * = No Stop for Repeated Start
/S(text)[CR]	**Slave Transmit Message** Write the specified data bytes to a requesting I^{2}C Master Receiver device.
/(*)T(text)[CR]	**Master Transmit Message** Master Transmit the specified data bytes to the current Destination I^{2}C Slave device. * = No Stop for Repeated Start
/Un[CR]	**I^{2}C Bus Time-oUt** Set I^{2}C Bus Time-oUt in msec (0=Disable)
/V[CR]	**Display Firmware Version** (Major XX.XX Minor) (Requires Version 2.0 or later)
/X[CR]	**eXtended Commands** (See Prompt or User's Guide) (Requires Version 2.0 or later)
/Y[CR]	**Display Tx bYte Count** (Requires Version 2.0 or later)

Note: An online version of this programmer's reference is available at: http://www.mcc-us.com/203ug.htm

Synchronous Interface Events

Synchronous Events are those iPort/AFM interface activities initiated by the Host computer.

iPort/AFM Reset

This command resets iPort/AFM to its default state.

This command consists of three (3) sequential Ctr/R characters.

Ctr/R is the character code Decimal 18 and Hexadecimal 12, and can also be generated by holding down the Ctrl Key and pressing R.

Note: It is recommended that the Host computer turn off all serial port flow control before sending this command. Flow control should be enabled once the response is received.

```
Command: Ctrl/R,Ctrl/R,Ctrl/R   ‘iPort Reset
Response. *                     ‘iPort/AFM Ready
Default Setting:                 None
```

Status Display

This command displays current iPort/AFM status.

Command: //[CR] 'Status Display
Response:

iPort/AFM I^2C Host Adapter w/ASCII Fast Mode Interface Vxx.xx
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Visit our Web Site at: http://www.mcc-us.com

RS-232 Baud Rate (19.2KHz)
Destination I^2C Slave Address (4EH)
Echo/Prompt (Disabled)
Flow Control (XON/XOFF)
Hex Only Display (Enabled)
I^2C Connection (Closed)
General Call (Enabled)
iPort’s own Slave Address (6EH)
I2C Bus Clock Rate (100 KHz)
iNterrupt Signal (Released)
I2C Bus Time-oUt (10000 msec)

RS-232 Baud Rate

This command sets the RS-232 Baud Rate. (0=19.2k, 1=57.6k, 2= 115.2k)

```
Command:   /B[0|1|2][CR]        'Set RS-232 Baud Rate
Response 1: /BC0[CR]            'Baud Change Complete
Response 2: /BC1[CR]            'Baud Change Complete
Response 3: /BC2[CR]            'Baud Change Complete
Response 3: /I89[CR]            'Invalid Command Argument
```

Default Setting: /B0[CR]

Close I^{2}C Connection

This command disconnects iPort/AFM from the I^{2}C Bus.

Command: /C[CR]	'Close I^{2}C Connection
Response: /CCC[CR]	'Close Connection Complete
Default Setting:	'Closed

Set Destination I^{2}C Slave Address

This command sets the destination I^{2}C Slave Address (Hex 0,2...FE) for all subsequent Master Transmit or Receive operation.

Command: /Dxx[CR]	'Set Destination I^{2}C Slave Address
Response 1: *	'iPort/AFM Ready
Response 2: /I89[CR]	'Invalid Command Argument
Default Setting: 00	

Echo/Prompt Control

This command enables or disables data entry echo and prompts used as feedback to manual operations from a computer terminal.

Command: /E[0|1][CR]	'Echo/Prompt Control [0 = Off, 1 = On]
Response: *	'iPort/AFM Ready
Default Setting:	Off

Flow Control

This command selects the serial communication handshaking protocol to be use in communicating with the Host computer.

iPort/AFM implements either XON/XOFF (by default) or RTS/CTS flow control protocols. Flow control is used by the iPort/AFM to limit character flow to and from the Host computer to avoid overflowing internal communication buffers and lost data.

The XON/XOFF protocol inserts characters directly into the ASCII data stream. XON (Hexadecimal 11) is used to enable the flow of data. XOFF (Hexadecimal 13) is used to stop the flow of data.

The RTS/CTS protocol uses two additional wires in the cable connecting communicating devices. The RTS wire is an output signal. It indicates that the device generating the signal has buffer space available, and can receive. The CTS wire is an input signal. It indicates that the other device has buffer space available, and can receive.

In general, XON/XOFF requires a minimal three-wire connection, Ground, Transmit Data, and Receive Data. This protocol does insert control characters into the stream of data, and may not be appropriate for all Host systems. If supported, these control characters are normally automatically stripped out of the data stream by Host communication driver software, and are not visible at the application program level.

The RTS/CTS protocol requires a serial port, cabling, and Host communication driver software that supports the additional control signals.

Command: /F[0|1][CR]	Flow Control [0 = XON/XOFF, 1 = RTS/CTS]
Response: *	'iPort/AFM Ready
Default Setting:	XON/XOFF

I^{2}C General Call Control

This command enables or disables iPort/AFM response to I^{2}C Bus General Call (Address 00) messages.

Command: /G[0|1][CR]	' I^{2}C General Call [0 = Disabled, 1 = Enabled]
Response: *	'iPort/AFM Ready
Default Setting:	Enabled

Hex Only Display Control

This command controls Hex Only (~00...~FF) output of Master or Slave received data.

When enabled, all received I^{2}C message data bytes are displayed in Hex (~00…~FF) form.

When disabled, received I^{2}C message data bytes representing ASCII printable characters are displayed as their ASCII printable character. Non-ASCII printable data bytes are always displayed in Hex (~00…~FF) form.

Command: /H[0|1][CR]   'Hex Only Display [0 = Disabled, 1 = Enabled]
Response: *   'iPort/AFM Ready
Default Setting: Enabled

Set iPort/AFM’s Own I^{2}C Slave Address

This command sets iPort/AFM's own I^{2}C Slave Address (Hex 2...FE). Subsequent I^{2}C messages to this address will cause iPort/AFM to become an active Slave device on the bus.

Command: /Ixx[CR]   'Set iPort/AFM’s Own I^{2}C Slave Address
Response 1: *   'iPort/AFM Ready
Response 2: /I89[CR]   'Invalid Command Argument
Default Setting: 6E

I^{2}C Bus Clock Rate Control

Set the I^{2}C Bus master clock rate.
(0=23, 1=86, 2=100, 3=400KHz)

Command: /K[0|1|2|3][CR] 'Set iPort/AFM’s Clock Rate
Response 1: *
Default Setting: /K2[CR]

The iPort/AFM clock rate for standard commands is controlled by the oscillator crystal we use on our microcontroller. This crystal has been selected to give accurate RS-232 baud rates, as the RS-232 baud rate must exactly match the rate used by the host computer. Master I2C clock rates are the fastest possible given the required crystal frequency. Slave I2C clock rates are driven by the external master device, with possible clock-stretching as required to store or retrieve message data.

Command Menu Display

This command displays iPort/AFM’s command menu.

Command: /M[CR]   'Command Menu Display
Response:
iPort/AFM Command Menu Syntax: [Select], (Optional), xx=[00..FE], n=[1..32767]

//	Status Display
/B[0|1|2]	RS-232 Baud Rate Control (0=19.2, 1=57.6, 2=115.2KHz)
/C	Close I2C Connection
/Dxx	Set Destination I2C Slave Address
/E[0|1]	Echo/Prompt Control (0=Disable, 1=Enable)
/F[0|1]	Flow Control (0=XON/XOFF, 1=RTS/CTS)
/G[0|1]	General Call Control (0=Disable, 1=Enable)
/H[0|1]	Hex Only Display Control (0=Disable, 1=Enable)
/Ixx Set	iPort/AFM's Own I2C Slave Address
/K[0|1|2|3]	I2C Bus Clock Rate Control (0=23, 1=86, 2=100, 3=400 KHz)
/M	Menu Display
/N([0|1|A|R])	iNterrupt Signal Monitor/Control/Status (0=Disable, 1=Enable / A=Assert, R=Release / <CR>=Status
/O	Open I2C Connection
/(*)Rn	Master Rx Message *=No Stop
/S(text)	Slave Tx Message
/(*)T(text)	Master Tx Message *=No Stop
/Un	Set I2C Bus Time-oUt in msec 0=Disable)
/V	Display Firmware Version (Major XX.XX Minor)
/X[...]...	Extended Cmds (See Prompt or User's Guide)
/Y	Display Tx bYte Count

Interrupt Signal Control/Status

The INT signal allows the iPort/AFM to participate in $\overline{\text{INT}}$ master and/or slave communications.

Command: /N0[CR] Disable Monitor
/N1[CR] Enable Monitor
/NA[CR] Assert $\overline{\text{INT}}$ Signal
/NR[CR] Release $\overline{\text{INT}}$ Signal
Response: *
Default Setting: /N0, /NR

Open I^2C Connection

This command activates iPort/AFM as an active device on the I^2C Bus.

Command: /O[CR] 'Open I^2C Connection
Response: /OCC[CR] 'Open Connection Complete
Default Setting: Closed

Master Read Message

This command causes iPort/AFM to read the specified number of data bytes from the currently selected Destination I^{2}C Slave Address with or without generating an I^{2}C Stop condition after the last byte is received.

Enter Byte Count (Decimal 0...32767) then Press Enter, or ESCape to Cancel.

A Byte Count of Zero (0) represents a Variable Length message, where the first byte read from the I^{2}C Slave device indicates the number of additional trailing bytes are available to read. iPort/AFM automatically reads the first byte, then the additional bytes as specified by the first byte. All message bytes including the Length byte are returned to the Host computer.

The received text is a representation of the data bytes within the Master Receive message. The format of this data is controlled by the current setting of the Hex Only Display Control .

If the device acknowledges its I^{2}C Slave Address, the specified number of bytes are read from the current Destination I^{2}C Slave Address. iPort/AFM acknowledges all bytes read except the last. If not disabled, the message is then terminated with an I^{2}C Stop condition.

Sending Master Receive messages with No Stop allows the Master to retain exclusive control of the I^{2}C Bus until it finally sends a Stop. During this time, the Master can send additional (Repeated Start) Master Transmit or Master Receive messages to the same or other I^{2}C Slave devices.

Command: /(*)Rnnnn[CR]	'Master Read Message (* = No Stop)
Response 1: /MRCtext[CR]	'Master Read Complete
Response 2: /SNA[CR]	'Slave Not Acknowledging
Response 3: /I81[CR]	'iPort/AFM is Busy, Command Ignored
Response 4: /I83[CR]	' I^{2}C Arbitration Loss Detected
Response 5: /I88[CR]	'iPort Connection Not Open
Response 6: /I89[CR]	'Invalid Command Argument
Default Setting:	None

Slave Transmit Message
This command should be issued to iPort/AFM in response to a Slave Transmit Request (/STR). This command causes iPort/AFM to write the specified data bytes to the requesting I^{2}C Master Receiver device.

Enter Message Bytes (1 or more Printable ASCII or Hex-equivalent ~00..~FF), then Press Enter, or ESCape to Cancel.

Note 1: Upon receiving a Slave Transmit request from a Master Receiver device on the I^{2}C Bus, iPort/AFM outputs a Slave Transmit Request to its Host device, and initiates an I^{2}C Clock Stretch (SCL Low) until a Slave Transmit Text command is received from the Host computer. While clock stretching, no other messages can be transmitted on the I^{2}C Bus.

Note 2: The tilde (~) character and the Carriage Return (CR) character are used as special marker characters within all iPort/AFM transmit text messages. These characters may not be used within the text of a message, but must be replaced by the following "Hex equivalent" characters:

Tilde replaced by "~7E"
Carriage Return replaced by "~0D"

iPort/AFM automatically translates "Hex equivalent" characters to their single-byte value for transmission across the I^{2}C Bus.

All entered data bytes are transmitted to the requesting Master Receiver device. Slave Transmit stops upon receiving the first negative acknowledgment (Nack) from the Master Receiver.

Command: /Stext[CR]	'Slave Transmit Message
Response 1: /STC[CR]	'Slave Transmit Complete
Response 2: /I88[CR]	'iPort Connection Not Open
Response 3: /I8A[CR]	‘Slave Transmit Request Not Active, Cmd Ignored
Default Setting:	None

Examples:

/Sabcd1234[CR]	‘ASCII Printable characters "abcd1234"
/S~00~01~02[CR]	‘Binary data bytes 00, 01,02

```
/Sab~7Ecd[CR]        ‘Tilde embedded in ASCII Printable characters
/S12~0D24[CR]        ‘Carriage Return embedded in ASCII Printable characters
```

Master Transmit Message
This command causes iPort/AFM to write the specified data bytes to the currently selected Destination I^{2}C Slave Address with or without generating an I^{2}C Stop condition after the last byte is transmitted.

Enter Message Bytes (0 or more Printable ASCII or Hex-equivalent ~00..~FF), then Press Enter, ESCape to Cancel.

Note: The tilde (~) character and the Carriage Return (CR) character are used as special marker characters within all iPort/AFM transmit text messages. These characters may not be used within the text of a message, but must be replaced by the following "Hex-equivalent" characters:

Tilde replaced by "~7E"
Carriage Return replaced by "~0D"

iPort/AFM automatically translates "Hex equivalent" characters to their single-byte value for transmission across the I^{2}C Bus.

All entered data bytes are transmitted to the Destination I^{2}C Slave Receiver device. Master Transmit stops upon receiving the first negative acknowledgment (Nack) from the Slave Receiver. If not disabled, the message is then terminated with an I^{2}C Stop condition.

Sending Master Transmit messages with No Stop allows the Master to retain exclusive control of the I^{2}C Bus until it finally sends a Stop. During this time, the Master can send additional (Repeated Start) Master Transmit or Master Receive messages to the same or other I^{2}C Slave devices.

```
Command: /(*)Ttext[CR]    'Master Transmit Message
                          (* = No Stop)
Response 1: /MTC[CR]      'Master Transmit Complete
Response 2: /SNA[CR]      'Slave Not Acknowledging
Response 3: /I81[CR]      'iPort/AFM is Busy, Command Ignored
Response 4: /I83[CR]      ' I²C Arbitration Loss Detected
Response 5: /I88[CR]      'iPort Connection Not Open
```

Default Setting: None

Examples:

```
/Tabcd1234[CR]       ‘ASCII Printable characters "abcd1234"
/T~00~01~02[CR]      ‘Binary data bytes 00, 01,02
/*T~00~01~02[CR]     ‘Binary data bytes 00, 01,02 with No Stop
/Tab~7Ecd[CR]        ‘Tilde embedded in ASCII Printable characters
/T12~0D24[CR]        ‘Carriage Return embedded in ASCII Printable characters
```

Set I^{2}C Bus Time-oUt in msec

Set bus time-out in msec (0=disable)

The iPort/AFM reports a bus time-out if no bus activity for the specified time occurs within an I^{2}C Bus message.

```
Command: /Unnnn[CR]      'I2C Bus time-oUt
Response: *
```

Display Firmware Version (requires V2.00+)

Display firmware version

```
Command: /V[CR]                 'Firmware Version
Response: /VCCXX.XX[CR]         '(Major XX.XX Minor)
```

eXtended Commands (requires V2.00+)

The eXtended commands are used to generate “out-of-spec” signaling. eXtended commands cannot use the I2C hardware to control the SCL and SDA lines, as the I2C hardware only generates I2C compatible signals. The eXtended commands use firmware to “bit-bang” the SCL and SDA lines. This firmware cannot operate as fast as the hardware, and it can be interrupted at any time by internal interrupts. The eXtended commands run directly off the command characters as they are received on the RS-232 link. Speed of execution of eXtended commands is controlled by the RS-232 baud rate, the execution speed of the firmware, delays caused by execution interruptions that may occur while a command is executing, and I2C Bus clock-stretching by external slave devices.

The following commands manipulate the I^{2}C Clock (SCL) and data (SDA) lines.

Command: /X[S|~xx|R|r|P|0|1|?|D|d|C|c|L|A| |"]..., then Press Enter or ESCape
Enter /X followed by zero or more sub-commands, the [CR]

Response: /XCC(see commands below)[CR]

High Level Sub-Commands:

S = Send Start
~xx = Send Byte (xx = 00...FF)(response = A or N)
R = Read Byte with Ack (response = ~xx)
r = Read Byte with Nak (response = ~xx)
P = Send Stop

Mid Level Sub-Commands:

0 = Send 0 Bit
1 = Send 1 Bit
? = Read Bit (response = 0 or 1)

Low Level Sub-Commands:

D = Set SDA High
d = Set SDA Low
C = Set SCL High
c = Set SCL Low
L = Read SCL (response = 0 or 1)
A = Read SDA (response = 0 or 1)

Misc Sub-Commands:

space = no action
“comment” = no action

Examples:

Master transmit three bytes to slave address 0x4e using high level, mid level, and low level sub-commands.

High Level Command:/X S ~4e ~01 ~02 ~03 P [CR]
High Level Response: /XCCAAAA[CR]

Mid Level Command:/X S 01001110 ? 00000001 ? 00000010 ? 00000011 ? P [CR]

```
Mid Level Response: /XCC0000[CR]
```

```
Low Level Command:/X dc dCcDCcdCcdCcDCcDCcDCcdCc DCAc
dCcdCcdCcdCcdCcdCcdCcDCc DCAcdCcdCcdCcdCcdCcdCcDCcdCc DCAc
dCcdCcdCcdCcdCcdCcdCcDCc DCAc dCD[CR]
Low Level Response: /XCC0000[CR]
```

Master read three bytes from slave address 0x4F. First two bytes are acknowledged by master.

```
Command: /X S ~4f Rrr P [CR]
Response: /XCCA~xx~xx~xx[CR]      ‘(xx = 00...FF)
```

Master transmit a Write WCR command to a Xicor X9241 at slave address 0x50. WCR data is 0x00.

```
Command: /X S ~50 ~a0 ~00 P [CR]
Response: /XCCAAA[CR]
```

Master transmit a Write WCR command to a Xicor X9241 at slave address 0x50. WCR data is 0x3f.

```
Command: /X S ~50 ~a0 ~3f  P [CR]
Response: /XCCAAA[CR]
```

Issue a Read WCR command to a Xicor X9241 at slave address 0x50.

```
Command: /X S ~50 ~90 ~R  P [CR]
Response: /XCCAA~xx[CR]           ‘(xx = 00...FF)
```

Issue an Increment Wiper command to a Xicor X9241 at slave address 0x50.

```
Command: /X S ~50 ~20 1 P [CR]
Response: /XCCAA[CR]
```

Issue an Decrement Wiper command to a Xicor X9241 at slave address 0x50.

```
Command: /X S ~50 ~20 0 P [CR]
Response: /XCCAA[CR]
```

Display Tx bYte Count (requires V2.00+)

Returns the number of bytes received by the slave device in the last master transmit message.

```
Command: /Y[CR]                    'Tx bYte Count
Response: /TBCn[CR]                'n =00000...32767
```

Asynchronous Interface Events

Asynchronous Events are those iPort/AFM interface activities initiated by the iPort/AFM I^{2}C Host Adapter in response to activities on the I^{2}C Bus.

Slave Transmit Request

This event is caused by the reception of an I^{2}C Bus Slave Transmit message directed at the current iPort/AFM's own Slave address.

Prompt: /STR[CR]	'Slave Transmit Request
Command: /Stext[CR]	'Slave Transmit Text

The normal Host computer response is to send a Slave Transmit Text (/Stext[CR]) command.

Note: Upon receiving a Slave Transmit request from a Master Receiver device on the I^{2}C Bus, iPort/AFM outputs a Slave Transmit Request to its Host device, and initiates an I^{2}C Clock Stretch (SCL Low) until a Slave Transmit Text command is received from the Host computer. While clock stretching, no other messages can be transmitted on the I^{2}C Bus.

Slave Receive Complete

This event is caused by the reception of an I^{2}C Bus Slave Receive message directed at the current iPort/AFM's own Slave address.

The received text is a representation of the data bytes within the Slave Receive message. The format of this data is controlled by the current setting of the Hex Only Display Control .

Prompt: /SRCtext[CR]	'Slave Receive Complete
Command:	None Required

General Call Receive Complete

This event is caused by the reception of an I^{2}C Bus Slave Receive message directed at the I^{2}C General Call Address (00), when iPort/AFM's General Call recognition is enabled.

The received text is a representation of the data bytes within the Slave Receive message. The format of this data is controlled by the current setting of the Hex Only Display Control .

Prompt: /GRCtext[CR]　　‘General Call Receive Complete
Command:　　None Required

I^{2}C Bus Time-out Detected
Prompt: /I85[CR]　　I^{2}C Bus Time-out Detected

Cause: iPort/AFM issues this response when an I^{2}C Bus message lasts for more than 1 second. No corrective action is taken by iPort/AFM. No Host response is required, but this event can be used to detect bus problems.

iNterrupt Signal Assert

Prompt: /NSA[CR]　　iNterrupt Signal Assert (low) Detected

iNterrupt Signal Release

Prompt: /NSR[CR]　　iNterrupt Signal Release (high) Detected

iPort/AFM Prompts

iPort/AFM Prompts are messages generated by iPort/AFM in response to Host computer commands.

iPort/AFM Ready

Prompt: * ‘iPort/AFM Ready

Cause: iPort/AFM is ready for the next Host command.

Slave Not Acknowledging

Prompt: /SNA[CR] ‘Slave Not Acknowledging

Cause: There is no response (I^{2}C Slave Address Acknowledgment) during a Master Transmit or Receive operation from an I^{2}C Slave device at the current Destination I^{2}C Address.

iPort/AFM Busy

Prompt: /I81[CR] ‘iPort/AFM Busy

Cause: Host attempted a Master operation while iPort/AFM was busy. Host should repeat the last command.

I^{2}C Bus Arbitration Loss

Prompt: /I83[CR] ‘I^{2}C Arbitration Loss Detected

Cause: iPort/AFM lost I^{2}C Bus Arbitration while Master Transmitting or Master Receiving an I^{2}C message. Host should repeat the last command.

I^{2}C Bus Error Detected

Prompt: /I84[CR] ‘I^{2}C Bus Error Detected

Cause: iPort/AFM has detected a error condition on the I^{2}C Bus. Host should repeat the last command or issue an iPort/AFM Reset command.

I^{2}C Bus Time-out Detected

Prompt: /I85[CR] ‘I^{2}C Bus Time-out Detected

Cause: iPort/AFM issues this command when an I^{2}C Bus message lasts for more than 1 second. No corrective action is taken by iPort/AFM. No Host response is required, but this event can be used to detect bus problems.

iPort/AFM Connection Closed

Prompt: /I88[CR] ‘iPort/AFM Connection is Closed.

Cause: Host is attempting to perform an I^{2}C Bus message operation while the iPort/AFM Connection is Closed. The Host should issue an Open I^{2}C Connection command before attempting to perform I^{2}C Bus message operations.

Invalid Command Argument

Prompt: /I89[CR] ‘Invalid Command Argument Detected

Cause: This event normally indicates the value of a Host command argument was out of range. The Host should reissue command with correct arguments.

Slave Transmit Request Not Active

Prompt: /I8A[CR] ‘Slave Transmit Request Not Active

Cause: This event indicates the Host attempted to issue a Slave Transmit Text command when no Slave Transmit Request was present.

Invalid iPort/AFM Command

Prompt: /I8F[CR] ‘Invalid iPort/AFM Command

Cause: This event normally indicates that an invalid command was issued by the Host. The Host should reissue the correct command.

iPort/AFM RS-232 Receive Buffer Overflow

Prompt: /I90[CR] ‘iPort/AFM RS-232 Receive Buffer Overflow

Cause: This event normally indicates that data sent to the iPort/AFM via the RS-232 serial port has been lost. Check your Host Computer Serial Port Flow Control (XON/XOFF, or Hardware) to make sure it matches current iPort/AFM Flow Control. Also check if Host Computer FIFO buffers in the 16550 UART are enabled. If so, reduce Transmit Buffer level.

Example Code

The following examples are written in MS Visual Basic V3 for Windows using the serial communications control (MSCOMM.VBX). It can be used as a guide in implementing iPort/AFM interface programs in other programming languages and operating environments.

Note: This example code is available online at: http://www.mcc-us.com/202ug.htm#ExampleCode.

iPort/AFM Reset

```
Comm1.Output = Chr$(18)             'Ctrl/R
Comm1.Output = Chr$(18)             'Ctrl/R
Comm1.Output = Chr$(18)             'Ctrl/R
```

iPort/AFM Initialization

```
Comm1.Output = "/f0"           'Set iPort/AFM XON/XOFF Flow Control
Comm1.Output = Chr$(13)

Comm1.Output = "/i70"          'Set iPort/AFM’s Own Slave Address
Comm1.Output = Chr$(13)

Comm1.Output = "/d4e"          'Set Destination Slave Address
Comm1.Output = Chr$(13)

Comm1.Output = "/o"            'Open I$^2$C Connection
Comm1.Output = Chr$(13)
```

Master Transmit Message

```
Comm1.Output = "/T~00~01"      'Send Master Tx Command
Comm1.Output = Chr$(13)             'Terminate Command
```

Master Receive Message

```
Comm1.Output = "/R10"          'Send Master Rx Command
Comm1.Output = Chr$(13)             'Terminate Command
```

Communication Event Processing

```
Static Sub Comm1_OnComm ()
Static LineBuf$

While Comm1.InBufferCount
        Msg$ = Comm1.Input ' Get Comm input character
        CharIn$ = Msg$
```

```
If Msg$ = Chr$(13) Then Msg$ = ""    ' Remove CR
If Msg$ = Chr$(10) Then Msg$ = ""    ' Remove LF
If Msg$ = "*" Then                   ' if iPort/AFM Ready
        Msg$ = "****"                        ‘ Substitute Token
        CharIn$ = Chr$(13)                   ‘ Terminate Line
End If
LineBuf$ = LineBuf$ + Msg$           'Add new text to line buffer

If CharIn$ = Chr$(13) Then           ' if Carriage Return detected
        iPortResp$ = Left$(LineBuf$, 4)      'Isolate Response Code

        ' Test for iPort/AFM Synchronous Interface Events

        If (StrComp(iPortResp$, "/OCC") = 0) Then
                ' Open Connection Complete Processing
                TextBox.Text = "/OCC Open Connection Complete"

        ElseIf (StrComp(iPortResp$, "/MTC") = 0) Then
                ' Master Transmit Complete Processing
                TextBox.Text = "/MTC Master Tx Complete"

        ElseIf (StrComp(iPortResp$, "/MRC") = 0) Then
                ' Master Rx Complete Processing
                TextBox.Text = LineBuf$   'Update Display

        ElseIf (StrComp(iPortResp$, "/STC") = 0) Then
                ' Slave Tx Complete Processing
                TextBox.Text = "/STC Slave Tx Complete"

        ElseIf (StrComp(iPortResp$, "/CCC") = 0) Then
                ' Close Connection Complete Processing
                TextBox.Text = "/CCC Close Connection Complete "

        ElseIf (StrComp(iPortResp$, "/BC0") = 0) Then
                ' iPort/AFM Baud Change 0 {19.2K}
                TextBox.Text = "iPort/AFM Baud Change 0 {19.2K} "

        ElseIf (StrComp(iPortResp$, "/BC1") = 0) Then
                ' iPort/AFM Baud Change 1 {57.6K}
                TextBox.Text = "iPort/AFM Baud Change 1 {57.6K} "
```

```
ElseIf (StrComp(iPortResp$, "/BC2") = 0) Then
        ' iPort/AFM Baud Change 2 {115.2K}
        TextBox.Text = "iPort/AFM Baud Change 0 {115.2K} "

' Test for iPort/AFM Asynchronous Interface Events

ElseIf (StrComp(iPortResp$, "/SRC") = 0) Then
        ' Slave Rx Complete Processing
        TextBox.Text = LineBuf$           'Update Display

ElseIf (StrComp(iPortResp$, "/GRC") = 0) Then
        ' General Call Rx Complete Processing
        TextBox.Text = LineBuf$           'Update Display

ElseIf (StrComp(iPortResp$, "/STR") = 0) Then
        ' Slave Tx Request Processing
        Comm1.Output = "/S~00~01"     'Send Slave Tx Msg
        Comm1.Output = Chr$(13)         'Terminate Command
        TextBox.Text = LineBuf$           'Update Display

ElseIf (StrComp(iPortResp$, "/NSA") = 0) Then
        ' iNterrupt Signal Assert Detected
        TextBox.Text = iNterrupt Signal Assert Detected
        'Update Display

ElseIf (StrComp(iPortResp$, "/NSR") = 0) Then
        ' iNterrupt Signal Release Detected
        TextBox.Text = iNterrupt Signal Release Detected
        'Update Display

' Test for iPort/AFM Response Messages

ElseIf (StrComp(iPortResp$, "****") = 0) Then
        TextBox.Text = "* iPort/AFM Ready" 'Update Display

ElseIf (StrComp(iPortResp$, "/SNA") = 0) Then
        TextBox.Text = "/SNA Slave Not Acknowledging"

ElseIf (StrComp(iPortResp$, "/I81") = 0) Then
        TextBox.Text = "/I81 iPort/AFM Busy" 'Update Display

ElseIf (StrComp(iPortResp$, "/I83") = 0) Then
```

```
                TextBox.Text = "/I83 Arbitration Loss" 'Update Display

            ElseIf (StrComp(iPortResp$, "/I84") = 0) Then
                TextBox.Text = "/I84 I2C Bus Error Detected"

            ElseIf (StrComp(iPortResp$, "/I85") = 0) Then
                TextBox.Text = "/I85 I2C Bus Time-out Detected"

            ElseIf (StrComp(iPortResp$, "/I88") = 0) Then
                TextBox.Text = "/I88 iPort/AFM Connection Closed"

            ElseIf (StrComp(iPortResp$, "/I89") = 0) Then
                TextBox.Text = "/I89 Invalid Command Argument"

            ElseIf (StrComp(iPortResp$, "/I8A") = 0) Then
                TextBox.Text = "/I8A Slave Tx Request Not Active"

            ElseIf (StrComp(iPortResp$, "/I8F") = 0) Then
                TextBox.Text = "/I8F Invalid iPort/AFM Command"

            ElseIf (StrComp(iPortResp$, "/I90 = 0) Then
                TextBox.Text = "/I90 iPort/AFM Rx Buffer Overflow”

            Else
                TextBox.Text = LineBuf$   'Other Update Display
            End If

        LineBuf$ = ""
        End If
Wend
End Sub
```

iPort/AFM Revision Report

This section defines revisions and changes made to the iPort/AFM interface:

Revision: 1.02

1. Initial Release

Revision: 2.00

1. Add Firmware Version Command.
2. Add eXtended Commands.
3. Add Tx bYte Count Command.

Additional Information

For additional information on the I^{2}C Bus, please refer to the following:

“The I^{2}C and How to Use It”
http://www.mcc-us.com/i2chowto.htm

"80C51-Based 8-Bit Microcontroller" Data Handbook.
Philips Semiconductors, Tel. (800)227-1817

" I^{2}C Peripherals for Microcontrollers" Data Handbook.
Philips Semiconductors, Tel. (800)227-1817

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http://www.mcc-us.com

Appendix A

Interface Connector and Plug Information

MCC uses two (2) different connectors and plug assemblies. These parts are all compatible with one another and are interchangeable.

Connectors

Molex SEMCONN ACCESS.bus Receptacle Connector
Molex Part # 15-83-0064

AMP SDL (Shielded Data Link) Connectors for ACCESS.bus
AMP Part # 4-943197-1

Plugs

Molex SEMCONN ACCESS.bus Plug
Molex Part # 15-83-1564

AMP SDL (Shielded Data Link) Plug for ACCESS.bus

Bush	Amp Part # 520851-1
Ferrule	Amp Part # 520433-1
SDL (Shell)	Amp Part # 520461-1
SDL (Shell)	Amp Part # 520460-1
SDL	Amp Part # 4-520424-1

Additional Cables Available

MCC Part #	CAB4	I^{2}C Interface Cable, 48inches (4ft)
MCC Part #	CAB8	I^{2}C Interface Cable, 96 inches (8ft)
MCC Part #	CAB16	I^{2}C Interface Cable, 192 inches (16ft)
MCC Part #	CABCL	I^{2}C and SMBus Clip Lead Cable
MCC Part #	AXM-12G	1 Ft. INT-Trigger Cable