

I2C01

I2C Interface Module

Universal I²C interface for custom I/O boards

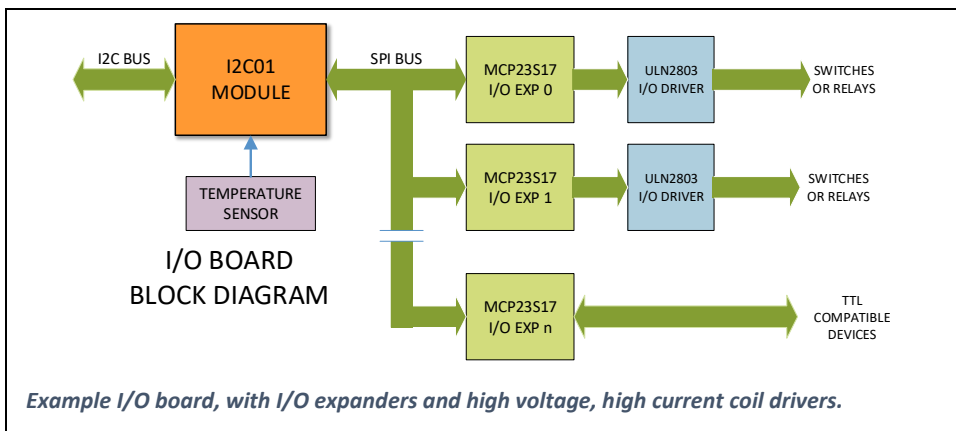


Description

The I2C01 module is a component of the Modular Control System. The module is a small business card sized daughter board designed to allow the OEM to design and build custom I/O boards or backplanes for the control of RF switches, relays, lamps, fans and other devices. The I/O boards only need to contain I/O expander chips, I/O connectors and any interface driver chips as required by the application. These boards can be simple 2-layer boards for most applications and can be designed as a mechanical backplane to connect directly with RF switches and other devices to eliminate chassis wiring. Multiple boards with

I2C01 modules may be combined with other boards and the MSC02 controller board to build large or small custom control systems with minimal NRE. The modules and other boards are controlled by the industry standard I²C bus and are interconnected with standard Ethernet cables. The module is configured by the controller board. Custom design services are available for a “turn-key” system.

The I2C01 is a “smart module”, its on-board processor handles the control of the attached devices, off-loading the main controller board. The module is programmed with the parameters of the devices when the system is configured so when the controller needs to change a



Features:

- *Compatible with the Modular Control System*
- *Provides a means for the OEM to build custom I/O driver boards or backplanes*
- *On board processor offloads main controller board*
- *Contact actuation counters for each channel*
- *Controls latching and non-latching switches and relays*
- *Supports many standard RF switches*
- *Supports step attenuators*
- *I²C bus control using standard Ethernet cables*
- *Multiple boards can be controlled by one controller bd.*
- *Monitors temperature and supply voltages*
- *Minimal chassis wiring*
- *Reference I/O Board designs available*
- *Custom I/O Board design services available*

Applications:

- *Test & Measurement*
- *Communication Systems*
- *Instrumentation*
- *Radio/Antenna matrix control*
- *Naval & other marine systems*

Device Control:

- *RF switch matrixes*
- *Attenuators*
- *Relays*
- *Lamps & LEDs*
- *Fans*
- *Mechanical devices*
- *Synthesizer and DDC control*

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setting such as a RF switch position, all it needs to send to the module is the switch number and the new position.

One example is the control of a multi-position latching switch with a common reset line, the I2C01 processor would first pulse the reset coil for the programmed time, then pulse the proper coil to set the desired position. As the required pulse timing is typically 10-20 milliseconds for each coil, once the command is sent to the I2C01, the controller board is free to continue to the next switch or device without having to wait for the pulse timing to complete. If a path in a matrix switch is being set, this will allow the action to be processed in parallel. The I2C01 module can also process multiple switch commands in parallel as the command structure allows the controller board to send a list of switch position commands.

System Architecture

The Modular Control System consists of a MSC02 Modular System Controller Board and as many driver boards as needed. The system control is via I²C serial buses using standard Ethernet cables. All modules have two parallel I²C connectors so they can be “daisy chained” on the bus. Other types of boards can also be included in the system as well as a front panel color touch screen.



I2C01 Module on a 72 Channel Switch Driver Board

This is an example usage of the I2C01 module on a custom switch driver board. This board is designed to drive 9 6-position switches and 9 2-position latching switches which plug directly into the board with no cables.

System configuration, switch types and other device parameters are pre-programmed in the MSC02 controller board’s EEPROM using simple SCPI commands and can be loaded using batch files.

I2C01 Configuration

The I2C01 modules are configured by the MSC02 controller board over the I2C bus when the system is assembled. The I2C01 stores its configuration in its own EEPROM so it is ready at power on.

I2C01 modules can be configured to control up to 32 Microchip MCP23S17 16-bit I/O expanders (512 bits) which in turn can control up to 100 switches or relays with a separate command for each one. The I/O expanders have 2 8-bits ports and each port can be configured to control switches with up to 8 positions or multiple switches or relays in any mix up to 8 control lines. For example, a port could control two 4-position switches, two 3-position switches with two SPDT switches or one 8-position switch. Switches larger than 8-positions can be controlled using multiple ports.

The I2C01 can also be configured to control step attenuators. The attenuation value for each control line is programmed and the attenuator can be set by just specifying the total attenuation value. This also allows the attenuator to be calibrated to match actual values if desired.

I2C01 I²C Module – Data Sheet

The control ports can also be set with 8-bit values in decimal or hexadecimal to control lamps or other devices.

The I2C01 has service request capability and can notify the controller of specific events such as operation complete to validate that all commands have been executed or in case of a system error such as a power supply voltage out of range or an over temperature event.

The module temperature and supply voltages are monitored and reported to the controller on command.

The I2C01 contains counters which can be enabled to count the number cycles for each switch pole or relay to provide a warning when the device reaches a pre-determined number of cycles. In a production test environment, this will allow the devices to be replaced when their maximum cycles specification is reached.

Supported Devices

The standard I2C01 firmware supports the following devices with low side coil drive requirements, please consult the factory if additional device support is needed.

RF Switches

- 1 to 8 poles non-latching
- 1 to 8 poles latching
- 1 to 7 poles latching w/reset

Step Attenuators

- 1 to 8 sections non-latching
- 1 to 4 sections latching (2 lines per section)

Relays

- Non-latching (1 coil)
- Latching (2 coils)

Other Devices

- Single line on/off
- Multiple lines, decimal or binary encoding

I2C01 I²C Module Specifications

Module/Board Interface

I/O Expander Type

Microchip MCP23S17 16-bit I/O Expander, up to 32 devices.

Connector Type

Industry standard headers with male pins compatible with standard receptacles. 2 each (P1 and P2).

Pins	14
Rows	1
Pins spacing	0.1"

Signals

+5V power	Power from I ² C bus
+3.3V power	Regulated
Ground	Signal ground
CHASSIS GND	I ² C bus shield
SPI SCLK	SPI clock
SPI MOSI	Master Out, Slave In data
SPI MISO	Master In, Slave Out data
SPI SEL1	Expander 0-7 Enable
SPI SEL2	Expander 8-15 Enable
SPI SEL3	Expander 16-23 Enable
SPI SEL4*	Expander 24-31 Enable
SPI INTA-	Interrupt A
SPI INTB-	Interrupt B
RESET-	Circuit reset
SER TX*	Serial Tx data or SPI SEL4 24-31 Enable
SER RX	Serial Rx data
ERR LED	Error LED
RDY LED	Ready LED
ADDR LED	Address LED
SRQ LED	SRQ on LED
TEMP MEAS	Temperature sensor input
SW VOLTAGE	Coil voltage sense input

* Note
SPI SEL4 and SER TX share the same pin selected by firmware. Serial data requires special firmware.

Power Requirements

Logic Power

5V @ < 5 mA Supplied by the MSC02 Controller Bd. on the I²C cable

I²C Interface

The I²C bus signals are fully buffered at a 5V level and include a service request line.

Connector type

RJ45 (2) shielded, wired in parallel to allow daisy chaining the bus (J1)

I²C Signals

SCL	Twisted pair w/ground
SDA	Twisted pair w/ground
INT (SRQ)	Twisted pair w/ground
+5V DC	2-wires
GROUND	3-wires (part of twisted pairs)

I²C Modes

I ² C mode	Slave
Address Mode	7-bit
Addresses	1 per module, 112 possible (programmable)
Default address	64

Measurements

Module temperature	-10 to 60 C
Supply voltages:	Switch Voltage, 5V, 3.3V

Configuration and Control

Configuration and Control is via the MSC02 Controller Bd. using standard SCPI commands. Once configured, the setup is stored in the I2C01's micro controller's EEPROM.

Configuration:

- Switch & relay settings
- I/O port setup
- Attenuator step settings

Control Commands:

- Switch/Relay control
- Attenuator control
- I/O port control

Physical

Size, L x W x H

2.0 x 2.65 x 1.0 inches

Temperature

Operation	-10C to +50C
Storage	-40C to +85C
Humidity	0-90% RH non-condensing

Connectors

I ² C	(2) RJ45
Board Headers	(2)14-pin header pins on .1" centers
Programming	(1) 6-pin header on .1" centers

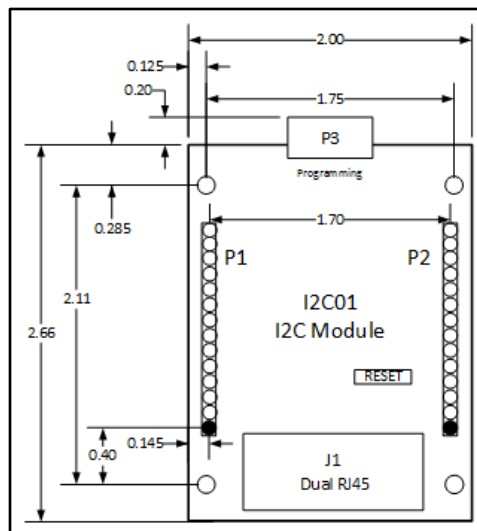
LED Indicators

ERR, RDY, SRQ, ADDR

Certifications

Our assembly facility is ISO 9001 and ISO 13485 certified.

All boards are RoHS certified



I2C01 Installation Drawing

Note: Consult factory for detailed circuit board layout information