IEEE 488/GPIB PRODUCTS

DESCRIPTION

The Model 4861A is a compact, IEEE-488.2/GPIB-to-Analog Interface that provides signals for controlling analog devices from the GPIB bus. The Model 4861A has four floating analog output channels, four differential analog inputs, digital output drivers and digital inputs. The analog values can be scaled to match the physical values of the input signals or of the controlled parameters. The scale factors and all other user set configuration parameters are saved in flash memory until changed. The 4861A accepts both industry standard SCPI commands and easy-to-use short form commands. Typical 4861 A applications are controlling power supplies, providing analog stimuli or measuring analog signals.

OEM board versions of the 4861A are available in a variety of configurations to match the analog control needs. The 4861A's firmware can be customized to add new commands or operate with an alternate language such as the MATE CIIL command set.

Analog Outputs

The 4861A's analog outputs are individually isolated by 750 volts from digital ground. Channel 4 is referenced to the A/D converter ground. Each analog output can be individually set to a 0 to + 10, a ±10, or to a ±5 volt output range. Resolution is 1 part in 2^{16} . The analog outputs have separate range, scale factor, offset and limit values that the user can program to match the controlled application.

Analog Inputs





The 4861A's analog inputs are four differential signals that multiplexed into a 12 bit A/D converter as unipolar or bipolar voltages. Each input has an individual 10, 1, or 0.1 volts full scale range setting. The analog inputs are scanned at 200s/sec rate and are internally averaged. The averaged readings can be reported as voltages or individually scaled to correspond to the measured parameter, i.e. volts, amps, watts etc. The analog inputs have 750 volts of isolation from digital ground

Digital I/O

The Model 4861A provides four relay driver outputs and eight digital inputs. The digital outputs are open-collector darlington drivers that sink up to 300 mA . Output #4 can be used as a Fault Output signal to display error conditions. The digital input lines have pullup resistors and accept TTL/ CMOS levels or contact closure inputs. The 4861A can monitor the digital inputs and use the 488.2 status reporting structure to generate an SRQ (Service Request) when a change occurs.

4861A IEEE-488.2 ANALOG INTERFACE

- Provides four floating 16-bit analog outputs with 750 Vdc isolation. *Controls analog devices without ground loops.*
- Four differential analog inputs with individual programmable ranges.
 Programmable inputs for reading voltage sources, current shunts, sensors etc.
- High current drivers can operate external relays etc. Digital control of external devices
- Digital inputs read or monitor discrete signals. Generates SRQ on selected signal changes.
- User setable scale factors for analog signals. Matches 4861A commands and responses to real values.
- OEM board versions available with serial (RS-232/RS-485) and GPIB interfaces. Choice of interfaces.
- Includes sample control, calibration and configuration programs.
 Complete software package.





4861A OEM Board



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Scaling

Programmable scale factors and offsets let the user program the 4861A's outputs and read back measured values in real world numbers. The 4861A's output voltage follows the equation

Vout = (M * Vcmd) + B.

Figure 2 shows two examples of output voltage scaling by changing the slope (M) and offset (B) values. Similarly, measured voltages may be scaled to provide a true response values or converted to other units when measuring sensor signals. The scaling values may be saved in the 4861A's flash memory.

Calibration

The 4861A is digitally calibrated for increased accuracy and to eliminate all internal adjustments. The analog outputs are corrected to $< \pm 4$ bits. The analog inputs are calibrated for each range and channel. The calibration factors are saved separately in flash memory and are recalled at power turnon. Full calibration instructions and a PC calibration program are included with each unit.

IEEE-488.2 and SCPI Compatibility

The Model 4861A complies with the IEEE-488.2 STD and responds to all of the required common commands. The 4861A uses SCPI (Standard Commands for Programmable Instruments) commands for ease of programming and also responds to the short form commands for easy control from a computer keyboard.

Table 2 shows the 4861 A's SCPI command tree. The SYSTem command group sets the GPIB address and enables the external address for the board version. The STATus group reads back the digital inputs through the Questionable Status Register. Changes in the digital inputs can be used to generate an SRQ. The INSTrument command group sets the channel address for the MEASure and SOURce groups. The MEASure and SOURce command groups control the analog input and output functions. The OUTput group controls the four output lines. The CALibration group customizes the board and calibrates the unit.



Figure 2 Output Voltages for different Scale Factors and Offsets

Physical Description

The 4861A is packaged in ICS's compact metal minibox case that is only 7.2 x 7.2 inches square and 1.5 inches high. One or two 4861As can be rack mounted in a 1 U (1.75 inches) high rack mount-The rear panel contains the ing kit. analog-digital connector, the power jack and the IEEE-488 connector. Analog and digital connections for are made through a 62-pin D shell connector. Table 4 lists the analog and digital signal-pin assignments. Mating connectors are available with solder eyelet or poke-in pins. Power is provided by a wall mounted adapter but the user can run the 4861A from any 12 Vdc source. The all metal case provides excellent EMI/ RFI protection.

TABLE 1 SHORT-FORM COMMAND S

Command	Function
Cn	Selects channel
DB n	Sets analog polarity
D nn.nnn	Sets analog output
Τn	Enables Trigger n
M nn.nnn	Sets analog scale factor
B nn.nnn	Sets analog offset
L nn.nnn	Sets output limit
DD h	Sets digital outputs
DP h	Sets digital polarity
OC h	Sets digital outputs
OP h	Sets digital polarity
A? n	Read analog input n
AR n	Sets analog input range
AB n	Sets input polarity
AF n	Sets input averaging
AC nn.nnn	Sets input gain
AO nn.nnn	Sets input offset
AM	Enables auto scan
DO nn.nnn	Calibrates output offsets
DC nn.nnn	Calibrates input gain
DL nn.nnn	Calibrates input offset

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:	BITS <numeric></numeric>
:	SBITs <numeric></numeric>
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:	EOMchr <numeric></numeric>
:	NETwork <boolean></boolean>
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CONCOMMENTS TO THE

OEM Board Version

4861A board vesions are available for OEM applications. Board versions are designed to be mounted in the host's chassis and are powered from the host's power supply. On OEM boards, the GPIB, LED and Serial headers are mounted vertically for quick cable connections and to minimize the board footprint.(See Figure 2). The OEM board configurations are listed in Table 3.

Optional RS-232/RS-485 Interfaces

OEM board versions can be equipped with RS-232/RS-485 serial interfaces. The serial interfaces provide all of the functionality of the GPIB interface but allow control of the 4861A from a PC's COM port or from an RS-485 network. The RS-232 port is a 3-wire interface with Tx and Rx signals. Signal isolation is available on special order. The RS-485 port is a 2-wire, half-duplex interface with a pullup-pull-down resistor terminating network that biases the lines when idle. The 4861A's firmware supports up to sixteen 4861As on a single RS-485 network.

GPIB Header and Address Switch

OEM boards have a 26 pin header for remoting the GPIB and address switch signals to the rear panel. Standard 4861As save their GPIB address in flash memory and use a SCPI command to change it. OEM boards have additional input lines to read an external address switch when a rear panel mounted switch is desired. The GPIB header mates with a flat ribbon cable from ICS's GPIB Connector/Address switch assemblies. These compact, business card size assemblies are a convenient way to mount a GPIB Connector and an address switch on the rear panel.

LED Header

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

OEM Customization

The user's IDN message, scale factors and other user set parameters are saved in the 4861A's flash memory. This makes the completed assembly respond as the OEM's product. A lock function hides these variables from the end user and prevents accidental changes to the setup.

Starter Kit

ICS offers Starter Kits that provide everything needed to install and test a 4861A Board. The Starter Kit includes a 4861A-24 Board, a GPIB Connector/ Switch Board Assembly, mating connector, a GPIB bus cable, a 488-PCILt GPIB PCI card or a 488-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. Order P/N 114595-01 for the 488-PCILt card and 114595-03 for the 488-USB. Limit of one Starter Kit per customer.

TABLE 4 ANALOG-DIGITAL SIGNALS

Signal	Pin	Signal	Pin
Vcc	1		
Digital Out V Con	n 2		
Digital Out 1	6	Digital Out 3	4
Digital Out 2	5	Digital Out 4	3
Digital Return	7	Digital Return	28
Digital Ground	48	Digital Input 3	22
Digital Input 6	44	Digital Input 2	47
Digital Input 5	43	Digital Input 1	46
Digital Input 4	45	Digital Input 7	23
		Digital Input 8	24
Analog Input 1+	11	Analog Input 1-	32
Analog Input 2+	10	Analog Input 2-	31
Analog Input 3+	9	Analog Input 3-	30
Analog Input 4+	8	Analog Input 4-	29
Analog Out 1+	42		
Analog Out 1-	21		
Chassis Gnd	20		
Analog Out 2+	40		
Analog Out 2-	19		
Chassis Gnd	18		
Analog Out 3+	36		
Analog Out 3-	15		
Chassis Gnd	14		
Analog Out 4+	34		
Analog Out 4-	13		
Chassis Gnd	12		
+ 12 Vdc Input*	17	+12 Vdc Return	16
+ 12 Vdc Input*	39	+12 Vdc Return	38
+ 12 Vdc Input*	60	+12 Vdc Return	59
Chassis Ground	53	Chassis Ground	33

 TABLE 3
 OEM BOARD CONFIGURATIONS

Part	An	alog	Int	erfaces		Notes
Number	Outputs	Inputs	GPIB	RS-232	2 RS-485	
114578-22 114578-23 114578-24	2 3 4	4 4 4	Yes Yes Yes	Yes No Yes	Yes No Yes	



Figure 3 4861A OEM Board Dimensions

4861A SPECIFICATIONS

IEEE 488 Bus Interface

IEEE 488 Bus interface meets IEEE STD 488.1-1987 and has the following capabilities.

SH1, AH1, T6, L4, SR1, PP0, DC1, RL1, DT1, C0 and E1/E2 drivers. Bus drivers incorporate power-up/ down protection to prevent sending invalid data to the bus.

GPIB Address Capability: 0-30

SRO Generation

SRQs are generated if the event and summary bits are enabled and the event or signal change occurs. Events include the 488.2 Event Status Bits and the monitored digital inputs.

488.2 Common Commands

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

Optional Serial Interface

RS-232/RS-485 asynchronous interfaces on an internal 10 pin header. Data rates up to 115.2 Kbaud.

RS-232 interface includes TX, RX, and ground signals. Optional isolation by special order.

RS-485 interface includes TX/RX+ and RX/RX- signals with a 220 ohm load resistor and $1 \text{ K}\Omega$ pullup/pulldown resistors. Network mode supports 16 units on one network.

Certifications and Approvals

Meets Part 15, Class A of FCC Docket 20780 and EEC Standards EN 55022 and 50082-1.



Figure 3

4861A Rear Panel

Digital Lines

All parameters are specified at 25 °C. Range is jumper selected.

Analog Outputs

Channels 2,3 or 4 Ranges 0 to +10, ±10, ±5 Vdc Output current ±5 mA typ. Isolation 750 Vdc, Ch# 4 is referenced to A/D ground. Zero Unipolar 0 Bipolar Mid range 1 part in 65,535 Resolution Non-linearity ± 4 bits Zero error ± 8 bits (Unipolar) ± 4 bits (Bipolar) **End Point Error** ±30 mV Temp Drift Gain ±15 typ., 40 max. PPM/°C Unipolar Offset ±25 PPM FSR/° C ±35 PPM FSR/° C Bipolar Zero Temperature -10 °C to +55 °C Output ripple 30 mV P-P, 500 kHz Update time 8 msec from command terminator.

Analog Inputs

All parameters are specified at 25 °C. Polarity is jumper selected. Channels Range 0.1, 1 or 10 volts Polarity Unipolar or bipolar Max. Input 30 V max. 1 Megohm Input Impedance Isolation 750 volts Resolution 1 part in 4096 std Non-linearity ± 1 bit on 10 V range FS Error 10V 1V 100mV Unipolar 5mV 1mV 0.5mV Bipolar 10mV 2mV 1mV Temp Drift $17 \text{ PPM}/^{\circ}\text{C}$ **End Point** 2 x FS error **Read time** 8.5 msec max.

Inputs	8 lines with 33 Kohm pullups for TTL/ CMOS signals or con tact closure to ground.
Logic Levels	$Low = 0 \pm 0.5 Vdc$ $High = > 2.4 Vdc$
Query time	10 msec to GPIB response
Outputs	4 darlington driver outputs with diodes to V common input
Logic Levels	On < 0.7 V @ 20 mA On < 1.2V @ 200 mA Off = V Com - 0.7 V
V Common Output delay	48 Vdc maximum 3 msec from comd terminator

Physical

Size W x H x D (Std Units) 185.2 x 38.6 x 185.2 mm (7.29 x 1.52 x 7.29 inches)

Size W x H x D (OEM Boards) 177.8 x 29.5 x 177.8 mm (7.0 x 1.16 x 7.0 inches)

Weight 3 lbs (1.4 kg)

Connectors

62-pin D shell
24-pin GPIB (Std)
26-pin header (Bd)
10-pin header
8-pin header

Temperature

Storage	-10 °C to +55 °C -20 °C to +80 °C
Power	+12 +1/-0.3 Vdc, 7 VA

Included Accessories (Std Units)

Instruction Manual AC Power Adapter **Configuration Program Disk** Mating Connector

OKDERING INFORMATION	Part Number
GPIB<-> Analog Interface with A/D, 4 channels D/A and US 115 VAC adapter	4861A-24
GPIB<-> Analog Interface with A/D, 2 channels D/A and US 115 VAC adapter	4861A-22
GPIB<-> Analog Interface with 4 channels D/A and US 115 VAC adapter	4861A-14
GPIB<-> Analog Interface with 2 channels D/A and US 115 VAC adapter	4861A-12
Add option code for 230 VAC adapter -E (Europe), -B (UK), -A (Australia)	4861A-nn-x

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