



2003 USB to Digital Board

- Provides 40 user configured digital I/O lines.
- Inputs TTL/CMOS and contact closures. Drives 48 mA.
- Automatic event and status change detection.
- Provides GPIB functionality over a USB link.
- Easy programming with SCPI and short form commands.
- Microsoft's Virtual COM driver never becomes obsolete.
- Support includes a menu driven configuration program and ICS's USBkybd program.
- Interchangeable with ICS's 4803 GPIB, 2303 Serial and 8003 Ethernet Digital Interface Boards.

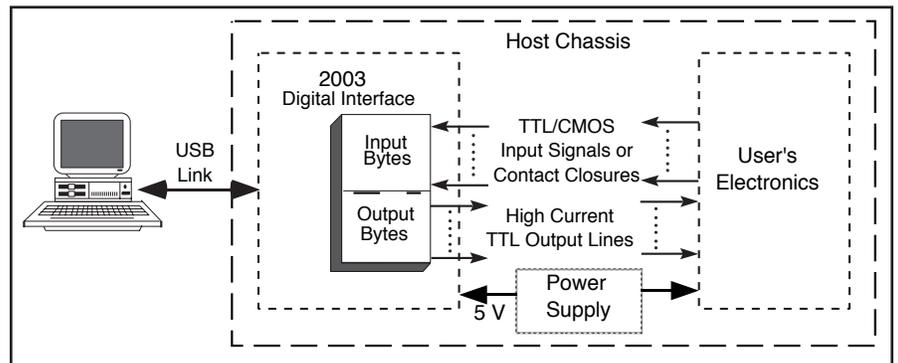
## DESCRIPTION

ICS's Model 2003 USB <=> Digital Interface Board provides 40 user programmable, bidirectional data lines for controlling devices, for transferring digital data or for monitoring digital signals. The 2003's USB interface provides all of the functionality of ICS's 4803 GPIB-to-Digital Interface but allows for control of the digital signals via a USB Interface. The 2003 is interchangeable with ICS's other xx03 boards and can use all of their existing accessories including the xx03DVR Relay Driver Board.

The 4802 has a female USB 'B' jack for direct connection to any PC or USB Hub. The 4802 is designed so it can be mounted against the rear panel of a host chassis with the USB connector protruding thru the rear panel or mounted anywhere inside the chassis. Each 2003 includes a short USB extension cable with a panel mount 'B' female connector to provide USB access on the rear panel. An on-board regulator lets the board accept 5 to 15 Vdc power from an existing host power supply.

The 2003's digital signals are on rows A and C of a 96-pin DIN connector. Signal connections can be made with a flat-ribbon cable, by a wired connector or by piggybacking the 2003 on top of a larger PC board.

The 2003 includes a complete manual, a USB extension cable and a Support CD. The Support CD includes example programs and an USBkybd program that lets a user control the 2003 from any PC keyboard.



A 2003 being used to control a test chassis

✓ RoHS Compliant



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## 2003: DESCRIPTION

### Versatile Digital Interface

The 2003's digital interface is easily configured as inputs or outputs in 8-bit byte increments. Inputs are tristated gates with 33 kohm pullup resistors; outputs are heavy-duty TTL drivers with 24 mA source-48 mA sink capability. Data transfer can be to or from specific bytes, as bit commands that set or reset a single bit, or as strings of data to or from multiple bytes. The user can mix the digital transfer methods as he assigns the input and output bytes. The setup configuration and last output values can be saved in the 2003's flash memory and becomes the new power-on configuration. The 2003's Stable output signal can be used to enable external devices after the digital I/O lines have been configured.

### Controlling the Digital Interface

Figure 2 shows the different ways the 2003's digital I/O lines can be used to transfer data. Arrows show the data direction. Figure 2 shows how short form commands control the data transfer but the user can do the same operations with SCPI commands. The data bytes can be assigned in any order to fit the application.

The bit and byte commands automatically set the data direction for their respective data bytes when the command is first executed. Bit command examples are Close, Open and Read which operate bits on bytes 1 and 2. Pulse commands can pulse single or multiple lines at the same time. A common pulse width setting is used for all of the output lines.

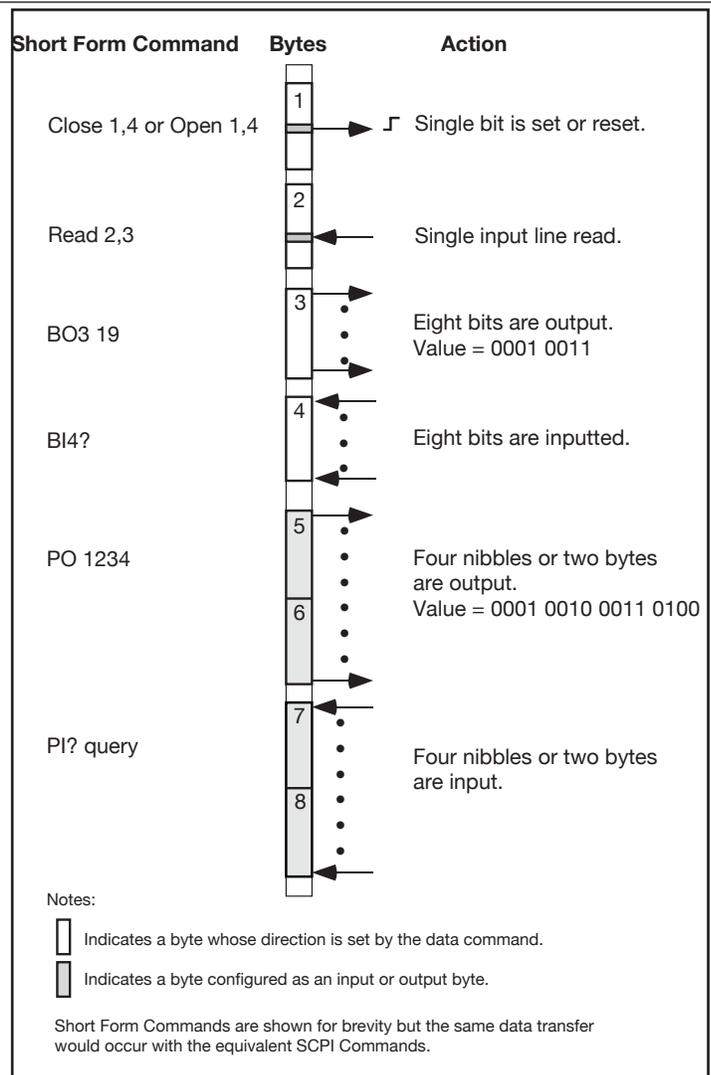
Byte commands write or read all 8 bits in a byte. Figure 2 shows the BO3 command writing all 8 bits to byte 3 and the BI4? query reading all bits from byte 4. Data strobes can be manually generated if needed. The user can set the data polarity on a bit or byte basis for all of the bytes controlled by the bit and byte commands.

String commands transfer one or multiple bytes of data at a time. String commands work on data bytes that are pre-configured as part of the input or output string by the CONFIGure commands. The user can configure 1 to 5 bytes as inputs and/or as outputs to make data words up to 40-bits wide. Figure 2 shows two bytes (bytes 5 and 6) configured as outputs and their values are set by the four hex digits in the PO command. A data strobe is automatically generated when data is outputted by a string command. The data strings can be a series of decimal values, ASCII HEX characters, or the 30-3F HEX characters used in ICS's older interfaces.

Figure 2 has two bytes (bytes 7 and 8) that have been configured as the input string. The PI? query reads 16 bits of data from bytes 7 and 8. Data can be inputted with or without handshaking. The parallel input data can be formatted as decimal numbers, as ASCII HEX characters, or into any user selected character set.

### Input Signal Monitoring

The 2003 can monitor up to fifteen input lines on bytes 1 and 2 for signal changes and generate a Service Request Message (SRM) to notify the computer when changes occur. The user's



**Figure 2 2003 Digital Data Transfer Methods**

(Figure 2 shows 8 bytes for illustrative purposes even though the 2003 only has 5 bytes)

program can then query the registers in the 2003's IEEE-488.2 Status Reporting Structure to determine the input signal states and which signal(s) changed state. The user's program can then take the appropriate action. Application Bulletin 48-18 describes how to configure the 2003's Status Reporting Structure registers and includes a program example.

### GPIB Functionality

The 2003 is an IEEE-488.2 compatible device and provides GPIB functionality over a USB link. The 2003 is functionally and physically equivalent to ICS's 4803 GPIB <=> Digital Interface Board. The 2003 executes the same commands as the other xx03 boards to control the digital I/O lines and responds to all of the IEEE-488.2 Common Commands.

Service Requests are handled differently because the 2003's USB interface does not have a SRQ line that can be asserted to request service. Instead, the 2003 transmits an asynchronous Service Request Message (SRM) to alert the application that it needs service. SRM generation is controlled in the same manner that SRQs generation is handled in any IEEE-488.2 instrument.

## 2003: DESCRIPTION

### Windows Drivers

The 2003 uses Microsoft's standard drivers for Virtual COMM Ports. These drivers are maintained by Microsoft so they will always be current, no matter how the operating system changes. Currently these drivers are available for Windows XP (SP2) or later, Vista and Windows 7, 8 and Windows 10 operating systems. When the operating system detects a 2003 board it creates a new Virtual COMM Port for communicating with the 2003.

### Application Software

Application programs written for the 2003 are similar to those written for the other xx03 boards. The command syntax is the same. Visual Basic and C/C++ programs reference the MSCOMM function and a virtual COMM port when sending commands or reading back response messages instead of GPIB calls. Programs written with VISA calls only need to change the VISA Resource Name to access the virtual COMM port. Example programs are included in the Support CD.

### OEM Configuration Features

The user can change the board's IDN message to personalize the 2003 as part of the end product. The IDN message, and the 2003's parallel interface configuration are saved in nonvolatile Flash memory. A lock command protects the configuration settings from being accidentally changed by the end user.

### Signal Connections

The 2003 has a USB 'B' connector for the USB Bus and a DIN connector for the parallel digital signals.

If the 2003 can be mounted at the rear panel so its USB connector protrudes through the rear panel. If mounted inside the chassis, a Panel Mount B extension cable extends the USB Bus to the 2003 board.



Figure 3 895016 USB Extension Cable

The 2003's parallel interface connector is a 3-row, female 96-pin DIN connector with the 40 digital I/O lines, handshaking and status signals on rows A and C. Mating solder-pin connectors, solder eyelet connectors or the 112343 open-end flat-ribbon cable, shown in Figure 4, can be used with the standard 2003 boards.

2003 boards are also available with a male DIN connector mounted on the circuit side, as shown in Figure 5, so the 2003 can be piggybacked on a larger PCB assembly. This is a good mounting method when the design is such that a PC board is needed for other devices in the chassis since it eliminates a cable and wiring. 2003 boards with the circuit side connector also mount onto the Relay Driver board shown on page 4.

### Starter Kit

An Starter Kit is available for first time 2003 users that includes a 2003 card, a USB Cable, a USB Extension Cable, mating DIN connectors and Open-end Flat-ribbon cable, manual and Support CD with sample programs. Limit of one starter kit per customer.

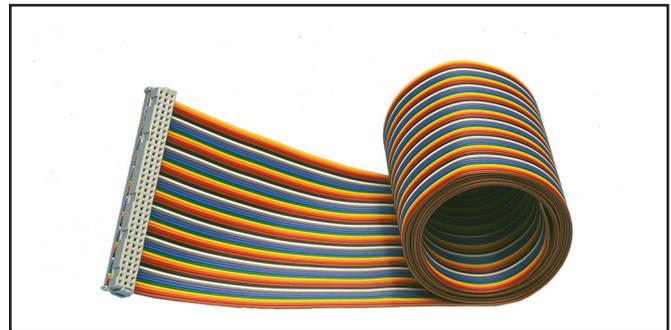


Figure 4 112343 Open-end Digital Cable

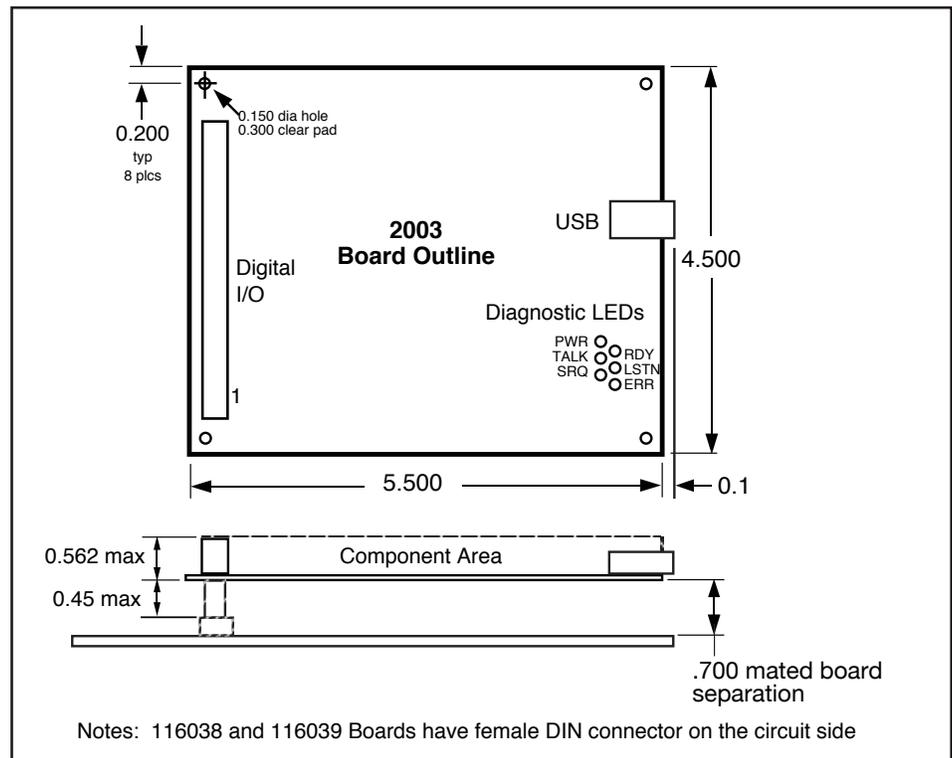


Figure 5 2003 Outline and Mounting Dimensions

## 2003: ORDERING GUIDE

Select from one of the two 2003 board styles and then pick your accessory items.

Part Selection	Qty	Part Number
Standard 2003 board with the digital IO connector on the component side	(1)	2003 or 116032 Board only(1)
Select one mating digital IO connector - Solder eyelet     Solder pins   or   Flat-ribbon cable       Select an Open end, flat ribbon cable assembly, 5 feet long   or     Select the 4803 Relay Driver Board (Mounts on top of std 2003)	(1) (1) (1)  (1)  (1)	902023 902067 902124  112343  115522 (3)
Select a USB Panel mount 'B' to 'B' cable- 1 foot long     2 feet long	(1) (1)	895016 895017 (1)
2003 board with the digital IO connector on the circuit side (facing down) for mounting on another PC board	(1)	116038 or 116039 Board only
Select a mating digital IO connector with solder pins for the PC board   or     Select the 4803 Relay Driver Board	(1)  (1)	902257 or 902058  115490
Select a USB Panel mount 'B' to 'B' cable- 1 foot long     2 feet long	(1) (1)	895016 895017 (1)

- Notes: 1. The Model 2003 and 116038 Boards include a 895017 USB Extension Cable, a manual and Support CD. P/Ns 116032 and 116039 are board only versions and do not include any accessories.  
 2. New customer must order one 2003 or 116038 before ordering board only versions.  
 3. Recommend using a 116038 or 116039 Board with the digital I/O connector on the circuit side that sits on top of the 115490 Relay Driver Board.

## Relay Driver Board

The 4803DVR Board expands the 2003's digital drive capability by providing forty 300 mA relay drivers on a board with convenient screw terminals. A 2003 with J3 mounted on the circuit side piggybacks on the 4803DVR board to make a compact assembly that is less than 1.25 inches high. The 4803DVR board can be configured for 40, 32 or 24 lines to be relay driver outputs. The remaining lines can be used as standard TTL I/O lines.

The 4803DVR Board is powered by the 9-32 volt, relay power supply that powers the relays. The 4803DVR Board supplies the 5 Vdc power to operate the 2003, eliminating the need for a separate power supply. See the 4803DVR Board datasheet for complete specifications.

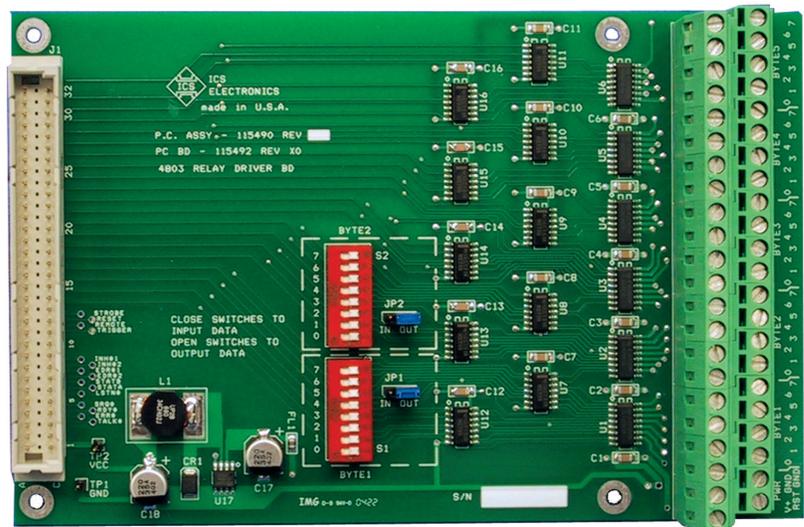


Figure 6 4803 Relay Driver Board

## 2003: SPECIFICATIONS

### USB Interface

Provides USB control through a virtual COMMPort using the Microsoft standard driver for Virtual COMMPorts.

### USB Standard

USB 2.0 full-speed (12 MHz) Interface for USB 2.0 and 3.0 ports.

### Supported Operating Systems

Windows XP (SP2) or later,  
Vista  
Windows 7, 8 and 10

### Data Rates and Formats

Baud Rate: 115.2 Kbaud

### Command Sets

SCPI and short form commands listed in Table 1 plus the following IEEE 488.2 Common Commands:

\*CLS, \*ESE, \*ESE?, \*ESR?, \*IDN?, \*OPC, \*OPC?, \*PSC, \*PSC?, \*RCL, \*RST, \*SAV, \*SRE, \*SRE?, \*TRG, \*TST, and \*WAI.

### Signal Characteristics

The 2003's digital I/O signals have the following electrical characteristics. All time delays listed here are maximums, all pulse widths are minimums.

**Data** 40 lines in five 8-bit bytes

**Status** 2 general purpose inputs

**Input Logic Levels** High = > +2.4 V  
Low = < 0.5 V @ -200  $\mu$ A  
33 Kohm pullup to +5 Vdc for normally open contacts.  
Max High = 5.5V

**Input Timing** Two External Data Ready inputs with Inhibit outputs. Sets within 1  $\mu$ s of the active edge of the EDR Input signal and resets after data is loaded. Data loading time for 6 BCD/HEX characters is 4 ms (typ.)

**Output** High = >3 V with 3 mA source

**Logic** High = >2 V with 24 mA source

**Levels** Low = 0.0 to +0.8 Vdc, 48 mA sink

**Output Timing** Data is transferred to the output within 1.6ms after receipt of a terminator; output data stabilizes 0.35 ms prior to the data transfer strobe.  
Pulse width 10 to 30000 ms

**DataStb** Output pulse width, 40  $\mu$ s

**Trigger** Output pulse width, 40  $\mu$ s

**Reset** True during 2003 Reset time (1 ms)

**Remote** Output level true when 2003 is in its remote state.

### Diagnostic Indicators

Six on board LEDs. Low true drive signals on digital I/O connector for remote LEDs

PWR, RDY, TALK, LSTN, SRQ and ERR

### Physical

#### Size, L x W x H

139.7 x 114.3 x 12.7 mm  
(5.5 x 4.5 x 0.5 inches)

#### Connectors and Headers

USB: B female jack  
Digital: 96-pin, 3 row male DIN conn, rows A & C.

#### Temperature standard version

Operation -10° C to +70° C  
Storage -20° C to +85° C

#### Humidity

0-90% RH without condensation

**Power** +5 Vdc @ 400 mA (typical)

**Construction** RoHS Compliant

### Included Accessories

Instruction Manual  
Support CD with USBkybd and sample programs  
USB Rear panel extension cable, 2 ft long  
USB cable, 5 ft long

### Available Accessories

See the Ordering Guide on page 5 for all optional items.

Open-end rainbow ribbon cable, 5 ft, P/N 112343

Mating DIN Connectors:  
P/N 902023 Solder Eyelet  
P/N 902067 Dip Solder  
P/N 902124 Flat ribbon Cable

### ORDERING INFORMATION

Part Number

USB <=> Parallel Digital Interface Board (Includes Instruction Manual and Support CD) 2003

USB <=> Parallel Digital Interface Board (Board only) 116032

Open-end 64-conductor, rainbow colored flat ribbon cable, 5 feet long 112343