

# IEEE 488/SERIAL BUS INTERFACES

## 2367

### SERIAL DATA ACQUISITION AND CONTROL

#### DESCRIPTION

The Model 2367 Serial Data Acquisition and Control Board provides analog and digital signals for controlling a device and the capability to read back analog voltages, digital signals and temperatures. The 2367's serial interface has selectable RS-232, RS-422 or RS-485 signals and supports point-to-point or network connections. The 2367 has a SCPI command parser and an IEEE-488.2 Status Structure so it provides the user with true GPIB functionality over a serial link.



2367 Data Acquisition and Control Module

The 2367 is housed in a small 7 in x 7 in Minibox that can either sit on a bench or be rack mounted in your test system. Analog, digital and thermocouple connections are made via a 62-pin metal-shell connector on the 2367. Serial signals are on a standard 25-pin DB connector. The 2367's configuration settings are set with SCPI commands and saved internally in flash memory. The SCPI commands can also be used to query the current configuration.

The serial settings and all of the I/O configuration settings can be changed with SCPI commands and are saved in the 2367's internal flash memory.

#### Temperature Measurements

The 2367 has four thermocouple inputs for reading temperatures in the host chassis. The 2367's on card compensation circuit accepts J type thermocouples and provides calibrated readings from -100 to + 400 °C with a resolution of 0.1 °C.

#### Analog I/O

The 2367 has six single ended analog inputs with programmable unipolar and bipolar input ranges. The ranges are 0 to + 5, 0 to +10, -5 to +5 and -10 to +10 Vdc. Resolution is 1 parts in 12 bits. Inputs are digital filtered to reduce measurement noise. The 2367's six analog outputs have a fixed 0 to + 5 Vdc output range with a resolution of 1 part in 10 bits.

#### Digital I/O

The 2367 has 32 digital I/O lines that can be configured as inputs or outputs in 8 bit byte increments. When used as outputs the lines are latched and can sink 48 mA or source 24 mA. As inputs the lines have pullup resistors so they can sense TTL, CMOS or contact closure inputs.

- Combines analog I/O, digital I/O, relay drivers and temperature readings in one board.  
*Versatile serial control board handles many applications.*
- User selectable RS-232 or RS-422 / RS-485 interface.  
*Flexible serial interface supports point-to-point and network connections.*
- Uses SCPI commands and IEEE-488.2 status reporting structure.  
*Provides GPIB functionality over a serial link.*
- Optional packet protocol adds checksum protection to each message.  
*Added protection against erroneous messages.*
- Rugged metal case that can be rack mounted.  
*Suitable for portable or airborne applications.*
- Support includes a menu driven configuration program and an example Visual Basic program.  
*Easy to use, easy to program.*
- Companion Terminal Board simplifies test connections.  
*Saves connection time.*

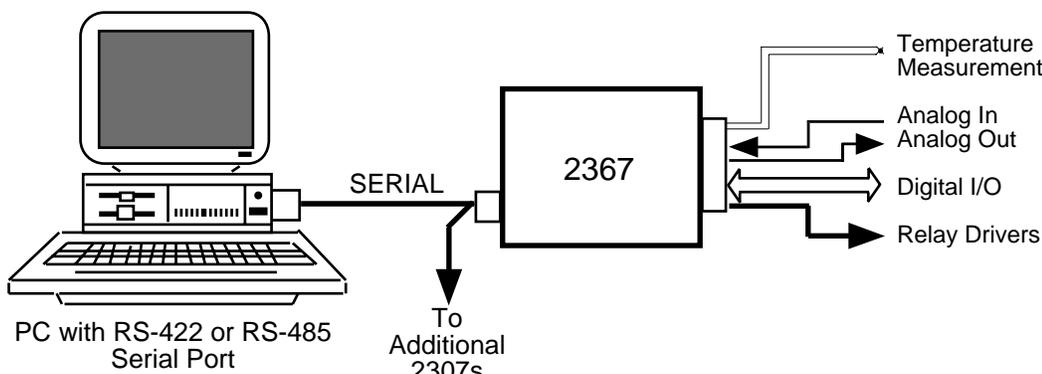


Figure 1 A Typical 2367 Application



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## 2367: DESCRIPTION

### Relay Drivers

The 2367 has 6 relay driver outputs that can sink up to 300 mA to operate external relays, solenoids or other devices.

### Signal Connections

The 2367 uses metal shell connectors with mechanical locking studs to assure trouble free connections in vibration prone installations. The 2367's rugged construction makes it suitable for ground, portable or even airborne applications.

### 2367 Configuration Features

The user can set the 2367's IDN message to personalize the 2367 as part of the end product. The IDN message, the serial settings, the I/O signal configuration and settings are saved in the 2367's nonvolatile Flash memory. The saved settings are recalled as the default settings at power turn-on. A lock command and write jumper protect the configuration settings from being accidentally changed by the end user.

### SCPI Command Parser

The Model 2367 includes a SCPI command parser, an IEEE-488.2 STD status structure and also responds to all of the required 488.2 common commands. The 2367's parser lets the user program with the SCPI commands (Standard Commands for Programmable Instruments) shown in Table 1 or use short form commands.

Table 1 shows the 2367's SCPI command tree. The SYSTEM command group sets the 2367's serial interface parameters and enables serial address detection for network connections.

## 2367 SCPI COMMAND TREE

<b>SYSTEM</b>	<b>Serial Configuration</b>
:COMM	
:SERial	
:BAUD	<numeric> [9600]
:BITS	7   8
:PARITY	ODD   EVEN   NONE
:SBITS	1   2
:NETwork	0   1
:ADDRess	0-15
:PROTocal	0   1
:ERRor?	
:VERSion?	(1996.0)
<b>STATus</b>	
:OPERation	
:CONDition?	
:ENABle	<numeric>
:QUEStionable	<b>Digital Inputs</b>
:CONDition?	
:ENABle	<numeric>
:PTRansistion	<numeric>
:NTRansistion	<numeric>
<b>CONFigure</b>	<b>Data Strings</b>
[:DIGital]	
:INPut	<channel list>
:POLarity	boolean
:OUTput	<channel list>
:POLarity	boolean
<b>FORMat</b>	<b>Data Format</b>
[:DATA]	
:TALK	
:LISTen	
<b>SOURce</b>	<b>Outputs</b>
:VOLTage	<b>Analog</b>
[:LEVel]	
[:IMMediate]	
[:AMPLitude]	<numeric>
:TRIGgered	
[:AMPLitude]	<numeric>
:LIMit	
[:AMPLitude]	<numeric>
:OFFset	
[:AMPLitude]	<numeric>
:RANGe	<numeric>
:SLOPe	
[:AMPLitude]	<numeric>
[:DIGital]	<b>Port Outputs</b>
:DATA	
[:VALue]	0-255
:PORTn	0-255
:POLarity	0-255
<b>ROUTe</b>	<b>Relay Driver Outputs</b>
:CLOSe	<channel list>
:STATe?	
:OPEN	<channel list>
:ALL	

## 2367 SCPI COMMAND TREE Cont'd

<b>MEASure</b>	<b>Analog Inputs</b>
:VOLTage?	
[:DC]	<channel list>
:RANGe	<numeric>
:POLarity	<numeric>
:AVERage	<numeric>
:TEMPerature	<channel list>
<b>SENSe</b>	<b>Digital inputs</b>
[:DIGital]	
:DATA	
[:VALue]?	
:PORT	<channel list>
:PORTn?	
:POLarity	<numeric>
<b>CALibrate</b>	<b>Calibrate</b>
:MEASURE	
:GAIN	<numeric>
:NGAIN	<numeric>
:OFFset	<numeric>
:IDN	<string>
:FAULT	0   1

The STATUS group can sense digital input changes through the Questionable Status Register.

The CONFigure commands group multiple bytes together as inputs or outputs so they can pass data as strings. Unconfigured bytes can be directly read or written to with the byte oriented commands.

The FORMat commands set the data format used for transferring data as strings.

The SOURce command group controls the analog input and digital output functions. Digital outputs can be set by direct writes to a specific port or by strings of data written to the configured output ports.

The ROUTe commands set and clear the relay driver outputs.

The MEASure command group sets the input ranges and reads the analog and temperature input values.

The SENSe group controls the digital input functions. Digital inputs can be read directly from a specific port or as a data string from the configured input ports.

The CALibrate group saves the calibration values in Flash and has a default command to restore the factory settings.

## 2367: DESCRIPTION

### Serial Interfaces

The 2367 provides RS-232 and RS-422/RS-485 signals on its 25-pin serial connector. Signal selection is made by jumpers on the 2367. The RS-232 interface is a full-duplex, three wire interface. The RS-422/RS-485 interface is a four wire interface with TX and RX signal pairs. The transmitter can be set for full or half duplex operation. RS-485 network connections are made by externally jumpering the TX and RX signal pairs.

### Networking Capabilities

The 2367 can be operated on a RS-422 or RS-485 network by prefixing messages to the 2367 with a two character address sequence. The 2367's serial address detection capability lets the user control up to sixteen 2367s on a single network. When address recognition is enabled, the 2367 looks for presence of the STX character followed by its own address before acting upon the remainder of the attached command string. The address is saved in the 2367's Flash memory. A separate command lets the user enable or disable the address sequence.

### Packet Protocol

The 2367 also supports message packets that include a checksum for added message security in noisy environments. Each received message is verified against the checksum before being executed. Valid messages are responded to with a response or an acknowledgment message. Invalid messages are responded to with a command error message. The message syntax is:

STX Addr Comd...ETX Checksum

The packet protocol requires the use of an address for the 2367 even when the 2367 is being used on a point-to-point connection. A separate command lets the user enable or disable the packet protocol.

### Physical Description

The 2367 is packaged in one of ICS's small metal-enclosed Minibox case that is less than 1.6 inches high. It may be

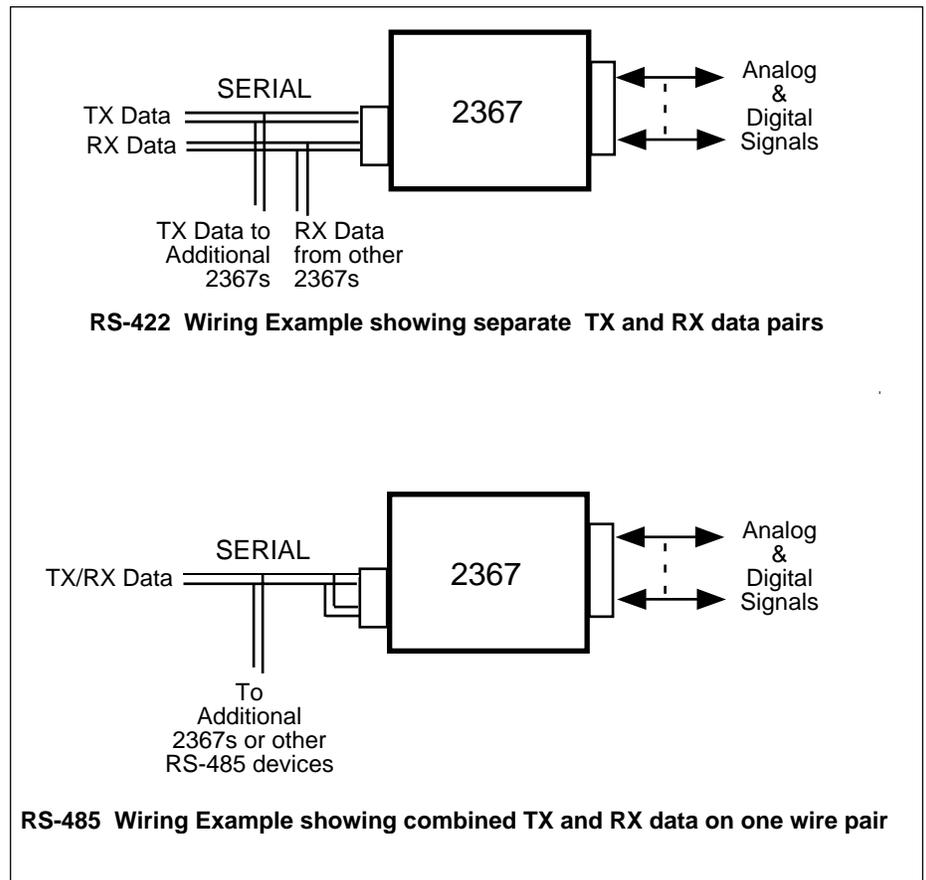


Figure 2 RS-422 and RS-485 Wiring Examples

used as a stand-alone module or in a 19 inch rack mount kit. The rear panel contains a 25-pin Serial connector, a power jack and the analog-digital signal connector. Mating connectors are available with solder eyelets, poke-in pins or with right-angle solder tails. Unregulated DC power is provided by an included power adapter.

### OEM Board Only Versions

The 2367 is 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 the Serial (RS-232 and RS-485) and GPIB interface configurations listed in Table 3. On the OEM boards, the interface headers are mounted vertically to minimize the board footprint and the boards have 4-40 x 0.187 inch standoffs in each corner for ease of mounting.

### GPIB Header

On board versions with a GPIB interface, the 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. See the separate GPIB Connector/ Address data sheet for assembly details and outline dimensions. The user can either enable the external GPIB address switch or use the board's internal GPIB address which is stored in Flash memory.

### LED Header

An 8 pin header on the OEM boards allows easy extension of the board's LED driver signals to the user's front panel.

## 2367: SPECIFICATIONS

### Serial Interface and Commands

Provides RS-232 and RS-422/RS-485 asynchronous serial interfaces. Signal type selected by jumpers on the board.

#### RS-232 Interface

Signals: AB, BA and BB  
Mode: Full Duplex

#### RS-422/RS-485 Signals

Signals: TX/RX pairs  
Mode: Half duplex with or without network address detection

#### Data Rates and Formats

Baud Rate: 300 to 115.2 Kbaud  
Data bits: 7 or 8  
Stop bits: 1 or 2  
Parity: Odd, Even or None

#### Command Sets

SCPI and short form commands listed in Table 1 plus the following IEEE 488.2 Common Commands:

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

**Table 2 Programmable Functions**

Baud Rate, Serial Format  
Enable Network Addressing  
Set Network Address  
IDN Message  
String input (Talk) bytes  
Input data polarity  
Input data format  
Input data conversion  
Input control signal polarities  
String output (Listen) bytes  
Output polarity  
Output data Format  
488.2 Status Enable Registers  
Byte out polarities  
Byte in polarities  
Output Driver Settings  
Read Temperature 1:4  
Read Analog Inputs 1:6  
Set analog Outputs 1:4

**Table 3 OEM Board Configurations**

Part Number	Interfaces		
	GPIB	RS-232	RS-485
115097-01	Yes	No	No
115097-02	No	Yes	Yes
115097-03	Yes	Yes	Yes

### Digital I/O

32 lines configurable as input or outputs in 8-bit byte increments.

Input High = > +2.4 V  
Logic Low = < 0.5 V @ -200  $\mu$ A  
Levels 33 Kohm pullup to +5 Vdc for normally open contacts.

Output High = > 3 V with 3 mA source  
Logic High = > 2 V with 24 mA source  
Levels Low = 0.0 to +0.8 Vdc, 48 mA sink

### Analog Inputs

6 single ended inputs with programmable ranges.

Ranges  $\pm 10$ ,  $\pm 5$ , 0 to +5, 0 to +10Vdc  
Resolution 1 part in 12 bits  
Accuracy 2 bits  
Offset 3 bits

### Analog Outputs

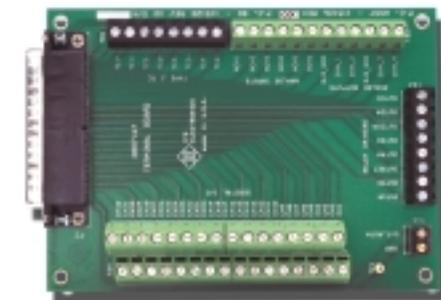
4 outputs with common ground.

Vout 0 to 5 Vdc  
Resolution 1 part in 10 bits  
Accuracy 3 bits  
Offset 6 mv

### Driver Outputs

6 open collector relay drivers

I<sub>max</sub> 300 mA  
V<sub>max</sub> 48 Vdc



**4867/2307 Terminal Board Assembly**

### Temperature Measurements

Four type J thermocouple inputs

Range: -100 to +400 °C  
Resolution 0.1 °C  
Accuracy  $\pm 2$  °C exclusive of thermocouple error

### Diagnostic Indicators

Six Front Panel LEDs:  
PWR, RDY, MTA, MLA, SRQ and ERR.

### Physical

Size, L x W x H  
139.7 x 114.3 x 12.7 mm  
(5.5 x 4.5 x 0.5 inches)

### Connectors and Headers

GPIB: 26-pin (2 row x 13 pin) header  
Data: 62-pin DC shell female connector  
Power: 2 screw terminals

### Temperature

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

### Humidity

0-90% RH, no condensation

### Power

9 to 32 Vdc at 2 VA

### Included Accessories

Instruction Manual  
Configuration Disk with sample programs  
62-pin mating connector.  
UL/CSA/VDE/CE approved AC power adapter provided for:  
US - 115  $\pm 10\%$  Vac, 60 Hz (std)  
Europe - 230  $\pm 10\%$  Vac, 50/60 Hz  
UK - 230  $\pm 10\%$  Vac, 60 Hz  
Japan - 100  $\pm 10\%$  Vac, 50/60 Hz

## ORDERING INFORMATION

	Part Number
Serial Data Acquisition and Control Module with 115 VAC adapter	4867
Serial Data Acquisition and Control Module with 230 VAC adapter. Specify: -E (Europe), -B(UK), -A(Australia)	
4807/2307 Terminal Board Assembly	115124