RS-232/RS-485 SERIAL INTERFACES

RS-232/RS-485 TO ANALOG INTERFACE

- **Four 16-bit analog outputs with 1,000 Vdc isolation.**
  Controls analog devices without ground loops.

- **Four isolated differential analog inputs with programmable ranges.**
  Scalable inputs for reading voltage sources, current shunts, sensors etc.

- **User setable scale factors for all analog signals.**
  Matches 2361B commands and data to real values.

- **High current drivers can operate external relays etc.**
  Digital control of external devices

- **Digital inputs read or monitor external signals.**
  Generates Service Request Message on selected signal changes.

- **Choice of 3 serial protocols.**
  Supports RS-232 point to point and RS-485 networks.

- **Includes example control, configuration and LabVIEW programs.**
  Complete software support.

DESCRIPTION

The Model 2361B is a compact, RS-232/RS-485 to Analog Interface that provides isolated analog signals for controlling analog devices over a serial path. The Model 2361B has four floating analog output channels, four isolated 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 2361B's serial interface provides the functionality of a GPIB interface with control from any PC's COM port or over a RS-485 network. The 2361B accepts both industry standard SCPI commands and ICS's easy-to-use short-form commands. Typical 2361B applications are controlling power supplies, providing analog stimuli or measuring analog signals.

The Model 2361B is the latest version of the 4861 GPIB to Analog Interfaces with many improvements. It is functionally and physically interchangeable with the 2361 or 2361A versions.

2361B Serial to Analog Interface

Analog Outputs

The 2361B's analog outputs are individually isolated from digital ground and from each other. 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 2361B has four isolated differential analog inputs that are multiplexed into a 16 bit A/D converter, scanned 150 times a second and internally averaged. The A/D converter can be set for unipolar or bipolar inputs with programmable 10, 1 and 100 mV ranges. The A/D readings can be reported as voltages or scaled to correspond to the measured parameter, i.e. volts, amps, watts, psi, etc. The analog inputs have 1,000 volts of isolation from digital ground. The A/D converter's ground is tied to D/A #4's ground in the standard unit and isolated with the -I option.

Digital I/O

The Model 2361B provides eight digital inputs and four relay driver output signals. The digital inputs have pullup resistors and can accept TTL/CMOS levels or contact closures. The 2361B's firmware provides for direct reading of the digital signals or for monitoring the signals for changes. Any changes in the digital inputs can be used to generate a Service Request Message. The digital outputs are darlington drivers that sink up to 300 mA and incorporate protection diodes for driving relays or other inductive devices. Each output can be individually controlled. Output #4 can also be used as a Fault Output signal to display error conditions.
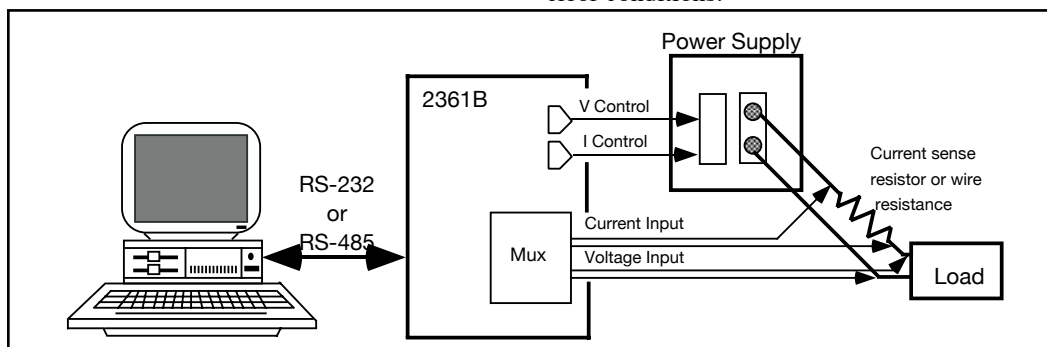
CE Approved

☑ RoHS Compliant

Figure 1   Using the 2361B to control a power supply and measure its outputs

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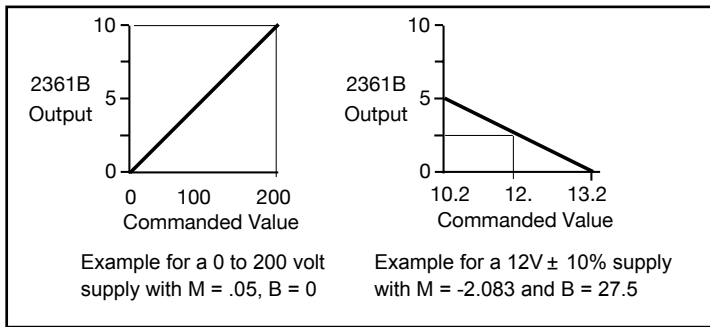
7034 Commerce Circle
Pleasanton, CA 94588
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Output Scaling

Programmable scale factors and offsets let the user program the 2361B's output and read measured values in real world numbers. The 2361B's output voltage follows the equation

$$Vout = (M * Vcmd) + B.$$

Figure 2   Output Voltages for different Scale Factors and Offsets

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 actual values for divided inputs or converted to other units when measuring sensor signals. The scaling values may be saved in the 2361B's Flash memory.

2361B Improvements

The 2361B includes several improvements over prior 4861 models. D/A and A/D isolation has been increased from 750 to 1,000 volts. D/A channel #4 has always provided a small amount of power to the A/D section so they share a common ground. The 2361B can be ordered with fully isolated A/D and D/A channel #4. The A/D resolution has been increased to 16 bits which results in increased accuracy for the measured signals. The 2361B now supports standard terminated command strings, addressed command strings and a secure packet protocol for improved network operation.

IEEE-488.2 and SCPI Commands

The Model 2361B includes an IEEE-488.2 Status Reporting Structure and responds to all of the required 488.2 common commands. The 4861B uses SCPI (Standard Commands for Programmable Instruments) commands for ease of programming and also responds to ICS's short form commands for easy control from a computer keyboard.

Table 1 shows a portion of the 2361B's SCPI command tree. The SYSTem command group sets the Serial parameters and enables the Serial address function for RS-485 networks. The STATus group can sense digital input changes through the Questionable Status Register. The INSTrument command group sets the input or output channel number. The MEASure and SOURce command groups control the analog input and output functions. The OUTput group controls the four digital output lines. The CALibration commands let the OEM configure the unit as their own product.

RS-232/RS-485 Interfaces

The 2361B provides both RS-232 and RS-485 signals on it's 25-pin rear panel connector. The RS-232 interface is a full-duplex, three wire interface. The RS-485 interface is a two wire, half duplex interface for point-to-point or network connections.

TABLE 2   SCPI COMMAND TREE

SCPI Commands		Short Form Cmds
SYSTem	General	
:COMM		
:SERial		
:EXTernal	1 (On) | 0 (Off) [0]	
:BAUD	<numeric>[9600]	
:PARity	EVEN | ODD | [NONE]	
:BITS 7 | [8]		
:SBITs [1] | 2		
:NETwork	Off | ADDRess | PACKet [Off]	
:ADDRess	<numeric> [4]	
:GPIB		
:ADDRess	<numeric> [4]	
:EXTernal	1 (On) | 0 (Off) [0]	
:UPDAte		
:ERRor?		
:VERsion?		
STATus		
:OPERation	WTG Status	
[:EVENt]?		
:CONDition?		
:ENABle	<numeric>	
:QUEStionable	Digital Inputs	
[:EVENt]?		
:CONDition?		
:ENABle <numeric>		
:PTRansition	<numeric	
:NTRansition	<numeric>	
INSTrumentChannel Select		
:NSELect	<numeric>	C
SOURce Analog Outputs		
:VOLTage		
[:LEVel]		
[:IMMediate]		
[:AMPLitude]	<numeric>	D
:TRIGgered		
[:AMPlitude]	<numeric>	T
:LIMit		
[:AMPlitude]	<numeric>	L
:OFFset		
[:AMPlitude]	<numeric>	B
:POLarity	<numeric>	DB
:SLOPe		
[:AMPlitude]	<numeric>	M
:DIGitalDigital Outputs		
:DATA		
[:VALue]	0-15	DD
:POLarity	0-15	DP
OUTPut Digital Outputs		
:STATe	<boolean>	OC
:POLarity	1 | 0	OP
INITate Trigger Enable		
[:IMMediate]		TI
:CONTinuous	<boolean>	TC
MEASureAnalog Inputs		
:VOLTage?		
[:DC]	channel list	A?n
:RANGe	10, 1, 0.1	AR
:POLarity	1 | 2	AB
:AVERage	<numeric>	AF
CALibrate		
:IDN	string	
:DATe	mm/dd/yyyy	
:FAULT	1 (On) | 0 (Off) [0]	
:LOCK	1 (On) | 0 (Off) [0]	

Serial Protocols

The 2361B supports three serial protocols. Terminated command strings are the default protocol and are commands terminated with a linefeed character. The addressed commands protocol prefixes each command with a start of text character (STX) and an address number (0x30 thru 0x3F). The packet protocol encloses each command or response in a checksumed packet. The 2361B always sends a prompt or a response packet to indicate that it is ready for the next command.

Physical Description

The 2361B is packaged in ICS's compact Minibox case that is only 7.2 x 7.2 inches square and 1.5 inches high. One or two 2361Bs can be rack mounted in a 1 U (1.75 inches) high rack mounting kit. The 2361B's rear panel, shown in Figure 3, contains the analog-digital connector, the power jack and the serial connector. Analog and digital connections for are made through a 62 pin D shell connector. Mating connectors are available with solder eyelet or poke-in pins. Table 4 lists the analog and digital signal-pin assignments. Power is provided by a wall mounted adapter but the user can run the 2361B from any 12 Vdc regulated source.

OEM Board Versions

The 2361B is available as a board version for OEM applications. Board versions include a GPIB interface and are designed to be mounted in the host's chassis and powered from the host's power supply. The boards are available with various output configurations as listed in Table 3.

Serial Header

On OEM boards, the 2361B's 25-pin rear panel Serial connector is replaced with a 10-pin header for remoting the serial signals to the rear panel. The 10-pin header has pins on 0.1 inch centers and mates with a variety of connectors including flat ribbon cable type connectors. The Serial header includes the 2361B's RS-232 and RS-485 signals plus a reset input signal.

GPIB Header

OEM boards also have a GPIB interface with a 26 pin header for remoting the GPIB and address switch signals to the rear panel. The GPIB address can be saved in flash memory with a SCPI command or set by reading an an external address switch at power turn-on time. The GPIB header mates with 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 provides LED drive signals and a +5 Vdc line to extend the 2361B's LEDs to the user's front panel.

OEM Customization

2361B's firmware allows the user to store his IDN message, scale factors and other setup parameters in the 2361B's Flash memory. This effectively integrates the 2361B into the end product and makes the system appear as the OEM's product. A lock function hides the setup variables from the end user and prevents accidental changes to the setup.
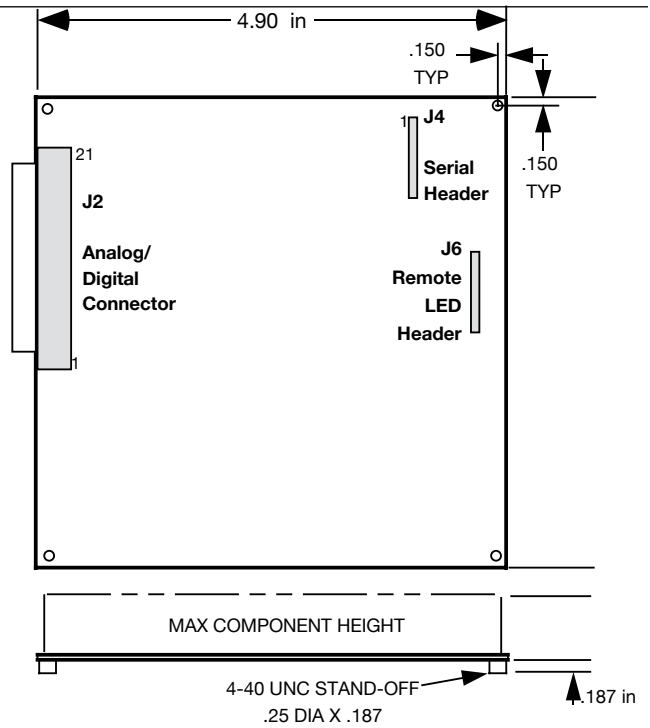

Figure 4   2361B OEM Board Dimensions

TABLE 3   ANALOG-DIGITAL SIGNALS

| Signal	Pin	Signal	Pin
Vcc	1		
Digital Out V Com	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
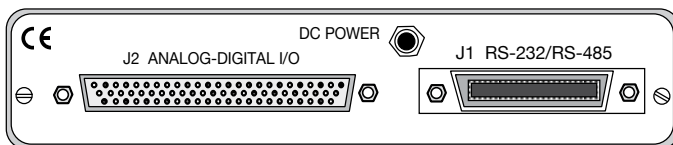
Figure 3   2361B Rear Panel

2361B SPECIFICATIONS

Serial Interface

Provides RS-232 full duplex and RS-485 (RS-422) half duplex asynchronous serial interfaces.

RS-232 Interface
Signals:	AB, BA and BB
Mode:	Full Duplex

RS-485 Signals
Signals:	TX/RX pair
Mode:	Half duplex with or without address detection
Addresses:	0 to 15
Termination:	220 ohm load resistor and 1 KΩ pullup/pulldown

Common Specifications
Baud Rate:	1200 to 38.4 Kbaud
Data bits:	7 or 8
Stop bits :	1 or 2
Parity:	Odd, Even or None

Serial Protocols
Terminated messages
Addressed messages - Address range 1-16
Packets (RS-485 only)

Command Sets
SCPI and short form commands listed in Tables 1 and 2 plus the following 488.2 Common Commands: *CLS, *ESE, *ESE?, *ESR?, *IDN?, *OPC, *OPC?, *PSC, *PSC?, *RCL, *RST, *SAV, *SRE, *SRE?, *TRG, *TST, and *WAI.

Service Request Message
Asynchronous Service Request Messages generated in lieu of SRQ signal.

SRM nn LF	where nn is the Status Byte value.

Certifications and Approvals

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

Analog Outputs

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

Channels	2,3 or 4
Ranges	0 to +10, ±10, ±5 Vdc
Output current	±5 mA typ.
Isolation	1,000 Vdc, Ch# 4 is referenced to A/D ground in -24 units. Ch# 4 is floating in -24-I units.
Zero	
Unipolar	0
Bipolar	Mid range
Resolution	1 part in 65,535
Non-linearity	± 4 bits
Zero error	± 8 bits (Unipolar) ± 4 bits (Bipolar)
End Point Error	± 8 bits
Temp Drift	
Gain	±15 typ., 40 max.PPM/° C
Unipolar Offset	±25 PPM FSR/° C
Bipolar Zero	±35 PPM FSR/° C
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	4		
Range	0.1, 1 or 10 volts		
Polarity	Unipolar or bipolar		
Max. Input	30 V max.		
Input Impedance	1 Megohm		
Isolation	1,000 volts, shares D/A #4 ground in standard unit. -I option provides separate grounds.		
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 PPM/°C		
End Point	2 x FS error		
Read time	8.5 msec max.		

Digital Inputs

Inputs	8 lines
Logic Levels	
Low	0 ± 0.5 Vdc
High	> 2.4 Vdc
Pullup Resistors	33 kohm to +5 Vdc.
Query time	10 msec to GPIB response

Digital Outputs

Outputs	4 darlington driver outputs with diodes to V common input
Logic Levels	
On	< 0.7 V @ 20 mA < 1.2V @ 200 mA
Off	V Com - 0.7 V
V Common	48 Vdc maximum
Output delay	3 msec from command 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	
Analog/Digital	62-pin D shell (All)
IEEE bus	26-pin header (OEM Bd)
RS-232/RS-485	DB-25S (Module) 10-pin header (OEM Bd)
LEDs	8-pin header (OEM Bd)
Temperature	
Operation	-10° C to +55° C
Storage	-40 °C to +70 °C
Power	+12 ± 0.3 Vdc, 7 VA

Included Accessories

Instruction Manual
Support CD with utility and example programs
Mating 62-pin connector and hood
CE/UL/CSA/VDE approved 100/240 VAC power adapter with with US/Japan, European, UK and Australia/China plugs.
Operates over 80/240 Vac, 60 Hz.

ORDERING INFORMATION	Part Number
Serial<-> Analog Interface with A/D, 4 channels D/A, and universal 100/240 VAC adapter	2361B-24
Serial<-> Analog Interface with isolated A/D, 4 channels D/A, and universal 100/240 VAC adapter	2361B-24-I
OEM 2361B Board with A/D, 4 channels D/A with GPIB and Serial I/O	114578-24

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