

# IEEE 488/GPIB BUS INTERFACES

## DESCRIPTION

The 4863 is an IEEE-488/GPIB/HP-IB to Digital Interface that provides 48 programmable digital lines that can be configured as inputs or outputs in eight bit bytes. Each data line has a pullup resistor for sensing contact closures or TTL/CMOS inputs. As outputs, each line is latched and can source 24 mA or sink up to 48 mA. The 4863 can also be configured to monitor up to 15 input lines for changes. Applications include interfacing devices with parallel digital signals to the GPIB bus, controlling discrete devices from the GPIB bus, monitoring digital signals for changes and outputting blocks of data.

The Model 4863 is a member of ICS's Minibox™ interface family. All Minibox™ interfaces are IEEE 488.2 compatible, use SCPI commands for ease of programming and are packaged in a CE compliant metal case that is less than 1.6 inches (39 mm) high. Rack mounting kits are available for mounting one or two Model 4863s in a single 1U high space.

## Versatile Digital Interface

The 4863'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 4863'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.

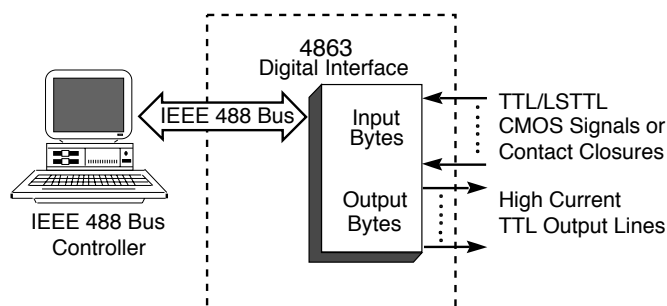


Figure 1 4863 Block Diagram



4863 Parallel Interface

## Data Transfer Methods

Data transfer between the computer and the 4863'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 in one command.

- 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 4863 has three address modes. In the Single Address Mode, the user can set the 4863's configuration and transfer data as described above. In the Dual Primary or Single Primary-Dual Secondary Mode, the lower address behaves like the Single Address Mode. The upper address transparently passes strings of data to the configured output bytes or reads 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.

## Controlling the Digital Interface

Figure 2 shows the different ways the 4863 can be used to transfer data. The arrows show the data direction. The user can use SCPI or ICS's Short Form commands to control the digital interface. Short form commands are used in Figure 2 for brevity.

## 4863 GPIB ↔ PARALLEL DIGITAL INTERFACE

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

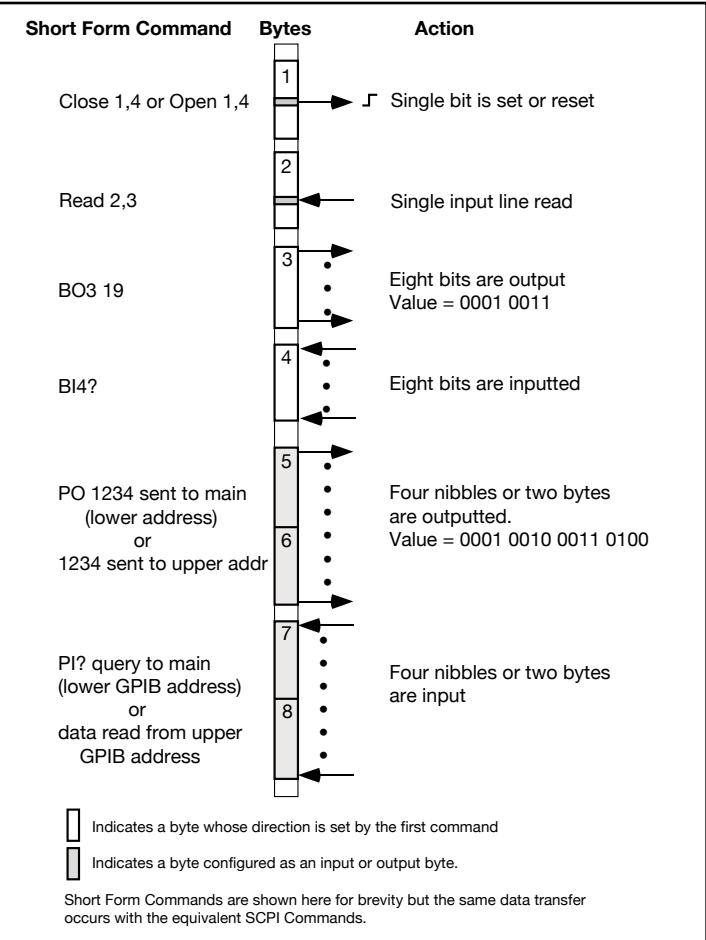
- Provides a user-definable, 48-line parallel interface with bit, byte, pulse, string and binary data transfer capabilities. *Fully configurable to the user's needs by bus commands.*
- Signal monitor feature allows the 4863 to detect signal changes on 15 inputs. *Relieves controller of time consuming polling function*
- High-current drivers and input pullup resistors. *Drives more devices, longer lines and inputs CMOS signals or switch contacts.*
- Device configuration and bus address stored in Flash. *Saves your setup values.*
- IEEE-488.2 compatible unit uses SCPI commands and Short Form commands. *Includes latest GPIB program advances.*
- Packaged in small 1U high metal case. *Smaller size with EMI/RFI protection.*
- Includes a menu-driven configuration program. *Steps user through configuration choices.*

CE Approved

RoHS

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**Figure 2 4863 Digital Transfer Methods**  
(Figure shows 8 bytes for illustrative purposes. Actual 4863 has 6 bytes)

Controlling the Digital Interface continued

The bit, byte and pulse commands automatically set the data direction for their data bytes. Bit command examples are Close, Open and Read which operate on bits in bytes 1 and 2. All eight bits in byte 3 are written by the BO3 command. Data strobes can be manually generated if needed. Pulse commands can be used to pulse an output bit to its logically on level. 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 1 to n 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 128-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 setup 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. The user configures the desired output bytes, sets the listen format to binary and enables either dual address mode. The 4863 is then addressed at its upper GPIB address and the binary data is outputted to the 4863. The 4863 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 4863 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 4863'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 4863 generates an SRQ to alert the Bus Controller to the event. The user can query the 4863's Questionable Registers to determine the input signal states and which signal(s) changed state. See Application Bulletin 48-18 for more details and a program example.

Controlling the 4863

Figure 3 shows the 4863's configuration and data transfer commands as a SCPI Command Tree. Each SCPI command has a corresponding Short Form command which can be used 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 individual bits in an output byte and the 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. ROUTe: PULS or ROUTe:PULSe:CHAN commands pulse any output line. Pulse width is set by the ROUTe:PULSe:WIDTh command.

SOURce Output string commands can send strings of data to bytes that have been pre-configured 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 the SENSe byte commands read data from a specific byte.

SENSe String Commands read data from bytes that have been pre-configured 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 4863 with his own IDN string, lock settings to prevent changes and reset the unit to the factory settings.

4833 Compatibility

The 4863's transparent data transfer mode and short form configuration commands are similar to ICS's Model 4833 GPIB to Parallel Interfaces. Users familiar with the Model 4833 will be able to use many of the same commands and command syntax when configuring the 4863's interface.

## 4863 SCPI COMMAND TREE

SCPI Commands	Short Form Commands	
SYSTem		
:COMM		
:GPIB		
:ADDRESS	<numeric>	
:EXT		
:MODE	SINGle   DUAL   SEC	
:ERRor?		
:VERSion?		
CONFigure		
[: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>	
SENSe	<b>Input</b>	
:BIT?	byte,bit	READ?
:READ?	byte	BREAD?
[:DIGital]		
:DATA		
[[:VALue]?		PI?
:PORT?	number or <channel list>	BI?
:PORTn?		BIn?
:POLarity?		IPn
:RESet:EDR		ER
ROUTe	<b>Bit Comds</b>	
: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
[SOURce]	<b>Port Output</b>	
[[:DIGital]		
:DATA		
[[:VALue]	0-255	PO
:PORTn	0-255	BOn
:POLarity	0-255	OPn
:STRobe		SP
CALibrate	<b>Calibrate Configuration</b>	
:IDN	string (72 char max)	
:DATE	mm/dd/yy	
:DEFault		
:LOCK	1(On)  0(Off) [0]	

Figure 3 4863 SCPI Command Tree

## Digital IO Connections

All of the 4863's Digital I/O signals are brought out on a 62-pin connector on the rear panel of the 4863. There are several ways to connect to the 4863:

A 62-pin mating connector with a metal shell is provided with each 4863. The user can solder wires to the mating connector that is supplied with each 4863. The connector accepts 24 to 28 AWG wire sizes.

The user can purchase a five foot long, open-end round cable (P/N 114508) and connect a connector to the open end. The cable wires can also be soldered directly to a PC board or to the devices connecting to the 4863.

The user can purchase a Digital I/O extension cable with male connectors that provides a pin-to-pin extension of the 4863's Digital I/O signals. Mount a female connector (P/N 902268) on the users PC board to complete the signal connection.

See the Ordering Guide page for a graphical list of the 4863's connection options.

## OEM Board Version

The 4863 is also available as a board version for OEM applications. Board versions are designed to be mounted in the host's chassis and are powered from the host's 12 to 32 volt power supply. The boards are available with GPIB and Serial interface configurations listed in Table 1. On the OEM boards, the interface headers are mounted vertically to minimize the board footprint. The Digital I/O connector is the same right angle 62-pin connector with lock studs supplied on the 4863 boxed units. A mating connector and hood is included with OEM board.

## GPIB Address

Standard 4863's store their GPIB address in Flash memory and use a SCPI command to change it. On OEM boards, extra digital input lines are provided to input the GPIB address from an external address switch at power turn-on. The SCPI external address enable setting selects which address is used at power turn-on.

## GPIB Header

On OEM boards, the 4863's GPIB connector is replaced with a 26-pin vertical header for remoting the GPIB bus and address switch signals to the rear panel. The 26 pin header mates with a flat ribbon cable from ICS's GPIB Connector/Address switch assemblies. These compact, business card size assemblies provide a convenient way to mount a GPIB Connector and an address switch on the rear panel.

## RS-232/RS-485 Interfaces

OEM board versions are available with an optional RS-232/RS-485 serial interface. The serial interface operates at rates up to 115,200 baud. The serial interface provides all of the functionality of the GPIB interface but allows for control of the 4863 by any PC's COM port or by an RS-485 network. Up to sixteen 4863s can be placed on a single RS-485 network. The 4863s are addressed by a two character address sequence that proceeds the actual command. When the OEM board has both interfaces, the unit defaults to the serial interface until the GPIB interface enters the Remote state.

4863: APPLICATIONS

LED Header

An 8 pin header on the OEM boards allows easy extension of the 4863's LEDs to the user's front panel.

OEM Customization

The 4863's firmware allows the user to store an IDN message and other setup parameters in the 4863's Flash memory. This effectively integrates the board into the user's system and makes the 4863 appear as part of the OEM's product. A lock function hides the setup variables from the end user and prevents accidental changes to the setup.

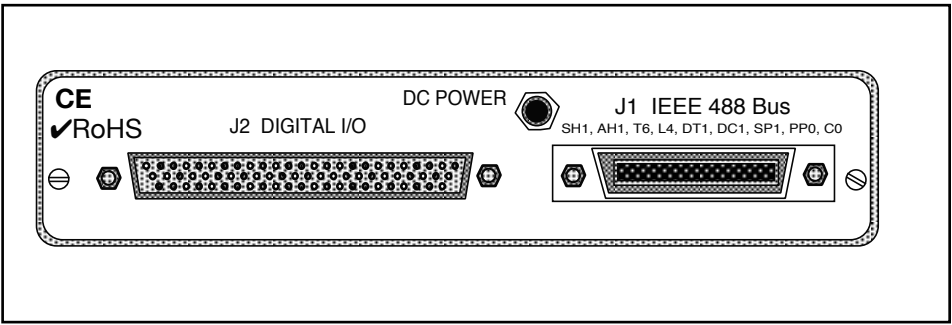


Figure 4 4863 Rear Panel

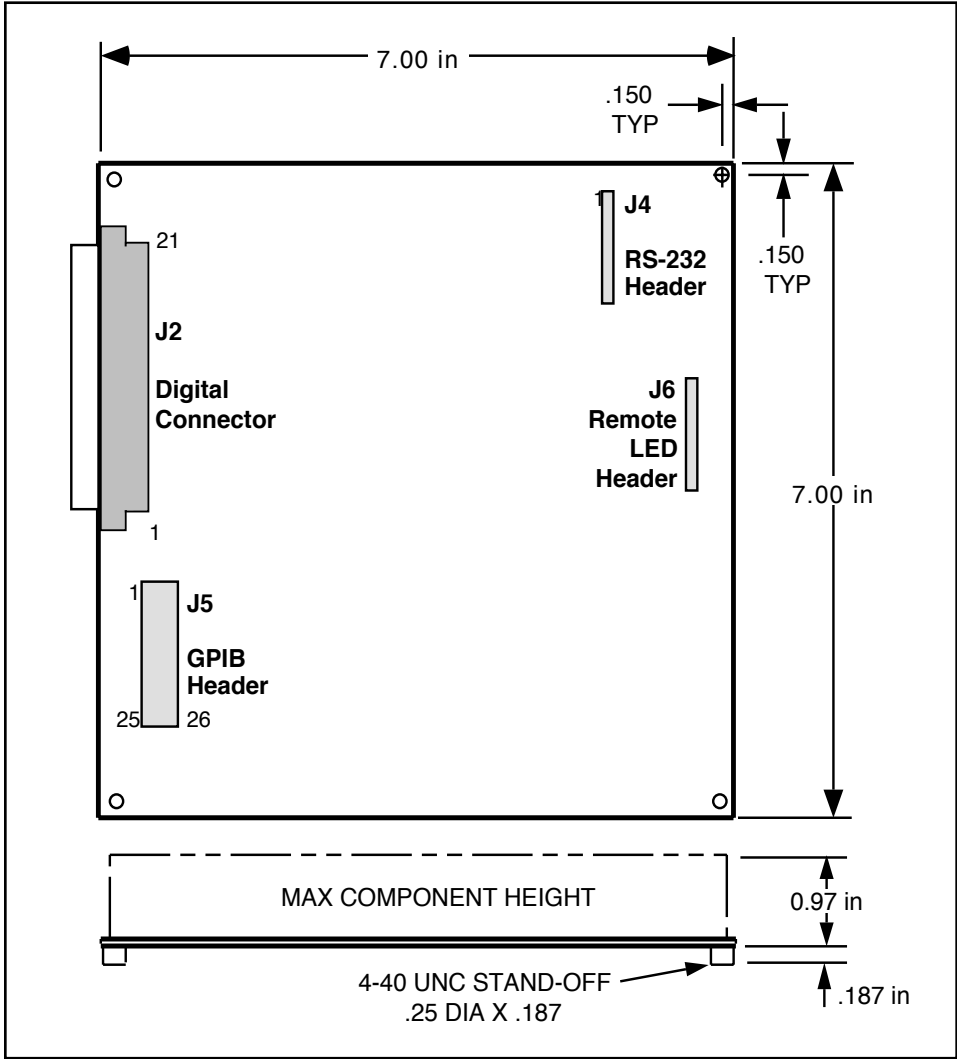


Figure 5 4863 OEM Board Dimensions

TABLE 1 4863 OEM BOARD CONFIGURATIONS

Part Number	Interfaces		
	GPIB	RS-232	RS-485
114514	Yes	No	No
114515	Yes	Yes	Yes
114711	No	Yes	Yes

OEM 4863 Boards include Instruction Manual, Support CD, mating digital I/O connector and hood. GPIB Connector/Switch Assemblies and cables are ordered separately.

Starter Kit

The OEM Starter Kit provides the OEM designer with everything needed to install and test a 4863 OEM Board. The kit includes a 114515 OEM Board with GPIB and Serial interfaces, a GPIB Connector/Switch Board Assembly, a GPIB bus cable, a serial cable, a 488-USB2 GPIB Controller module, GPIB Drivers and software. The software package includes ICS's GPIBkybd program, a Visual Basic control program and 4863 sample LabView programs. Order the 4863 OEM Starter Kit as P/N 114499. Limit is one to a customer.

## 4863: ORDERING GUIDE

Select the 4863 and then pick your accessory items.

Part Selection	Qty	Part Number
Standard 4863 Minibox with 48 I/O lines. Includes a 62-pin mating connector and hood	(1)	4863
<div> <div> <div></div> <div>Select an extra mating digital I/O connector, 62-pin male -</div> </div> <div> <div>solder eyelet</div> <div>hood</div> </div> </div>	<div>(1)</div> <div>(1)</div>	<div>902270</div> <div>902105</div>
<div> <div> <div></div> <div>Select an Open end, 62 conductor, 28 AWG wire cable assembly, 5 feet long</div> </div> <div> <div>or</div> <div>Select the Digital Extension Cable, pin-to-pin connections, male connectors (Dash number is cable length in feet)</div> <div>and</div> <div>Select mating female connector with right angle PCB tails</div> </div> </div>	<div>(1)</div> <div>(1)</div> <div>(1)</div>	<div>114508</div> <div>114714-003 (Note 1)</div> <div>902268</div>
4863 OEM board with 48 I/O lines. Includes a 62-pin mating connector and hood		
<div> <div> <div></div> <div>GPIB Interface only</div> </div> <div> <div>GPIB and Serial Interfaces</div> </div> </div>	<div>(1)</div> <div>(1)</div>	<div>114514</div> <div>114515</div>
<div> <div> <div></div> <div>Select a GPIB Connector/Address Switch Assembly -</div> </div> <div> <div>Horizontal style</div> <div>Vertical style</div> </div> </div>	<div>(1)</div> <div>(1)</div>	<div>113640-L (Note 2)</div> <div>113642-L (Note 2)</div>
<div> <div> <div></div> <div>Select an extra mating digital I/O connector, 62-pin male -</div> </div> <div> <div>solder eyelet</div> <div>hood</div> </div> </div>	<div>(1)</div> <div>(1)</div>	<div>902270</div> <div>902105</div>
<div> <div> <div></div> <div>Select an Open end, 62 conductor, 28 AWG wire cable assembly, 5 feet long</div> </div> <div> <div>or</div> <div>Select the Digital Extension Cable, pin-to-pin connections, male connectors (Dash number is cable length in feet)</div> <div>and</div> <div>Select mating female connector with right angle PCB tails</div> </div> </div>	<div>(1)</div> <div>(1)</div> <div>(1)</div>	<div>114508</div> <div>114714-003 (Note 1)</div> <div>902268</div>

Notes:

1. The dash number is the cable length in feet.
2. -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.

4863: SPECIFICATIONS

IEEE 488 Bus Interface

The 4863'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 4863 conforms to SCPI 1995.0 Specification.

Table 2 Programmable Functions

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

Signal Characteristics

The 4863's parallel I/O signals have the following electrical characteristics. All time delays listed here are maximums, all pulse widths are minimums.

Lines	48 Digital I/O plus 2 Status Inputs
Input Logic Levels	High => +2.0 V @ ±10 μA Low = <0.8 V @ 250 μA with 33 Kohm pullup to +5 Vdc for sensing contacts. Max High = 5.5 V
Input Timing	External Data Inhibit line 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 4863 has been addressed as a Talker
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 is transferred to the output 0.6 to 5.3 ms after receipt of a terminator depending upon transfer method.
Pulse Width	10 to 30000 ms in 10 ms steps 50 ms default
Data Stb Trigger Clear Reset	Output pulse width, 5 μs Output pulse width, 5 μs Output pulse width, 5 μs Output pulse width, 40 μs for *RST command and true during 4863 reset time (70 ms)

Controls and Indicators

POWER	Front-panel switch
LEDs	
PWR	Indicates power on
RDY	Unit has passed self test
TALK	Unit is addressed to talk
LSTN	Unit is addressed to listen
SRQ	Unit is asserting SRQ
ERR	Unit has detected a command error

Physical

Size	W x H x D 7.29 x 1.52 x 7.45 inches (1185.2 x 38.6 x 189.2 mm)
Weight	3 lbs (1.4 kg)
Temperature	-10°C to +55°C Operating -40°C to +70°C Storage
Humidity	0-90% RH no condensation
RFI/EMI	CE Certified
Connectors and Headers	IEEE bus: Std 24-pin metal shell w/ metric studs I/O: 62-pin female, metal DC shell connector with lock studs Serial: 10-pin male header LEDs: 8-pin male header
Power	9 to 32 Vdc @ 3 VA
Included Accessories	Instruction Manual Mating Connector and Hood CD-ROM with GPIB Keyboard Controller program and Configuration Utility. UL/CSA/VDE approved AC power Adapters provided for: US 115±10% Vac, 60 Hz (std, no dash) -U Universal 100-230 Vac, 50/60 Hz with plugs for Australia, China, Europe, Japan, UK and US.

ORDERING INFORMATION

	Part Number
IEEE 488 Bus Parallel Digital Interface with 115 VAC adapter	4863
IEEE 488 Bus Parallel Digital Interface with 100-230 VAC adapter.	4863-U
OEM IEEE 488 Bus to Parallel Digital Interface Boards (Pwr adapter not included. See Table 1 for accessories)	See Table 1
OEM IEEE 488 Bus to Parallel Digital Interface Board Starter Kit	114499