User's Guide

iPORT/USB 2™

USB to I²C Host Adapter with *Circuit Sense*™

MCC
Micro Computer Control
Small Area Network Specialists

www.mcc-us.com

Introduction

The MCC iPort/USB 2™ USB to I²C Bus host adapter with *Circuit Sense* allows any Windows, Linux, or Mac OS X host computer to become an I²C Master or Slave device, transmitting or receiving I²C messages between the host computer and one or more I²C devices across an I²C Bus.

This user's guide describes the installation and operation of the iPort/USB 2 host adapter, Virtual Communication Port (VCP) driver, iPort Utility Pack Software for Windows, and includes the Programmer's Reference for creating custom applications.

Are you new to I²C? Want to know more? We suggest you review "What is I²C?" at www.mcc-us.com/I2CBusTechnicalOverview.pdf.

This MCC product uses NXP (Philips) components and is licensed to use the I²C Bus.

"Purchase of Philips I²C components conveys a license under the Philips' I²C patent to use the components of the I²C system, provided the system conforms to the I²C specifications defined by Philips."

I²C Bus is a trademark of NXP (Philips) Corporation.

28-JAN-2019

DISCLAIMER: Micro Computer Control Corporation makes no representations or warranties with respect to the contents hereof and specifically disclaims any implied warranties of merchantability or fitness for any particular purpose. Further, Micro Computer Control Corporation reserves the right to revise the product described in this publication and to make changes from time to time in the content hereof without the obligation to notify any person of such revisions or changes.

WARNING - Life Support Applications: MCC products are not designed for use in life support appliances, devices, or systems where the malfunction of the product can reasonably be expected to result in a personal injury.

WARNING - Radio Frequency Emissions: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC rules. These limits are designed to provide reasonable protection against interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause interference to radio communications. Operation of this equipment in a residential area is likely to cause interference, in which case the user will be required to correct the interference at his own expense.

WARNING - Electrostatic Discharge (ESD) Precautions: Any damage caused by Electrostatic Discharge (ESD) through inadequate earth grounding is NOT covered under the warranty of this product. See the “Electrostatic (ESD) Precautions” section of this guide for more information.

Created in the United States of America

Table of Contents

USB to I²C Bus Host Adapter

with

Circuit Sense™

User's Guide

Model: MIIC-208

1 Overview

The iPort/USB 2, MCC's USB to I²C Bus host adapter with *Circuit Sense,* allows any Windows, Linux, or Mac OS X host computer to become an I²C Bus Master or Slave device, transmitting or receiving I²C messages between the host computer and one or more I²C devices across an I²C Bus. *Circuit Sense*, our new I²C Bus voltage

sensing technology, allows the iPort/USB 2 to work with the latest I²C Bus devices at voltages an low as 0.5 volts.

1.1 iPort/USB 2 Product Features

- OS Support: Windows, Linux, Mac OS X
- High Performance Processor Increases Throughput (2x to 200x).
- USB Bus Powered with USB 2.0 Type B Jack.
- Built-in ESD, Over-voltage, and Reverse-voltage Protection.
- Switch Controlled Properties:
  - I^2C Bus Power Source (3.3v or 5v @100ma).
  - I^2C Bus Voltage Sense (0.5v to 5v, Enable or Disable).
  - I^2C Bus Pull-Ups (1.8K ohm, Enable or Disable).
- Software Controlled Properties:
  - I^2C Bus Master Clock Rates: 23KHz, 86KHz, 100KHz Std, 400KHz Fast
  - I^2C Bus General Call Enable
  - I^2C Bus Time-Out (0-32K ms)
  - I^2C Bus Interrupt Signal Control (Assert, Release, Monitor)
  - Host Communication Flow Control (XON/XOFF or RTS/CTS)
  - User Interface Echo/Prompt Enable
  - User Data Format (HEX or ASCII/HEX)
- Supported I^2C Bus Activities:
  - Master and Slave Functions
  - Transmit, Receive, and Tx/Rx Data Functions
  - Multi-Master Arbitration Loss Detection
  - Clock-stretch Detection
  - Bus Time-Out Detection
  - Interrupt Signal Generation and Detection
  - 7-bit Slave Address Generation and Detection
  - Up to 32K data bytes in a single message
  - SMBus Packet Error Detection
  - eXtended Commands for 2-Wire, "I^2C-Like" Low-level SCL/SDA Signal Control
- Software Support:
  - Virtual ComPort Drivers
  - Application Software
  - Software Development Tools
- Compatible with existing iPort/AI, iPort/AFM, iPort/USB, i2cStick, and iPort/LAN applications.
- USB-IF (Full-Speed) and MS WHQL Certified.
- US-FCC and EUR-CE EMC Compliant.
- RoHS/Lead-Free Compliant.

1.2 iPort/USB 2 Package

The iPort/USB 2 package includes the following items:

- iPort/USB 2, USB to I^2C Bus Host Adapter.
- iPort/USB 2 Mini Clip-lead Cable.
- iPort/USB 2 USB 2.0 A/B Interface Cable.
- iPort/USB 2 Quick Start Guide.
- iPort/USB 2 Travel Case.
- Online Items*
  - iPort/USB 2 Datasheet
  - iPort/USB 2 User's Guide (this document)
  - iPort/USB 2 Virtual ComPort Drivers
  - iPort Utility Pack Software
  - Application Software.
  - Software Development Tools

(* www.mcc-us.com/iPortUSB-2)

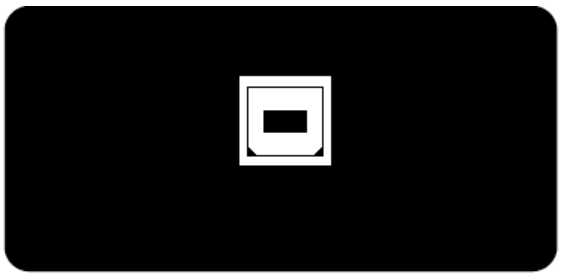
1.3 System Requirements

a. A host computer with one free USB port or self-powered USB hub.
b. A host computer with one of the following operating systems:

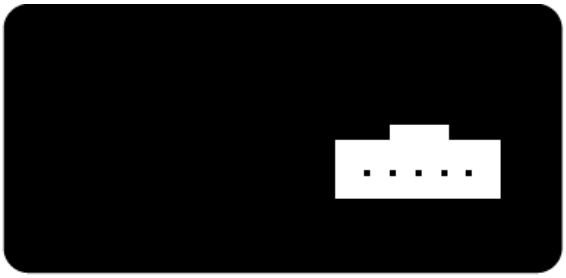
- Windows XP+
- Linux 2.6+
- Mac OSX 10.5+

2 Interconnects

The iPort/USB 2 includes two interconnections:



USB Connector



I^2C Interface Connector

2.1 USB Connector

A USB 2.0 Type B Jack provides connection from the I^2C Bus host adapter to a USB port on the host computer or self-powered USB hub.

The iPort/USB 2 operates as a high-power (>100 mA) bus-powered USB device, with up to 100 mA of (user optional) switch-selectable 3.3v or 5v for I^2C Bus target system power.

2.1.1 Virtual Communications Port (VCP)

The iPort/USB 2 uses a Virtual Communications Port (VCP) interface to communicate with a host computer. The VCP interface is created on the host computer via a software driver loaded on the host computer. Drivers are available for several operating systems. These drivers can be installed separately, or while installing the iPort Utility Pack.

The drivers and installation instructions are available online at the following web address:

www.mcc-us.com/iPortUSB-2

After the driver software is installed, plug the iPort/USB 2 into a host computer USB port. Upon detecting the device, the operating system will automatically load the driver and create a new “virtual” serial port for communicating with the iPort/USB 2. Once installed, application programs running on the host computer can communicate with the iPort/USB 2 via the operating system serial port Application Program Interface (API).

The iPort/USB 2 VCP includes the following communication signals:

- TX - Transmit Data (Host Computer to iPort/USB 2).
- RX - Receive Data (iPort/USB 2 to Host Computer).
- RTS - Request to Send (Host Computer to iPort/USB 2).
- CTS - Clear to Send (iPort/USB 2 to Host Computer).

Serial communications flow-control options include X-ON/X-OFF (default) or RTS/CTS. The flow-control method used by a host computer application should match the flow-control method selected for use by the iPort/USB 2 host adapter.

2.2 I^2C Mini Interface Connector

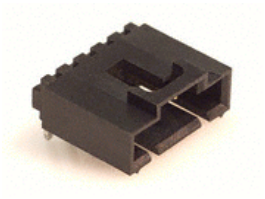
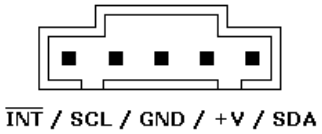
The iPort/USB 2 I^2C Bus host adapter includes a five wire (1x5) 2.54 mm (.100"), positive locking, shrouded header receptacle connector (see Appendix A) for interfacing to an external I^2C Bus. Interface lines provided include:

- I^2C Clock (SCL)
- I^2C Data (SDA)
- I^2C /INTerrupt
- Ground
- +V

Minimum wiring for I^2C Bus communications include I^2C Bus Clock, Data, and Ground. Use of the /INTerrupt and +V wires in the I^2C Interface connector are user optional.

NOTE: See the Hardware Configuration section below for additional information

on configuring the I²C Bus interface.

	
I²C Bus Mini Interface Receptacle	Mini Interface Receptacle Pinout

I²C Bus Mini-Clip-Lead cables are available to connect the iPort/USB 2 adapter to a target system. Each clip-lead is identified (White=C=SCL, Red=V=+V, Green=D=SDA, Black=G=Ground, Gray=(no mark)=/INTerrupt).

I²C Bus Mini-Interface cables with two Mini Interface plugs are also available to connect the I²C adapter to an external I²C Bus.

2.3 /INTerrupt Signal

The /INTerrupt signal is an extra pin found on some I²C devices. The /INT signal allows a slave-only device to attract the attention of a bus master device by lowering the /INT signal to a logical low voltage level.

The iPort/USB 2 provides an open-collector /INT signal which can be connected to a corresponding pin on a bus master or slave device. The /INT signal allows the iPort/USB 2 to participate in interrupt signaling between master or slave devices.

The iPort/USB 2 generates an I²C Bus interrupt assert (/INT=low) upon receiving an iNterrupt Assert command from the host computer. The interrupt signal is released (/INT = high) when the iPort/USB 2 is addressed as an I²C Bus slave device, or an iNterrupt Release command is received from the host computer.

Interrupt monitoring is enabled upon receiving an Enable /INT Monitor command from the host computer. Interrupt monitoring causes the iPort/USB 2 to monitor the /INT signal level, and automatically send a notification to the host computer when the /INT signal changes state.

3 Hardware Configuration

3.1 *Circuit Sense™*

The iPort/USB 2 introduces MCC's *Circuit Sense* technology. Circuit Sense allow the I^2C interface +V wire can operate in two modes, Power Source Mode and Voltage Sense Mode. Mode selection is controlled by the MODE slide switch on the side of the unit enclosure.

- **Power Source Mode** - The +V wire can supply power (3.3v or 5v @ 100 mA) Vcc to an external I^2C Bus system. Voltage selection is controlled by the SOURCE slide switch on the side of the unit enclosure. In Power Source Mode, the voltage of the iPort/USB 2 SCL, SDA, and /INT internal pull-ups, if enabled, and Voltage Sense circuit (0.3Vcc Low_{MAX}, 0.7Vcc $High_{MIN}$) is selected by the SOURCE switch. (Use of the +V wire in Power Source Mode is user optional).

  Power Source Mode is similar to the standard mode of operation on earlier versions of MCC I^2C Bus host adapters.

- **Voltage Sense Mode** - The +V wire is connected to the external I^2C Bus system pull-up supply voltage (0.5v to 5v) Vcc, and automatically adjusts iPort/USB 2 SCL, SDA, and /INT voltage sense circuit levels to match (0.3Vcc Low_{MAX}, 0.7Vcc $High_{MIN}$). In Voltage Sense Mode, the voltage of the iPort/USB 2 SCL, SDA, and /INT internal pull-ups, if enabled, is equal to the external voltage (Vcc) applied to the +V wire. (Use of the +V wire in Voltage Sense Mode is required).

3.2 Pull-up Resistors

I^2C Bus systems are based on open-collector technology requiring pull-up devices on each signal wire (SCL, SDA, /INT). These pull-up devices usually take the form of pull-up resistors connected to bus power.

The I^2C adapter includes a PULL-UPS slide switch used to enable or disable internal 1.8K ohm pull-up resistors attached to the SCL, SDA, and /INT lines. Every I^2C Bus system must have at least one pull-up on the signal lines. In some cases, the pull-ups may be present in the external I^2C Bus circuit. Use this switch to configure the pull-up resistors for your system.

3.3 Connecting to an SMBus Target System

If you are connecting the I^2C adapter to a SMBus target system, you should follow these steps BEFORE applying power:

- Shut off the iPort/USB 2 internal pull-ups (See Pull-up Resistor section).
- Use external SMBus rated (appoximately15k ohms) pull-up resistors. These pull-ups may already be present in the target system.
- Visit our I^2C versus SMBus FAQ page (www.mcc-us.com/I2CSMBusFAQ.htm).
- See the SMBus Specification for additional details.

Special Note for SMBus Users: MCC's I^2C adapters are designed to be I^2C Bus compatible, not SMBus compatible. Some features of the SMBus protocol not supported include time-outs, device reset, and Packet Error Check byte processing. The non-supported SMBus features may, or may not, permit the use of the I^2C adapter in your SMBus application. Consult the MCC FAQ web page and SMBus Specification for details.

4 ESD (Electrostatic Discharge) Precautions

Zap! Everyone is familiar with walking across a rug and getting zapped when touching a metal object. But how can that zap damage electronics.

Electrostatic discharge is defined as the transfer of charge between bodies at different electrical potentials. Electrostatic discharge can change the electrical characteristics of a semiconductor device, degrading or destroying it. Electrostatic discharge also may upset the normal operation of an electronic system, causing equipment malfunction or failure.

When connecting the I^2C adapter to a host computer and a target system, extreme care must be taken to avoid electrostatic discharge. Failure to follow ESD protection procedures when using the I^2C adapter could damage the host computer, I^2C adapter, or the target system, and void product warranty coverage.

4.1 Host Computer Grounding

Case 1 - Desktop and Single-board Computers. The chassis on a desktop or single-board host computer must be connected to earth ground to comply with safety regulations. If the computer chassis is NOT connected to earth ground for

some reason (i.e., use of a two-prong power mains plug), the host computer power supply ground will float to some unknown voltage potential.

Case 2 - Laptop Computers. Laptop computers present special ESD problems. Most laptop computers use an external double-insulated mains power supply which is NOT connected to the mains earth ground. This means that the laptop chassis is floating at some unknown voltage potential.

In either case, upon connection to the I^2C adapter and the target system, the host computer will discharge energy through its USB or RS-232 port to the I^2C adapter, and on to the target system. This discharge could damage the host computer, I^2C adapter, and the target system.

4.2 Grounding Solutions

To avoid damage to the host computer, I^2C adapter, or target system, follow these instructions:

- Wear an earth grounded wrist strap, or discharge any static charge build-up, when handling the I^2C adapter or any target system devices.
- Ensure that both the host computer and target system are connected to a common earth ground point.
- Make sure that all interconnections are made BEFORE applying power to the host computer, I^2C adapter, and target system.
- If you are using a laptop computer or host computer that is NOT connected to mains earth ground, make a hard-wired connection from the host computer (i.e., port connector shell) and the target system ground connector to a common earth ground point.
- Avoid plugging and unplugging system components while the host computer or target system is powered.
- Ensure that any devices connected to the target system are properly grounded to the common earth ground point.
- If unsure how to properly ground system components, seek electrical expert help.

WARNING: Any damage caused by Electrostatic Discharge (ESD) through inadequate earth grounding is NOT covered under the warranty of this product.

5 Driver Software Set-Up

This section provides information on how to install, update, and uninstall the iPort/USB software driver on a Windows-based host computer. Driver information for all operating systems is available at the link below:

www.mcc-us.com/iPortUSB-2

1. Driver Install (Windows)

The iPort/USB 2 uses a Virtual Communications Port (VCP) driver that is available separately at the link above, or pre-installed with the iPort Utility Pack Software (See the installation instructions in “Part 2 - iPort Utility Pack for Windows” of this User’s Guide). Pre-installation places the VCP driver into the Windows Driver Store, ready for installation when the iPort/USB 2 is first plugged into the host computer.

After iPort Utility Pack installation, the VCP driver may also be pre-installed at a later date with the Driver Install short-cut on the iPort Utility Pack Start menu.

2. Driver Update (Windows)

iPort/USB 2 VCP drivers are posted on the MCC website (www.mcc-us.com/iPortUSB-2). Use Windows Device Manager (Start | Settings | Control Panel | System | Device Manager | Ports (COM & LPT)) to see the current version of the iPort/USB 2 driver installed on your computer, and determine if newer driver is available. If a newer VCP driver is available, follow website instructions to download and install a driver update on your computer.

3. Driver Uninstall (Windows)

The iPort/USB 2 VCP driver can be uninstalled using Windows Device Manager (Start | Settings | Control Panel | System | Device Manager | Ports (COM & LPT)), or the Driver Uninstall short-cut on the iPort Utility Pack Start menu.

6. Hardware Set-Up

This section provides information on connecting the I^2C adapter to your host computer and I^2C Bus target system.

1. USB Connection

After completing the Driver Installation instructions above, plug the iPort/USB 2 adapter into a free USB port on your host computer or self-powered USB hub. If this is the first time the iPort/USB 2 is connected to the host computer, the operating system will automatically install the VCP driver and assign the iPort/USB 2 a communications port address (COMn, /dev).

You can find the ComPort number assigned to the iPort/USB 2 by running the iPort Utility Pack Message Center or Message Manager software, and selecting the iPort/USB 2 device, use Windows Device Manager (Start | Settings | Control Panel | System | Device Manager | Ports (COM & LPT)), or use the OS X or Linux ls /dev command to find the communications port address assigned to the iPort/USB 2.

2. I^2C Bus Connection

Connect the I^2C Bus cable to the I^2C adapter and your I^2C device. You can make this connection with the I^2C Mini Clip-Lead cable or I^2C Mini Interface Cable.

The I^2C Bus interconnect includes 5 wires, Clock (SCL), Data (SDA), Ground (GND), /INTerrupt (/INT), and +V. The minimum connection for I^2C Bus communication is Clock, Data, and Ground. You may not need to, or want to, connect the additional wires to your target system. Refer to the “Hardware Configuration” sections for details.

If you have any questions on I^2C adapter setup and configuration, please visit our FAQ page (http://www.mcc-us.com/faq.htm), or contact our technical support team (support@mcc-us.com).

7. Software Support

MCC offers the following categories of I²C Bus software support:

I²C Bus Communication Utilities

iPort Utility Pack for Windows

The iPort Utility Pack for Windows provides a quick-start to I²C Bus communications. The Utility Pack includes two Windows-based application that will help you get started sending and receiving I²C Bus messages quickly and easily.

iPort Message Center

iPort Message Center is a bus master application with a spreadsheet-like user interface. Each row in the spreadsheet represents a single I²C Bus message. A message can transmit data to a specified slave device, or read data from a specified slave device. Received data is automatically displayed in the spreadsheet.

Message options include repeated-start, and a time delay after each message. One or more messages in the spreadsheet are transmitted in sequence, and can auto-repeat at the completion of the last message.

iPort Message Manager

iPort Message Manager is a bus master/slave application that can master transmit, master receive, slave transmit, and slave receive I²C Bus messages. Message options include master transmit and transmit/receive, and auto-repeat

iBurner I²C Bus EEPROM Programmer

iBurner is our I²C Bus EEPROM Programmer software package for Windows. With iBurner, you can quickly and easily blank-check, program, read, and verify a wide variety of I²C Bus EEPROMs. iBurner also supports scripting, allowing EEPROM programing serialization and automation.

I²C Bus Software Development Tools

MCC provides three methods for creating custom application software for ASCII Interface I^2C Bus Adapters:

MS.NET Class Library

The MS.NET Class Library provides a comprehensive set of tools for the creation of robust I^2C Bus applications. Included are Constructors, Methods, Properties, Events, Enumerations, and SampleCode for Visual Basic.NET, Visual C#, Visual C++, Visual J#, and LabVIEW.

LabVIEW VI Library

The LabVIEW VI Library provides a complete set of low-level, mid-level, and high-level Virtual Instruments (VIs) for the LabVIEW developer. Included are VIs for establishing a connection to the Adapter, performing I^2C Bus Master and Slave operations, and Sample LabVIEW applications.

ASCII Command Interface

The ASCII Command Interface provides a direct low-level ASCII command application program interface to the I^2C Bus Adapter. ASCII commands can be accessed from a terminal emulation program running on the host computer, or from an application program using host computer operating system serial port functions.

iPort/USB 2 software support and more is available at:

www.mcc-us.com/iPortUSB-2

iPort/USB 2 Revision Report

This section defines revisions and changes made to the iPort/USB 2 interface:

Revision: 1.00

1. Initial Release

Additional Information

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

“What is I^2C?”
www.mcc-us.com/I2CBusTechnicalOverview.pdf

“Frequently Asked Questions (FAQ)”
www.mcc-us.com/faq.htm

"The I^2C and How to Use It"
www.mcc-us.com/i2chowto.htm

"I^2C-bus specification and user manual"
NXP Semiconductors N.V.
www.nxp.com/documents/user_manual/UM10204.pdf

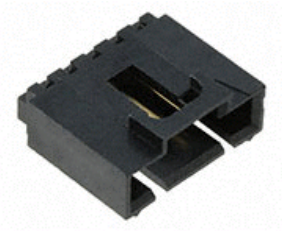
"Home :: NXP Semiconductors"
www.nxp.com

Appendix A - I²C Connector Information

I²C Bus Interface Connector and Plug Information

The iPort/USB 2 uses the following 1x5 2.54 mm (.100") pitch, 0.64 mm (.025") square pin, header and plug assemblies for the I²C Bus interface.

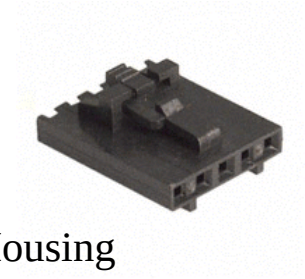
I²C Header Receptacle



Molex C-Grid® SL™ 70553 Header

Molex Part # 70553-0004

I²C Plug Housing



Molex C-Grid® SL™ 70066 Crimp Housing

Molex Part # 50-57-9405

Molex C-Grid® SL™ 70058 Crimp Terminal

Molex Part # 16-02-0102

The following I²C Cables are available from MCC

MCC Part # I2CMCL5 5-wire I²C Mini Clip Lead Cable 0.3 m (1')
MCC Part # I2CMIC5-2 5-wire I²C Mini Interface Cable 0.6 m (2')

Declaration of Conformity

FCC Statement

DECLARATION OF CONFORMITY WITH FCC RULES FOR ELECTROMAGNETIC COMPATIBILITY

We, Micro Computer Control Corporation, of 83 Princeton Avenue #1D / PO Box 275, Hopewell, New Jersey 08525 USA, declare under our sole responsibility that the product:

iPort/USB 2 (#MIIC-208)

to which this declaration relates:

CE Declaration of Conformity

We, Micro Computer Control Corporation, of 83 Princeton Avenue #1D / PO Box 275, Hopewell, New Jersey 08525 USA, declare under our sole responsibility that the **iPort/USB 2 (#MIIC-208)**, to which this declaration relates, is in conformity with General Emissions Standard EN55022:2010 (CISPR22:2008) Class A, and General Immunity Standard EN 55024: 2010 (CISPR22:2010).

Test Laboratory Information:

MET Laboratories, Inc.
Test Report Number: EMC85413-EN
Test Report Date: April 13, 2015
Technical file held by: Micro Computer Control Corporation, 83 Princeton Avenue #1D / PO Box 275, Hopewell, New Jersey 08525 USA, or its applicable authorized distributor or representative

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