IEEE 488/GPIB BUS INTERFACES

4803

GPIB ⟷ PARALLEL DIGITAL INTERFACE

A flexible interface between the IEEE 488 Bus and devices with digital signals.

- Provides a user-definable, 40-line parallel interface with bit, byte, pulse, string and binary data transfer capabilities. *Fully configurable to the user's needs by bus commands.*
- Signal monitor feature allows the 4803 to detect signal changes on 15 inputs. *Relieves controller of time consuming polling operation.*
- High-current drivers and input pullup resistors. *Drives more devices, longer lines and inputs CMOS signals or switch contacts.*
- IEEE-488.2 compatible unit uses SCPI commands and Short Form commands. *Includes latest GPIB program advances*
- Device configuration, user's IDN message and bus address stored in Flash. *Stored setup eliminates program initialization statements.*
- Optional Swich Control Program with SCPI commands. *Easy control of multi-line switches and attenuators.*
- Interchangeable with ICS's USB, Serial or Ethernet (LAN) to digital boards. *Easy conversion path.*

☑ RoHS Compliant

Description

The Model 4803 GPIB <-> Digital Interface Board is an IEEE-488.2/GPIB to digital interface with 40 I/O lines that can be used to easily adapt devices with digital signals to the IEEE-488/GPIB/HP-IP bus. In a typical application, the 4803 is located inside the device and is powered by the device's +5 volt power supply. All signal connections can be made with plug-in flat ribbon cables that directly connect to the GPIB and digital headers on the 4803. When used with the companion GPIB Connector/Address Switch Board, the 4803 becomes a quick and easy way to add an IEEE-488.2 interface to most digital devices. An optional Generic Switch Control Program adds additional SCPI commands that make it easy to control multi-line switches and attenuators.

The 4803 includes a complete manual and a configuration disk with sample programs. A Starter kit is available that has everything a non-GPIB user needs to install a 4803 in his chassis and control it from the GPIB bus.

4803 Interface Card and GPIB Connector/Address Switch Cable Assembly

Versatile Digital Interface

The 4803's digital interface is configured with commands from the GPIB Bus. The configuration commands permit the user to designate the data lines as inputs and/or outputs in 8-bit byte increments, connect bytes into strings, set data polarity, data format, and handshake modes. The user can set the output lines to his desired values and save the current configuration in the 4803's Flash memory. The saved configuration becomes the new power-on configuration. At power turn-on, the Digital I/O lines are initially tristated and then set to the saved configuration. A Stable signal is asserted after the digital I/O lines are configured to enable external logic or relays.

Data Transfer Methods

Data transfer between the computer and the 4803's digital interface can be by individual bits, by bytes or as strings of data values to multiple bytes as shown in Figure 2.

• Bit commands set or reset specific bits in a byte or query a bit's status. New pulse commands let the user pulse single or multiple output lines at the same time.

• Byte commands set all 8 bits in a specific byte or read data from a byte.

• String transfer commands send strings of data characters to one or more output bytes to make a multi-byte output word or read a string of data from one or more input bytes. The user designates these bytes as inputs or outputs when configuring the board.

In the Single Address Mode, the user can set the 4803's configuration and transfer data as described above. In the Dual Address Mode, the lower address behaves like the Single Address Mode. The upper address can be used to transparently transfer data to configured output bytes or to read data from configured input bytes. The data is sent or read without having to parse any commands, eliminating the parsing time and speeding up the data transfer. When the binary data format is used, the 4803 can output data at rates > 50 Kbytes/sec.

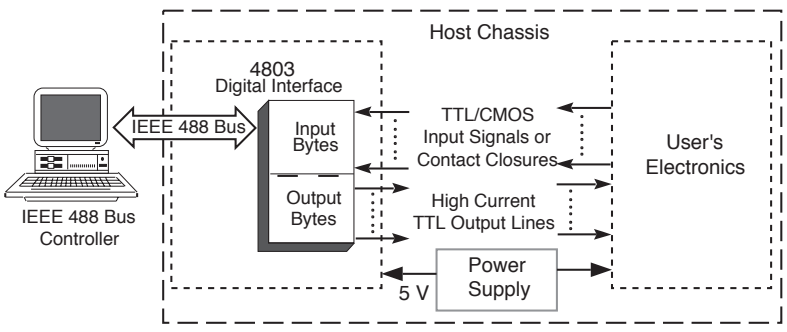

Figure 1 A typical 4803 Application

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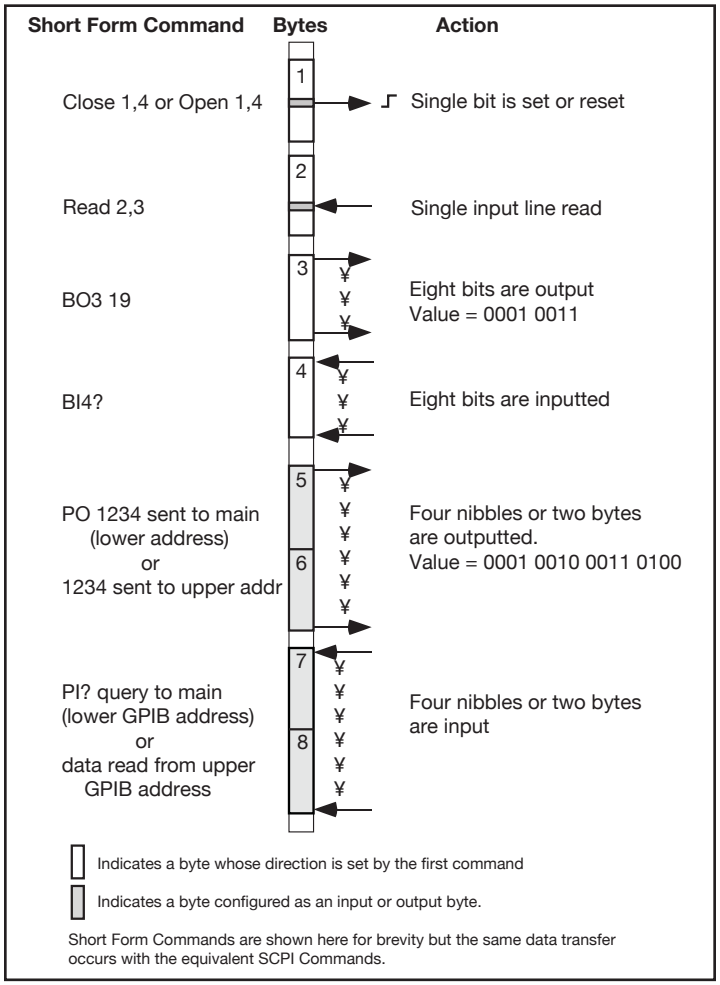

Figure 2 4803 Digital Transfer Methods
(Figure shows 8 bytes for illustrative purposes. Actual 4803 has 5 bytes)

Reading The Input Signals

The 4803 has three ways to read the digital interface lines and input digital data as shown in Figure 2:

- Bit queries read the status of an individual bit from a specific byte.
- Input byte commands read 8 bits of data from a specific byte.
- Strings of data can be read from multiple bytes with a data transfer command or inputted transparently. These bytes are preset as string input bytes by the CONFigure command. For input strings, the 4803 reads the configured input bytes, converts the data to the selected output format, and outputs it as a string of characters. Data can be inputted with or without handshaking. The input data can be formatted as decimal numbers, as ASCII HEX characters, or into a user selected character set.

Transparent Data Transfer

The user can input and output data without using a string command by addressing the 4803 at its upper GPIB address. Data is read from the configured input bytes each time the 4803 is addressed to talk. The data is input and formatted just as it would be for reading strings of data.

When transparently outputting data, the 4803 converts the data and outputs it to the configured output bytes. Data can be outputted with or without handshaking. The 4803 automatically generates a data strobe each time it loads all of the configured output data bytes. Multiple data words can be transmitted in the same command by inserting a comma between data words.

Input Signal Monitoring

The 4803 can monitor up to fifteen lines for signal changes and generate an SRQ to notify the Application program when changes occur. Monitoring is done by setting the 4803's Questionable Transition register to detect positive and/or negative signal transitions and enabling bits in the Questionable Event register. When the enabled bit(s) are detected, the 4803 generates an SRQ to alert the Application to the event. The user's Application program can query the 4803's Questionable Condition Register to determine the input signal states and the Event Register to learn which signal changed state. Application Bulletin 48-18 describes how to configure the 4803's Status Reporting Structure and includes a program example.

Outputting Data

The 4803 has three ways to control the digital interface and output data as shown in Figure 2:

- Bit commands set, reset or pulse bits in a specific byte.
- Output byte commands set all bits in a byte and latch an output value (0 to 255) into a specific byte. Data Strobes can be manually generated if needed.
- Strings of data can be outputted to multiple bytes with a command or transferred transparently. These bytes are preset as string output bytes by the CONFigure command. The 4803 converts the data string characters into bytes, latches the data in the configured output bytes and generates a data strobe pulse to update the external device. The data strings can be a series of decimal values, ACSII HEX characters, or the 0x30-0x3F HEX characters used in ICS's earlier interfaces.

Controlling the 4803

Figure 3 shows the 4803's configuration and data transfer commands as a SCPI Command Tree. Each SCPI command has a corresponding Short Form command for quick programming. Most of the functions can also be queried to verify the command setting. (i.e. IPn? reads back the byte's polarity setting)

The ROUTe bit commands let the user set/reset and pulse individual bits in an output byte Data Strobes can be manually generated if needed. The PULSe commands pulse any output line as a byte,bit value or as a channel number. A common pulse width is set by the ROUTe:PULSe:WIDTh command. Multiple lines can be pulsed in the same command.

SOURce Output byte commands latch an 8-bit value into a specific output byte without pre-configuring the bytes. The SOURce string commands let the user send strings of data to bytes that have been preconfigured as outputs (with the CONFigure command) and generate a data strobe with a single command. The data format is controlled by the FORmat command. Transparent data transfer is possible in the Dual Address Mode where bytes from the GPIB bus are formatted and outputted to the previously configured output bytes.

SENSe bit commands read the state of a specific bit in an input byte and SENSe byte commands read data from a specific byte.

SENSe string commands read data from bytes that have been preconfigured as input bytes by the CONFigure command. The data format on the GPIB bus is controlled by the FORmat command.

CALibrate Commands let the user personalize the 4803 with his own IDN string, lock settings to prevent changes and to reset the unit to the factory settings.

4803 SCPI COMMAND TREE

SCPI Commands		Short Form Cmds
SYSTem	**GPIB Settings**	
:COMM		
:GPIB		
:ADDRESS	<numeric>	
:EXT		
:MODE	SINGle | DUAL | SEC	
:ERRor?		
:VERSion?		
CONFigure	**Configure I/O**	
[:DIGital]		
:INPut	<channel list>	N
:POLarity	0 | 1	TPn
:HANDshake	<boolean>	TBn
:OUTput	<channel list>	LN
:POLarity	0 | 1	LPn
:HANDshake	<boolean>	LH
:CLEar	0 | 1	C
:EDR	0 | 1	E
:INHibit	0 | 1	I
:REMote	0 | 1	R
:RESet	0 | 1	X
:STRobe	0 | 1	S
:TRIGger	0 | 1	TR
:ASTATus	0 | 1	A
:BSTATus	0 | 1	B
FORmat		
:TALK	<ASCii | Hex | HEXL | Table>	
:TRANSlation	<16 char string>	V
:LISTen	<ASCii | Hex | HEXL | BIN | 4833>	
ROUTe	**Bit Commands**	
:CLOSe	byte, bit	CLOSE
:OPEN	byte, bit	OPEN
:RESET	byte	BRESET
:PULSe	byte,bit	PL
:CHANnel	number or channel list	PC
:WIDTh	10-30000 [50]	PW
SENSe	Input Data	
[:DIGital]		
:DATA		
[:VALue]?		PI?
:PORT?	number or <channel list>	BI?
:PORTn?		BIn?
:POLarity?	Pn	
:RESet:EDR	ER	
:BIT?	0-1	READ?
:BYTe?	0-255	BREAD?
[SOURce]	**Output Data**	
[:DIGital]		
:DATA		
[:VALue]	0-255	PO
:PORTn	0-255	BOn
:POLarity	0-255	OPn
:STRobe		SP
CALibrate	Calibrate Configuration	
:IDN	string (72 char max)	
:DATe	mm/dd/yy	
:DEFault		
:LOCK	1(On)| 0(Off) [0]	

Figure 3 4803 SCPI Command Tree

4803 Connections

The 4803 has three vertical connectors which accept flat ribbon cable connectors. Two of the connectors contain the GPIB signals. The 4803 only requires that one of the GPIB connectors be used to connect it to the GPIB bus. The unused connector can be left open. The third connector is a DIN connector with the digital I/O signals. Figure 5 shows some of the connection possibilities.

Connector J1 is a 24-pin connector that is designed for direct connection to a GPIB bus connector. Use a flat ribbon cable like ICS's P/N 114439-L that has a 24-pin plug on one end and a GPIB connector on the other end. (L is the cable length in cm) Punch a 'D' hole on the rear panel with two mounting holes. Use the metric lock studs supplied with the cable to mount the GPIB connector on the rear panel of the chassis.

Connector J2 is a 26-pin connector that contains the address switch input signals as well as the GPIB bus signals. When the external address function is enabled, the 4803 uses these signals to set the GPIB address at power-on time. Connector J2 mates with ICS's GPIB Connector/Address Switch Board Assemblies. The Connector/Address Switch Assemblies are small, business card size PC assemblies that mount a GPIB connector and an 8-bit Address rocker switch to the rear panel of a chassis. They have a flat ribbon cable which plugs into J2. The assemblies are available in two layout styles. Refer to the GPIB Connector/Address Switch data sheet for the GPIB Connector/Address Switch styles, mounting dimensions and cable lengths.

Connector J3 is a 96-pin female DIN connector with male pins that uses rows A and C for the 4803 digital I/O signals and power. Mating DIN connectors have solder eyelet, wirewrap or solder pins or use ICS's rainbow ribbon cable assembly.

Mounting Options

Standard 4803 boards have the connectors facing up on the component side and are meant to be mounted against a panel or chassis floor. Access the digital signals with a flat ribbon cable or wire to the mating solder eyelet connector.

4803 boards are also available with a male DIN connector mounted on the circuit side so the 4803 can be piggybacked on a larger PCB assembly as shown in Figure 4. This is a good mounting method when you already have to layout a PC board for mounting other devices since it eliminates a cable and wiring. Use a 902257 or a 902058 female DIN connector on the PC board.

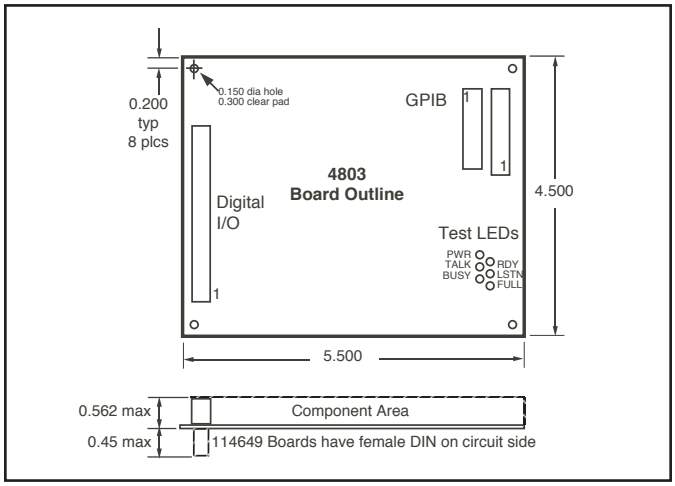

Figure 4 4803 Mounting Dimensions

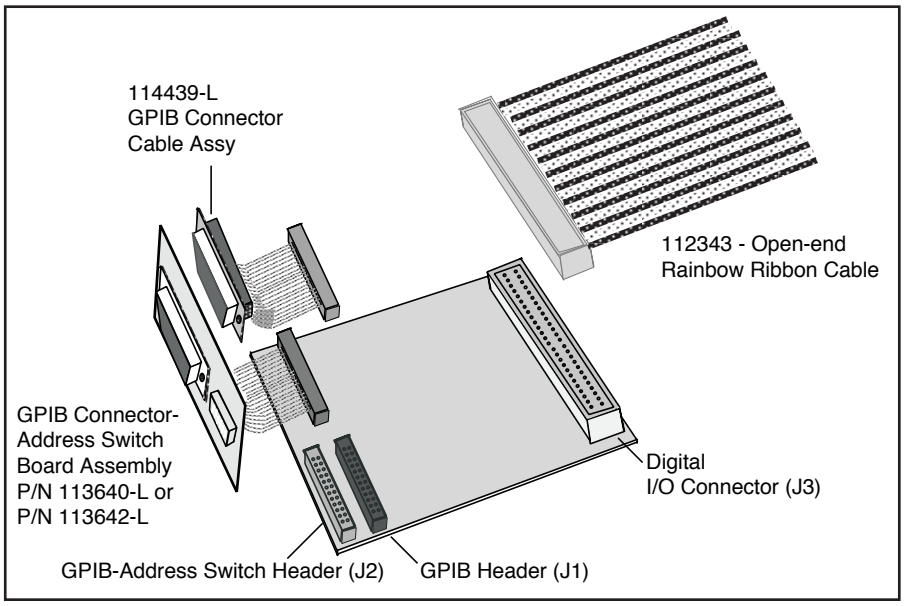

Figure 5 4803 Connection Methods

GPIB address in the 4803's flash memory. The standard cable length is 90 cm but shorter lengths are available.

The second header has just GPIB signals and mates with a GPIB Interface Cable Assembly that connects the 4803 to a GPIB connector mounted on the rear panel of the host chassis. The GPIB Interface Cable Assembly is a flat-ribbon cable with a GPIB connector on one end. The GPIB end includes two metric studs for mounting the GPIB connector shell to the rear panel. The GPIB Interface Cable Assembly cable assembly is shown in Figure 8 and is available in any length up to 90 cm. The 4803's GPIB Address is saved internally when using the GPIB Interface Cable Assembly.

4803 Relay Driver Board

The xx03DVR Board expands the 4803's drive outputs by providing forty 500 mA relay drivers with convenient screw terminals. A 4803 with the J3 Digital I/O connector mounted on the circuit side, P/N 114648, piggybacks on the xx03DVR board to make a compact assembly as shown in Figure 6. The xx03DVR board can be configured for all 40 lines as relay driver outputs or for less drivers and for 8 or 16 4803 TTL I/O lines.

Power for the xx03DVR Board is taken from the relay power supply which can be 7 to 32 Vdc. The xx03DVR board has a 5 V switching regulator that uses about 2.5 VA of relay power to supply 5 Vdc power to the its internal logic and to the 4803. The xx03DVR Board eliminates the need for a separate power supply for the 4803 board. Refer to the separate xx03DVR Board data sheet for complete specifications and mounting dimensions. Order the 4803 as part number 114648 to mate with the xx03DVR Board.

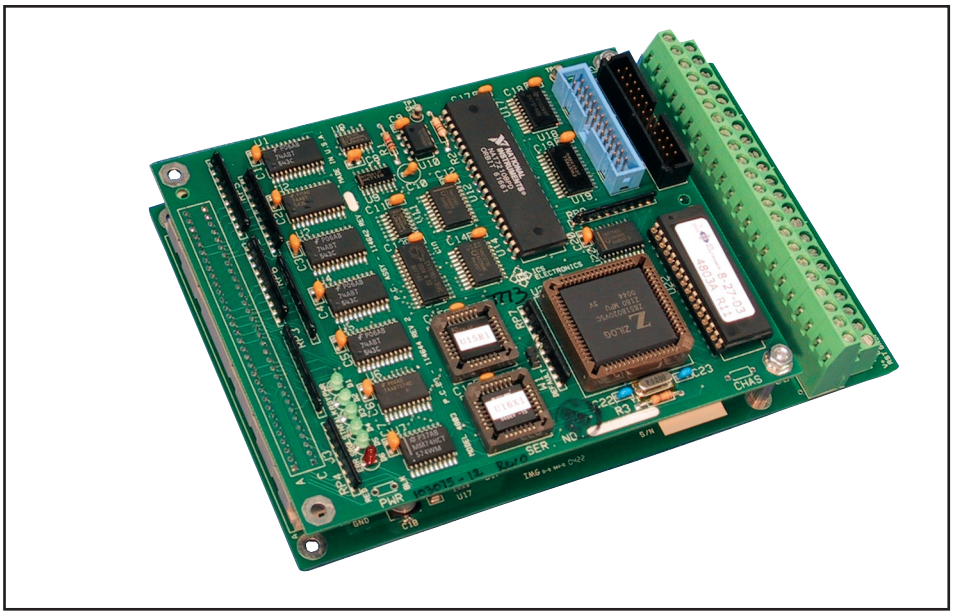

Figure 6 114848 and xx03 Relay Driver Board (P/N 115490)

GPIB Connection Cables

4803 boards have two GPIB headers. One header has both GPIB and address switch signals and mates with a GPIB Connector/Address Switch Cable Assembly to mount a GPIB Connector and address switch on the rear panel of the host chassis. The GPIB Connector/Address Switch Cable Assembly comes in two styles as shown in Figure 7. Both styles are business card size, PC board assemblies with a GPIB connector, metric studs and a 8 position rocker switch. The Address Switch lets a user set the GPIB address externally rather than saving the

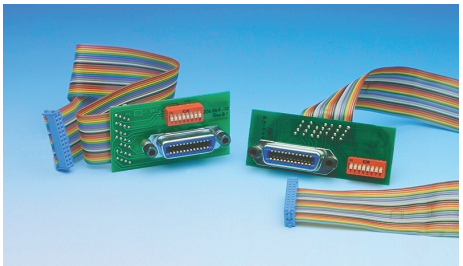

Figure 7 GPIB Connector/Address Switch Assemblies P/N 113642-L and P/N 113640-L

Note: '-L' in the cable assembly part numbers stands for cable length in cm from 10 to 90 cm.

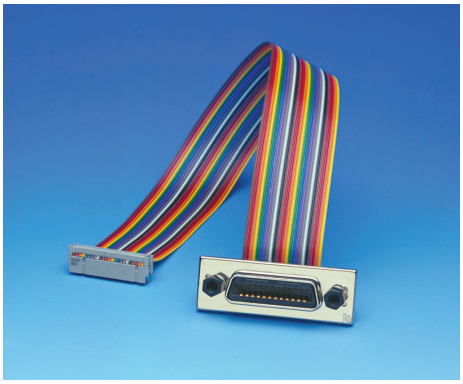

Figure 8 GPIB Interface Cable P/N 114439-L

Select from one of the two 4803 board styles and then pick your accessory items.

Part Selection		Qty	Part Number
Standard 4803 board with the digital IO connector on the component side		(1)	4803
Select one mating digital IO connector -	Solder eyelet	(1)	902023
	Solder pins	(1)	902067
or	Flat-ribbon cable	(1)	902124
Select an Open end, flat ribbon cable assembly, 5 feet long		(1)	112343
or			
Select the xx03 Relay Driver Board (Mounts on top of std 4803)		(1)	115522 (Note 3)
Select a GPIB Connector/Address Switch Assembly -	Horizontal style	(1)	113640-L
	Vertical style	(1)	113642-L
or			
Select a GPIB Flat ribbon Interface Cable with metric studs		(1)	114439-L
4803 board with the digital IO connector on the circuit side (facing down) for mounting on another PC board		(1)	114648
Select digital IO connector with solder pins for the mating PC board		(1)	902257 or 902058
or			
Select the xx03 Relay Driver Board (Holds the 114648/114649 boards)		(1)	115490
Select a GPIB Connector/Address Switch Assembly -	Horizontal style	(1)	113640-L
	Vertical style	(1)	113642-L
or			
Select a GPIB Flat ribbon Interface Cable with metric studs		(1)	114439-L

Notes:

1. -L is the cable length in cm. You can order any length from 10 to 90 cm. Standard stocked lengths are: 30, 45, 60 and 90 cm. Select an appropriate length as it is best to not have extra cable coiled up in the chassis to minimize EMI pickup. See the GPIB Connector/Address Switch Assembly data sheet for more details.

2. Add a -7 suffix to the part number when ordering a 4803 or board with a special program.

3. The 114648 and 115490 is the recommended 4803-xx03DVR Board combination. Only order the 115522 if you already have a standard 4803 board with the Digital I/O connector on the component side.

IEEE 488 Bus Interface

The 4803's 488 Bus interface meets IEEE STD 488.1-1987 and has the following capabilities:

SH1, AH1, T6, L4, SR1, PP0, DC1, RL0, DT1, C0 and E2 drivers.

Address Capability
Dual primary addresses or single primary with secondary addresses 00 and 01. Primary address range: 0-30.

SRQ Generation
SRQs are generated if the unit is not a talker, if SRQs are enabled and if an Enabled Event Status Register bit or an monitored digital input change occurs. Digital inputs monitored by the Questionable registers.

488.2 Common Commands
*CLS, *ESE, *ESE?, *ESR?, *IDN?, *OPC, *OPC?, *RCL, *RST, *SAV, *SRE, *SRE?, *STB, TST? and *WAI

SCPI Commands
Used to set and query all programmable functions. The 4803 conforms to SCPI 1994.0 Specification.

Signal Characteristics

The 4803's parallel I/O signals have the following electrical characteristics. All time delays listed here are maximums, all pulse widths are minimums.

Inputs	40 Digital I/O , 2 Status and Reset Inputs
Input Logic Levels	High = > +2.0 V @ ±10 µA Max High = 5.5 V Low = <0.8 V @ 250 µA with 33 Kohm pullup to +5 Vdc for sensing contacts.
Output Logic Levels	High = >3 V with 3 mA source High =>2 V with 24 mA source Low = 0.0 to +0.55 Vdc, 48 mA sink
Output Timing	Data output 0.6 to 5.3 ms after receipt of a terminator depending upon transfer method.
Pulse	10 to 30000 ms

Handshake Lines

Input	External Data Ready #1 and #2
Output	Inhibit #1 and #2 set within 1 µs of the active edge of the EDR Input signal and resets after data is loaded. Data loading time for 6 BCD/HEX characters is 0.15 ms (typ.) after the 4803 has been addressed as a Talker
Data Stb	Output pulse width, 5 µs
Trigger	Output pulse width, 5 µs
Remote	Output level asserted when in the remote state
Reset	Output pulse width, 40 µs for *RST command and true during 4803 reset time (70 ms)
Stable	Output level asserted when Digital I/O lines have been configured.

Protection
EDR and Status Inputs diode limited from - 0.7 to +5.7 Vdc

Diagnostic Indicators

Six on board LEDs with drive signals on the DIN connector for remote LEDs
PWR, RDY, TALK, LSTN, SRQ and ERR

Physical

Size, L x W x H
139.7 x 114.3 x 14.3 mm
(5.5 x 4.5 x 0.562 inches)

Connectors and Headers
GPIB: 24-pin 3M 2524 male conn.
GPIB/Addr: 26-pin 3M 2526 male conn.
Digital I/O: 96-pin, 3 row male DIN conn using rows A & C.

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

Humidity
0-90% RH without condensation

Power
+5 Vdc @ 400 mA (typical)

Included Accessories

Instruction Manual
Configuration Disk with sample programs

Available Accessories

See the Ordering Guide on page 4 for a complete list of accessory items.

GPIB flat ribbon cable 90 cm max., P/N 114439-90.
GPIB Connector/Addr Sw Assy with flat ribbon cable, 90 cm max., P/N 113640-90 or P/N 113642-90.
See the GPIB Conn/Sw data sheet.
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
IEEE 488.2 to Parallel Digital Interface Board (Includes Instruction Manual and Configuration Disk)	4803
IEEE 488.2 to Parallel Digital Interface Board (Board only)	114642
4803 with connector on circuit side (Includes Instruction Manual and Configuration Disk)	114648
4803 with connector on circuit side (Board only)	114649
GPIB Connector/Address Switch Assemblies	see separate data sheet
GPIB Flat Ribbon Cables	see separate data sheet
Open-end Rainbow colored flat ribbon cable, 5 feet long	112343