

# IEEE 488/GPIB BUS INTERFACES

## 4823B GPIB ↔ PARALLEL DIGITAL INTERFACE

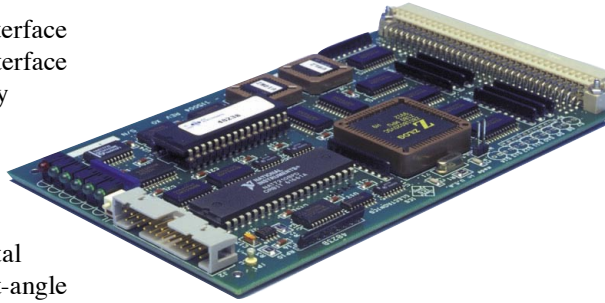
### DESCRIPTION

The Model 4823B GPIB <-> Digital Interface Board is an IEEE-488.2/GPIB to digital interface with 56 I/O lines that can be used to easily adapt devices with digital signals to the IEEE-488/GPIB or HP-IP bus. In a typical application, the 4823B is located inside the device chassis and is powered by the device's +5 volt power. All digital signal connections are on a 96-pin right-angle DIN connector at one end of the card. A 26-pin header on the other end of the 4823B contains the GPIB Bus and address switch input signals. The header connects to a companion GPIB Connector/Address Switch Board that mounts a GPIB Connector and Address Switch on the rear panel of the chassis.

4823B boards are also available with optional vertical and circuit-side DIN connectors to facilitate piggybacking the 4823B on a larger PC board. The 4823B's pinouts match the first 56 pins of ICS's earlier 4823A card so that the 4823B can be used as a replacement for the 4823A in applications that use no more than 56 I/O lines.

### Versatile Digital Interface

The 4823B'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 4823B'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.



4823B Interface Card

### Data Transfer Methods

Data transfer between the computer and the 4823B'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.
- 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 he configures the board.

The 4823B has two address modes. In the Single Address Mode, the user can set the 4823B'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 transparently passes strings of data to the output bytes or reads data from 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 4823B can output data at rates > 50 Kbytes/sec.

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

- Provides a user-definable, 56-line parallel interface with bit, byte, string and binary data transfer capabilities. *Fully configurable to the user's needs by bus commands.*
- Signal monitor feature allows the 4823B to detect signal changes on 15 inputs. *Relieves controller of time consuming polling function.*
- High-current drivers and input pullup resistors. *Drives more devices, longer lines and inputs CMOS signals or switch contacts.*
- Device configuration, user's IDN message and bus address stored in Flash. *Stored setup eliminates program initialization statements.*
- Lock feature prevents accidental loss or change of user configuration. *Protects your configuration and IDN message.*
- Packaged on 3U VME size card with 4823A pinouts. *Can be used to replace 4823A cards in 56 line applications.*
- Includes a menu-driven configuration program. *Steps user through configuration choices.*

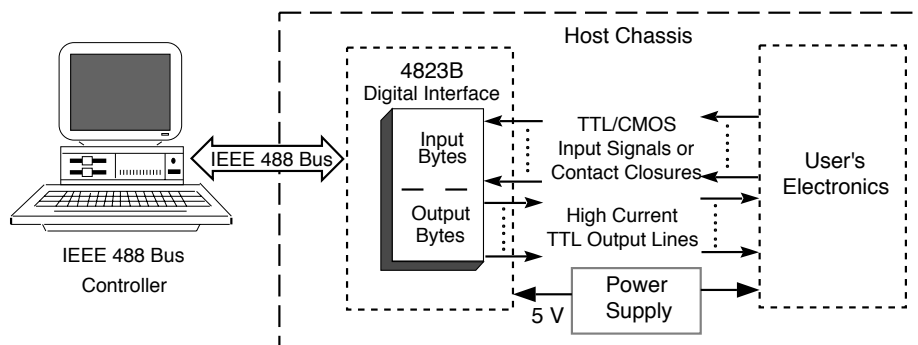


Figure 1 A typical 4823B Application



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## 4823B: APPLICATION

The 4823B has three GPIB address modes: a single primary address, dual primary addresses or a primary address with secondary addresses 0 and 1. The single primary address and the lower address in either dual mode, are used for all commands, queries and for transferring data to and from the digital interface with data commands. The upper GPIB address in either dual mode is used to transparently transfer data between the GPIB bus and the configured bytes in the 4823B's digital interface. The GPIB address and modes are saved in flash as part of the 4823B's configuration.

### Controlling the Digital Interface Bytes

Figure 2 shows the different ways the 4823B can be used to transfer data. The arrows show the data direction. The bit and byte commands automatically set the data direction for their data bytes. Bit command examples are Close, Open and Read which operate on bytes 1 and 2. All eight bits in byte 3 are written by the BO3 command. Data strobes can be manually generated if needed. All eight bits in byte 4 are read by the BI4? query. 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 can transfer multiple bytes of data at a time. String commands only work on data bytes that are pre-configured as input or output bytes by the CONFIGure commands. The user can configure 1 to n bytes as inputs and/or as outputs to make data words up to 56-bits wide. Figure 2 shows two bytes (bytes 5 and 6) configured as outputs and two bytes (bytes 7 and 8) configured as inputs. All 16 bits in bytes 5 and 6 are output by the PO command. A data strobe is automatically generated when data is outputted by a string command. The PI? query reads 16 bits of data from bytes 7 and 8. The user can select the data format, data polarity, data strobe polarity and handshaking for the string commands.

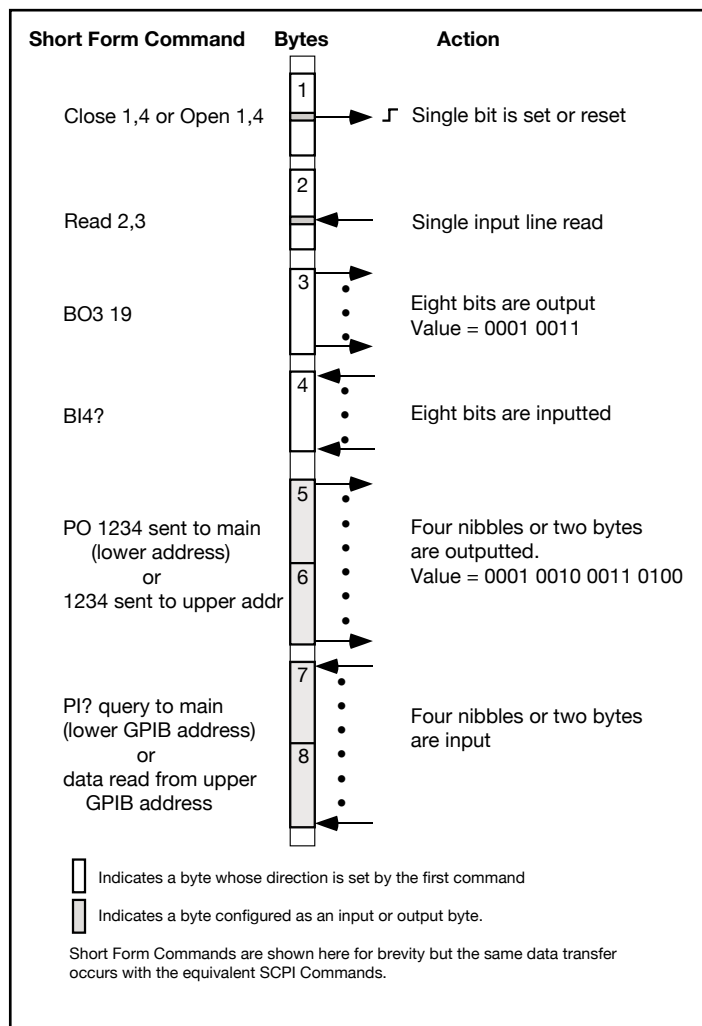
The configuration and output data values can be saved at any time. The saved configuration and output values become the new power turn-on default values and are restored when the unit is reset or when power is turned on. This allows a user to set the output signal states at power turn-on time.

### Binary Data Transfer

The binary data transfer mode can be used to quickly output large blocks of data to test devices or to load signal generators. The user configures the desired output bytes, sets the listen format to binary and enables either dual address mode. The 4823B is then addressed at its upper GPIB address and the binary data is outputted to the 4823B. The 4823B latches each bus character in a separate output byte and then pulses the data strobe when all bytes have been loaded. This sequence repeats until all of the data has been transferred.

### Input Signal Monitoring

The 4823B can monitor up to fifteen of the digital inputs for signal changes and generate an SRQ to notify the Bus Controller when changes occur. Monitoring is done by setting the 4823B'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 4823B generates an SRQ to alert the Bus Controller to the event. The user can query the 4823B's Questionable Registers to determine the input signal states and which signal changed state. See Application Bulletin 48-18 for more details and a program example.



**Figure 2 4823B Digital Interface Data Transfer Methods**  
(Figure shows 8 bytes for illustration purposes. Actual 4823B only has 7 bytes)

### Controlling the 4823B

Figure 3 shows the 4823B'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)

### Outputting Data

The ROUTe Bit Commands let the user set/reset individual bits in an output byte and SOURCE Output byte commands latch an 8-bit value into a specific output byte without pre configuring the bytes. Data Strobes can be manually generated if needed.

SOURCE Output Commands can send strings of data to bytes that have been pre configured as outputs and generate a data strobe with a single command. The 4823B converts the data string characters into packed HEX bytes, latches the data in the previously 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 30-3F HEX characters used in ICS's earlier interfaces. Transparent data transfer is possible in the Dual Address Mode. Here bytes from the GPIB bus are formatted and outputted to the previously configured output bytes. When binary format is selected, the bytes are transferred directly from the GPIB bus to the output bytes without any formatting.

## 4823B: Application

### Reading The Input Signals

SENSe Bit commands read the state of a specific bit in an input byte and SENSe byte commands read data from a specific byte without pre configuring the byte as an input byte.

SENSe String Commands read data from previously configured input bytes. For input strings, the 4823B 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.

### 4823B Connections

The 4823B has a connector for the Digital interface and a separate connector for the GPIB signals and Address inputs.

The Digital I/O connector, J1, is a 96-pin right-angle male DIN connector that contains the 4823B's digital I/O and power signals. The 4823B's pinouts are the same as the first 56 lines of ICS's older 4823A Interface Card. Mating DIN connectors are available with solder eyelet, or solder pins. 4823B boards are also available with a male DIN connector mounted vertically on the component side or with a female DIN connector mounted vertically downwards on the circuit side of the board so the 4823B can be mounted on a larger PCB assembly.

The GPIB connector, J2, is a 26-pin header that contains the GPIB bus and external address switch input signals. When the external address function is enabled, the 4823B reads its GPIB address from the rocker switch at power-on time. Connector J2 mates with ICS's GPIB Connector/Address Switch Board Assemblies which 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. The assemblies have a flat ribbon cable which plugs into the header on the 4823B. Refer to the separate data sheet for styles, mounting dimensions and cable lengths.

### 4823A Replacement Concerns

The 4823B can be used as a pin-to-pin replacement for ICS's earlier 4823A if the following concerns are addressed:

1. The 4823A application used only the first 56 I/O lines.
2. The 4823A split inputs and outputs on 4-bit nibble boundaries while the 4823B splits the inputs and outputs on 8-bit byte boundaries.
3. The 4823A only did transparent data transfers so driver routines or test programs may need some alteration to work with 4823B's string transfer commands or with the 4823B's dual address modes if transparent data transfer is desired.
4. Digital I/O lines should not be tied to each other unless connected with a 470 ohm or larger resistor.

### 4823B Starter Kit

A 4823B Starter Kit is available for the first time GPIB user. The Starter Kit includes a 4823B Board, a GPIB Connector/Switch Board Assembly, mating DIN connectors, a GPIB bus cable, a 488-PCII/GPIB PCI card or a USB GPIB Controller for the PC, 488.2 Drivers and software. The software package includes a keyboard command line program, a Visual Basic configuration program and example programs. Limit of one Starter Kit per customer.

## 4823B SCPI COMMAND TREE

SCPI Commands		Short Form Cmds
<b>SYSTEM</b>	<b>GPIB Settings</b>	
:COMM		
:GPIB		
:ADDRESS	<numeric>	
:EXT		
:MODE	SINGLE   DUAL   SEC	
:MONITOR	<boolean>	
<b>CONFigure</b>	<b>Configure I/O</b>	
[[: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
<b>FORmat</b>		
:TALK	<ASCIi   Hex   HEXL   Table>	
:TRANSlation	<16 char string>	V
:LISTen	<ASCIi   Hex   HEXL   BIN   4833>	
<b>ROUte</b>	<b>Bit Commands</b>	
:CLOSe	byte, bit	CLOSE
:OPEN	byte, bit	OPEN
:RESEt	byte	BRESET
<b>SENSe</b>	<b>Input Data</b>	
[[:DIGital]]		
:DATA		
[[:VALue]]?		PI?
:PORT?	number or <channel list>	BI?
:PORTn?		BlIn?
:POLarity?		IPn
:RESet:EDR		ER
:BIT?	0-1	READ?
:BYTe?	0-255	BREAD?
[[:SOURce]]	<b>Output Data</b>	
[[:DIGital]]		
:DATA		
[[:VALue]]	0-255	PO
:PORTn	0-255	BOn
:POLarity	0-255	OPn
:STRobe		SP
<b>CALibrate</b>	<b>Calibrate Configuration</b>	
:IDN	string (72 char max)	
:DATE	mm/dd/yy	
:DEFault		
:LOCK	1 (On)   0 (Off) [0]	

Figure 3 4823B SCPI Command Tree

### OEM Customization

OEM customization can be as simple as presetting the 4823B's I/O configuration and replacing ICS's IDN message or more complex by adding special SCPI commands and functions to the 4823B's firmware. ICS can quote special firmware changes and a Software Development Kit is available for OEMs who want to modify the 4823B's firmware.

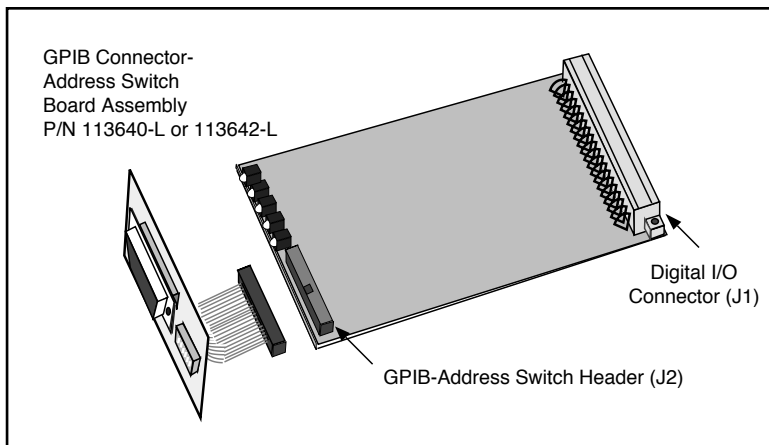
## 4823B: ORDERING GIUIDE

Select from one of the three 4823B board styles and then pick your accessory items.

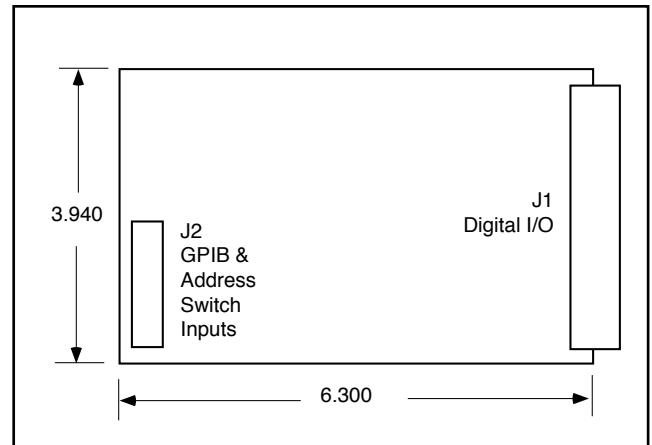
Part Selection	Qty	Part Number	
Standard 4823B board with the digital IO connector on the component side	(1)	4823B	
— Select one mating digital IO connector -	Solder eyelet	(1)	902023
	Solder pins	(1)	902025
— Select a GPIB Connector/Address Switch Assy -	Horizontal style	(1)	113640-L
	Vertical style	(1)	113642-L
	Vertical style w/no sw	(1)	113643-L
	Horizontal style w/no sw	(1)	113649-L
4823B board with the digital IO connector on the circuit side (facing down)			
— for mounting the 4823B on another PC board		(1)	114988
— Select digital IO connector with solder pins for the mating PC board		(1)	902058
— Select a GPIB Connector/Address Switch Assy -	Horizontal style	(1)	113640-L
	Vertical style	(1)	113642-L
	Vertical style w/no sw	(1)	113643-L
	Horizontal style w/no sw	(1)	113649-L
4823B board with a vertical digital IO connector on the component side			
— Select one mating digital IO connector -		(1)	902023
Solder pins		(1)	902025
— Select a GPIB Connector/Address Switch Assy -	Horizontal style	(1)	113640-L
	Vertical style	(1)	113642-L
	Vertical style w/no sw	(1)	113643-L
	Horizontal style w/no sw	(1)	113649-L

### Notes:

- 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.



**Figure 4 4823B Connection Method**



**Figure 5 4823B Outline Drawing**

## 4823B: Specifications

### IEEE 488 Bus Interface

The 4823B'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 0 and 1. 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 if a 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 4823B conforms to SCPI 1994.0 Specification.

**Table 2 Programmable Functions**

GPIB Bus Address
Address mode
Input Bytes
Input Signal polarity
Input Handshaking
Talk data format
Talk data conversion table
Output Bytes
Output Polarity
Output Handshaking
Listen data format
Control line polarities
SENSe input polarities
SOURce output polarities
STATus register configurations

### Signal Characteristics

The 4823B's parallel I/O signals have the following electrical characteristics. All time delays listed here are maximums, all pulse widths are minimums.

Inputs 56 Digital I/O ,  
2 Status and Reset Inputs  
Input High => +2.0 V @ ±10 μA  
Logic Low =< 0.8 V @ 250 μA  
Levels with 33 Kohm pullup to +5 Vdc for sensing contacts.  
Max high = 5.5 V

Input External Data Inhibit line  
Timing SETS 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 4823B has been addressed as a Talker

Output High => 3 V with 3 mA source  
Logic High => 2 V with 24 mA source  
Levels Low = 0.0 to +0.55 Vdc, 48 mA sink

Output Data is transferred to the  
Timing output 0.6 to 5.3 ms after receipt of a terminator depending upon transfer method.

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 4823B reset time (70 ms)

### Reset Inputs

The 4823B is reset by a low going pulse on the External Reset input line or by pressing a miniature push-button on front edge of the 4823B's PCB

### Diagnostic Indicators

Six on board LEDs  
PWR On when power applied  
RDY On when self test passed  
TALK On when addressed to talk  
LSTN On when addressed to listen  
SRQ On when asserting SRQ line  
ERR On when ESR error bits set

### Physical

#### Size, L x W x H

160 x 100 x 15 mm  
(6.3 x 3.94 x 0.60 inches)

#### Connector and Headers

GPIB/Addr: 26-pin 3M 2526 male connector.  
Digital I/O: 96-pin, 3 row male DIN connector

#### 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 CD with sample programs

#### Available Accessories

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

GPIB Connector/Addr Sw Assemblies with flat-ribbon cables are described on the GPIB Connector/Switch data sheet.

Mating DIN Connectors:

P/N 902023 Dolder Eyelet  
P/N 902025 Dip Solder  
P/N 902058 Male Dip Solder

## ORDERING GUIDE

	Part Number
IEEE 488.2 to Parallel Digital Interface Board (Includes Instruction Manual and Configuration CD)	4823B
IEEE 488.2 to Parallel Digital Interface Board (Board only)	115002
IEEE 488.2 to Parallel Digital Interface Board with vertical connector, Manual and Configuration CD	114982
IEEE 488.2 to Parallel Digital Interface Board with vertical connector (Board only)	114983
IEEE 488.2 to Parallel Digital Interface Board with circuit side connector, Manual and Configuration CD	114988
IEEE 488.2 to Parallel Digital Interface Board with circuit side connector (Board only)	114989
4823B Starter Package with 4823B, 488-LPCI, Bus Cable, GPIB Connector/Switch Bd, and Connectors	114999-01
4823B Starter Package with 4823B, 488-USB2, Bus Cable, GPIB Connector/Switch Bd, and Connectors	114999-02
GPIB Connector/Address Switch Assemblies and Mating Connectors	See separate data sheets