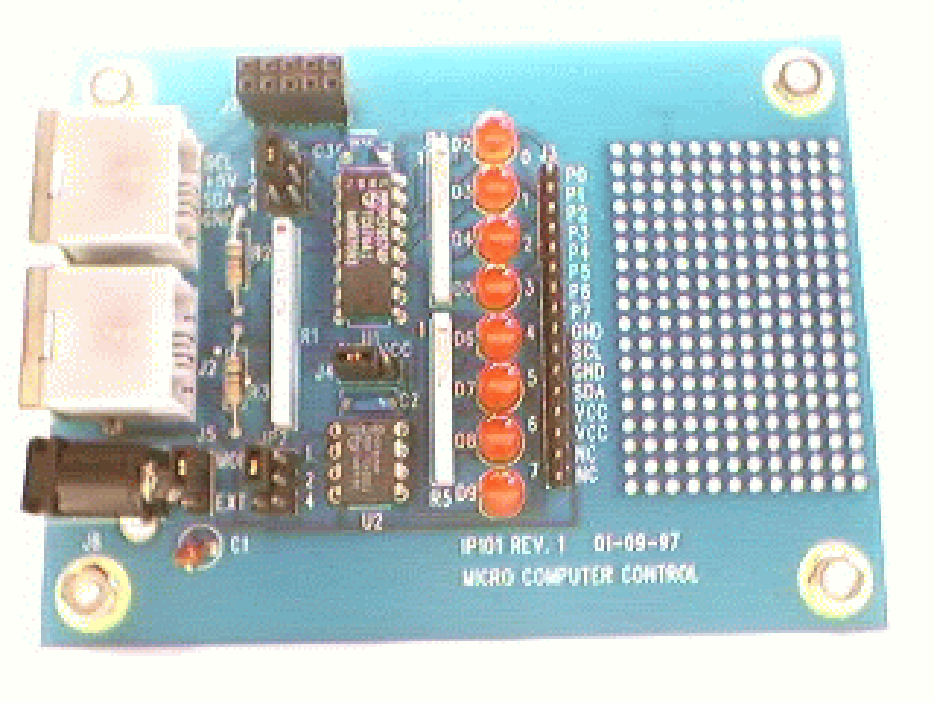
User's Guide

IP-101
I²C Bus Prototyping Card
Revision 1



Micro Computer Control
Small Area Network Specialists

Micro Computer Control Corporation
www.mcc-us.com

I^2C Prototyping Card

Model IP-101
Revision 1

User's Guide

Overview

I^2C Bus is the Inter-Integrated Circuit serial bus developed by Philips Semiconductor for inter-IC communications in consumer electronics products such as stereos, televisions, and VCRs. This highly efficient and cost effective communications link is now being adopted by leading technology companies worldwide for chip, board, and system level communications.

An I^2C Bus network can support up to 127 Master or Slave devices with a simple 2-wire interface. I^2C devices can be as simple as RAM, EEPROM, or I/O devices, or have the full-blown processing power of an embedded microcontroller or microprocessor.

The MCC **IP-101 I²C** Prototyping Card provides an excellent platform for experimenting with the I²C Bus. It includes:

- A Phillips PCF8574 8-bit Input/Output Expander for the I²C Bus.
- A Philips PCF8570 256-8-bit Static RAM for the I²C Bus in a memory socket suitable for a variety of I²C RAM and EEPROM devices.
- I²C Bus and Power connectors.
- A breadboard area suitable for various experimental or test circuits.

Packing Slip

The **IP-101** I²C Prototyping kit includes the following items:

1. The IP-101 I²C Prototyping Card.
2. I²C Interface Cable.
3. Configuration Instructions**.**

Interconnects

The IP-101 I^{2}C Prototyping Card includes the following interconnections:

1. +5VDC Power

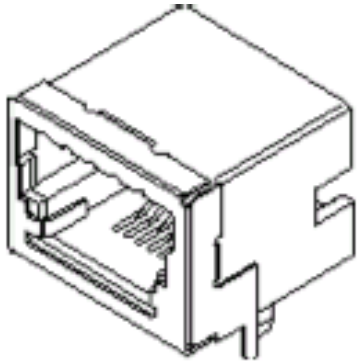
The IP-101 I^{2}C Prototyping Card can be powered in one of two ways, from the I^{2}C interface connector, or from the power jack.

If the unit is powered from the I^{2}C interface connector (J1 or J2), the power control jumper (J5) must be set to MOD (the default Factory Setting). If the unit is powered from the power jack (J6), a +5VDC Wall Transformer (DigiKey Part# T309-ND) is required, and the power control jumper (J5) must be set to EXT.

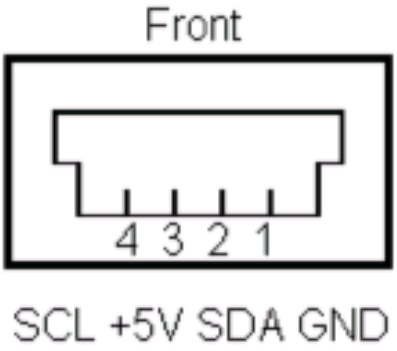
2. I^{2}C Interface Connectors

The IP-101 I^{2}C Prototyping Card includes two (J1 and J2) four wire, positive locking, modular connectors (Molex Part#15-83-0064 Socket, #15-83-1564 Plug) for interfacing to an external I^{2}C Bus. Lines provided include:

1. I^{2}C Clock (SCL)
2. Data (SDA)
3. Ground
4. +5VDC



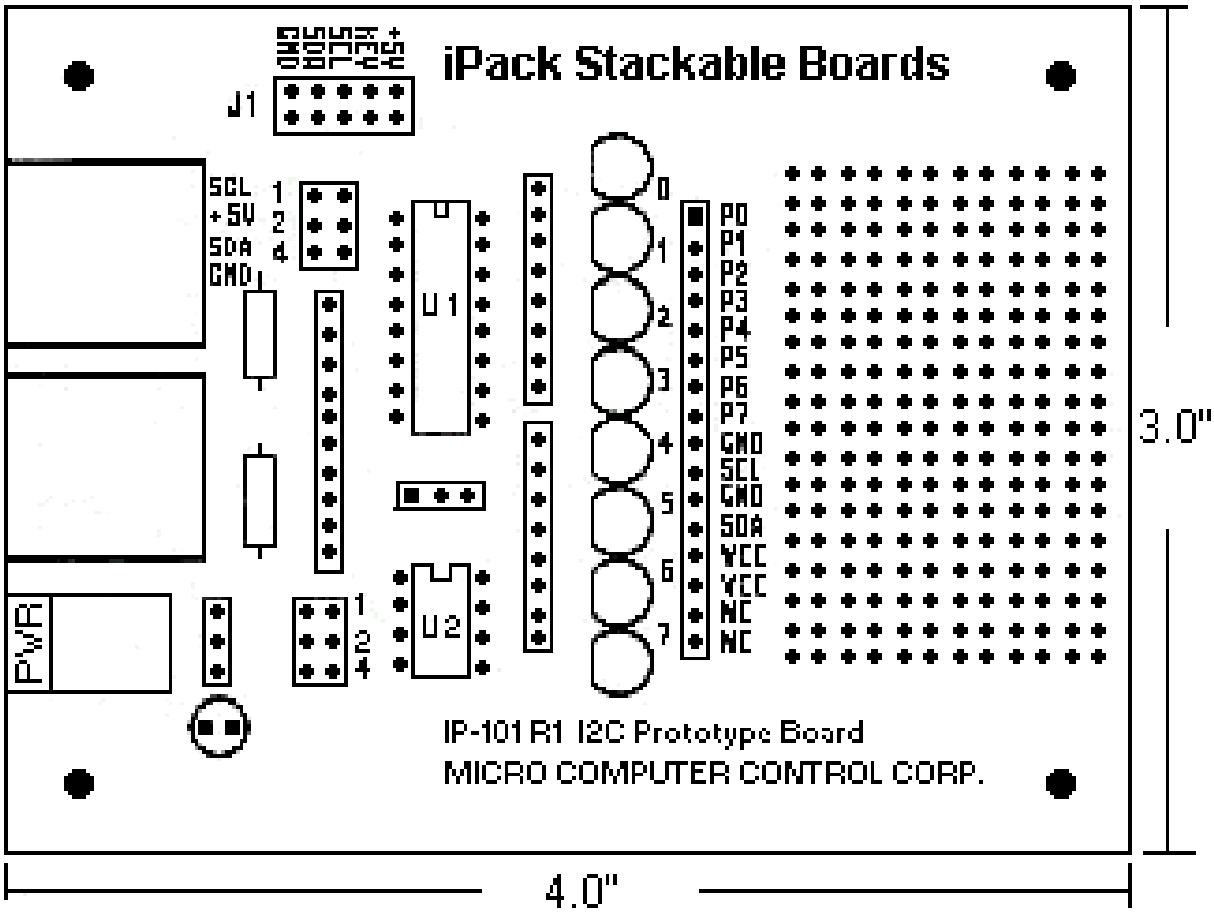
Molex SEMCONN™
ACCESS.bus Receptacle Connector



An I^2C Interface Cable (White=SCL, Red=+5VDC, Green=SDC, Black=Ground) is provided to connect to a external I^2C Bus. Standard two connector four foot long interface cables are available. Contact MCC for other cable configurations.

3. iPack Stackable Connector

The stack connector (J1) provides access to IP-101 power and I2C Bus, and allows stacking of iPack compatable boards.



Configuration

All I^2C slave devices have an address in the I^2C address space. This address space includes all 8-bit even numbers (0x00...0xFE). Address Zero (0x00) is a special Broadcast Address, and is not supported by all devices. I^2C slave device addresses can be:

Single Fixed Address

The I^2C slave device address is set when the device is manufactured or programmed.

Selectable Address

The I^2C slave device supports a limited range of addresses. These devices usually have one or more pins that allow the selection of a specific address within the supported range. The specific address can be set by connections on the printed circuit board hosting the device, or can be jumper selectable. Selectable addressing allows multiple identical devices to exist on the same I^2C Bus at the same time, with each device having a different I^2C slave address.

Programmable Address

An I^2C slave devices could support the reprogramming of its address in response to system events. Commands to set the slave address can come across the I^2C Bus, can originate with other device interfaces, or can be generated internally.

The IP-101 I^2C Prototyping Card supports selectable addressing, and includes three onboard jumpers to control I/O Port and Memory Socket configuration. These jumpers include:

I/O Expander I^{2}C Slave Address Configuration (JP1)

The Philips PCF8574 8-bit Input/Output Expander for the I^{2}C Bus (U1) provides
8-bits of Input or Output at a selectable I^{2}C slave address. This device has three pins (p1=A0, p2=A1, p3=A2) that allows the selection of one of eight possible addresses, starting with the device base address 0x40. These three address select lines are controlled by positioning jumper blocks on header connector JP1 on the card.

JP1.4	**JP1.2**	**JP1.1**	**Device I^{2}C Slave Address**
OFF	OFF	OFF	0x4E (Factory Default Setting)
OFF	OFF	ON	0x4C
OFF	ON	OFF	0x4A
OFF	ON	ON	0x48
ON	OFF	OFF	0x46
ON	OFF	ON	0x44
ON	ON	OFF	0x42
ON	ON	ON	0x40

Memory Socket I^{2}C Address Configuration (JP2)

The Memory Socket (U2) supports a variety of eight (8) pin DIP I^{2}C RAM and EEPROM memory devices with selectable slave addresses. These memory devices typically have three pins (p1=A0, p2=A1, p3=A2) that allows the selection of one of eight possible addresses, starting with a device base address that is device dependent. (A typical example is the Philips PCF8570 256x8-bit Static RAM device with a base address of 0xA0.) These three address select lines are controlled by positioning jumper blocks on header connector JP2 on the card.

JP2.4	JP2.2	JP2.1	Device I²C Slave Address (for PCF8570 Static RAM)
OFF	OFF	OFF	0xAE (Factory Default Setting)
OFF	OFF	ON	0xAC
OFF	ON	OFF	0xAA
OFF	ON	ON	0xA8
ON	OFF	OFF	0xA6
ON	OFF	ON	0xA4
ON	ON	OFF	0xA2
ON	ON	ON	0xA0

Memory Socket TEST Pin Configuration (J4)

The Memory Socket (U2) also supports TEST pin (p7) configuration. This pin is used in a variety of ways that is dependent on the specific memory device. (A typical example is the Philips PCF8570 256x8-bit Static RAM device where the TEST pin is used for Power Saving Mode control.) This pin is controlled by positioning the jumper block on header connector J4 on the card.

GND	VCC	Device I²C Slave Address (for PCF8570 Static RAM)
OFF	OFF	Device Dependent
OFF	ON	Power Saving Mode On
ON	OFF	Power Saving Mode Off (Factory Default Setting)

Accessing I²C Bus Devices

All I²C slave devices have a message protocol that defines how to access the device. Bus protocols for IP-101 I²C Prototyping Card devices are as follows:

Philips PCF8574 8-bit Input/Output Expander

Each I/O pin on the PCF8574 can be used as an Input or Output.

To treat a pin as an output, set or clear the pin's bit position (P7=D7,...P0=D0) in the I^2C message data byte and write the byte to the PCF8574.

To treat a pin as an input, set all input pin bit positions (P7=D7,...P0=D0) in the I^2C message data byte and write the byte to the PCF8574. To read the input pin's logic level, read the entire byte from the PCF8574 and test the pin's bit position in the received I^2C message data byte.

Start	Slave Address	0	Ack	Data	Ack	stoP

Write I/O Expander Port (WRITE Data).

Start	Slave Address	1	A	Data	Nack	stoP

Read I/O Expander Port (READ Data).

Philips PCF8570 256x8-bit Static RAM

The PCF8570 provides 256 bytes of static RAM. Like any RAM device, you can read or write any byte within the device.

Accessing a byte within an I^2C memory device requires that you specify both the I^2C device slave address and the address of the memory byte within the device. In the case of the PCF8570, the memory byte address is contained in the first message byte following the slave address.

The PCF8570 also supports continuous reading, where the memory byte address is auto-incremented after each read.

S	Slave Address	0	A	Memory Address	A	Data	A	...	Data	A	P

Set RAM Address and Write RAM byte(s) (WRITE Address, WRITE Data).

S	Slave Address	0	A	Memory Address
S	Slave Address	1	A	Data	A	...	Data	N	P

Set RAM Address and Read RAM byte(s) (WRITE Address, READ Data).

S	Slave Address	1	A	Data	A	...	Data	N	P

Read RAM byte(s) (READ Data).

Additional Information

For additional information on the I^2C Bus or specific I^2C devices see the device manufacturer's data sheet or refer to the following:

Philips Semiconductors
811 East Arques Ave.
Sunnyvale, CA 94088
Tel. (800)227-1817

"80C51-Based 8-Bit Microcontroller" Data Handbook.

Philips Semiconductors

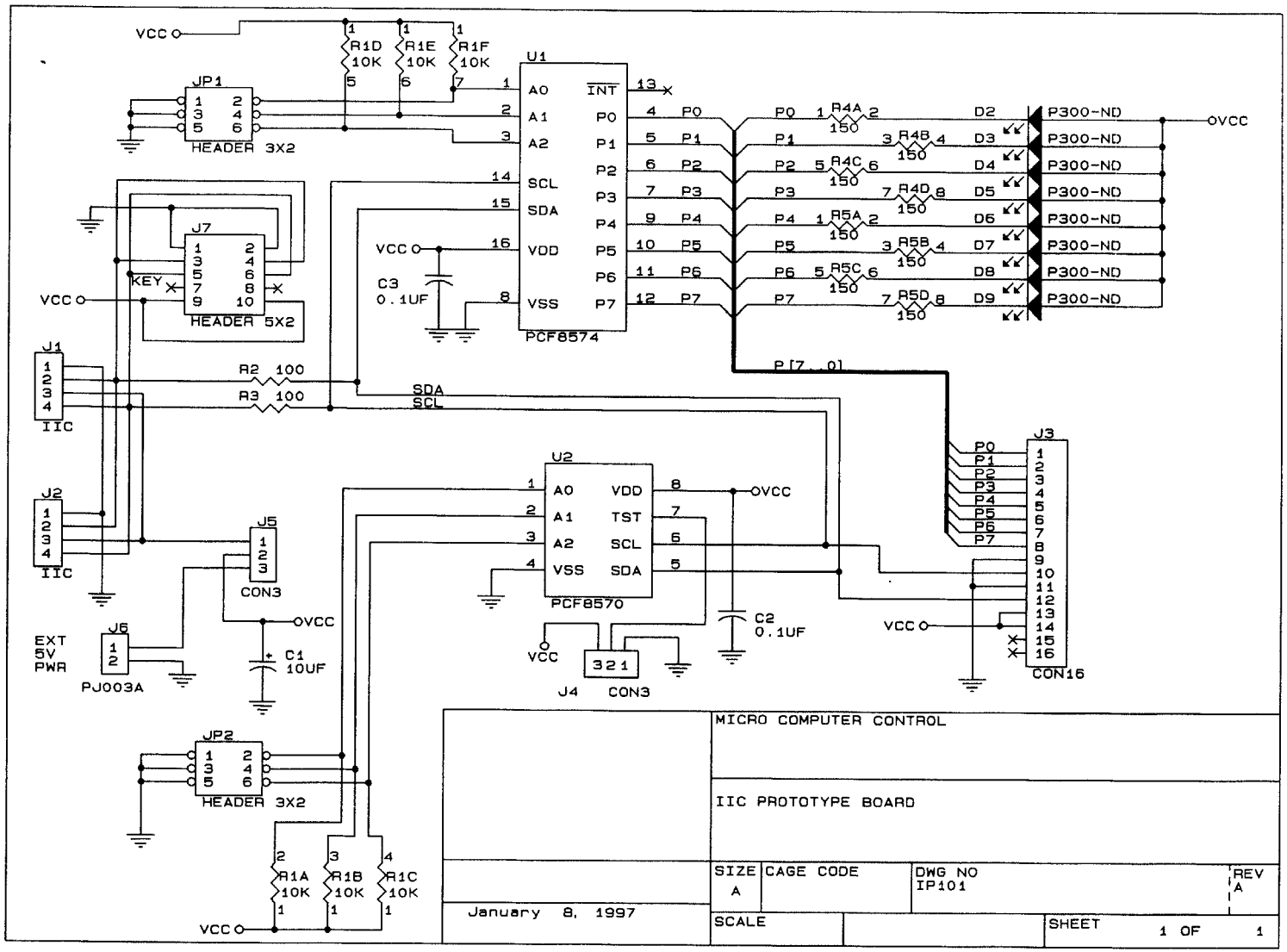
"I2C Peripherals for Microcontrollers" Data Handbook.

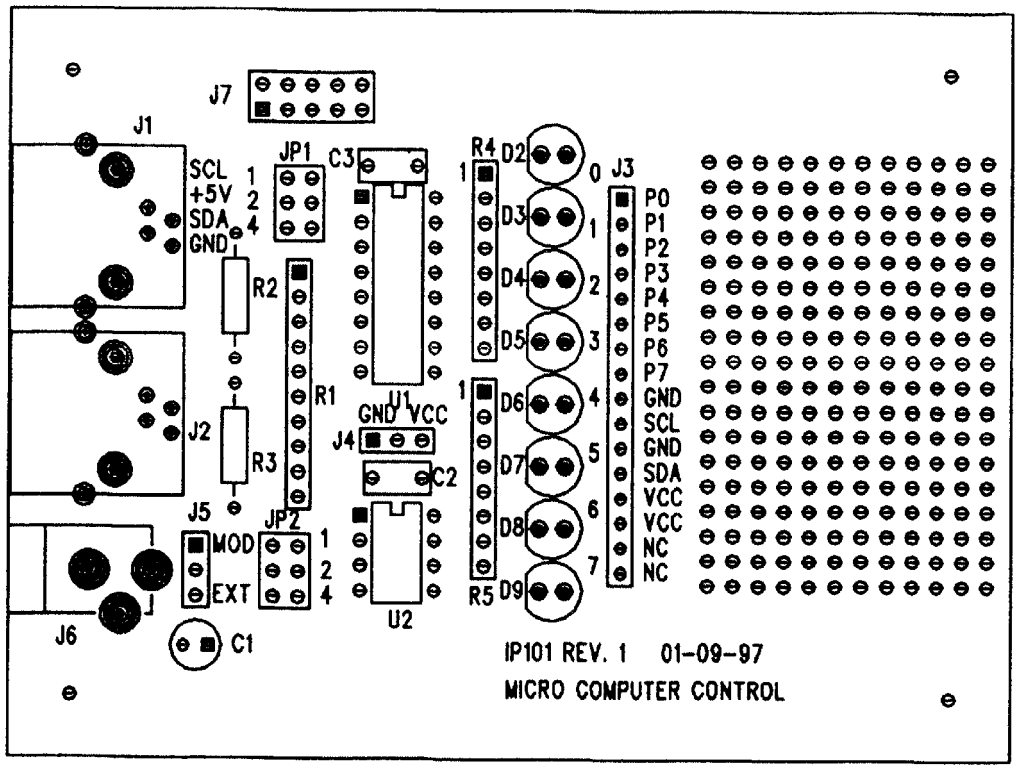
TEL(609)466-1751 FAX (609)466-4116

For the latest product information, configuration availability, and technical tips visit our Web Site at:

http://www.mcc-us.com

June - 2000 PrototypingBoard.wpd


VCC
R1D 10K
R1E 10K
R1F 10K
JP1
HEADER 3X2
U1
A0
A1
A2
SCL
SDA
VDD
VSS
INT
P0
P1
P2
P3
P4
P5
P6
P7
PCF8574
R4A 150
R4B 150
R4C 150
R4D 150
R5A 150
R5B 150
R5C 150
R5D 150
D2
D3
D4
D5
D6
D7
D8
D9
P300-ND
OVCC
J7
KEY
HEADER 5X2
C3 0.1UF
P[7..0]
J1
IIC
R2 100
R3 100
SDA
SCL
J2
IIC
U2
A0
A1
A2
VSS
VDD
TST
SCL
SDA
PCF8570
C2 0.1UF
J3
CON16
J5
CON3
EXT 5V PWR
J6
PJ003A
C1 10UF
J4
CON3
JP2
HEADER 3X2
R1A 10K
R1B 10K
R1C 10K
MICRO COMPUTER CONTROL
IIC PROTOTYPE BOARD
SIZE A
CAGE CODE
DWG NO IP101
REV A
January 8, 1997
SCALE
SHEET 1 OF 1



JAN. 09, 1997 ARTWORK COMPONENT SIDE

MCC IP101 REV. 1 SILK SCREEN COMPONENT SIDE