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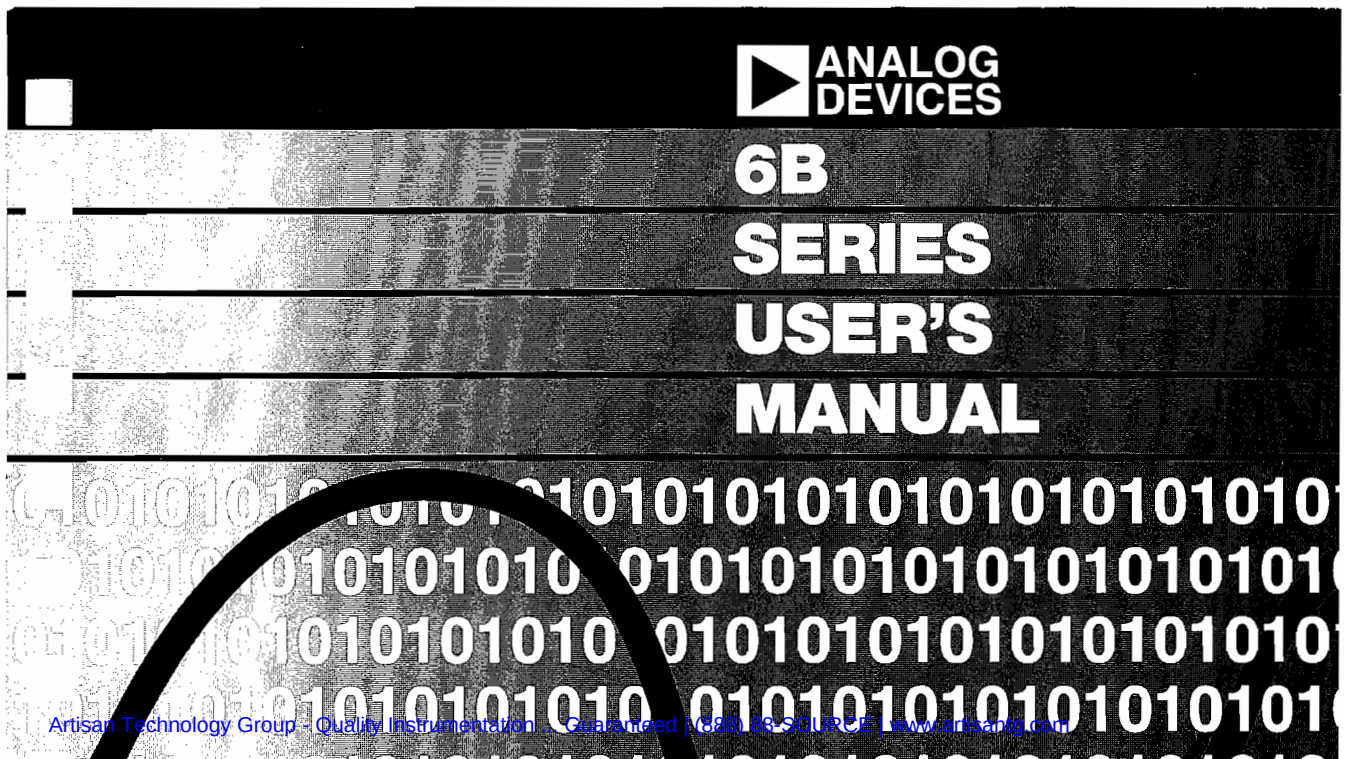
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ANALOG DEVICES

6B SERIES USER'S MANUAL

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Preface

The *6B Series User's Manual* provides all the information required to install, configure, calibrate, read data from, and write data to 6B Series modules and the 6B50 digital I/O board. It is intended for system designers responsible for building data acquisition systems.

The *6B Series User's Manual is* organized as follows:

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- Chapter 1 provides an overview of the features of 6B Series

- Appendix B contains examples of each of the data formats for each input and output range.
- Appendix C contains instructions for calibrating analog I/O modules.
- Appendix D contains the information needed to troubleshoot a 6B Series system.
- Appendix E contains a summary of 6B Series commands arranged by syntax and by the particular module/board supported.
- Appendix F contains sample programs for reference when writing individual application programs.
- Appendix G contains information on where to obtain common parts and accessory items associated with a 6B Series system.

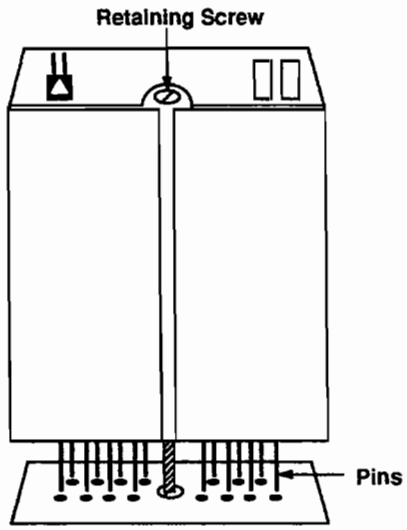
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1 Description

The 6B Series product family consists of modules, boards, and backplanes, which provide a direct interface between your host computer and a variety of analog input, analog output, and digital I/O applications. This chapter describes the features of the 6B Series analog input and analog output modules, the 6B Series backplanes, and the 6B50 digital I/O board. If you require more technical information, refer to Chapter 5.

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Description



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Figure 1-1. 6B Series Module

Description

Modules Available

The following input modules are available:

- **6B11 Module -** The 6B11 module accepts input from J, K, T, E, R, S, and B thermocouples, millivolt inputs from ±15 mV to ±500 mV, voltage inputs from ±1 V to ±5 V, and process current inputs. It returns data in engineering units, such as °C, V, or mA, as percent of full-scale range (FSR), or in twos complement hexadecimal format.
- **6B12 Module -** The 6B12 module accepts millivolt inputs from ±150 mV to ±500 mV, voltage inputs from ±1 V to ±50 V, and process current inputs. It returns data in engineering units, such as mV, V, or mA, as percent of FSR, or in twos complement hexadecimal format.
- **6B13 Module -** The 6B13 module accepts input from platinum, nickel, and copper RTDs and returns linearized data in

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Description

For applications that require the synchronized sampling of more than one input signal, all 6B11 analog input modules, all 6B12 analog input modules, and all 6B50 digital I/O boards can be programmed to simultaneously sample their input values. The synchronized data can be read back later.

Refer to Chapters 3 and 4 for more information on programming analog input modules.

6B21 Analog Output Module

The 6B21 analog output module provides digitally controlled, isolated current loop output to a resolution of 12 bits. Select an output range of either 0 to 20 mA or 4 to 20 mA.

Software is used to configure 6B21 modules for address, output range, baud rate, data format, checksum status, slew rate, and

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Description

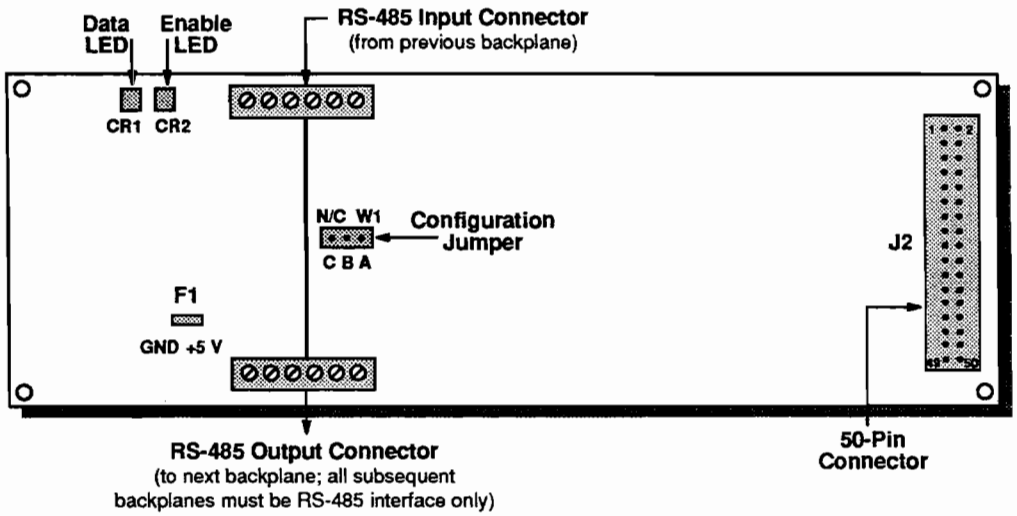
6B50 Digital I/O Board

The 6B50 digital I/O board allows data to be read from and written to 24 digital I/O channels on three 8-bit ports (A, B, and C). Access the three digital I/O ports with industry standard digital I/O panels, such as the STB-50A Screw Termination Board, the DB-16 Digital I/O Backplane, and the DB-24 Digital I/O Backplane. Connect the digital I/O panel through the 50-pin connector (J2) on the 6B50 board. Refer to Application Wiring in Chapter 2 for more information.

Each channel on a 6B50 board is bidirectional. Use each channel as either an input channel or an output channel. The logic level associated with each channel is provided either by an external device, such as a switch whose contact closure state is being monitored, or by the on-board output signal, which is used when writing a value to a channel. The output transistor is active-low. A logic 1 indicates that the output signal is ON and

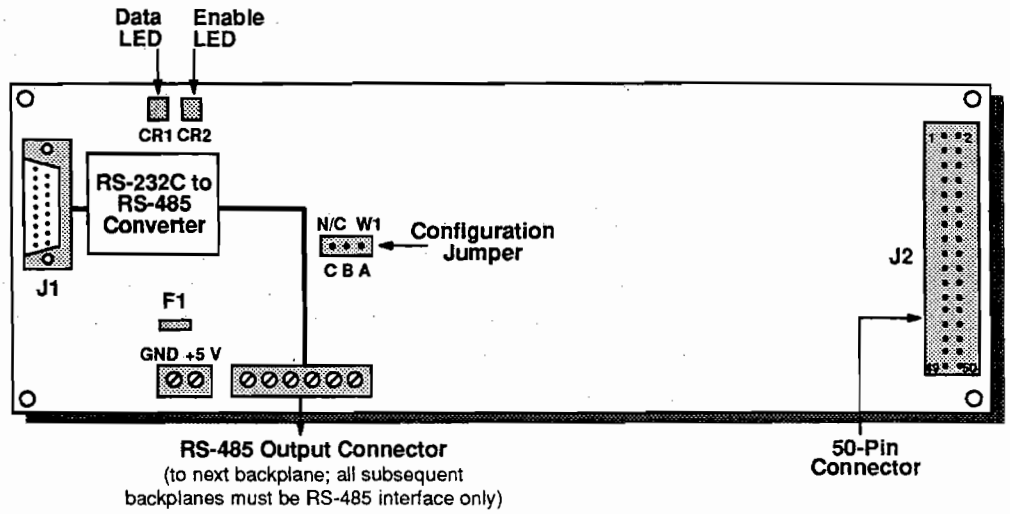
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Description



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Figure 1-2. 6B50-1 Board



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Figure 1-3. 6B50-2 Board

Description

The configuration jumper is intended strictly for verification and configuration; install the jumper in position BC during normal operation. For more information on the configuration jumper, refer to Appendix A.

Power Supply

Each 6B50 digital I/O board requires an external +5 V power supply, which you connect to the +5 V and GND screw terminals on the board. A shunt diode provides polarity reversal protection to the board. A fuse (F1) protects the board from damage caused by short circuits. Refer to Providing Power to Backplanes and Boards in Chapter 2 for more information.

Networking

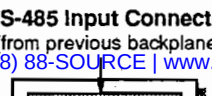
You can connect multiple 6B50 digital I/O boards and 6B Series backplanes in an RS-485 network. Two LEDs (labeled CR1 and

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6B Series Backplanes

The following 6B Series backplanes are available for use with 6B Series modules:

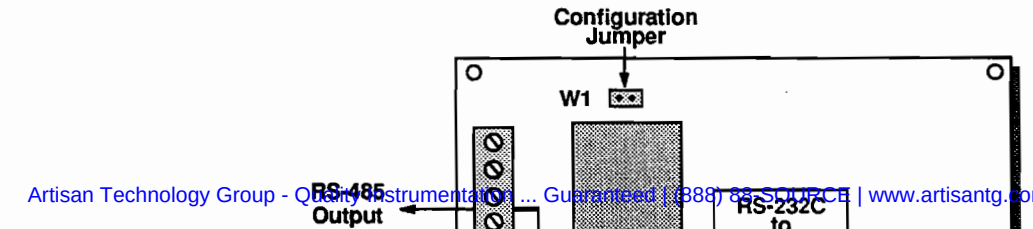
- **6BP01-1 Backplane** - The 6BP01-1 backplane, shown in Figure 1-4, is a single-channel backplane. It has one RS-485 input connector for connecting to the previous 6B Series backplane or 6B50 digital I/O board in a network. (Note that since the 6BP01-1 backplane does not contain an RS-485 output connector, you cannot connect the 6BP01-1 to any backplanes or boards farther in the network.)



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Description

- **6BP01-2 Backplane** - The 6BP01-2 backplane, shown in Figure 1-5, is a single-channel backplane. It has an RS-485 output connector for connecting to the next 6B Series backplane or 6B50 board in a network and an RS-232C connector for connecting to a host computer. It also has an RS-232C-to-RS-485 converter that allows the 6B modules to communicate with the host.



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Description

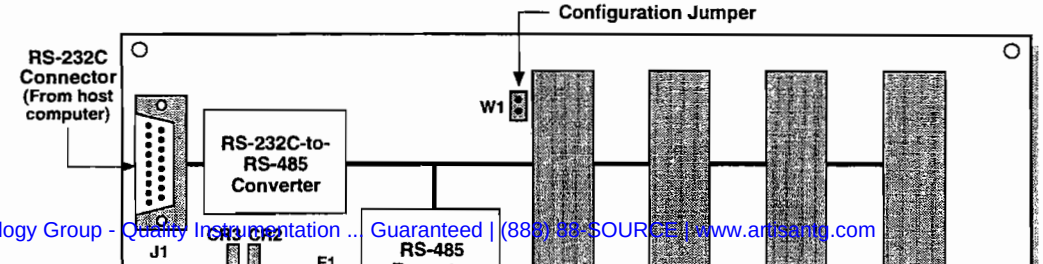
- **6BP04-1 Backplane** - The 6BP04-1 backplane, shown in Figure 1-6, is a 4-channel backplane. It has two RS-485 connectors, one for connecting to the previous 6B Series backplane or 6B50 digital I/O board in a network and one for connecting to the next backplane or board in the network. It also has an RS-485 repeater that allows you to connect the backplane to another backplane or board at a distance of up to 4000 feet.

Note: The 6BP04-1 INPUT and OUTPUT connections (shown in Figure 1-6), may NOT be interchanged when wiring a 6B Series system... in the event they are interchanged, the 6BP04-1 and subsequent 6B backplane boards will not respond – however, no damage will occur to the boards.

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Description

- **6BP04-2 Backplane -** The 6BP04-2 backplane, shown in Figure 1-7, is a 4-channel backplane. It has an RS-485 output connector for connecting to the next 6B Series backplane or 6B50 digital I/O board in a network and an RS-232C connector for connecting to a host computer. It also has an RS-232C-to-RS-485 converter that allows the 6B modules to communicate with the host, and an RS-485 repeater that allows the backplane to to be connected to another backplane or board at a distance of up to 4000 feet.



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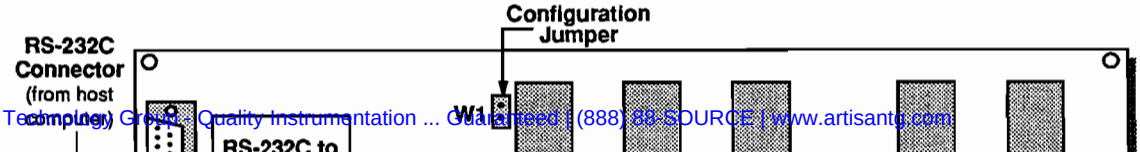
- **6BP16-1 Backplane** - The 6BP16-1 backplane, shown in Figure 1-8, is a 16-channel backplane. It has two RS-485 connectors, one for connecting to the previous 6B Series backplane or 6B50 digital I/O board in a network and one for connecting to the next backplane or board in the network. It also has an RS-485 repeater that allows you to connect the backplane to another backplane or board at a distance of up to 4000 feet.

Note: The 6BP16-1 INPUT and OUTPUT connections (shown in Figure 1-8), may NOT be interchanged when wiring a 6B Series system... in the event they are interchanged, the 6BP16-1 and subsequent 6B backplane boards will not respond – however, no damage will occur to the boards.

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Description

- **6BP16-2 Backplane** - The 6BP16-2 backplane, shown in Figure 1-9, is a 16-channel backplane. It has an RS-485 output connector for connecting to the next 6B Series backplane or 6B50 digital I/O board in a network and an RS-232C connector for connecting to a host computer. It also has an RS-232C-to-RS-485 converter that allows the 6B module to communicate with the host and an RS-485 repeater that allows you to connect the backplane to another backplane or board at a distance of up to 4000 feet.



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Description

Features

Besides the RS-485 connector(s), RS-232C connector, RS-232C-to-RS-485 converter, and RS-485 repeater, each 6B Series backplane contains the following:

- **Screw Termination Block** - Each channel on a 6B Series backplane has a screw termination block with four screw terminals for connecting applications. These screw terminals satisfy all transducer inputs and process current outputs, and they provide excitation when necessary.
- **CJC Sensors** - A CJC (cold junction compensation) sensor is permanently installed for each channel on a 6B Series backplane to accommodate the 6B11 module. When thermocouple wires are connected to the screw terminals, the CJC sensor measures the temperature of the screw terminals and applies a correction term to the thermocouple reading.

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Description

- **Configuration Jumper -** The configuration jumper (W1) allows verification of the configuration of a module by forcing the module into a known state. The configuration jumper is connected to the leftmost module position on a 6B Series backplane. If a module is installed in this leftmost position and if the configuration jumper is installed, on power-up the module is forced into a known address (00H), baud rate (9600), and checksum status (disabled). The module can be addressed to verify and change its configuration.

  The configuration jumper must be used to establish or alter the address, baud rate and checksum status for a 6B Series module.

  The configuration jumper is intended strictly for verification and configuration; *do not use this jumper during normal operation.* For more information on the configuration jumper, refer to Appendix A.

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Description

Caution: If the power lines across the high and low signal screw terminals are accidentally connected while a current conversion resistor is connected, the resistor will open circuit internally.

- **Shunt Diode -** A shunt diode on each 6B Series backplane provides polarity reversal protection to the backplane.
- **Fuse -** A fuse (F1) on each 6B Series backplane protects the backplane from damage caused by short circuits or by the failure of one of the modules on the backplane. Refer to Replacing the Fuse in Chapter 2 for information on replacing the fuse.
- **Status Indicators -** Two LEDs (labeled CR3 and CR2) indicate the status of the communication lines. Refer to Communica-

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Description

all 6B Series modules have the CE (Communité Européenne) mark on their label. Satisfying these requirements indicates that each 6B module will neither create noise which will cause interference with other products in its environment, nor be susceptible to noise created by equipment in that environment.

Please refer to Appendix K for additional details on the EMC tests as well as the setup information when applying the 6B Series Modules to comply to the EMC Directive in heavy industrial applications.

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2 Setup and Installation

A 6B Series system consists of backplanes, modules, boards, a host computer, and I/O applications in an arrangement appropriate for your installation. This chapter provides guidelines to follow when setting up and installing a 6B Series system. As you set up your system, keep the following considerations in mind:

- Carefully plan the layout and configuration of your system before you begin.

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Setup and Installation

Hardware and Software Requirements

The following equipment is required to set up a 6B Series system:

- Host computer, such as an IBM® PC™, IBM PC/XT™, or IBM PC AT™-compatible, with an accessible RS-232C serial communication port.
- RS-232C male-to-female DB-25 cable (AC1382), RS-232C male-to-female DB-9 cable (AC1385), or other compatible cable (up to 50 feet).
- +5 V power supply for each 6B Series backplane or 6B50 digital I/O board; refer to Providing Power to 6B Series Backplanes and Boards in this chapter for more information.
- 6B Series modules, as needed.
- One 6B Series backplane or 6B50 digital I/O board with an

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After grounding has been established, remove the module, backplane, or board and inspect it for signs of damage and loose components. If the module, backplane, or board appears damaged in any way, contact your local Analog Devices sales office. Do not attempt to use a damaged module, backplane, or board.

Store unused modules, backplanes, and boards in the antistatic bags in which they were shipped.

Installing Modules

To install a 6B Series module into its permanent socket on the 6B Series backplane, perform the following steps:

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Setup and Installation

Configuring Modules and Boards

The following parameters of 6B Series modules and boards are user-configurable:

- Address (all modules and boards)
- Baud rate (all modules and boards)
- Checksum status (all modules and boards)
- Input range (6B11, 6B12, 6B13 only)
- Output range (6B21 only)
- Data format (6B11, 6B12, 6B13, 6B21 only)
- Integration time (6B11, 6B12, 6B13 only)
- Slew rate (6B21 only)

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Table 2-1 Factory Configuration of 6B Series Modules and Boards

Module	Parameter	Factory Configuration
6B11 and 6B11HV	Address	00H
	Baud rate	9600
	Checksum status	Disabled
	Input range	±5 V
	Data format	Engineering units
	Integration time	50 ms (60 Hz)
	Slew rate	Not applicable
6B12 and 6B12HV	Address	00H
	Baud rate	9600
	Checksum status	Disabled
	Input range	±5 V
	Data format	Engineering units
	Integration time	50 ms (60 Hz)
	Slew rate	Not applicable
6B13	Address	00H

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Setup and Installation

You must reconfigure all factory-default parameters that are not appropriate to your application using either the 6B Series Utility/Demo software or a user-written application program. For information on the 6B Series Utility/Demo software, refer to Appendix A or the READ.ME file on the 6B Series Utility/Demo disk. For information on the 6B Series command set, which is required for user-written application programs, refer to Chapters 3 and 4.

Note: Since all 6B Series modules and boards are shipped with address 00H and no two modules or boards can have the same address, you must change the factory-default address for every module and board in the system.

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When you finish configuring a module, write the range and the

6. If you are using the 6B Series Utility/Demo software, search for the module or 6B50 board using the *Search* option.
7. Change the baud rate or checksum status for the module or 6B50 board.
8. Turn the power off to the backplane or board.
9. If you are configuring a module, install the module in the destination socket on the 6B Series backplane and remove the configuration jumper. If you are configuring a 6B50 board, install the configuration jumper in position BC.
10. Apply power to the backplane or board.

Note: Whenever you configure or reconfigure a 6B Series module or 6B50 digital I/O board for baud rate or

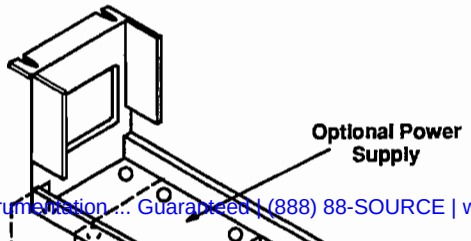
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Setup and Installation

Rack Mount: AC1380

Two 6BP04 backplanes (6B04-1, 6B04-2, 6B04HV-1 or 6B04HV-2), one 6BP16-1 or 6BP16-2 backplane, or two 6B50-1 or 6B50-2 digital I/O boards can also be mounted in a 19" rack using a rack-mount kit (AC1380). An Analog Devices 955, 977 or PWR-01 power supply can also be mounted in the rack mount. The rack mount weighs 1.7 pounds (775 grams). Dimensions are shown in Appendix H.

Install the backplane or board in the rack mount, as shown in Figure 2-1.



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Mounting Power Supplies

Models 955 and 977 modular power supplies are provided with four threaded inserts, #4-40 × 0.15 inch deep. To mount these supplies in the AC1380, use the 4, # 4-40 × 3/16 inch screws inserted through the 0.147 inch diameter holes located in the left corner of the AC1380. Refer to Figure 2-1.

Mounting Backplanes

The 6B backplanes have pre-mounted standoffs. The AC1380 has a total of nine metric inserts, type M-3. To mount any of the backplanes or boards in the AC1380, use the 7 fillister head Phillips Drive M3 × 30 metric screws. Refer to Figure 2-1.

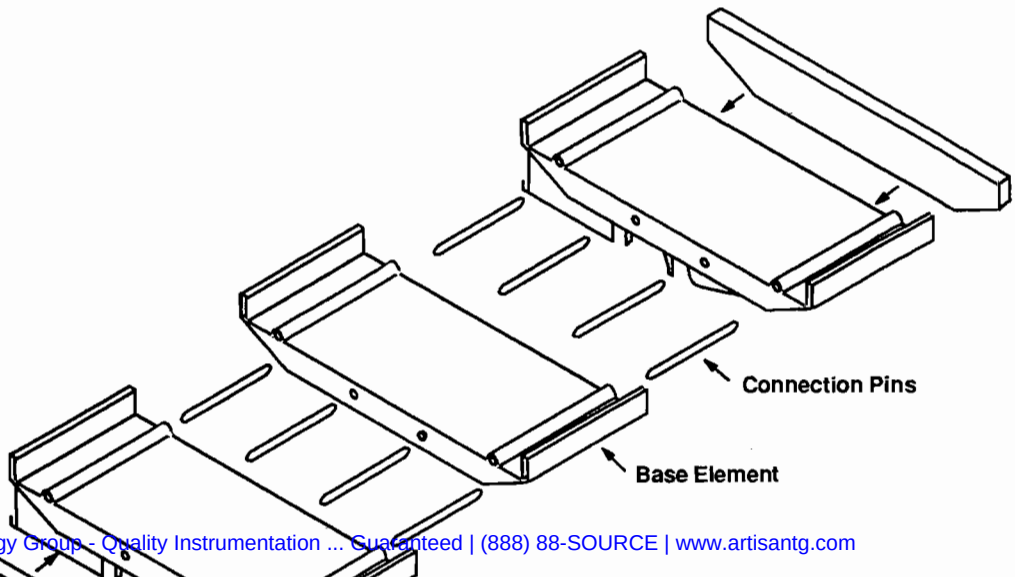
Rail Mount

The 6BP01-1 and 6BP01-2 backplanes can be mounted on DIN rails using Phoenix Universal Mounting (UM) assemblies. These assemblies include base elements with and without snap feet, side elements and connection pins.

One base element with snap foot and two side elements are required to mount a single 6BP01 backplane. Refer to Figure 2-2

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Connecting Multiple Backplane and Boards

Link multiple 6B Series backplanes and 6B50 digital I/O boards together by using the RS-485 connector and dual, twisted/shielded wire pairs, see Figure 2-8. In the RS-485 network, each 6B Series module counts as one load and each 6B50 digital I/O board counts as one load. Individual backplanes, without 6B modules, do not act as a load to the RS-485 network.

The maximum length of the network, and the maximum number of loads supported in a 6B series system, depends on the number of RS-485 repeaters in the network. Table 2-2 indicates which backplanes and boards contain repeaters. Also shown in Table 2-2 are the total loads each fully populated 6B backplane or board presents to the RS-485 network.

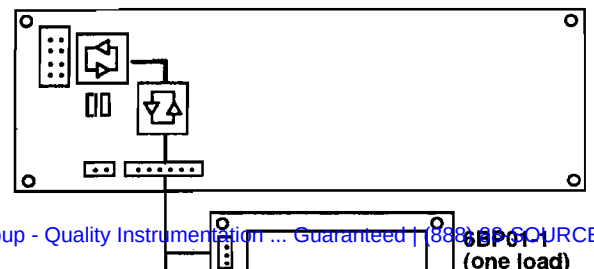
Table 2-2. Backplanes and Boards Containing Repeaters

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Limits

The maximum length of the interconnecting wire between two repeaters is 4000 feet, and the maximum number of loads between one repeater and another repeater is 32. (Note that the loads on the backplane containing the first repeater come "before" the first repeater and do not count as part of the maximum of 32 loads for the second repeater.) The maximum number of loads in an entire network is 256. Figure 2-4 illustrates a sample configuration.



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Each network can include only one backplane or one board that contains both an RS-232C connector and an RS-485 connector. This RS-232C/RS-485 backplane or board (6BP01-2, 6BP04-2, 6BP04HV-2, 6BP16-2, or 6B50-2) must be connected to an "RS-485 only" backplane or board (6BP01-1, 6BP04-1, 6BP04HV-1, 6BP16-1, or 6B50-1).

Types of Configurations

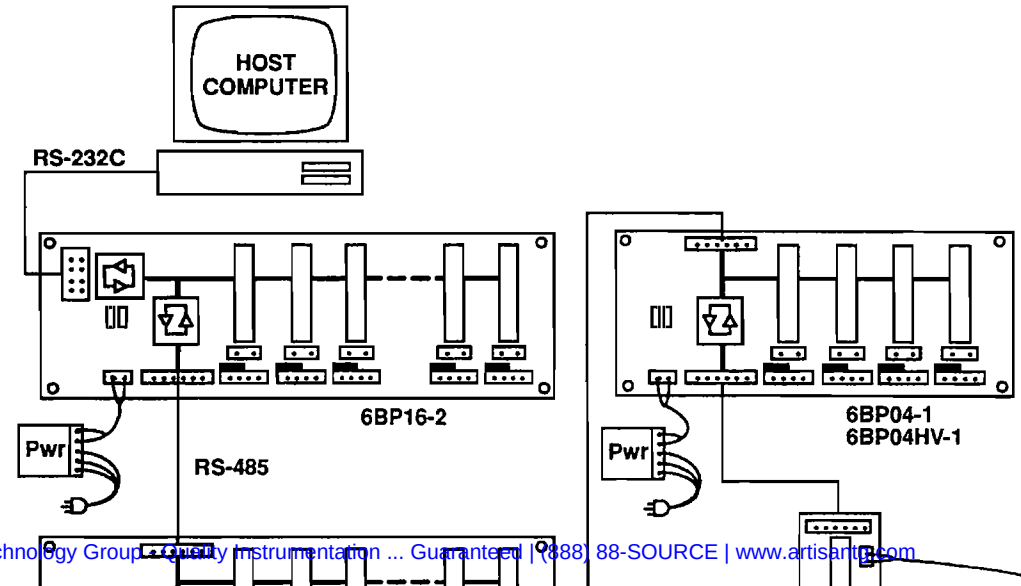
Multiple 6B Series backplanes and boards can be linked in a variety of configurations. These configurations are described in the following sections.

Daisy-Chain Configuration

In a daisy-chain configuration, connect the RS-485 output connector of one backplane or board to the RS-485 input connector of another backplane or board. An example of a daisy-chain configuration is shown in Figure 2-5.

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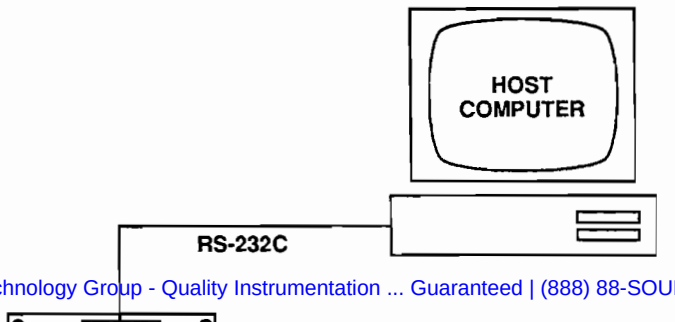
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Multidrop Configuration

In a multidrop configuration, you can connect multiple backplanes and boards (up to 32 loads) to the RS-485 output connector of a single backplane or board. An example of a multidrop configuration is shown in Figure 2-6.

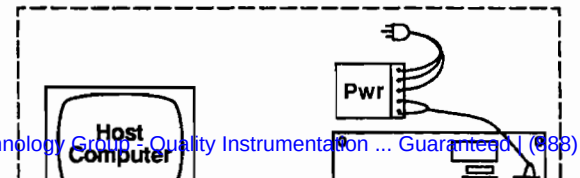


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Maintenance Configuration

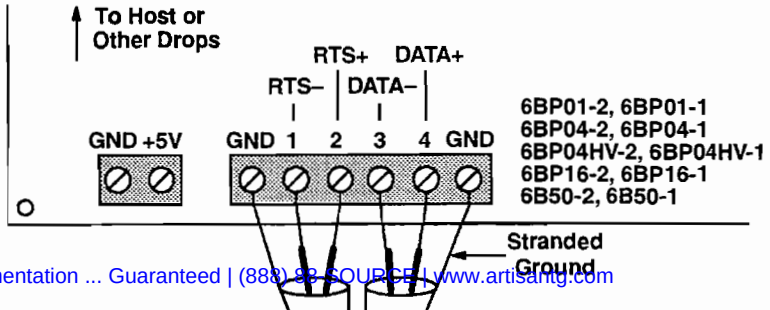
If your physical arrangement requires that your 6B Series system is far from the host computer, you can attach a 6BP01-2 backplane close to the host. Instead of installing a module in the 6BP01-2, you can use the 6BP01-2 socket as a maintenance socket to configure modules during initial installation and start-up and to test or reconfigure modules once the 6B Series system is up and running. An example of a maintenance configuration is shown in Figure 2-7.



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Recommended Wiring

It is recommended that the Belden 9842 cable (or equivalent) be used to connect two backplanes/boards using the RS-485 connector. This cable contains two twisted pairs of foil-shielded wire bundled together. Connect the two pairs and the individual shields to the terminal block as shown in Figure 2-8. Note: Z_C = 120 Ω for Belden 9842.



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Providing Power to Backplanes and Boards

You must connect a +5 V power supply to each 6B Series backplane or 6B50 digital I/O board. Power is bussed to all modules on a backplane.

Current Requirements

To calculate the total current requirement for each backplane or board, keep the following current requirements in mind:

- 100 mA for each analog input module.
- 250 mA for a 6B Series backplane.
- 200 mA for a 6B Series backplane.
- 225 mA for a 6B50 digital I/O board.

Selecting a

Caution: *Power supply voltages greater than +6.5 V can cause per-*

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Use any +5 V ±5% dc power supply that can supply 100 mA for each analog input module, 250 mA for each analog output module, 200 mA for each 6B Series backplane, and 225 mA for each 6B50 board. However, if an Analog Devices power supply is not used, keep the following in mind:

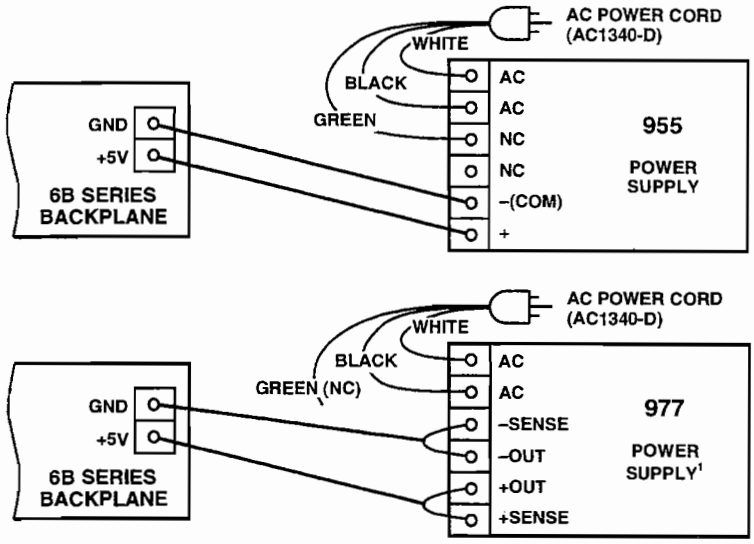
- The power supply used must have a rise time and fall time (10% to 90% of rated voltage) of less than 150 ms. If not, modules and boards may be incorrectly initialized, resulting in erratic operation.
- In applications where power supply voltage is not well regulated, or where power line transients can occur, use voltage clamp protection networks between the +5 V power supply and the 6B Series system.

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Connecting the

Connect the +5 V and ground on the power supply to the screw

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- Littelfuse 251.005, 5 A fuse (for multiple-module 6B Series backplanes).
- Littelfuse 251.01.5, $1^{1}/_{2}$ A fuse (for the 6B50 digital I/O board).

Mounting

You can mount a power supply using one of the following:

- **Rack Mount** - Install the power supply under the rack mount, using the screws provided.
- **Flush Mount** - Install the power supply on a separate platform next to the backplane or board.

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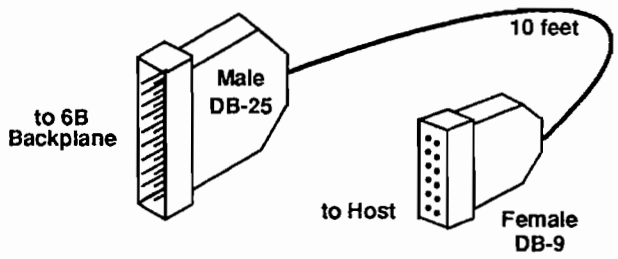
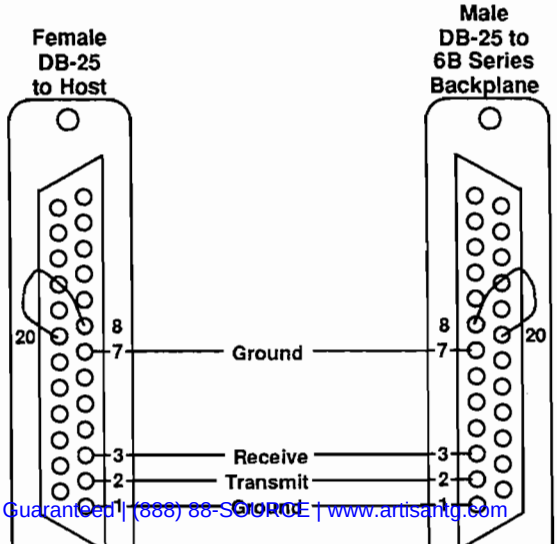


Figure 2-10b. AC1385 Cable

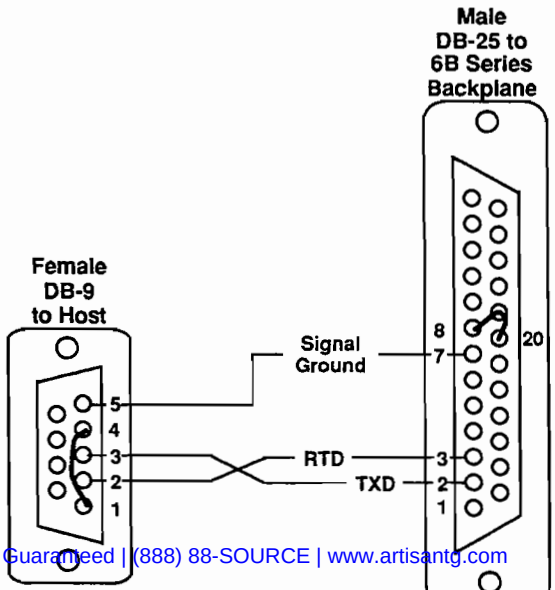
Notes: Use any RS-232C cable up to 50 feet in length. Since 6B Series backplanes and boards are not DTE (Data Terminal

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Communicating with the Host

All characters received by a 6B Series module or 6B50 digital I/O board from the host or transmitted by a 6B Series module or 6B50 digital I/O board to the host are asynchronous ASCII codes consisting of one start bit, eight data bits, and one stop bit. Since only the printable ASCII subset is used, the most significant bit (MSB) of each transmitted character is always 0 (and ignored), and the MSB of each received character is ignored.

To ensure compatibility with 6B Series modules and 6B50 boards, you must configure the host to transmit data in the following format:

- Eight data bits
- One stop bit

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- **Enable LED -** The yellow LED (CR3 on 6B Series backplanes, CR2 on the 6B50 digital I/O board) indicates whether the repeaters are enabled and whether any modules or boards are sending data to the host. When any module on this 6B Series backplane (or on any backplane farther in the network) or when this 6B50 board (or any 6B50 board farther in the network) is responding to an addressed command from the host, the yellow LED is on. When the communication lines are in the idling state, the yellow LED is off.

Using RS-485 Communication

Use half-duplex RS-485 communication to connect the host directly to a 6BP01-1, 6BP04-1, 6BP04HV-1, or 6BP16-1 backplane or 6B50-1 board in the following situations:

- If a longer distance is required between the host computer and the first 6B Series backplane or board than the 50 feet provided by your RS-232C cable.

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4. Connect the RXD– and TDX– to pin 3 of the 6B backplane (XCV–)
5. Be sure to configure the AT-485 board to operate in two-wire mode: TXRDY auto control.

Using a Modem

A modem is used to communicate with a 6B Series system at a remote location. The format of the characters sent and received through a modem is the same as the format of the characters sent and received through a host computer. Refer to Communicating with the Host in this section for more information.

Figure 2-12 illustrates the cable connections that are required when using a modem. Note that when attaching the modem to the 6B Series backplane or 6B50 board, only pins 1, 2, 3, and 7 must be connected; communication is not affected if you use a cable with additional pins.

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Table 2-3. Modem Switch Settings

Modem	Switch	Position	Meaning
Microcom AX/9624c Front Switch Settings	1	Up	Respond to DTR
	2	Down	Command set
	3	Down	Show result codes
	4	Down	Command echo on
	5	Up	Auto-answer on
	6	Up	Carrier follows remote system
	7	Up	Long form result codes
	8	Down	Smart mode
	9	Up	Rack mount modem support only
	10	Up	Asynchronous operation
Microcom AX/9624c Rear Switch Settings	1	Up	No flow control
	2	Up	
	3	Down	Auto-reliable mode
	4	Up	
	5	Up	Do not use MNP extended result codes

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Refer to Appendix F for a sample program to try when using a 6B Series system with a modem.

Application Wiring

The following sections contain information on attaching various types of analog I/O and digital I/O applications to 6B Series backplanes and 6B50 digital I/O boards.

Analog I/O Applications

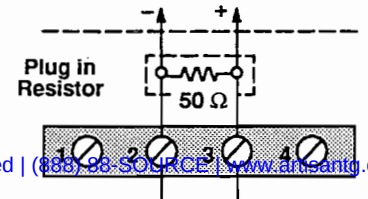
Attach analog I/O applications to a 6B Series backplane through the four screw terminals on the screw termination block associated with each 6B module. It is recommended that 14-22 AWG wire (18-22 AWG on the 6BP04HV-1 and 6BP04HV-2) be used to connect applications and that applications are placed as close to the screw terminals as possible. The following sections contain special considerations for attaching each analog input and analog output type.

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Each set of four screw terminals has a CJC sensor installed next to it for accurate measurement of the screw termination block temperature. To minimize thermal gradients, make sure that there is proper ventilation around the backplane.

Process Current Inputs

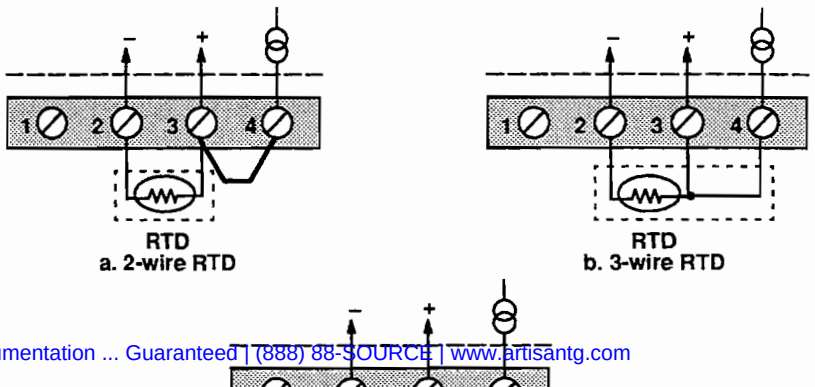
Figure 2-14 shows the wiring for process current inputs.



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RTD Inputs

Figure 2-15 shows 2-wire, 3-wire, and 4-wire connections for RTDs.

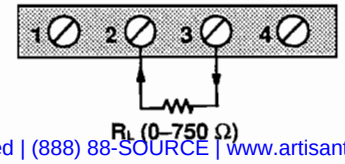


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Note: The 6B13 uses a 3-wire technique for sensing and compensating for lead resistance. This technique assumes that the lengths and resistances of all leads attached to the screw terminals are equal. Differences between the leads are not properly compensated for.

Current Outputs

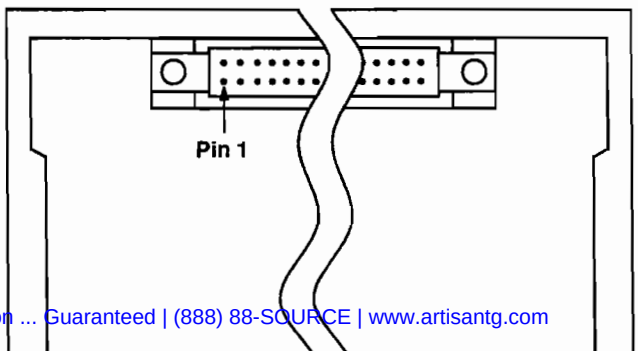
Figure 2-16 shows the wiring for current outputs.



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STB-50A Screw Termination Board

Use the STB-50A Screw Termination Board, shown in Figure 2-18, to measure and control low-level, TTL-compatible digital I/O signals.



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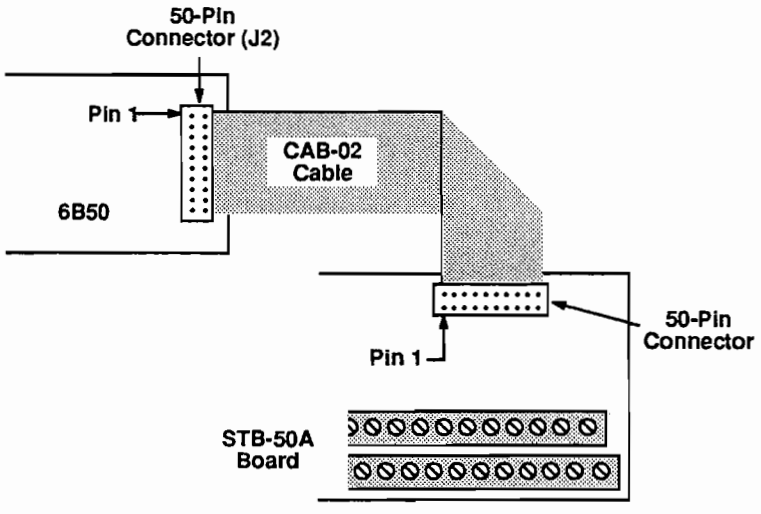
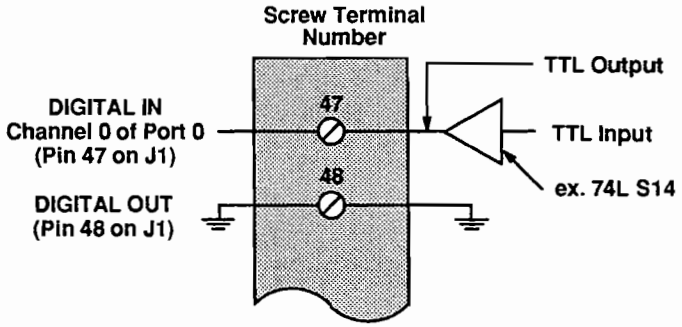
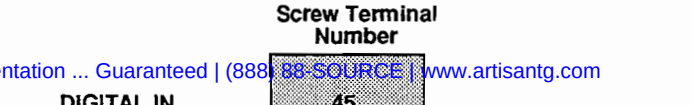


Figure 2-19. Attaching the STB-50A Screw

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a. TTL Input Example

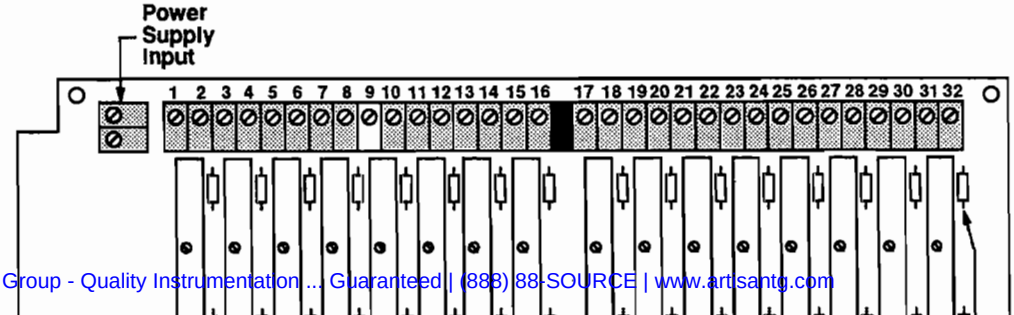


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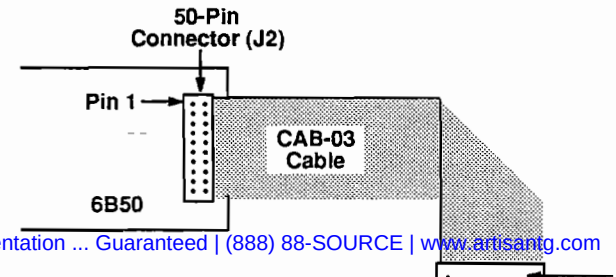
DB-16 Digital I/O Backplane

Use the DB-16 Digital I/O Backplane, shown in Figure 2-21, and its associated ac and dc I/O modules to measure and/or control high-level ac and dc signals or if isolation of the digital I/O is required.



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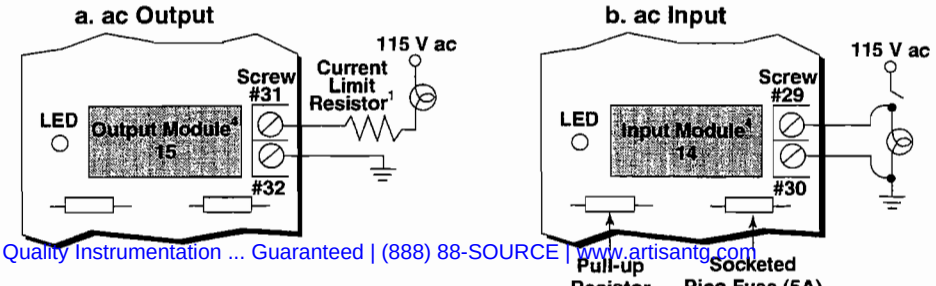
To attach a 6B50 board to a DB-16 backplane, use the 5-foot, 50-pin CAB-03 ribbon cable. Attach one end of the cable to the 50-pin connector (J2) on the 6B50, and attach the other end of the cable to the digital I/O connector on the DB-16 backplane. Make sure that pin 1 on the cable corresponds to pin 1 on the connector. Refer to Figure 2-22.



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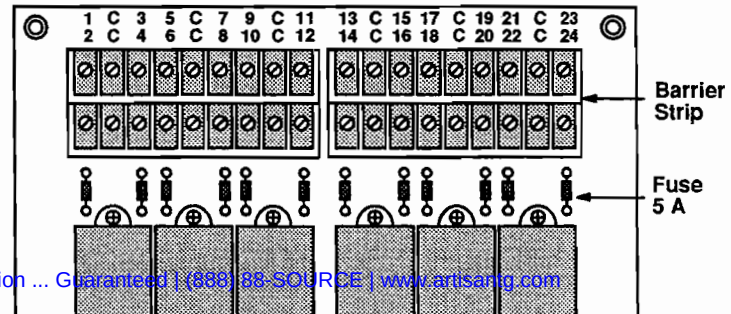
Figure 2-23 illustrates high-level ac and dc digital wiring using input and output modules on the DB-16 backplane. *Example a* illustrates turning a lamp on and off, *example b* illustrates monitoring whether the lamp is on or off, *example c* illustrates turning a relay coil on and off, and *example d* illustrates monitoring whether or not the relay coil is being energized.



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DB-24 Digital I/O Backplane

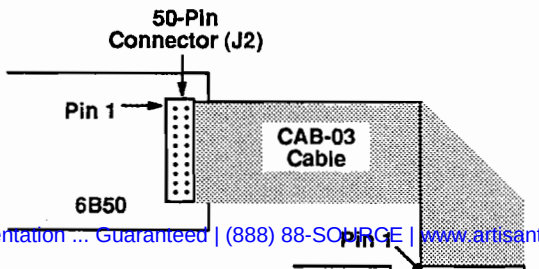
Use the DB-24 Digital I/O Backplane, shown in Figure 2-24, and its associated ac and dc I/O modules to measure and/or control high-level ac and dc signals or if isolation of the digital I/O is required.



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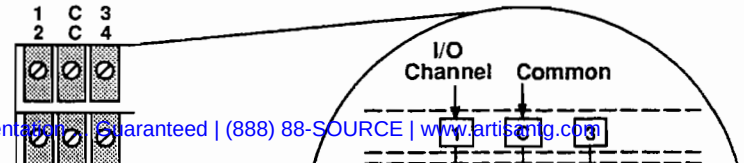
Setup and Installation

To attach a 6B50 board to a DB-24 backplane, use the 5-foot, 50-pin CAB-03 ribbon cable. Attach one end of the cable to the 50-pin connector (J2) on the 6B50, and attach the other end of the cable to the digital I/O connector on the DB-24 backplane. Make sure that pin 1 on the cable corresponds to pin 1 on the connector. Refer to Figure 2-25.



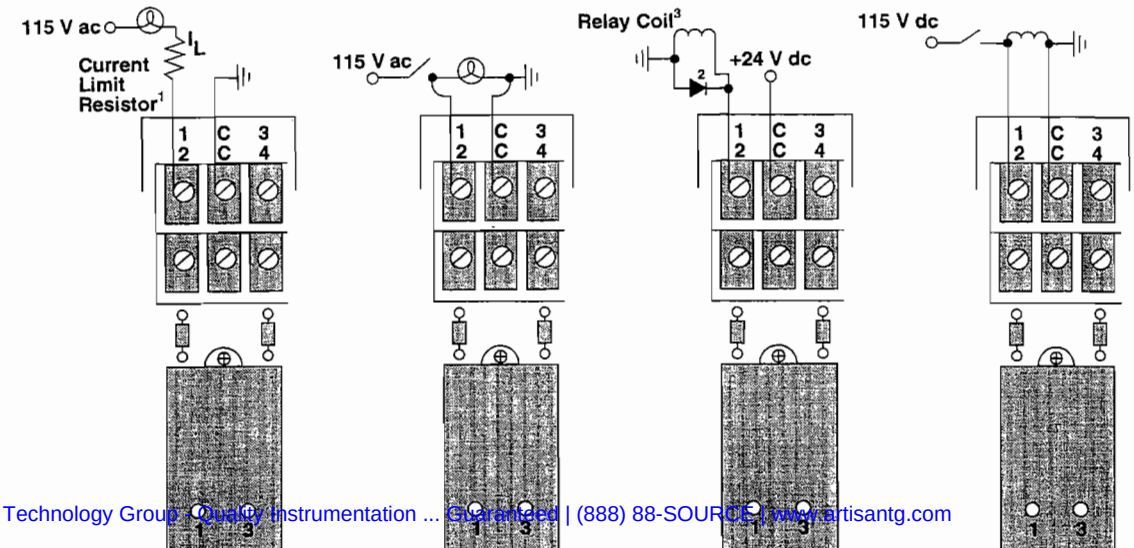
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The two common connections for each module on a DB-24 are connected to one another. Therefore, each of the four individual channels on the module can use either of its two common connections. Since the commons are connected, you must make sure that all the applications attached to the 4-channel module share the same common voltage reference. If two applications use different common voltage references, you must attach the applications to two different modules. Figure 2-26 illustrates how the channels and their commons are connected.



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Attaching Digital I/O Applications

To attach applications to a digital I/O panel, use 22-14 AWG twisted-pair wire and strip the wire back approximately $^1/_4$ inch (6.3 mm).

The 6B50 channels accessed through the STB-50A, DB-16, and DB-24 panels, as well as the associated pin on the 50-pin (J2) connector, are listed in Table 2-4.

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Table 2-4. Accessing Digital I/O Channels

6B50 Channel	STB-50A Screw Terminal	DB-16 Screw Terminals	DB-24 Screw Terminals	J2 Connector pin[2]
Port A, Bit 0	47	1, 2	1, C	47
Port A, Bit 1	45	3, 4	2, C	45
Port A, Bit 2	43	5, 6	3, C	43
Port A, Bit 3	41	7, 8	4, C	41
Port A, Bit 4	39	9, 10	5, C	39
Port A, Bit 5	37	11, 12	6, C	37
Port A, Bit 6	35	13, 14	7, C	35
Port A, Bit 7	33	15, 16	8, C	33
Port B, Bit 0	31	17, 18	9, C	31
Port B, Bit 1	29	19, 20	10, C	29

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3 Using the 6B Series Command Set

This chapter is intended for those who are using the 6B Series command set to write application programs that configure, calibrate, read data from, or write data to 6B Series modules and 6B50 digital I/O boards. It provides background information needed to use analog input commands, analog output commands, and digital I/O commands. For more detailed information, including the command syntax and examples, refer to Chapter 4.

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Using the 6B Series Command Set

Address

The address for each analog input module is a unique hexadecimal number between 00 and FF. All modules are shipped with address 00H. Since no two 6B Series modules or 6B50 digital I/O boards can have the same address, you must reconfigure the address of each analog input module when setting up your 6B Series system. It is recommended that you reserve address 00H for configuration and diagnostic purposes.

Input Range

Table 3-1 lists the input ranges that you can configure for an analog input module.

Table 3-1. Input Ranges

Module	Input Ranges
6B11 and 6B11HV	±15 mV ±50 mV

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Table 3-1. Input Ranges

Module	Input Ranges
6B13 and 6B13HV	Platinum RTD, –100°C to 100°C, α = 0.00385
	Platinum RTD, 0°C to 100°C, α = 0.00385
	Platinum RTD, 0°C to 200°C, α = 0.00385
	Platinum RTD, 0°C to 600°C, α = 0.00385
	Platinum RTD, –100°C to 100°C, α = 0.003916
	Platinum RTD, 0°C to 100°C, α = 0.003916
	Platinum RTD, 0°C to 200°C, α = 0.003916
	Platinum RTD, 0°C to 600°C, α = 0.003916
	Nickel RTD, –80°C to 100°C
	Nickel RTD, 0°C to 100°C
	Copper RTD (10 Ω @ 25°C), 0°C to 120°C
	Copper RTD (10 Ω @ 0°C), 0°C to 120°C

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Note

The engineering units format consists of a "+" or "–" sign, followed by five decimal digits and a decimal point; the resolution (position of the decimal point) depends on the configured input range, as follows:

- *±15 mV, ±50 mV input range* - Resolution is 1 µV (three decimal places).
- *±100 mV, ±150 mV, ±500 mV input range* - Resolution is 10 µV (two decimal places).
- *±1 V, ±5 V input range* - Resolution is 100 µV (four decimal places).
- *±10 V, ±50 V input range* - Resolution is 1 mV (three decimal places).
- *±20 mA input range* - Resolution is 1 µA (three decimal

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However, keep in mind that only readings within the input range are fully accurate and linear. Readings between ±100% and ±115% of FSR are not guaranteed to be accurate, but are typically linear. Readings beyond these limits are neither linear nor accurate.

- **Percent of FSR** - The percent of FSR format presents data as the value of the input signal relative to the calibrated full-scale range of the input (percent of full-scale range).

  The percent of FSR format consists of a "+" or "–" sign, followed by five decimal digits and a decimal point. The decimal point is fixed, and the maximum resolution is ±0.01%.

  For example, if an analog input module is configured for a ±5 V range and the input value is +2.0 V, the value returned

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For RTD input ranges (whether they are specified to zero or below zero), the percentage is based on the actual span of the specified range. For example, when using a nickel RTD specified for –80°C to +100°C, +100°C corresponds to +100% and –80°C corresponds to 0%.

The 6B Series analog input modules provide an overrange capability when configured for the percent of FSR data format. For example, if an analog input module is configured for a ±5 V range and the input value is +5.5 V, the value returned is +110.00.

However, keep in mind that only readings within the input range are fully accurate and linear. Readings between ±100% and ±115% of FSR are not guaranteed to be accurate, but are typically linear. Readings beyond these limits are neither linear nor accurate.

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For thermocouple input ranges (whether the thermocouple is specified to zero, below zero, or above zero), it is assumed that the input range is bipolar and symmetric about zero. For example, when using a type J thermocouple (0°C to 760°C), 760°C corresponds to 7FFFH and 0°C corresponds to 0000H (–760°C, if valid, would correspond to 8000). When using a type T thermocouple (–100°C to 400°C), +400°C corresponds to 7FFF, 0°C corresponds to 0000H, and –100°C corresponds to CCCCH (–400°C, if valid, would correspond to 8000). When using a type R thermocouple (500°C to 1750°C), +1750°C corresponds to 7FFFH and +500°C corresponds to 2492H (0°C, if valid, would correspond to 0000H and –1750°C, if valid, would correspond to 8000H).

For RTD input ranges (whether they are specified to zero or below zero), the two's complement hexadecimal value is based on the actual span of the specified range. For example,

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Integration Time

You can configure an analog input module for one of the following integration times:

- **50 ms (60 Hz operation)** - Used in the United States, or in any location with 60 Hz power. This integration time results in an input conversion rate of approximately 9 conversions per second and a normal mode rejection of 60 Hz interference.
- **60 ms (50 Hz operation)** - Used in Europe, or in any location with 50 Hz power. This integration time results in an input conversion rate of approximately 8.33 conversions per second and a normal mode rejection of 50 Hz interference.

There is no distinction in performance (other than throughput rate) between the 50 ms and 60 ms integration times. If power

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When the checksum feature is enabled, all commands to the module and all responses from the module contain a checksum. The checksum is expressed in a 2-character ASCII hexadecimal format and is transmitted just before the carriage return. The checksum is the modulo-256 sum of all the ASCII values of all the characters in the command preceding the checksum.

If the checksum is missing or incorrect in a command in which the checksum feature is enabled, the module does not respond.

Note: When configuring a 6B series system, all 6B modules and boards must be set to an identical checksum setting (i.e., enabled or disabled).

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Reading Data from

Using the 6B Series Command Set

Calibrating an Analog Input Module

The 6B Series command set provides the following commands for calibrating an analog input module:

- **Span Calibration Command** - Allows you to calibrate an analog input module to correct for gain errors.
- **Offset Calibration Command** - Allows you to calibrate a 6B13 analog input module to correct for offset errors.

The Span Calibration and Offset Calibration commands are generally used only when a module is installed.

Returning Status

The 6B Series command set provides the following commands for returning the status of an analog input module:

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The Configuration command allows you to set the address, output range, baud rate, data format, slew rate, and/or checksum status for an analog output module; normally, the Configuration command is used only when a module is installed.

The Configuration command parameters are described in more detail in the following subsections.

Address

The address for each analog output module is a unique hexadecimal number between 00 and FF. All modules are shipped with address 00. Since no two 6B Series modules or 6B50 boards can have the same address, you must reconfigure the address of each 6B21 analog output module when setting up your 6B Series system. It is recommended that you reserve address 00 for configuration and diagnostic purposes.

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Using the 6B Series Command Set

Data Format

You can configure a 6B21 analog output module to use data in one of the following data formats:

- **Engineering Units** - The engineering units format presents data in natural units, such as milliamps. Since the total data string length, including digits and decimal point, is fixed at six characters, most computer languages can easily parse this format.

  The engineering units format consists of two decimal digits, a decimal point, and three decimal digits; the resolution is 1.5 μA.

  For example, if an analog output module is configured for a 0 to 20 mA range and the desired output value is +4.762 mA, the value specified is 04.762.

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The analog output modules provide an overrange capability when configured for the percent of span data format. However, keep in mind that only values within the output range are fully accurate and linear. Values between 100% and 110% (for the 0 to 20 mA output range) and between 100% and 112.5% (for the 4 to 20 mA output range) are not guaranteed to be accurate, but are typically linear.

- **Hexadecimal** - The hexadecimal format is the ASCII hexadecimal representation of the data. It is compact and provides fast communication, excellent resolution, and easy conversion to computer-compatible integer format.

  The hexadecimal format consists of a 3-character hexadecimal string, representing a 12-bit binary value. For the 0 to 20 mA output range, the resolution is 0.025% of span or 5 µA; 000 corresponds to 0 mA and FFF corresponds to 20 mA. For the

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- 4.0 mA/second
- 8.0 mA/second
- 16.0 mA/second
- 32.0 mA/second
- 64.0 mA/second
- 128.0 mA/second

Checksum

You can configure a 6B21 analog output module to incorporate checksum generation and checking into all commands. A checksum helps you detect errors in commands to the module from the host and responses from the module to the host. It does, however, reduce throughput by adding two characters to the command and two characters to the response.

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Calibrating an Analog Output Module

The 6B Series command set provides the following commands for calibrating a 6B21 analog output module:

- **Trim Calibration Command**
- **4 mA Calibration Command**
- **20 mA Calibration Command**

The three calibration commands are used together to calibrate an analog output module; they are generally used only when a module is installed.

Returning Status

The 6B Series command set provides the following commands for returning the status of an analog output module:

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Using the 6B Series Command Set

Digital I/O Commands

The 6B Series command set provides digital I/O commands that allow you to configure 6B50 digital I/O boards, read data from 6B50 digital I/O boards, write data to 6B50 digital I/O boards, and return the status of 6B50 digital I/O boards.

Configuring a Digital I/O Board

The Configuration command allows you to set the address, baud rate, and/or checksum status for a 6B50 digital I/O board. Normally, the Configuration command is used only when a board is installed.

The Configuration command parameters are described in more detail in the following subsections.

Address

The address for each 6B50 digital I/O board is a unique hexadecimal number between 00 and FF. All boards are

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When the checksum feature is enabled, all commands to the board and all responses from the board contain a checksum. The checksum is expressed in a 2-character ASCII hexadecimal format and is transmitted just before the carriage return. The checksum is the modulo-256 sum of all the ASCII values of all the characters in the command preceding the checksum.

If the checksum is missing or incorrect in a command in which the checksum feature is enabled, the board does not respond.

Reading Data from a Digital I/O Board

The 6B Series command set provides the following commands for reading data from a 6B50 digital I/O board:

- **Digital Data In Command** - Returns the input value from ports A, B, and C on a specified 6B50 digital I/O board.

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Using the 6B Series Command Set

Returning Status

The 6B Series command set provides the following commands for returning the status of a 6B50 digital I/O board:

- **Configuration Status Command** - Allows you to read the configuration of a specified 6B50 digital I/O board.
- **Reset Status Command** - Indicates whether a specified 6B50 digital I/O board was reset since the last time you executed this command.

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4 Command Reference Guide

This chapter describes the commands included in the 6B Series command set. The commands are listed in alphabetical order and are labeled according to the operation they perform: analog input, analog output, and digital I/O. It is recommended that you refer to Chapter 3 for background information before reading this chapter.

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Table 4-1. 6B Series Commands

Operation	Commands
Analog Input	Configuration – Analog Input
	Analog Data In
	Offset Calibration
	Span Calibration
	Synchronized Sampling
	Read Synchronized Data - Analog Input
	Configuration Status
	CJC Status
	Configuration - Analog Output
	Analog Data Out
	Start-up Output Current Configuration
	Trim Calibration
	4 mA Calibration

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Analog Data In

6B11, 6B12, 6B13
Analog Input

PURPOSE

The Analog Data In command returns the input value from the specified analog input module in the currently configured data format.

COMMAND SYNTAX

`#AA(cr)`

COMMAND ARGUMENTS

is the delimiter character.

AA represents the 2-character hexadecimal address of the analog input module whose value you want to return. Values for *AA* range from 00 to FF.

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(cr) represents the 1-character terminating character (carriage

Analog Data In

6B11, 6B12, 6B13
Analog Input

EXAMPLES

Command: `#23(cr)`
Response: `>+4.7653(cr)`

The input value at the module at address 23H is +4.7653 V. (The data format is engineering units.)

Command: `#E5(cr)`
Response: `>FF5D(cr)`

The input value at the module at address E5H is FF5D twos complement hexadecimal. (The data format is twos complement.)

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Command: `#1A(cr)`

Analog Data Out

6B21
Analog Output

PURPOSE

The Analog Data Out command specifies the output value used by the specified analog output module.

COMMAND SYNTAX

`#AA(data)(cr)`

COMMAND ARGUMENTS

is the delimiter character.

AA represents the 2-character hexadecimal address of the analog output module whose output value you want to specify. Values for *AA* range from 00 to FF.

(data) represents the desired output value. The range of values depends on the configured data format (either engineering units, percent of span, or hexadecimal). Refer to Analog Output

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Analog Data Out

6B21
Analog Output

REMARKS

The module does not respond if it detects a syntax error or communication error or if the specified address does not exist.

EXAMPLES

Command: `#2120.000(cr)`
Response: `>(cr)`

The output value for the module at address 21H is 20 mA. (The data format is engineering units.)

Command: `#09+050.00(cr)`
Response: `>(cr)`

The module at address 09H is configured for a 4 to 20 mA output range and a percent of span data format. (The span of

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CJC Status

6B11
Analog Input

PURPOSE

The CJC Status command allows you to read the value of the CJC sensor for the specified 6B11 analog input module. The value is returned in degrees C.

COMMAND SYNTAX

`$AA3(cr)`

COMMAND ARGUMENTS

$ is the delimiter character.

AA represents the 2-character hexadecimal address of the analog input module whose CJC sensor you want to read. Values for *AA* range from 00 to FF.

3 indicates the CJC Status command.

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CJC Status

6B11
Analog Input

AA represents the 2-character hexadecimal address of the module.

(cr) represents the 1-character terminating character (carriage return, 0DH).

REMARKS

The module does not respond if it detects a syntax error or communication error or if the specified address does not exist.

EXAMPLE

Command: `$233(cr)`
Response: `>+0024.9(cr)`

The value of the CJC sensor for the module at address 23H is 24.9°C.

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Configuration – Analog Input

6B11, 6B12, 6B13
Analog Input

PURPOSE

The Configuration - Analog Input command allows you to set the address, input range, baud rate, data format, checksum status, and/or integration time for an analog input module. The configuration information is stored in nonvolatile memory.

COMMAND SYNTAX

`%AANNTTCCFF(cr)`

COMMAND ARGUMENTS

% is the delimiter character.

AA represents the 2-character hexadecimal address of the analog input module you want to configure. Values for *AA* range from 00 to FF.

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Configuration – Analog Input

6B11, 6B12, 6B13

Analog Input

Table 4-2. Type Codes for Analog Input Modules

Module	Type Code (TT)	Input Ranges
6B11 and 6B11HV	00	±15 mV
	01	±50 mV
	02	±100 mV
	03	±500 mV
	04	±1 V
	05	±5 V
	06	±20 mA[1]
	0E	Type J thermocouple, 0°C to 760°C
	0F	Type K thermocouple, 0°C to 1000°C
	10	Type T thermocouple, –100°C to 400°C
	11	Type E thermocouple, 0°C to 1000°C
	12	Type R thermocouple, 500°C to 1750°C
	13	Type S thermocouple, 500°C to 1750°C

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CC represents the hexadecimal baud rate code. Table 4-3 lists the baud rate codes.

Table 4-3. Baud Rate Codes

Baud Rate Code (CC)	Baud Rate
01	300 baud
02	600 baud
03	1200 baud
04	2400 baud
05	4800 baud

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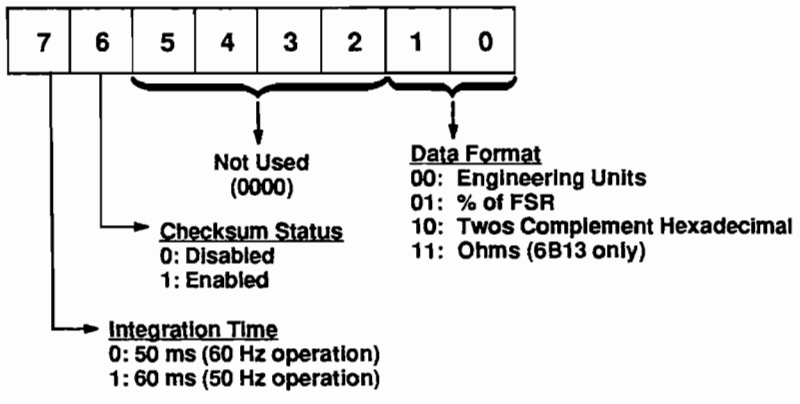


Figure 4-1. Data Format/Checksum/Integration Time Parameter

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AA represents the 2-character hexadecimal address of the module.

(cr) represents the 1-character terminating character (carriage return, 0DH).

REMARKS

If you are configuring a module for the first time, *AA* = 00 and *NN* equals the new address. If you are reconfiguring a module and changing the address, input range, data format, or integration time, *AA* equals the currently configured address and *NN* equals the current or new address. If you are reconfiguring a module and changing the baud rate or checksum status, you must install the configuration jumper, forcing the module to address 00H, while the configuration jumper is installed. *AA* = 00 and *NN* equals the current or new

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Command: `%2424050500(cr)`
Response: `?24(cr)`

An attempt was made to reconfigure the 6B Series analog input module at address 23H to address 24H with a new baud rate of 4800. The command was not accepted because the configuration jumper was not installed.

Command: `%FDFD000502(cr)`
Response: `?FD(cr)`

An attempt was made to configure the 6B13 analog input module at address FDH to an input range of ±15 mV, a baud rate of 4800, an integration time of 50 ms (60 Hz), twos

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Configuration – Analog Output

6B21
Analog Output

PURPOSE

The Configuration – Analog Output command allows you to set the address, output range, baud rate, data format, slew rate, and/or checksum status for an analog output module. The configuration information is stored in nonvolatile memory.

COMMAND SYNTAX

`%AANNTTCCFF(cr)`

COMMAND ARGUMENTS

% is the delimiter character.

AA represents the 2-character hexadecimal address of the analog output module you want to configure. Values for *AA* range from 00 to FF.

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CC represents the hexadecimal baud rate code. Table 4-5 lists the baud rate codes.

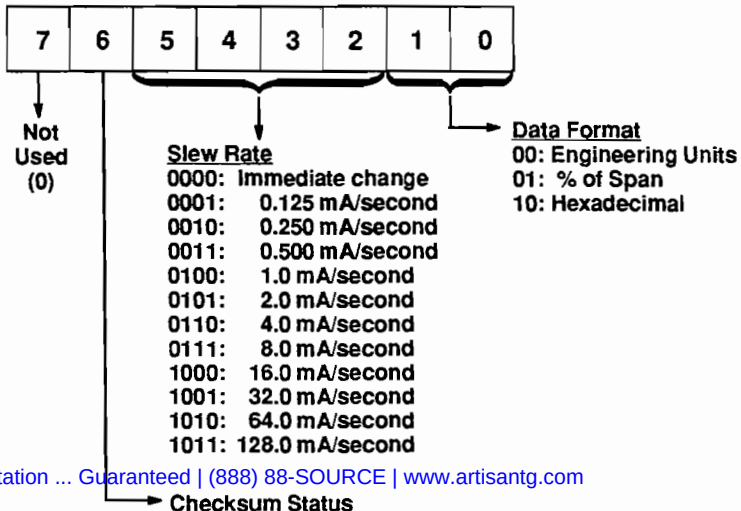
Table 4-5. Baud Rate Codes

Baud Rate Code (CC)	Baud Rate
01	300 baud
02	600 baud
03	1200 baud
04	2400 baud
05	4800 baud
06	9600 baud

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Configuration – Analog Output

6B21
Analog Output



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Configuration – Analog Output

6B21
Analog Output

RESPONSE ARGUMENTS

! is the delimiter character indicating a valid command.

? is the delimiter character indicating an error.

AA represents the 2-character hexadecimal address of the module.

(cr) represents the 1-character terminating character (carriage return, 0DH).

REMARKS

If you are configuring a module for the first time, *AA* = 00 and *NN* equals the new address. If you are reconfiguring a module and changing the address, output range, data format, or slew

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Configuration – Digital I/O

6B50
Digital I/O

PURPOSE

The Configuration - Digital I/O command allows you to set the address, baud rate, and/or checksum status for a 6B50 digital I/O board. The configuration information is stored in nonvolatile memory.

COMMAND SYNTAX

`%AANNTTCCFF(cr)`

COMMAND ARGUMENTS

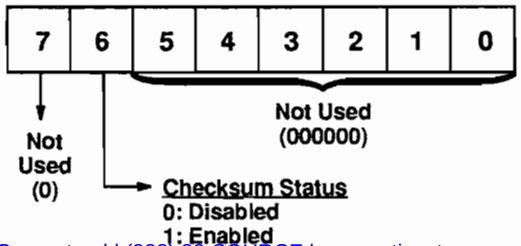
% is the delimiter character.

AA represents the 2-character hexadecimal address of the 6B50 board you want to configure. Values for *AA* range from 00 to FF.

NN represents the new hexadecimal address of the board.

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FF is the hexadecimal equivalent of the 8-bit parameter that represents the checksum status. The structure of the checksum parameter is shown in Figure 4-3. Note that bits 0 through 5 and bit 7 are not used and must be set to 0.



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RESPONSE ARGUMENTS

! is the delimiter character indicating a valid command.

? is the delimiter character indicating an error.

AA represents the 2-character hexadecimal address of the board.

(cr) represents the 1-character terminating character (carriage return, 0DH).

REMARKS

If you are configuring a board for the first time, *AA* = 00 and *NN* equals the new address. If you are reconfiguring a board and changing the address, *AA* equals the currently configured

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Configuration Status

6B11, 6B12, 6B13, 6B21, 6B50
Analog Input, Analog Output, Digital I/O

PURPOSE

The Configuration Status command allows you to read the configuration of the specified analog input module, analog output module, or 6B50 digital I/O board.

COMMAND SYNTAX

`$AA2(cr)`

COMMAND ARGUMENTS

$ is the delimiter character.

AA represents the 2-character hexadecimal address of the module or board whose configuration you want to read. Values for *AA* range from 00 to FF.

2 indicates the Configuration Status command.

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Table 4-7. Type Codes for 6B Series Modules and Boards

Module/ Board	Type Code (TT)	Input/Output Range
6B11 and 6B11HV	00	±15 mV
	01	±50 mV
	02	±100 mV
	03	±500 mV
	04	±1 V
	05	±5 V
	06	±20 mA
	0B	Type J thermocouple, 0°C to 760°C

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Table 4-7. Type Codes for 6B Series Modules and Boards (Cont.)

Module/ Board	Type Code (TT)	Input/Output Range
6B13 and 6B13HV	20	Platinum, –100°C to 100°C, α = 0.00385
	21	Platinum, 0°C to 100°C, α = 0.00385
	22	Platinum, 0°C to 200°C, α = 0.00385
	23	Platinum, 0°C to 600°C, α = 0.00385
	24	Platinum, –100°C to 100°C, α = 0.003916
	25	Platinum, 0°C to 100°C, α = 0.003916
	26	Platinum, 0°C to 200°C, α = 0.003916
	27	Platinum, 0°C to 600°C, α = 0.003916
	28	Nickel, –80°C to 100°C

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CC represents the baud rate code. Table 4-8 lists the meanings of the baud rate codes for 6B Series modules and boards.

Table 4-8. Baud Rate Codes

Baud Rate Code (CC)	Baud Rate
01	300 baud
02	600 baud
03	1200 baud
04	2400 baud
05	4800 baud

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EXAMPLES

Command: `$232(cr)`
Response: `!23050600(cr)`

The 6B Series analog input module at address 23H is configured for an input range of ±5 V, a baud rate of 9600, an integration time of 50 ms (60 HZ), engineering units data format, and no checksum checking or generation.

Command: `$012(cr)`
Response: `!01300614(cr)`

The 6B21 analog output module at address 01H is configured with a 0 to 20 mA output range, a 9600 baud rate, engineering units data format, a slew rate of 2 mA per second, and no

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Current Readback

6B21
Analog Output

PURPOSE

The Current Readback command directs a specified 6B Series analog output module to measure the current flowing through its current loop and to return the output value. Note that the value returned is a rough measurement and may not be the precise value.

COMMAND SYNTAX

`$AA8(cr)`

COMMAND ARGUMENTS

$ is a delimiter character.

AA represents the 2-character hexadecimal address of the analog output module whose current you want to measure. Values for *AA* range from 00 to FF.

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(data) represents the actual value of the current flowing through the current loop in the configured data format. The configured data format is either engineering units, percent of span, or hexadecimal. Refer to Analog Output Commands in Chapter 3 for more information.

(cr) represents the 1-character terminating character (carriage return, 0DH).

REMARKS

The module does not respond if it detects a syntax error or communication error or if the specified address does not exist.

EXAMPLE

Command: `$058(cr)`
Response: `!0519.387(cr)`

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Digital Data In

6B50
Digital I/O

PURPOSE

The Digital Data In command returns the input value from ports A, B, and C on a specified 6B50 board.

COMMAND SYNTAX

`$AA6(cr)`

COMMAND ARGUMENTS

$ is the delimiter character.

AA represents the 2-character hexadecimal address of the 6B50 board whose values you want to return. Values for *AA* range from 00 to FF.

6 indicates the Digital Data In command.

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(dataC) represents the 2-character hexadecimal input value read from port C.

(cr) represents the 1-character terminating character (carriage return, 0DH).

REMARKS

Each bit in the 2-character hexadecimal value returned represents the value of a channel in the port, where bit 0 corresponds to channel 0, bit 1 corresponds to channel 1, and so on. A value of 1 indicates that the voltage at the channel is low; a value of 0 indicates that the voltage at the channel is high. For example, if *(dataA)* = 24 (00100100), the voltage at channels 2 and 5 is low and the voltage at channels 0, 1, 3, 4, 6, and 7 is high.

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EXAMPLE

Command: `$336(cr)`
Response: `!05F000(cr)`

The input value of Port A on the 6B50 digital I/O board at address 33H is 05H (00000101), meaning that the voltage at channels 0 and 2 is low and the voltage at channels 1, 3, 4, 5, 6, and 7 is high. The input value of Port B is F0H (11110000), meaning that the voltage at channels 4, 5, 6, and 7 is low and the voltage at channels 0, 1, 2, and 3 is high. The input value at Port C is 00H, meaning that the voltage at all channels is high.

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Digital Data Out

6B50
Digital I/O

PURPOSE

The Digital Data Out command writes a specified output value to a port, or a channel within a port, on a specified 6B50 board.

COMMAND SYNTAX

`#AABB(data)(cr)`

COMMAND ARGUMENTS

is the delimiter character.

AA represents the 2-character hexadecimal address of the 6B50 board whose port you want to write to. Values for *AA* range from 00 to FF.

BB represents the port, or the channel within the port, to write to. To write an entire byte to an output port, the first character

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RESPONSE ARGUMENTS

> is the delimiter character indicating a valid command.

? is the delimiter character indicating an error.

AA represents the 2-character hexadecimal address of the module.

(cr) represents the 1-character terminating character (carriage return, 0DH).

REMARKS

You can execute the Digital Data Out command for only one port at a time. To write the same value to all three ports, you must execute the command three times.

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4 mA Calibration

6B21
Analog Output

PURPOSE

When calibrating a 6B21 analog output module, the 4 mA Calibration command indicates that the output current is exactly 4 mA. The 4 mA Calibration command is one of three commands you use to calibrate a 6B21 analog output module; you must also execute the Trim Calibration command and the 20 mA Calibration command.

COMMAND SYNTAX

`$AA0(cr)`

COMMAND ARGUMENTS

$ is a delimiter character.

AA represents the 2-character hexadecimal address of the analog output module you want to calibrate. Values for *AA*

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4 mA Calibration

6B21
Analog Output

REMARKS

It is assumed that either a milliammeter or a resistor and voltmeter is connected to the module's outputs both before and during the execution of this command. Refer to Appendix C for more information on the procedures to follow when performing an analog output module calibration.

The module does not respond if it detects a syntax error or communication error or if the specified address does not exist.

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Last Value Readback

6B21
Analog Output

PURPOSE

The Last Value Readback command returns the last output value sent to the specified module by the Analog Data Out command; refer to the Analog Data Out Command for more information. If the 6B21 module was just powered up or reset, the Last Value Readback command returns the start-up output value; refer to the Start-up Output Current Configuration command for more information.

COMMAND SYNTAX

`$AA6(cr)`

COMMAND ARGUMENTS

$ is a delimiter character.

AA represents the 2-character hexadecimal address of the

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(cr) represents the 1-character terminating character (carriage return, 0DH).

REMARKS

The module does not respond if it detects a syntax error or communication error or if the specified address does not exist.

EXAMPLE

Command: `$056(cr)`
Response: `!0520.000(cr)`

The last output value sent to the analog output module at address 05H was 20 mA. (The data format is engineering units.)

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Offset Calibration

6B13
Analog Input

PURPOSE

The Offset Calibration command allows you to calibrate a 6B13 analog input module to correct for offset errors.

COMMAND SYNTAX

`$AA1(cr)`

COMMAND ARGUMENTS

$ is the delimiter character.

AA represents the 2-character hexadecimal address of the analog input module you want to calibrate. Values for *AA* range from 00 to FF.

1 indicates the Offset Calibration command.

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Offset Calibration

6B13
Analog Input

REMARKS

Use the Span Calibration command to correct for gain errors. Refer to Appendix C for more information on the procedures to follow when performing an analog input module calibration.

The module does not respond if it detects a syntax error or communication error or if the specified address does not exist.

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Read Synchronized Data – Analog Input

6B11, 6B12
Analog Input

PURPOSE

The Read Synchronized Data - Analog Input command returns the value stored by the specified 6B11 or 6B12 analog input module during the last Synchronized Sampling command.

COMMAND SYNTAX

`$AA4(cr)`

COMMAND ARGUMENTS

$ is the delimiter character.

AA represents the 2-character hexadecimal address of the analog input module whose value you want to return. Values for *AA* range from 00 to FF.

4 indicates the Read Synchronized Data - Analog Input command.

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(status) represents the 1-character value indicating whether the data sampled by the module during the last Synchronized *Sampling* command was returned previously. If *(status)* = 1, the data from the last Synchronized Sampling command is being returned for the first time. If *(status)* = 0, the module returned data from the last Synchronized Sampling command at least once before.

(data) represents the value stored by the specified module during the last Synchronized Sampling command. The module returns the value in the configured data format. The configured data format is either engineering units, percent of FSR, twos complement hexadecimal, or ohms. Refer to Analog Input Commands in Chapter 3 for more information on data formats.

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Read Synchronized Data – Analog Input

6B11, 6B12
Analog Input

EXAMPLES

Command: `$054(cr)`
Response: `!051+48.347(cr)`

You waited at least 70 ms after executing a Synchronized Sampling command to all appropriate modules and boards in the 6B Series system. The input value stored by the analog input module at address 05H during the last Synchronized Sampling command was +48.347 V. (The data format is engineering units.) This is the first time the data has been returned.

Command: `$054(cr)`
Response: `!050+48.347(cr)`

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Read Synchronized Data – Digital I/O

6B50
Digital I/O

PURPOSE

The Read Synchronized Data - Digital I/O command returns the value stored by the specified 6B50 digital I/O board during the last Synchronized Sampling command.

COMMAND SYNTAX

`$AA4(cr)`

COMMAND ARGUMENTS

$ is the delimiter character.

AA represents the 2-character hexadecimal address of the 6B50 board whose values you want to read. Values for *AA* range from 00 to FF.

4 indicates the Read Synchronized Data - Digital I/O command.

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Read Synchronized Data – Digital I/O

6B50
Digital I/O

(status) represents the 1-character value indicating whether the data stored by the 6B50 digital I/O board during the last Synchronized Sampling command was returned previously. If *(status)* = 1, the data from the last Synchronized Sampling command is being returned for the first time . If *(status)* = 0, the board returned data from the last Synchronized Sampling command at least once before.

(dataA) represents the 2-character hexadecimal input value read from port A.

(dataB) represents the 2-character hexadecimal input value read from port B.

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(dataC) represents the 2-character hexadecimal input value read

Read Synchronized Data – Digital I/O

6B50
Digital I/O

If an external device is attached to a channel, the value returned represents the state of the external device. If no external device is attached to a channel, the value returned represents the last output value that you wrote to the channel.

The module does not respond if it detects a communication error, if the command is invalid, or if the specified address does not exist.

EXAMPLES

Command: `$054(cr)`
Response: `!105F000(cr)`

You waited at least 1 ms after executing a Synchronized Sampling command to all appropriate modules and boards in

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Reset Status

6B21, 6B50
Analog Output, Digital I/O

PURPOSE

The Reset Status command returns a bit indicating whether the specified analog output module or 6B50 digital I/O board was reset after you last executed this command.

COMMAND SYNTAX

`$AA5(cr)`

COMMAND ARGUMENTS

$ is a delimiter character.

AA represents the 2-character hexadecimal address of the module or board you are checking. Values for *AA* range from 00 to FF.

5 indicates the Reset Status command.

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(cr) represents the 1-character terminating character (carriage return, 0DH).

REMARKS

The module or board does not respond if it detects a syntax error or communication error or if the specified address does not exist.

EXAMPLES

Command: `$155(cr)`
Response: `!151(cr)`

The 6B50 digital I/O board at address 15H was reset or powered up after you last executed a Reset Status command. If you execute the command again without resetting the board, the response will be as follows:

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Span Calibration

6B11, 6B12, 6B13
Analog Input

PURPOSE

The Span Calibration command allows you to calibrate the specified analog input module to correct for gain errors.

COMMAND SYNTAX

`$AA0(cr)`

COMMAND ARGUMENTS

$ is the delimiter character.

AA represents the 2-character hexadecimal address of the analog input module you want to calibrate. Values for *AA* range from 00 to FF.

0 indicates the Span Calibration command.

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Span Calibration

6B11, 6B12, 6B13
Analog Input

REMARKS

The Span Calibration command performs an electronic nonvolatile calibration of the input range of a specified module. The module is calibrated to the input range for which it is configured; therefore, it is assumed that the proper calibration signal is connected to the module's inputs both before and during the execution of the Span Calibration command. Refer to Appendix C for more information on the procedures to follow when performing an analog input module calibration.

For the 6B13 analog input module, use the Offset Calibration command to correct for offset errors.

The module does not respond if it detects a syntax error or communication error or if the specified address does not exist.

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Start-up Output Current Configuration

6B21
Analog Output

PURPOSE

The Start-up Output Current Configuration command allows you to store the present value of the output current of the specified analog output module in the module's nonvolatile memory. The module uses this value as the default start-up current whenever the module is powered up or after a brownout condition occurs.

COMMAND SYNTAX

`$AA4(cr)`

COMMAND ARGUMENTS

$ is the delimiter character.

AA represents the 2-character hexadecimal address of the analog output module whose output current you want to store.

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REMARKS

The module does not respond if it detects a syntax error or communication error or if the specified address does not exist.

EXAMPLE

Command: `$034(cr)`
Response: `!03(cr)`

The present output value of the 6B21 analog output module at address 03H is 6.5 mA. This command stores this 6.5 mA value in memory. Whenever the module is reset or powered up, the output value is set to 6.5 mA.

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Synchronized Sampling

6B11, 6B12, 6B50
Analog Input, Digital I/O

PURPOSE

The Synchronized Sampling command instructs all 6B11 analog input modules, 6B12 analog input modules, and 6B50 digital I/O boards in the 6B Series system to sample their input values immediately and simultaneously. Each 6B11 and 6B12 module and each 6B50 board stores the data in a separate register in the module's or board's memory and then resumes normal operation. You can return the data later by executing the Read Synchronized Data - Analog Input command or the Read Synchronized Data - Digital I/O command.

COMMAND SYNTAX

#**

COMMAND ARGUMENTS

is the delimiter character.

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The 6B50 digital I/O board requires a maximum of 1 ms to perform conversions and normalize the data. Therefore, you should not execute any additional commands on a 6B50 board until at least 1 ms has elapsed. If you execute another command too soon, the software returns an error.

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Trim Calibration

6B21
Analog Output

PURPOSE

When calibrating a 6B21 analog output module, the Trim Calibration command adjusts the output current. The Trim Calibration command is one of three commands you use to calibrate a 6B21 analog output module; you must also execute the 4 mA Calibration command and the 20 mA Calibration command.

COMMAND SYNTAX

```
$AA3(number of counts)(cr)
```

COMMAND ARGUMENTS

$ is a delimiter character.

AA represents the 2-character hexadecimal address of the analog output module you want to calibrate. Values for *AA*

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Trim Calibration

6B21
Analog Output

RESPONSE SYNTAX `!AA(cr)`

RESPONSE ARGUMENTS

! is the delimiter character indicating a valid command.

AA represents the 2-character hexadecimal address of the module.

(cr) represents the 1-character terminating character (carriage return, 0DH).

REMARKS It is assumed that either a milliammeter or a resistor and voltmeter is connected to the module's outputs both before and during the execution of this command. Refer to Appendix C for

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20 mA Calibration

6B21
Analog Output

PURPOSE

When calibrating a 6B21 analog output module, the 20 mA Calibration command indicates that the output current is exactly 20 mA. The 20 mA Calibration command is one of three commands you use to calibrate a 6B21 analog output module; you must also execute the 4 mA Calibration command and the Trim Calibration command.

COMMAND SYNTAX

`$AA1(cr)`

COMMAND ARGUMENTS

$ is a delimiter character.

AA represents the 2-character hexadecimal address of the analog output module you want to calibrate. Values for *AA*

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20 mA Calibration

6B21
Analog Output

REMARKS

It is assumed that either a milliammeter or a resistor and voltmeter is connected to the module's outputs both before and during the execution of this command. Refer to Appendix C for more information on the procedures to follow when performing an analog output module calibration.

The module does not respond if it detects a syntax error or communication error or if the specified address does not exist.

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5 Technical Reference

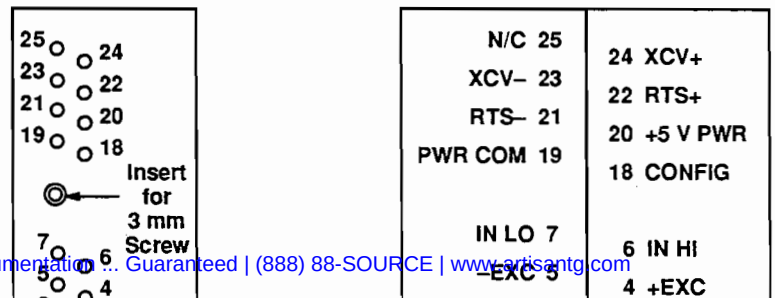
This chapter provides a technical description of the 6B Series modules, the 6B50 digital I/O board, the communication and networking capabilities of a 6B Series system, and the synchronized sampling of data from all 6B11 analog input modules, 6B12 analog input modules, and 6B50 digital I/O boards in the system. It also includes the specifications of 6B Series modules and the 6B50 digital I/O board.

The 6B Series modules offer signal conditioning, galvanic transformer-based isolation, scaling, analog-to-digital (A/D) or

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Technical Reference

All 6B Series modules are identical in size and can be mixed and matched on a 6B Series backplane. The modules are hard-potted and have sturdy 40 mil gold-plated pins. The socket layout and pin designations for each of the modules are shown in Figure 5-1.



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The module cases are made from a thermoplastic resin, which has a fire-retardant rating of 94V-O and is designed to withstand storage temperatures of -40°C to +85°C. Secure the modules in the backplane with a tapered captive screw. The modules contain labels on which to indicate the input/output range and address. The mechanical dimensions of a 6B Series module and socket are shown in Appendix H.

The 6B Series analog input and output modules are shipped from the factory fully calibrated, and the calibration coefficients are stored in nonvolatile EEPROM (Electrically Erasable Programmable Read-Only Memory). The modules should not require any recalibration; to recalibrate a module, refer to Appendix C.

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Analog Input

On the 6B Series analog input modules, the analog input (V_{IN}),

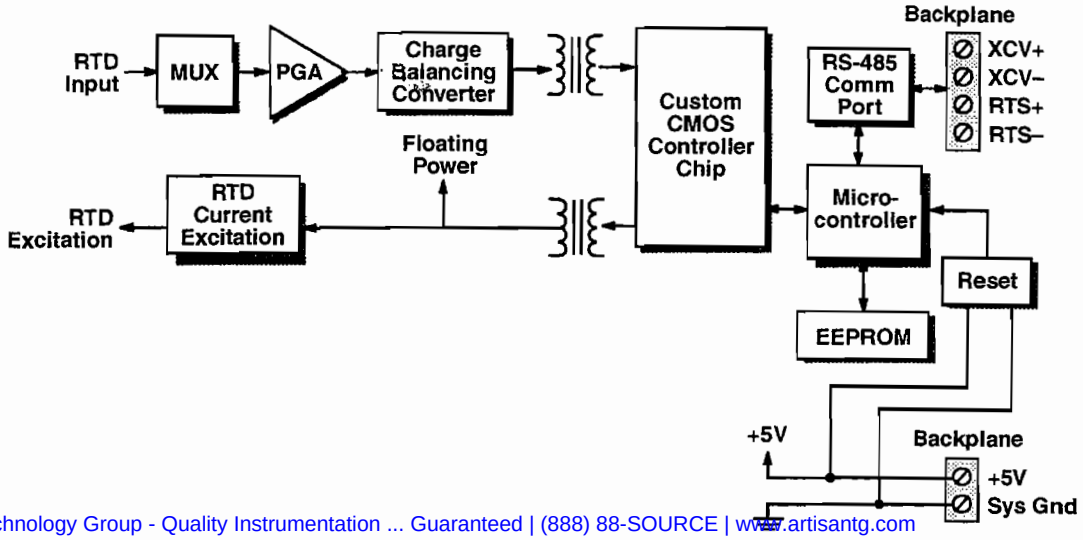
Technical Reference

The 80C52 microcontroller contains the entire executable program memory and performs scaling, ranging, calibration, internal temperature correction, and linearization. Linearization is needed for accurate temperature readings. The digitized analog input value points to a specific entry in a look-up table, where linearization slope (m) and intercept (b) values are stored. These values are combined with the raw value in a standard $y = mx + b$ calculation to produce a linearized value.

The data in the microcontroller is formatted for transmission to the RS-485 interface according to the programmable parameters stored in EEPROM. (Refer to Chapters 3 and 4 for more information on programming a 6B Series module.)

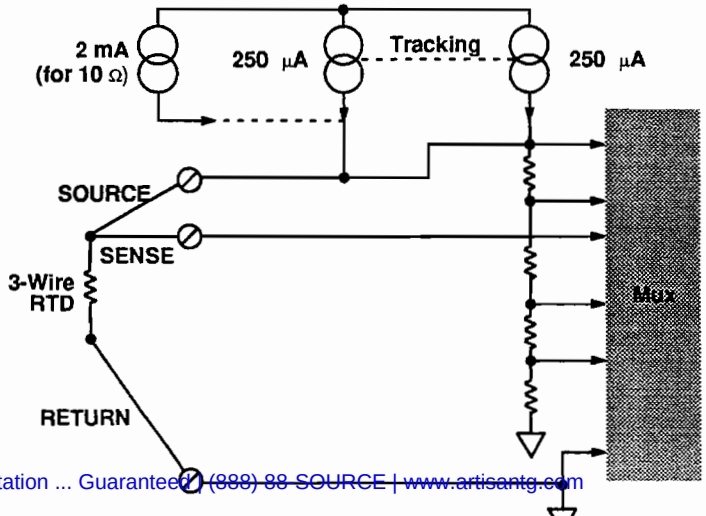
A low voltage reset monitor ensures reliable rest of the module when the supply voltage drops below 4.4 volts.

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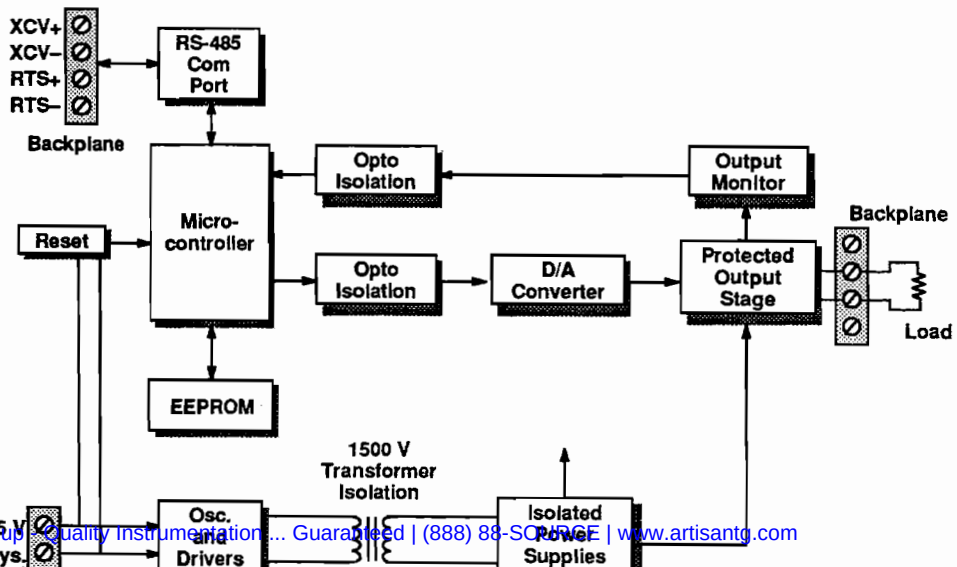
For the 10 Ω copper RTD, the 250 µA source current is too low to provide adequate drop across the RTD. Rather than change both current sources (or the multiplexer range resistors), a tracking 2 mA source is connected in parallel with the 250 µA RTD source. The known ratio between the RTD current source and the multiplexed resistor current source is used in the calculations.

Analog Output Modules

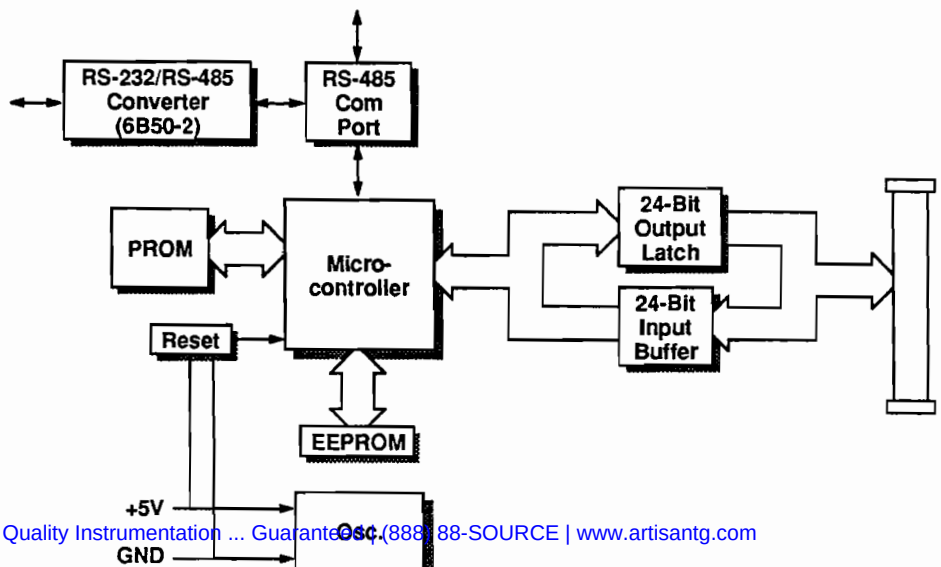
The 6B21 analog output module receives a command from the host through an RS-485 interface and converts this command into an isolated process current output. The 80C52 microcontroller controls the 12-bit digital-to-analog converter (DAC) through an optically isolated serial interface. The DAC drives the current loop through a protected voltage-to-current (V/I) converter. The output monitor is a V/F converter whose frequency is proportional to the loop current. This variable signal

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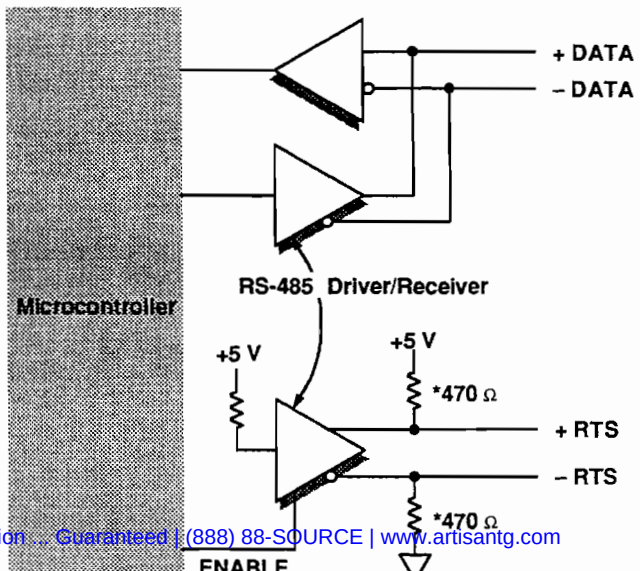


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To avoid conflicts that occur when several modules and boards try to send data at the same time, a simple command/response protocol is used. When the modules and boards are not transmitting, they are in a listen mode. Only the host can initiate a command/response sequence. When a module or board recognizes its address in a command message from the host, the module or board asserts the RTS line; this reverses the direction of any repeaters between the module or board and the host. The module or board then proceeds to transmit its response to the host without sending a handshake signal. When the module or board completes the transmission of the response, it relinquishes the RTS line. The host can then initiate a new transaction.

The networking capabilities of 6B Series backplanes and 6B50 boards include the following:

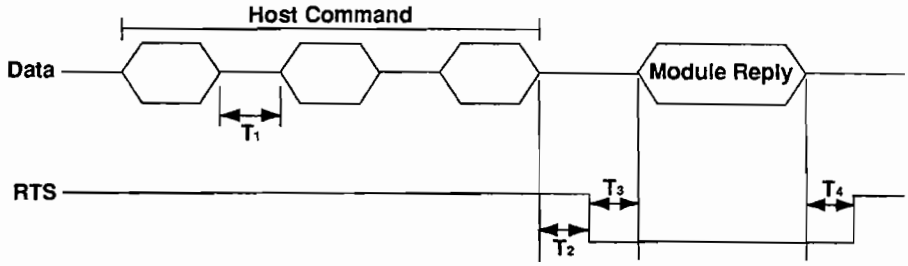
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not accept a new command until the previous response is complete. Note that a 6B21 analog output module that is in the process of "slewing" to a programmed output current can accept a new command.

- **RS-485 Connector -** The RS-485 connector allows connection of one backplane or board to another backplane or board in either a daisy-chain or a multidrop configuration. The network of backplanes and boards connected to a single RS-232C port can contain up to 256 loads, where each analog I/O module counts as one load and each 6B50 digital I/O board counts as one load.

  RS-485 is an EIA standard for multidropped systems, intended for serial data transmission over long distances. RS- 485 receivers have a common mode input range of –7 V to +12 V; this provides good noise rejection. On 6B Series backplanes and 6B50 digital I/O boards, RS-485 uses two

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	Fast Reply Commands	Slow Reply Commands
T1	20 char times @ current baud rate, maximum	*
T2	100 µs, typical	*
T3	1 ms + 1 char time @ current baud rate, typical	200 ms, typical
T4	100 µs, typical	*

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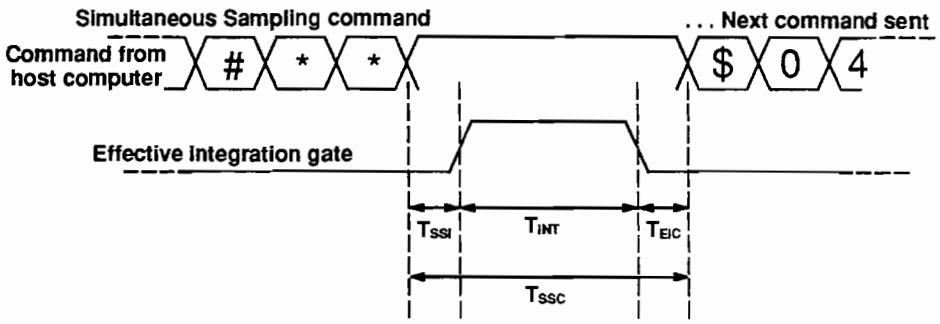
Technical Reference

Synchronized Sampling

The firmware of the 6B11 analog input module, 6B12 analog input module, and 6B50 digital I/O board allows you to sample data from all 6B11s, 6B12s, and 6B50s simultaneously. Each module or board stores the data in a separate register within its microcontroller and can access the data with a separate command.

The 6B11 and 6B12 require a maximum of 70 ms to perform conversions and normalize the data; the 6B50 requires a maximum of 1 ms to perform conversions and normalize the data. This time period includes the delay between the receipt of the Synchronized Sampling command and the onset of the integration period, the integration period itself, and the time required for linearization and/or scaling operations. A timing diagram is shown in Figure 5-9.

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Timing Parameter	Description	Minimum	Typical	Maximum
T_{SSI}	End of simultaneous sampling command to start of integration period	---	0.2 ms	9 ms
T_{INT}	Integration period	---	50 ms/ 60 ms	51 ms/ 61 ms

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Table 5-1. 6B Series Analog Input Module Specifications

Feature	Specification
Input Ranges	
6B11	Thermocouple, mV, V, mA
6B12	mV, V, mA
6B13	Pt, Ni, Cu RTDs
Output	RS-485
Accuracy[1]	
6B11[2], 6B12	±0.05% or better
6B13	±0.03°C (Pt, Ni)
Zero Drift	
6B11, 6B12	±0.3 µV/°C
6B13[3]	±0.005°C/°C
Span Drift	
6B11	±3 ppm/°C typical, ±25 ppm/°C maximum
6B12	±10 ppm/°C typical, ±50 ppm/°C maximum
6B13[3]	±0.005°C/°C

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Table 5-1. 6B Series Analog Input Module Specifications (cont.)

Feature	Specification
Lead Resistance Effect (6B13 only) 100 Ω Pt, 120 Ω Ni 10 Ω Cu	 0.0007°C/Ω 0.01°C/Ω
Cold Junction Compensation[5] Accuracy @ +25°C Over +5°C to +45°C Ambient	 ±0.25°C (±0.75°C maximum) ±0.5°C (±0.0125°C/°C)
Differential Input Protection	240 V rms continuous
Differential Input Transient Protection	ANSI/IEEE C37.90.1-1989
Input Resistance 6B11 6B12 6B13	 100 MΩ 1 MΩ N/A

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Table 5-1. 6B Series Analog Input Module Specifications (cont.)

Notes

[1]Accuracy depends on the configured input range. Refer to Tables 5-4 through 5-6 for specific accuracy by input range.

[2]6B11 and 6B11HV modules only. When measuring thermocouple signals, the CJC sensor accuracy should be added to the 6B11 and 6B11HV module accuracy to compute the overall system accuracy.

[3]Combined effect of zero drift and span drift.

[4]CJC sensor accuracy refers to the AC1361 sensor mounted on 6B series backplanes.

[5]Voltage rise time and fall time (10% to 90% of rated voltage) must be less than 150 ms.

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Table 5-2. 6B21 Analog Output Module Specifications

Feature	Specification
Range	0 to 20 mA, 4 to 20 mA
Overrange	+2 mA ±200 µA
Initial Accuracy	
Output Offset	±5 µA typical, ±15 µA maximum
Span	±0.02% FSR typical, ±0.05% FSR maximum
Output Offset Readback	±100 µA
Span Readback	±0.5% FSR
Accuracy vs Temperature (Temperature Coefficient)	
Output Offset	±1 µA/°C
Gain	±50 ppm/°C
Output Offset Readback	±5 µA/°C
Gain Readback	±200 ppm/°C

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Table 5-2. 6B21 Analog Output Module Specifications (cont.)

Feature	Specification
Differential Input Transient Protection	ANSI/IEEE C37.90.1-1989
Power Supply Requirements Voltage[1] (operating) Voltage (max. safe limit) Current Consumption Fuse (F1)	 +5 V dc ±5% +6.5 V dc 250 mA @ 5V 1.2 W Littelfuse 251.500 1/2 A (for single-channel 6B Series backplanes) Littelfuse 251.005, 5 A (for multiple-channel 6B Series backplanes)

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Table 5-3. 6B50 Digital I/O Board Specifications

Feature	Specification
Number of I/O Channels	24 (configurable as input or output)
I/O Circuit Configuration	Open collector outputs with 47 kΩ pull-ups to +5 V
Inputs High-Level Low-Level	 3.5 V minimum, 5.25 V maximum 0.8 V maximum
Outputs High-Level Current Low-Level Current High-Level Voltage	 50 µA @ +5 V 100 mA @ 1.1 V +5.25 V maximum
Communication RS-232C and RS-485 Baud Rates	 300, 600, 1200, 2400, 4800, 9600, 19.2K

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Table 5-4. Range Accuracy for 6B11, 6B11HV Modules

Input Range Code (Hex)	Input Range	Typical Accuracy	Maximum Error	Peak-To-Peak Noise	Units
00	±15 mV	±0.03	±0.06	±0.02	% of FSR
01	±50 mV	±0.015	±0.04	±0.01	% of FSR
02	±100 mV	±0.0055	±0.03	±0.00	% of FSR
03	±500 mV	±0.005	±0.03	±0.002	% of FSR
04	±1 V	±0.005	±0.03	±0.005	% of FSR
05	±5 V	±0.005	±0.03	±0.0015	% of FSR
06	±20 mA[1]	±0.008	±0.03	±0.005	% of FSR
0E	J thermocouple[2] 0 to 760°C	±0.4	±0.75	±0.14	°C
0F	K thermocouple[2]				

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Table 5-5. Range Accuracy for 6B12, 6B12HV Modules

Input Range Code (Hex)	Input Range	Typical Accuracy	Maximum Error	Peak-To-Peak Noise	Units
07	±50 V	±0.006	±0.03	±0.004	% of FSR
08	±10 V	±0.006	±0.03	±0.005	% of FSR
09	±5 V	±0.006	±0.03	±0.006	% of FSR
0A	±1 V	±0.006	±0.03	±0.007	% of FSR
0B	±500 mV	±0.01	±0.04	±0.008	% of FSR
0C	±150 mV	±0.03	±0.06	±0.02	% of FSR
0D	±20 mA[1]	±0.006	±0.03	±0.007	% of FSR

Note

[1] Excluding error contribution from current conversion resistor.

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Table 5-6. Range Accuracy for 6B13, 6B13HV Modules

Input Range Code (Hex)	Input Range	Typical Accuracy	Maximum Error	Peak-To-Peak Noise	Units
20	Pt, –100°C to 100°C, $\alpha = 0.00385$	0.02	0.15	0.03	°C
21	Pt, 0°C to 100°C, $\alpha = 0.00385$	0.03	0.15	0.04	°C
22	Pt, 0°C to 200°C, $\alpha = 0.00385$	0.03	0.15	0.04	°C
23	Pt, 0°C to 600°C, $\alpha = 0.00385$	0.05	0.15	0.05	°C
24	Pt, –100°C to 100°C, $\alpha = 0.003916$	0.03	0.15	0.03	°C
25	Pt, 0°C to 100°C,				

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Table 5-7. Power Supply Specifications

(typical @ +25°C, 115 V ac, 60 Hz, unless otherwise noted)

Feature	Model 955	Model 977	PWR-01
Input Voltage Range	105 V ac to 125 V ac	100 V ac to 130 V ac	85 V ac to 265 V ac
Frequency	50 Hz to 250 Hz	47 Hz to 400 Hz	47 Hz to 63 Hz
Output Voltage	5 V dc	5 V dc	5 V dc
Short Circuit Protection	Current Limited	Current Limited	Current Limited
Overvoltage Protection[1]	+6.2 V dc	+6.2 V dc	+6.0 V dc
Output Current	1000 mA	5000 mA	5000 mA
Voltage Accuracy	±2% maximum	±2% maximum	±1%, adjustable ±3%
Temperature Coefficient	±0.02%/°C	±0.02%/°C	±0.05%/°C
Line Regulation	±0.05%	±0.05%	±0.1%
Load Regulation	±0.15%	±0.1%	±0.5%

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Technical Reference

Table 5-8. 6BP01 Backplane Specifications

Feature	6BP01-1	6BP01-2
Channels	1	1
Interface[1]	RS-485	RS-232C
Isolation	2500 V rms	2500 V rms
Power Supply		
Voltage		
Operating	Passive	+5 V dc ±5%
Max. Safe Limit	N/A	+6.5 V dc
Current	N/A	200 mA
Fuse	Littelfuse® 251.500 1/2 A	Littelfuse® 251.005 5 A
Dimensions	4.25″ x 1.37″	4.25″ x 2.85″
Temperature Range		
Rated Performance	25°C to 85°C	25°C to +85°C
Storage	–40°C to +85°C	–40°C to +85°C

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Table 5-9. 6BP04 Backplane Specifications

Feature	6BP04-1	6BP04-2	6BP04HV-1	6BP04HV-2
Channels	4	4	4	4
Interface[1]	RS-485	RS-232C	RS-485	RS-232C
Isolation[2]	1500 V rms	1500 V rms	2500 V rms	2500 V rms
Power Supply				
Voltage				
Operating	+5 V dc ±5%	+5 V dc ±5%	+5 V dc ±5%	+5 V dc ±5%
Max. Safe Limit	+6.5 V dc	+6.5 V dc	+35 V dc	+35 V dc
Overvoltage Protection[3]	N/A	N/A	>+6.5 V dc	>+6.5 V dc
Current	200 mA	200 mA	200 mA	200 mA
Fuse	Littelfuse® 251.005 5 A	Littelfuse® 251.005 5 A	Littelfuse® 251.005 5 A	Littelfuse® 251.005 5 A
Dimensions	3.47″ x 6.5″	3.47″ x 6.5″	3.47″ x 6.5″	3.47″ x 6.5″
Temperature Range				

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Table 5-10. 6BP16 Backplane Specifications

Feature	6BP16-1	6BP16-2
Channels	16	16
Isolation[2]	1500 V rms	1500 V rms
Power Supply		
Voltage		
Operating	+5 V dc ±5%	+5 V dc ±5%
Max. Safe Limit	+6.5 V dc	+6.5 V dc
Current	200 mA	200 mA
Fuse	Littelfuse® 251.005 5 A	Littelfuse® 251.005 5 A
Temperature Range		
Rated Performance	–25°C to +85°C	–25°C to +85°C
Storage	–40°C to +85°C	–40°C to +85°C

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A Utility/Demo Software

This appendix contains a brief description of the 6B Series Utility/Demo software. It is intended for those users who want to configure, calibrate, read data from, or write data to 6B Series modules and 6B50 digital I/O boards without writing their own application programs.

The 6B Series Utility/Demo software is a menu-driven program provided by Analog Devices. It is shipped on a disk with your manual. You should copy the 6B Series Utility/Demo software into an appropriate directory on your hard drive. For

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Utility/Demo Software

6BWIN for Windows® 3.1 & NT 3.51 Installation Instructions

1. Start Microsoft® Windows
2. Insert the 6B Series Configuration/Utilities Disk into your computer's 3.5" floppy drive.
3. From the Program Manager™ choose **Run** . . . from the File Menu.
4. In the Command Line box, type "a:\setup," or "b:\setup" if your 3.5" disk drive happens to be drive B:, and click OK.
5. 6B-WIN Setup will ask for a path name, where 6B-WIN executable files and data files should be kept. If you would like Setup to create a directory for you, type in the directory name, or click on [OK] to select the default directory, "c:\6bwin."

Please refer to the 6B-WIN Help file for further information.

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Utility/Demo Software

To use the 6B Series Utility/Demo software, perform the following steps:

1. From the appropriate directory in DOS, enter the following:

   ```
   sixbccd [-m]
   ```

   (*-m* forces the 6B utility to use a monochrome display)

2. From the copyright screen, press <Escape> to display the Main Menu.

3. Use the arrow keys to highlight the appropriate option and press <Enter> to select the option.

The Main Menu options are described on the following pages. Note that when you are instructed to select an option, use the arrow keys to highlight the option and then press <Enter>.

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- *Print* - Select this option to poll all modules and boards on the 6B Series system and print the current configuration data for all the modules and boards on a specified printer.
- *Quit* - Select this option to return to the Main Menu.
- *Help* - Select this option to display additional information.

Note: The system asks you to indicate the highest address to poll. If you do not enter a number, the system defaults to 255 and polls all possible addresses. To save time, you can enter the lowest appropriate address instead.

- **Config** - Select this option to configure a 6B Series module or 6B50 digital I/O board. Select the appropriate module or

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Note: If you are specifying the baud rate for a module, the module must be installed in the socket nearest the configuration jumper (W1) with the configuration jumper installed. If you are specifying the baud rate for a 6B50 digital I/O board, the configuration jumper (W1) must be installed in position AB on the board. Refer to Configuring Modules and Boards in Chapter 2 for more information on configuring the baud rate.

– *Checksum* - Select this option to enable or disable the checksum feature. For more information on the checksum feature, refer to the appropriate Checksum section in Chapter 3.

Note: If enabling or disabling the checksum feature for a module, the module must be installed in the socket nearest

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– *Quit* - Select this option to return to the Main Menu without storing the new configuration in the module or board.

– *Help* - Select this option to display additional information.

Configuration Notes

Before the system allows you to configure any modules or boards, it must poll all the modules and boards to determine which are configurable. If appropriate, the system asks you to indicate the highest address to poll. If you do not enter a number, the system defaults to 255 and polls all possible addresses. To save time, instead enter the lowest appropriate address.

Since all modules and boards are shipped with address 00H and *no two modules or boards can have the same address, you* must initially configure the system with only one unconfigured module or board installed at a time. Once you have changed

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Note: Before the system allows you to calibrate any modules, it must poll all the modules and boards to determine which are available for calibration. If appropriate, the system asks you to indicate the highest address to poll. If you do not enter a number, the system defaults to 255 and polls all possible addresses. To save time, you can enter the lowest appropriate address instead.

- **Browse -** Select this option to display a list of all currently configured modules and boards. For each module or board, the system displays the address, the type code (Range), a description of the module or board, and the model number of the module or board. Press <Enter> or <Escape> to return to the Main Menu.

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- **InData -** Select this option to display the input value for each

that you are no longer in continuous sampling mode. Note that for modules and boards that do not support the synchronized sampling of data, the software displays the message COMM ERR instead of a value.

As the user moves from screen to screen to read data from other modules and boards, the software displays a pound sign (#) next to modules and boards whose data has already been read.

Press <S> to initiate another synchronized sampling of data. Press <C> to return to continuous sampling mode. Press <Escape> to return to the Main Menu.

- **OutData -** Select this option to specify an output value for an analog output module or a digital I/O board.

For analog output modules, use the arrow keys to increase or decrease the output value (Setpoint) until you reach the

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B

Input/Output Ranges and Data Formats

This appendix contains examples of each of the data formats for each input and output range.

Range Code (hex)	Input Range Description	Data Formats	+F.S.	Zero	–F.S.	Displayed Resolution
00	±15 mV	Engineering Units	+15.000	+00.000	–15.000	1 µV
		% of FSR	+100.00	+000.00	–100.00	0.01%

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Data Formats

Range Code (hex)	Input Range Description	Data Formats	+F.S.	Zero	–F.S.	Displayed Resolution
06	±20 mA	Engineering Units	+20.000	±00.000	–20.000	1 µA
		% of FSR	+100.00	±000.00	–100.00	0.01%
		Twos Complement	7FFF	0000	8000	1 LSB[1]
07	±50 V	Engineering Units	+50.000	±00.000	–50.000	1 mV
		% of FSR	+100.00	±000.00	–100.00	0.01%
		Twos Complement	7FFF	0000	8000	1 LSB[1]
08	±10 V	Engineering Units	+10.000	±00.000	–10.000	1 mV
		% of FSR	+100.00	±000.00	–100.00	0.01%
		Twos Complement	7FFF	0000	8000	1 LSB[1]
09	±5 V	Engineering Units	+5.0000	±0.0000	–5.0000	100 µV
		% of FSR	+100.00	±000.00	–100.00	0.01%

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Range Code (hex)	Input Range Description	Data Formats	Maximum Specified Signal	Minimum Specified Signal	Displayed Resolution
0E	Type J Thermocouple 0°C to 760°C	Engineering Units	+760.00	+000.00	0.1°C
		% of FSR	+100.00	+000.00	0.01%
		Twos Complement	7FFF	0000	1 LSB[1]
0F	Type K Thermocouple 0°C to 1000°C	Engineering Units	+1000.0	+0000.0	0.1°C
		% of FSR	+100.00	+000.00	0.01%
		Twos Complement	7FFF	0000	1 LSB[1]
10	Type T Thermocouple –100°C to 400°C	Engineering Units	+400.00	–100.00	0.01°C
		% of FSR	+100.00	–025.00	0.01%
		Twos Complement	7FFF	CCCC	1 LSB[1]
11	Type E Thermocouple	Engineering Units	+1000.0	+0000.0	0.1°C
		% of FSR	+100.00	+000.00	0.01%

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Data Formats

Range Code (hex)	Input Range Description	Data Formats	Maximum Specified Signal	Minimum Specified Signal	Displayed Resolution
22	100 Ω Platinum RTD α = .00385 0°C to 200°C	Engineering Units	+200.00	+000.00	0.01°C
		% of FSR	+100.00	+000.00	0.01%
		Twos Complement	7FFF	8000	1 LSB[1]
		Ohms	+175.84	+100.00	10 mΩ
23	100 Ω Platinum RTD α = .00385 0°C to 600°C	Engineering Units	+600.00	+000.00	0.01°C
		% of FSR	+100.00	+000.00	0.01%
		Twos Complement	7FFF	8000	1 LSB[1]
		Ohms	+313.59	+100.00	10 mΩ
24	100 Ω Platinum RTD α = .00392 −100°C to 100°C	Engineering Units	+100.00	−100.00	0.01°C
		% of FSR	+100.00	+000.00	0.01%
		Twos Complement	7FFF	8000	1 LSB[1]

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Data Formats

Range Code (Hex)	Input Range Description	Data Formats	Maximum Specified Signal	Minimum Specified Signal	Displayed Resolution
29	120 Ω Nickel RTD 0°C to 100°C	Engineering Units	+100.00	+000.00	0.01°C
		% of FSR	+100.00	+000.00	0.01%
		Twos Complement	7FFF	8000	1 LSB[1]
		Ohms	+200.64	+120.00	10 mΩ
2A	Copper RTD 10 Ω @ 25°C 0°C to 120°C	Engineering Units	+120.00	+000.00	0.01°C
		% of FSR	+100.00	+000.00	0.01%
		Twos Complement	7FFF	8000	1 LSB[1]
		Ohms	+13.665	+09.043	1 mΩ
2B	Copper RTD 10 Ω @ 0°C 0°C to 120°C	Engineering Units	+120.00	+000.00	0.01°C
		% of FSR	+100.00	+000.00	0.01%
		Twos Complement	7FFF	8000	1 LSB[1]
		Ohms	+15.050	+10.000	1 mΩ

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C Calibration Procedure

All 6B Series analog input and output modules are calibrated at the factory and generally do not need any recalibration. If recalibration is required, follow the analog input module or analog output module calibration procedures described in this appendix.

NOTE: 6B11HV, 6B12HV, 6B13HV Modules - These modules are identical to the 6B11, 6B12 and 6B13 modules, except for a higher Input-to-Output Isolation rating of 2500 V rms (vs. the "non-HV" rating of 1500 V rms). All 6B11, 6B12 and 6B13 infor-

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Calibration Procedure

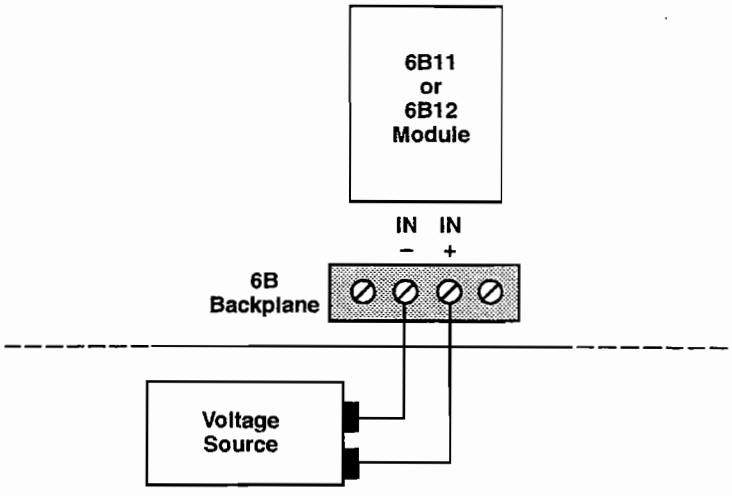


Figure C-1. Applying Calibration Voltage

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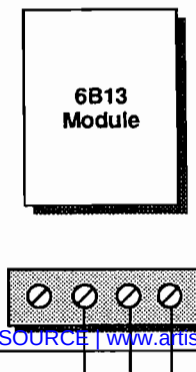
Table C-1. Calibration Voltage (cont.)

Module	Input Range Code (Hex)	Input Range	Calibration Voltage
6B11 and 6B11HV (cont.)	0F	K thermocouple 0 to 1000°C	+50 mV
	10	T thermocouple –100 to +400°C	+22 mV
	11	E thermocouple 0 to 1000°C	+80 mV
	12	R thermocouple 500 to 1750°C	+22 mV
	13	S thermocouple 500 to 1750°C	+22 mV
	14	B thermocouple 500 to 1800°C	+15 mV

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Calibration Procedure

4b. For 6B13 modules, apply the appropriate span calibration resistance to the screw terminals using a 3-wire connection, as shown in Figure C-2.



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Table C-2. Calibration Resistance

Input Range Code (Hex)	Input Range	Span Calibration Resistance	Offset Calibration Resistance
20	Pt, –100°C to 100°C α = 0.00385	140 Ω	60 Ω
21	Pt, 0°C to 100°C α = 0.00385	140 Ω	60 Ω
22	Pt, 0°C to 200°C α = 0.00385	200 Ω	60 Ω
23	Pt, 0°C to 600°C α = 0.00385	440 Ω	60 Ω
24	Pt, –100°C to 100°C α = 0.003916	140 Ω	60 Ω

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Calibration Procedure

Note: You must apply the voltage/resistance for at least 1 s before issuing the Span Calibration command, and you should hold it until the module acknowledges the command; this typically takes 150 ms.

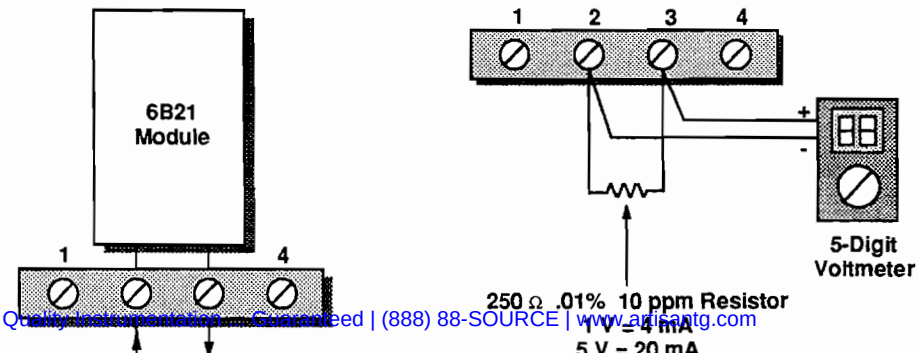
5. Execute the Span Calibration command. Refer to the Span Calibration command in Chapter 4 for more information.

6. For 6B13 modules, apply the appropriate offset calibration resistance to the screw terminals using a 3-wire connection, as shown in Figure C-2. Refer to Table C-2 for a list of offset calibration resistances for all input ranges.

Note: You must apply the resistance for at least 1 s before issuing the Offset Calibration command, and you should

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3. Attach either a 5-digit milliammeter or a 5-digit voltmeter with a shunt resistor (250 Ω, 0.01%, 10 ppm) to the appropriate module. Refer to Figure C-3.



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Calibration Procedure

8. Execute the Trim Calibration command as often as necessary until the output current is equal to exactly 20 mA.
9. Execute the 20 mA Calibration command to indicate that the present output current is exactly 20 mA.

Note: Make sure that you perform the entire procedure. You must calibrate both the 4 mA output current and the 20 mA output current.

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D Troubleshooting

This appendix contains general troubleshooting information and a procedure to follow if you have difficulty communicating with a 6B Series module or 6B50 digital I/O board.

General Troubleshooting

Table D-1 lists general symptoms and possible solutions for problems you may have when using 6B Series modules and 6B50 digital I/O boards. If, after checking out the following

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Table D-1. Troubleshooting a 6B Series System (cont.)

Symptom	Possible Cause	Possible Solution
Module or board is not operating properly.	The module or board is damaged or malfunctioning.	Contact your local Analog Devices sales office.
	Vibration or loose connections.	Cushion the source of vibration and tighten connections.
	Incorrect wiring.	Check wiring. Refer to Chapter 2 for more information.
	Missing or broken wires or cables.	Replace cables and wires.
	Overheating.	Control temperature; the ambient temperature should be less than 60°C.
	Electrical noise.	Control electromagnetic interference through better cable shielding and

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Table D-1. Troubleshooting a 6B Series System (cont.)

Symptom	Possible Cause	Possible Solution
Yellow LED and green LED on 6B Series backplane or 6B50 board is continually on.	The 6B50 board or one or more of the modules on the 6B Series backplane may be faulty.	Remove the 6B50 board and the modules one at a time to locate the faulty one. Begin testing on the last backplane or board with both LEDs on.
Green LED goes off.	You may have blown fuse F1.	Replace with Littelfuse 251.500, $^1/_2$ A (for single-channel 6B Series backplanes), Littelfuse 251.005, 5 A (for multiple-channel 6B Series backplanes), or Littelfuse 251.01.5, 1 $^1/_2$ A (for 6B50 digital I/O boards).
6B21 analog output module responds to all commands, but	The current loop is open.	Check wiring.

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Troubleshooting

Troubleshooting Communications

If your host computer is having difficulty communicating with a 6B Series module or 6B50 board, you can perform the following procedure with one module or board, and then continue with additional modules and boards you may have:

Note: This procedure uses DEBUG, which is normally included with the DOS operating system. It is assumed that DEBUG is located in the DOS directory and that an appropriate path is provided. For more information on DEBUG, refer to your DOS documentation.

---

1. From the DOS prompt, enter the following:

```
DEBUG <Enter>
```

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The system displays a hyphen (-), which is the DEBUG

`0040:0000 F8 03 F8 02`	Indicates that you have two serial communication ports set up as COM1 and COM2. If this is correct, go to step 3. If this is incorrect, check the configuration of your communication ports; refer to Attaching the Host Computer in Chapter 2.
`0040:0000 F8 02 00 00`	Indicates that you have one serial communication port set up as COM2. If you are using only one serial communication port, it must be set up as COM1. Check the configuration of your

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5. At the DOS prompt, enter the following BASIC program:

```
 10 OPEN "COM1:9600,N,8,1,cd,ds,cs,rs" FOR RANDOM AS 1
 20 INPUT "Input address of module (hex AA) ";b$
 30 IF b$ = "-1" THEN GOTO 100
 40 A$ = "#" + b$
 50 PRINT A$
 60 PRINT #1, A$
 70 INPUT #1, C$
 80 PRINT C$
 90 GOTO 20
100 END
```

Note: This program assumes you are using COM1. If you are using COM2, change *COM1* in line 10 to *COM2*.

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10. Run the BASIC program again, entering *00* at the prompt (*00* indicates module address 00H).

    The response from the module or board should be displayed on the screen. If the module or board does not respond, a wire may be crossed within the RS-232C cable, the module or board may be powered incorrectly, or the module or board may be defective.

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E Summary of Commands

Table E-1 contains a list of all commands in the 6B Series command set arranged by syntax. Table E-2 contains a list of all commands in the 6B Series command set arranged by module/board. Refer to Chapters 3 and 4 for a detailed description of these commands.

Table E-1. Summary of Commands (by Syntax)

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Command Syntax	Command Name	Modules/Boards Used

Summary of Commands

Table E-1. Summary of Commands (by Syntax) (cont.)

Command Syntax	Command Name	Modules/Boards Used
$AA4	Read Synchronized Data	6B11 analog input module 6B12 analog input module 6B50 digital I/O board
	Start-up Output Current Configuration	Analog output modules
$AA5	Reset Status	Analog output modules 6B50 digital I/O board
$AA6	Last Value Readback	Analog output modules
	Digital Data In	6B50 digital I/O board
$AA8	Current Readback	Analog output modules
%AANNTTCCFF	Configuration	Analog input modules

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Table E-2. Summary of Commands (by Module/Board)

Module/Board	Command Syntax	Command Name	Description
Analog Input Modules	#AA	Analog Data In	Returns the input value from a specified analog input module in the currently configured data format.
	%AANNTTCCFF	Configuration	Allows you to set the address, input range, baud rate, data format, checksum status, and/or integration time for an analog input module.
	$AA0	Span Calibration	Allows you to calibrate an analog input module to correct for gain errors.
	$AA1	Offset Calibration	Allows you to calibrate a 6B13

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Table E-2. Summary of Commands (by Module/Board) (cont.)

Module/Board	Command Syntax	Command Name	Description
Analog Output Modules	#AA(data)	Analog Data Out	Specifies an output value to be used by a specified analog output module.
	%AANNTTCCFF	Configuration	Allows you to set the address, output range, baud rate, data format, slew rate, and/or checksum status for an analog output module.
	$AA4	Start-up Output Current Configuration	Allows you to store the output value of a specified analog output module; the value is used as the start-up current whenever the module is powered up.

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Table E-2. Summary of Commands (by Module/Board) (cont.)

Module/Board	Command Syntax	Command Name	Description
Analog Output Modules (cont.)	$AA8	Current Readback	Returns the measured value of the current flowing through the current loop.
	$AA5	Reset Status	Indicates whether a specified analog output module was reset after you last executed this command.
Digital I/O	$AA6	Digital Data In	Returns the input value from ports A, B, and C on a specified 6B50 digital I/O board.
	#AABB(data)	Digital Data Out	Writes a specified output value to a port, or a channel within a port, on a specified 6B50 digital I/O board.

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F Sample Programs

This appendix contains sample programs that you can refer to when developing programs for communication to any 6B Series product.

Additional 6B sample programs (i.e., Visual Basic Program, using Custom Controls) are available from the Bulletin Board System (BBS). They may be obtained by dialing 617-461-4361 (8 Data Bits; 1 Stop Bit; No Parity; 1200/2400/4800/9600/14.2 K Baud.)

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Sample Programs

```
 20 CLS:KEY OFF:KEY (10) ON:ON KEY (10) GOSUB 250: ON ERROR GOTO 280
 30 LOCATE 25,1:PRINT "Press F10 to QUIT";:
 35 'Set up the com port as COM1: and baud rate as 9600
 40 PORT$="com1:":BAUD$="9600"
 50 '
 60 LOCATE 1,10:PRINT "Module      HEX       Module"
 70 LOCATE 2,10:PRINT "Number      Address   Reply"
 80 '
 85 'Open file #1 as the com port and set communication parameters
 90 OPEN PORT$+BAUD$+",n,8,1,cs,rs,cd,ds" FOR RANDOM AS #1
100 FOR MODNUM=0 TO 19
105 'Convert the module address to a HEX value and assure the address
    has 2 characters
110 MODNUM$=HEX$(MODNUM):IF LEN(MODNUM$)<2 THEN MODNUM$="0"+MODNUM$
115 'Assemble a DATA command for the current module address
120 CMD$="#"+MODNUM$
125 'Output the command to 6B via the com port as a string value
```

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Using a Modem

The program in this section is written in Microsoft QuickBASIC® version 4.5 and demonstrates the acquisition of data from four 6B11 modules that accept input from J type thermocouples.

```
CLS
DIM A$(4)
A$(0) = "#01": A$(1) = "#02": A$(2) = "#03": A$(3) = "#04"
OPEN "COM1: 2400,n,8" FOR RANDOM AS #1
LOCATE 5, 35: COLOR 14: PRINT "DIALING"
PRINT #1, "ATDT9,123-4567" :REM USE APPROPRIATE TELEPHONE NUMBER
INPUT #1, B$: INPUT #1, B$
CLS : COLOR 15
LOCATE 10, 20
PRINT B$: COLOR 2
FOR I = 1 TO 20000: NEXT I
```

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G

Source for Common Parts and Accessories

This appendix provides information on where to find some of the most common parts and accessory items associated with a 6B Series system. Table G-1 lists the parts and the manufacturers' part numbers. Analog Devices, Inc. makes no claims about the availability and quality of parts purchased through the vendors listed below. This information is listed for your convenience only.

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Common Parts and Accessories

Table G-1. Common Parts and Accessories for the 6B Series System (cont.)

Part Description	Part Number	Company
Jumper clips Package of 10 jumper clips (0.1 inch) Jumper clip (0.1 inch)	 AC1344 531-220-2	 Analog Devices Inc. (800) 426-2564 Amp Incorporated (800) 522-6752)
Power line cord	AC1340-D	Analog Devices, Inc. (800) 426-2564
Power Supplies 1 A power supply 5 A power supply 5 A power supply	 Model 955 Model PWR-01 Model 977	 Analog Devices, Inc. (800) 426-2564
Rack-mount kit	AC1380	Analog Devices, Inc. (800) 426-2564
Rail mounting		

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Table G-1. Common Parts and Accessories for the 6B Series System (cont.)

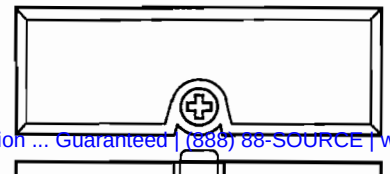
Part Description	Part Number	Company
Software packages	LabVIEW LabWindows LabWindows/CVI BridgeVIEW	National Instruments 6504 Bridge Point Parkway Austin, TX78730-5039 (512) 794-0100
	Genesis Control Series Winworks	Iconic, Inc. 100 Foxborough Boulevard Foxborough, MA 02035 (508) 543-8600
	Paragon TNT	Intec Controls Corp. 55 West Street Walpole, MA 02081 (508) 660-1221
	FIX-DMACS FIX-MMI	Intellution One Edgewater Drive

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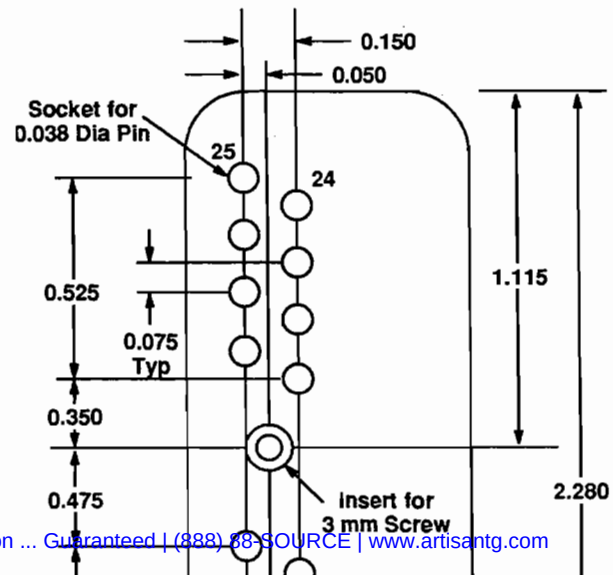
H Technical Diagrams

This appendix contains diagrams of the layouts and mechanical dimensions of 6B Series modules, backplanes, boards, and accessories. Note that the dimensions are given in inches first, followed by millimeters in parentheses.



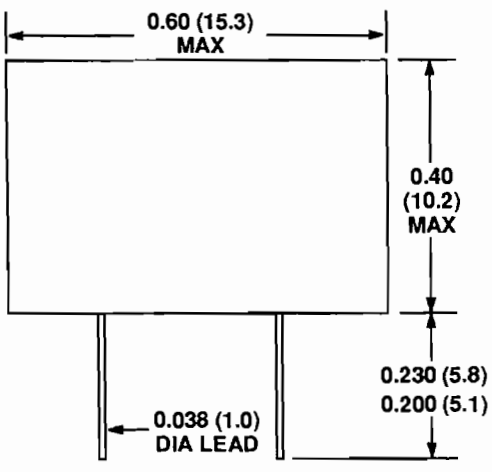
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Technical Diagrams



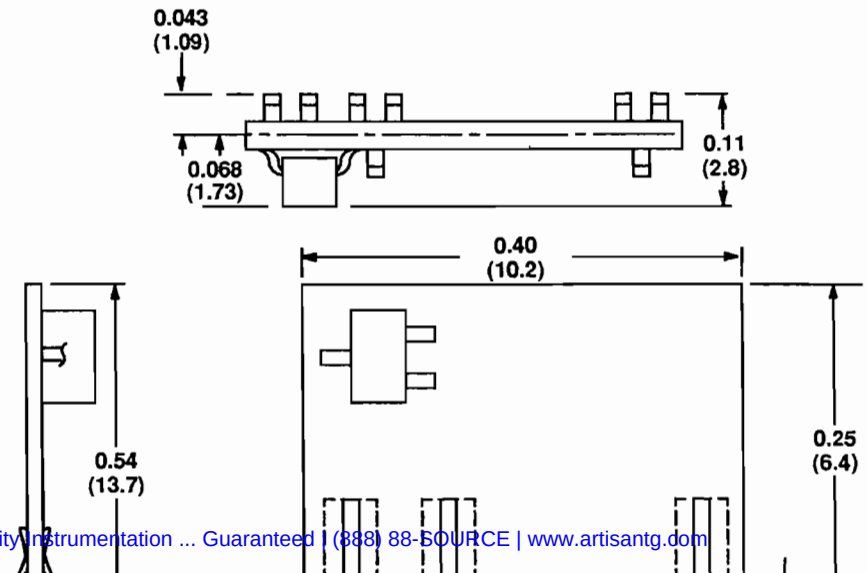
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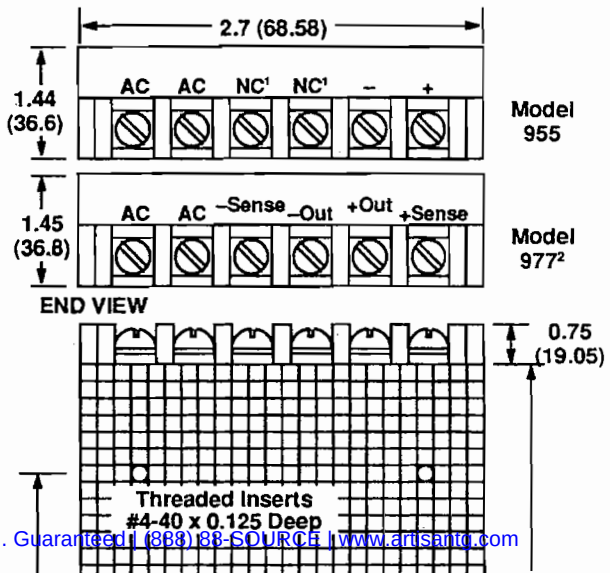
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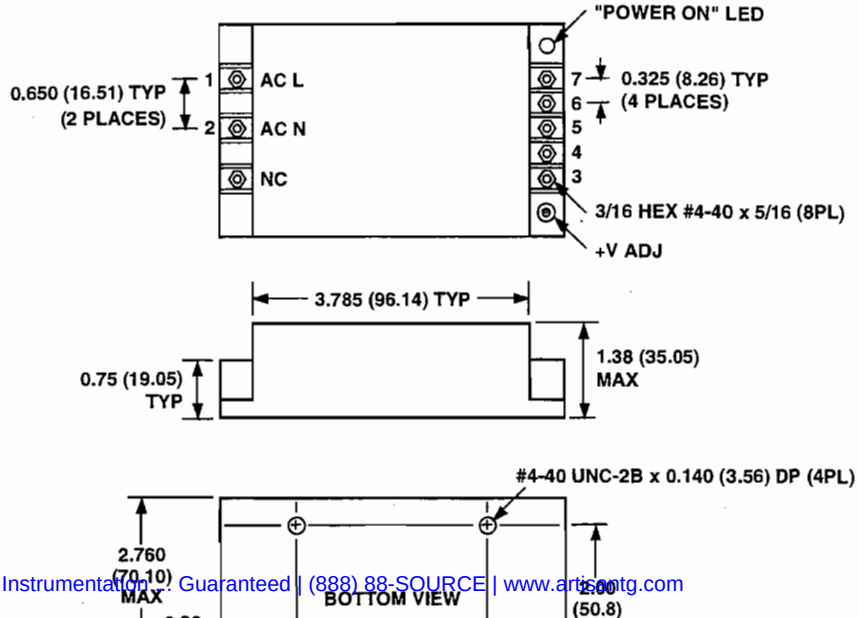
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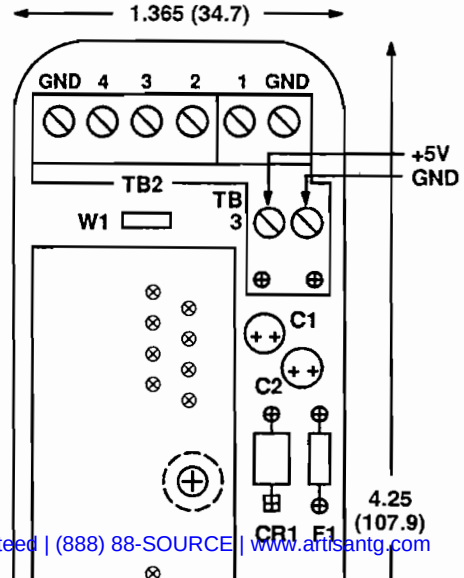
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Technical Diagrams



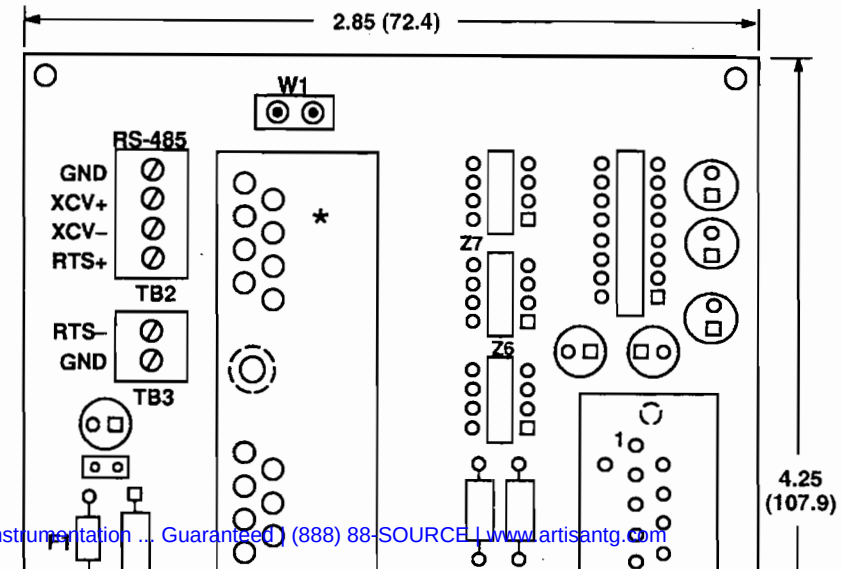
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Technical Diagrams



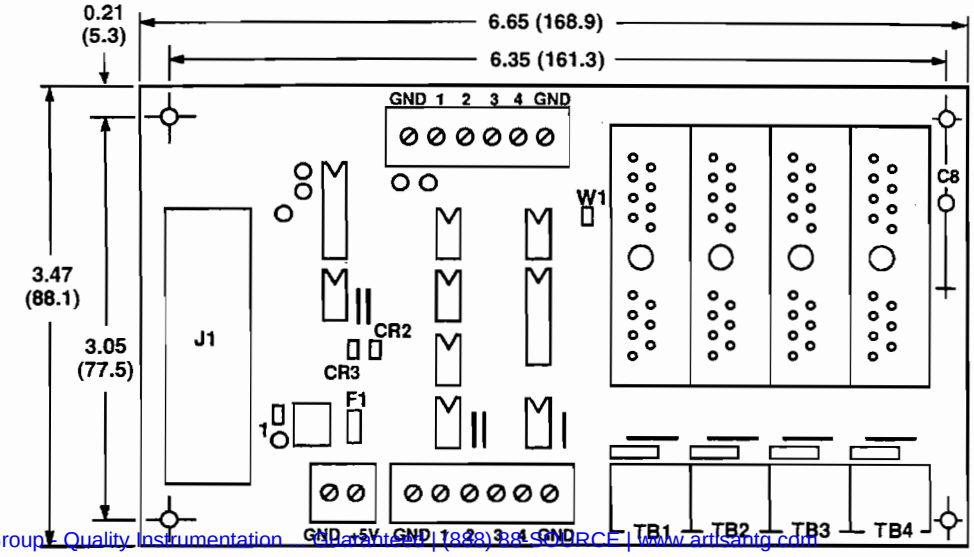
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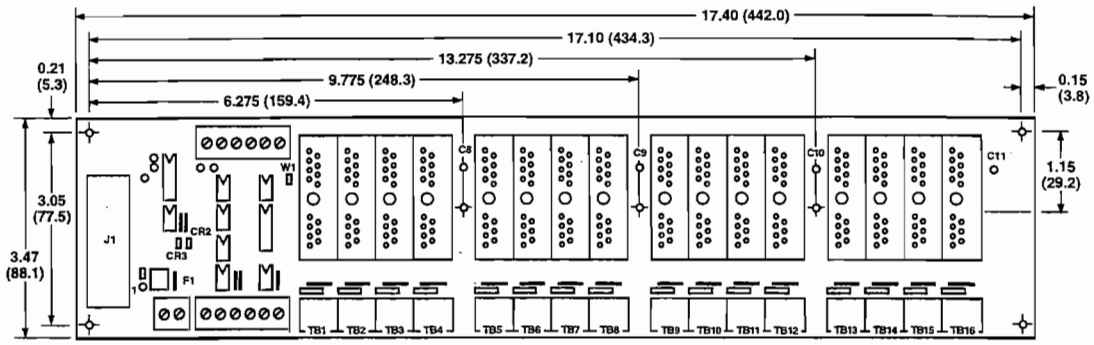
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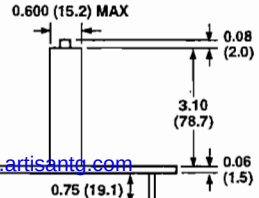
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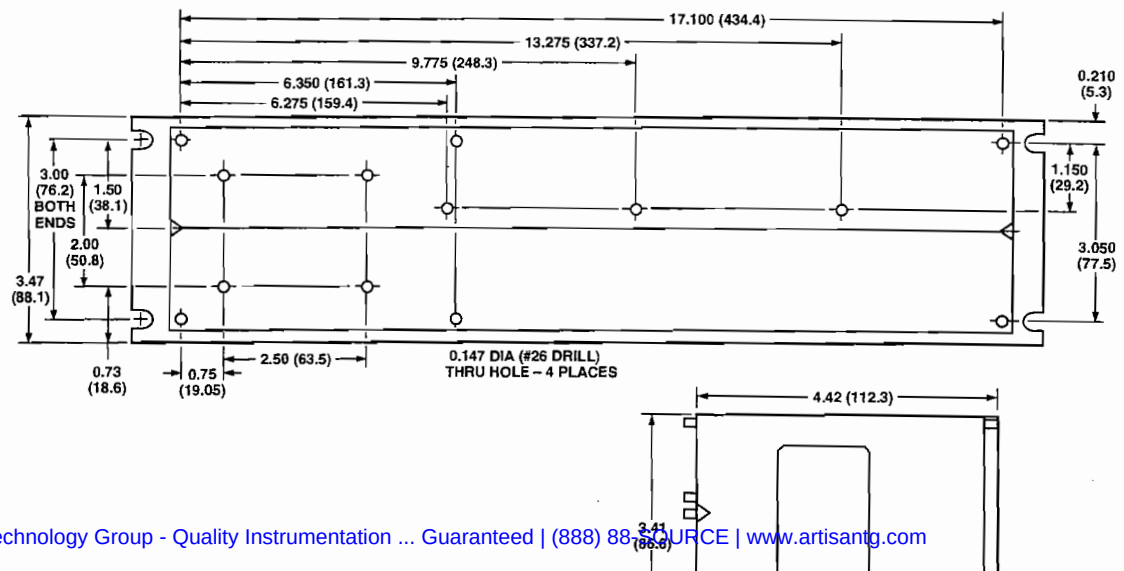
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I Channel Scanning Rates

The overall speed of communications between the host computer and a 6B Series system, will depend upon three selectable settings; (1) Baud Rate, (2) Checksum, (3) Output Data Format. In general, the fastest communication – 179 channels per second – will be achieved if checksum is disabled, baud rate is set at 19.2 K baud and twos complement format is selected. To determine the specific communication rate for other settings, refer to Tables I-1 through I-4.

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Checksum Table I-1 lists the time for one command/response (in ms) as a

Channel Scanning Rates

Command	Output Format	Total Characters	Time for One Command/Response (ms) Baud Rate 300	600	1200	2400	4800	9600	19200
Data	Eng. Units	13	374	188	94	48	24	13	7
Data	Twos Comp.	10	294	148	74	38	19	10	6
Data	% of FS	13	374	188	94	48	24	13	7
Configuration	n/a	16	627	413	307	253	227	213	207
Calibration	n/a	9	440	320	260	230	215	208	204
Status	n/a	15	428	214	108	54	28	14	8
CJC Data	Eng. Units	14	573	387	293	247	223	212	206

Table I-1. Time for One Command/Response, with Checksum Disabled.

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Channel Scanning Rates

Command	Output Format	Total Characters	Time for One Command/Response (ms) Baud Rate 300	600	1200	2400	4800	9600	19200
Data	Eng. Units	17	481	241	121	61	31	16	9
Data	Twos Comp.	14	401	201	101	51	26	14	7
Data	% of FS	17	481	241	121	61	31	16	9
Configuration	n/a	20	733	467	333	267	233	217	208
Calibration	n/a	13	547	373	287	243	222	211	205
Status	n/a	19	534	268	134	68	34	18	9
CJC Data	Eng. Units	18	680	440	320	260	230	215	208

Table I-3. Time for One Command/Response, with Checksum Enabled.

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J RS-232/RS-485 Primer

RS-232-C Interface

RS-232-C is an EIA standard for low speed serial data communications. It is intended for relatively short distances (50 feet or less) and relatively low speed (19,200 bits per second or less). It is designed to interface a single communicating device to a host computer, and does not support multi-party connections

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6B Implementation of RS-485

The RS-485 standard implemented with the 6B Series utilizes two twisted pair: one for differential data and the other for differential handshake (Request to Send).

Although the use of the RTS signal means that the RS-485 has two wire pairs instead of one, it solves two problems. First, it functions as a transceiver control line when connecting multidropped RS-485 units to RS-232, a standard that does not support multidrop operation. It also controls the direction of bckplane repeaters which extend the signal distance beyond the 4000 ft. limit to another 4000 ft.; and allows more than 32 nodes to be mulltidropped (which is an RS-485 limitation). The alternative method of internal timing is dependent on baud rate and affected by delays.

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K

Using 6B Series Modules to meet European Union Requirements

EMC Compatibility

The 6B Series Signal Conditioning Subsystem has been tested and has passed the stringent "heavy industrial" requirements of the European Union's electromagnetic compatibility (EMC) directive.

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In order to comply with the European Standards in a typical

European Union Requirements

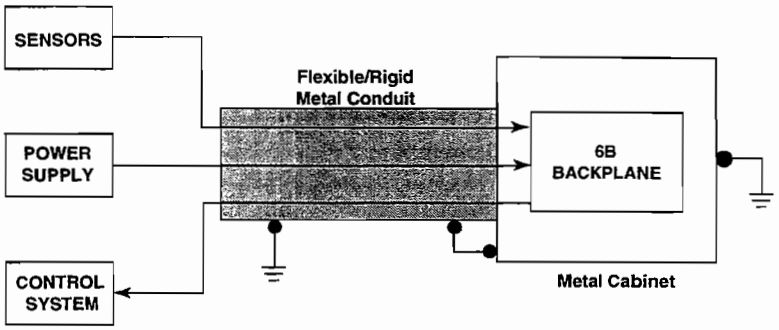


Figure K-1. General Wiring Configuration

CE Certification Tests

The 6B Series modules have been tested and certified according to the rigorous electromagnetic constraints of the EN50081-2 and EN50082-2 European Standards. A description of each test is given below, followed by Table K-1 listing the standards

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matrix scanner and a precision digital voltmeter. By subtracting the baseline reading taken with no RF field, the change was obtained and then expressed and stored as a percentage of span change. This test simulated the effect of system operation in an environment that is exposed to strong (heavy industrial) radiated electromagnetic waves.

2. Conducted RF Immunity The units were subject to conducted EMI via a RF generated signal resistively injected into the conductive layer of a standard flexible wire chase housing the wires from the system backplane. The point of contact was approximately 20 cm from the units. The field was swept from a frequency of 150 KHz to 80 MHz, with a 1 KHz modulation. The frequency increment size was 1% of the current frequency and the settling time at each frequency was two seconds. Ferrite beads were placed outside

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European Union Requirements

4. Pulsed RF Immunity The units were subjected to radiated RF at 900 MHz, 10 V/m, 100% square wave modulated at 200 Hz inside the RF chamber using a log-periodic. About 180 readings were taken with a settling time of two seconds for each reading. Both vertical and horizontal polarizations were tested. Once again, the percentage of span change was calculated and stored.

5. Magnetic Field Immunity The units were placed within two coils carrying current to generate a magnetic field of 30 A/m @, 50 Hz. The field strength was measured using a loop antenna and an oscilloscope. The units were placed in three configurations, X, Y and Z. relative to the magnetic field. The outputs of the units were scanned and the percentage of change calculated. This tested the units' behavior under stray magnetic fields.

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9. Emissions The units were tested for radiated and conducted emissions. The units were biased at maximum output and readings of field strength from 30 MHz to 1000 MHz in both vertical and horizontal polarization were taken. Readings from the AC main of the DC power supply from 50 KHz to 30 MHz were also taken.

Table K-1. List of Tests

No.	Test	Test Specification	Basic Standard	Test Setup	Criteria
1	Radiated RF Immunity	80-1000 MHz 10 V rms Modulated, 1 KHz, 80%	ENV 50140	ENV 50140	A
		0.15 to 80 MHz			

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European Union Requirements

Table K-2. Summary of Tests

No.	Test	Method	Criteria	Average Error*
1	Radiated RF Immunity	Modulated, vertical Modulated, horizontal	A A	0.006% of span 0.015% of span
2	Conducted RF Immunity		A	0.002% of span
3	Fast Transient Immunity		B	Less than published specifications
4	Pulsed RF Immunity	Horizontal Vertical	A A	0.002% of span 0.002% of span
5	Magnetic Field Immunity	X, Y, and Z direction	A	0.003% of span

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L Understanding Dynamic Data Exchange

Dynamic Data Exchange is a feature of Windows that allows two programs to share data commands with each other. DDE can be thought of as a direct link between two application programs. In most cases, one application is providing some form of data (either text or graphics) to another application. The application that is the source of the data is called the "server" and the application that is receiving the data is called the "client".

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A 32-Bit DDE Server (KEPDDE) software product with support

Understanding Dynamic Data Exchange

KEPDDE Features

Supports multiple device networks through a single interface using installable device drivers.
Supports AdvancedDDE, FastDDE, XL_Table and CF_Text data formats.
Supports NetDDE.
Supports concurrent serial port and PC card configurations.
Supports up to eight serial port connections simultaneously.
Dynamic client to device tag assignment capability.
Programmable scan times for each item.
Data transmission to client applications only if it has changed since the last update.
Channel connections displayed graphically.
Real-time reporting of DDE conversation status.
Configuration wizards speed device and channel configuration.
On-line help provided.
Includes simulator driver and demo project to help get you

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Understanding Dynamic Data Exchange

Driver Features

The 6B Series driver works in conjunction with KEPware's (KEPDDE) to provide data exchange between DDE clients and Analog Devices 6B Series modules.

Data update to the server only if it has changed since the previous update.
Supports synchronous data acquisition.
Supports communications through eight serial ports simultaneously.
Includes wizards for easy device and communications configuration.
Includes online help.

Supported Features

6B11, 6B11HV, 6B12, 6B12HV, 6B13 and 6B13HV Analog Input Modules

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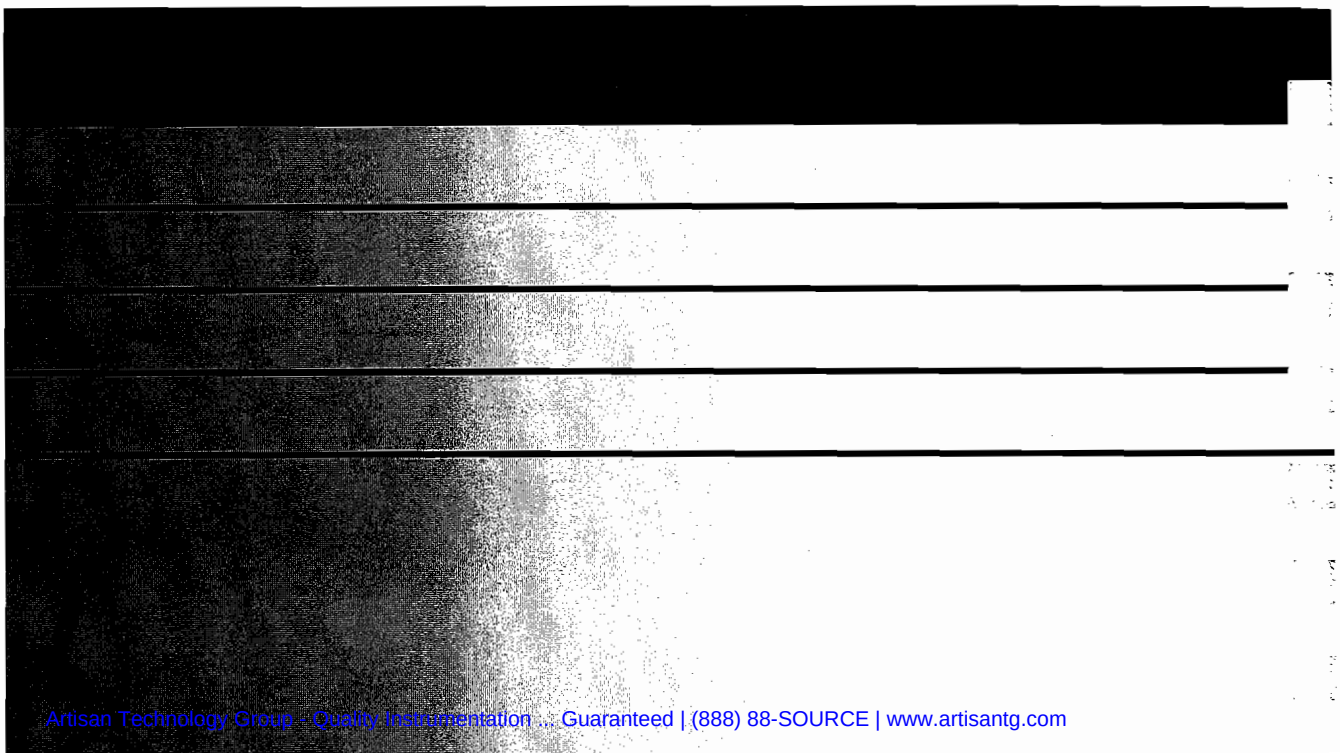
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