DATAQ®
INSTRUMENTS

The way PC-based instrumentation should be

DI-710 Series
16-Channel USB or Ethernet data logger

DI-715B Series
Ethernet Data Logger with Signal-Conditioned Inputs

User's Manual
Manual Revision W

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INSTRUMENTS

Warranty and Service Policy

Product Warranty

DATAQ Instruments, Inc. warrants that this hardware will be free from defects in materials and workmanship under normal use and service for a period of one year from the date of shipment. DATAQ Instruments' obligations under this warranty shall not arise until the defective material is shipped freight prepaid to DATAQ Instruments. The only responsibility of DATAQ Instruments under this warranty is to repair or replace, at its discretion and on a free of charge basis, the defective material.

This warranty does not extend to products that have been repaired or altered by persons other than DATAQ Instruments employees, or products that have been subjected to misuse, neglect, improper installation, or accident.

DATAQ Instruments shall have no liability for incidental or consequential damages of any kind arising out of the sale, installation, or use of its products.

Service Policy

1. All products returned to DATAQ Instruments for service, regardless of warranty status, must be on a freight-prepaid basis.

2. DATAQ Instruments will repair or replace any defective product within 5 days of its receipt.

3. For in-warranty repairs, DATAQ Instruments will return repaired items to the buyer freight prepaid. Out of warranty repairs will be returned with freight prepaid and added to the service invoice.

⚠ CAUTION ⚠

READ BEFORE CONNECTING INPUT SIGNALS TO YOUR DI-710

The DI-710 data acquisition device you have purchased and are about to use is **NOT** an **ISOLATED** product. This means that it is susceptible to common mode voltages that could cause damage to the device. **SUCH DAMAGE IS NOT COVERED BY THE PRODUCT'S WARRANTY**. Please read the following carefully before deploying the product. Contact DATAQ Instruments Support at 330-668-1444 for all questions. If you have purchased a DI-715B you do not need to follow these instructions.

This product can tolerate a maximum applied voltage of only ±20V peak without damage. Although you may be certain that the signal you want to measure is lower than this level, a common mode voltage (CMV) with an unknown value may combine with your signal of interest to exceed this ±20V limit. In such instances, the product will be damaged. Verify a CMV does not exist before connecting signals and acquiring data with your device. Use the following procedure to check for CMV:

1. DO NOT connect your data acquisition device to the device under test. If the device under test is connected to your data acquisition device, disconnect it.

2. Connect your data acquisition device to the appropriate interface on your PC (USB, Ethernet, RS-232 Serial, or Parallel Printer Port).

3. Apply power to your data acquisition device, your PC, and the device under test.

4. Use a digital voltmeter to make the following measurements:

    a. Measure the voltage (both the AC and DC range) between the ground terminal of your data acquisition device and Signal+ of the device under test. This measurement should not exceed the Full Scale Range of your data acquisition device.

    b. Measure the voltage (both the AC and DC range) between the ground terminal of your data acquisition device and Signal- of the device under test. This measurement should be at or very near 0 Volts.

    c. Measure the voltage (both the AC and DC range) between the ground terminal of your data acquisition device and Common of the device under test. This measurement should be at or very near 0 Volts.

5. Should ANY of these measurements exceed their recommendation **DO NOT CONNECT SIGNALS** to the data acquisition device. A common mode voltage may exist that could destroy the instrument. You MUST determine the source of the CMV and eliminate it before taking any measurements.
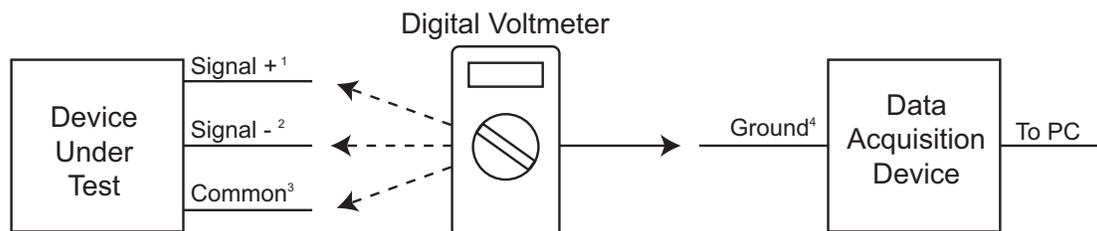
[1]Measured signal is not to exceed the Full Scale Range of your data acquisition device.

[2]Measured signal must be at or very near 0 volts.

[3]Measured signal must be at or very near 0 volts.

[4]Connect to AGnd (Analog Ground) port on DI-710 instruments.

Table of Contents

1. Introduction

Congratulations on your purchase of the DI-710 or DI-715B data logger/data acquisition system. DI-710 and DI-715B Instruments feature a variety of options—each explained fully in this manual. Options include a USB or Ethernet Interface, PGL or PGH gain settings, Stand-alone capability, and, for DI-715B instruments, thermocouple temperature measurment capability using DI-5B47 modules. DI-715B models accept DI-5B Industrial Signal Conditioning Modules. Use the table below to determine the options included with your Instrument.

Model No.	Options					
	Ethernet	USB	-H Gain	-L Gain	Stand-alone	Accepts 5B Modules
DI-710-UH*	N	Y	Y	N	N	N
DI-710-UHS*	N	Y	Y	N	Y	N
DI-710-UL*	N	Y	N	Y	N	N
DI-710-ULS*	N	Y	N	Y	Y	N
DI-710-EH*	Y	N	Y	N	N	N
DI-710-EHS*	Y	N	Y	N	Y	N
DI-710-EL*	Y	N	N	Y	N	N
DI-710-ELS*	Y	N	N	Y	Y	N
DI-715B-E	Y	N	Y	N	N	Y
DI-715B-ES	Y	N	Y	N	Y	Y
*All DI-710 models available with a 37-pin D sub connector (as opposed to two removable 16-port screw terminal blocks). Add "D" to the model number. See "37-pin D sub connector" on page 21.						

Features

The **DI-710** has the following features:

• Multiple Hardware options: USB or Ethernet Interface; PGL or PGH gain settings; and Stand-alone data logger Operation capabilities. All options available in any configuration.

• Per channel software-configurable settings: Single-ended or differential input; input gain; and calibration.

• 4,800 samples/second maximum sampling rate—up to 8,000 samples/second when recording to a memory card.

• 0.048 samples/second minimum sampling rate—0.0017 samples/second when recording to a memory card.

• 14-bit A/D converter for high resolution measurement accuracy.

• 16-entry input scan list allows you to scan any sequence of input channels at any available gain.

• The Stand-alone option allows the user to configure a recording session through their PC then record data in the field to a memory card (SD) **without** being connected to their PC.

The **DI-715B** has the following features:

• Accepts up to 8 DI-5B Modules accommodating virtually any industrial signal.

• Per channel software-configurable settings: input gain settings of 1, 2, 4, 8; calibration.

• 4,800 Hz maximum sampling rate—up to 8,000 Hz when in Stand-alone data logger operating mode.

• 0.048 samples/second minimum sampling rate—0.0017 samples/second when recording to a memory card.

- 14-bit A/D converter for high resolution measurement accuracy.

- 16-entry input scan list allows you to scan any sequence of input channels at any available gain.

- The Stand-alone option allows the user to configure a recording session through their PC then record data in the field to an SD card (**without** being connected to their PC).

Analog Inputs

DI-710 models provide 16 single-ended or 8 differential analog inputs (programmable per channel) that allow your analog signals to be converted into 14-bit digital data via an on board A/D converter. Two removable 16 position terminal blocks allow you to easily connect and record signals. The DI-710 features the following software-programmable input measurement ranges:

-L Models	-H Models
±10V full scale measurement range at a gain of 1	±10V full scale measurement range at a gain of 1
±1V full scale measurement range at a gain of 10	±5V full scale measurement range at a gain of 2
±100mV full scale measurement range at a gain of 100*	±2.5V full scale measurement range at a gain of 4
±10mV full scale measurement range at a gain of 1000*	±1.25V full scale measurement range at a gain of 8
*Gains of 100 and 1000 are limited to max throughput of 7200 and 900 Hz respectively when acquiring more than one channel of data.	

DI-715B models provide 16 *fixed* single-ended analog inputs that allow your analog signals to be converted into 14-bit digital data via an on board A/D converter. Differential input is not supported. Channels 9-16 are accessible through use of a DI-705 (see "The DI-705" on page 40). The DI-715B features the following software-programmable input measurement ranges:

Measurement Range	Gain Setting
±10V full scale	1
±5V full scale	2
±2.5V full scale	4
±1.25V full scale	8

Digital Input and Output

All DI-710 and DI-715B models contain 8 software-programmable digital lines (bits) for input/output operations. These lines provide an interface for the transfer of data between user memory and a peripheral device connected to the instrument. Digital inputs can monitor alarms or sensors with TTL outputs, while digital outputs can drive TTL inputs on control or measurement equipment. Remote control can be utilized with bits 0 and 1 and is easily accessed using WINDAQ Acquisition software or, for stand-alone models, in the stand-alone setup panel. To avoid using an analog input channel for Digital I/O, Channel 17 may be enabled as the digital channel. To use the Remote Control features in WINDAQ Acquisition software either Channel 1 or Channel 17 **must** be configured as the Digital Input channel. The digital bits on a DI-715B are only accessible through a DI-705 (see "The DI-705" on page 40).

Software

All software required to record and playback waveforms is included with the purchase of any DI-710 or DI-715B model including WINDAQ Acquisition and Playback software and the Dataq Instruments Hardware Manager.

WINDAQ® Recording and Playback Software

WINDAQ Acquisition and WINDAQ Waveform Browser allow you to record and playback data acquired through your instrument. Whether using a Stand-alone model or a PC-connected instrument, WINDAQ is an invaluable resource to analyzing your data. A special version (see "WinDaq Waveform Browser for SD" on page 35) of WINDAQ Waveform Browser (free) is required to read waveform data recorded to a Memory Card but is easily transferred to the standard version for more analytical features.

WINDAQ Acquisition software can be used to record waveforms directly and continuously to disk while monitoring a real time display of the waveforms on-screen. It operates and displays waveform signals in real time at the full sample rate of the instrument being used. There are two versions of WINDAQ Acquisition software available for use with DI-710 and DI-715B Instruments: WINDAQ/Lite and WINDAQ/High Speed option. WINDAQ/Lite is free but is restricted to recording throughput rates of 1108 Hz with a DI-710 or DI-715B. WINDAQ/High Speed option is an extra-cost option allowing you to record data at the speed of your data acquisition system. When you install the software, a trial version of WINDAQ/High Speed is automatically installed allowing you to run the software for a limited time. Activation is required for continued use to ensure compliance with the Software License Agreement. This software is accessed through the Dataq Instruments Hardware Manager which can be found in the Start menu under the WINDAQ program group called **Dataq Instruments Hardware Manager**.

WINDAQ Waveform Browser playback software (also known as "WWB") offers an easy way to review and analyze acquired waveforms. A built-in data file translator allows the user to display multiple waveforms acquired by WINDAQ Acquisition software or any of a wide range of data acquisition packages. The software's disk-streaming design allows data files of any length to be graphically displayed rapidly, in normal or reverse time directions. Seven standard cursor-based measurements, frequency domain, and statistical analysis functions help simplify waveform analysis and interpretation. WINDAQ Waveform Browser is free and installed when installing WINDAQ Software.

The DATAQ Instruments Hardware Manager

The DATAQ Instruments Hardware Manager allows you to effectively manage and run multiple instruments installed and connected to your PC or your Network—or even over the internet. This software can be found in the Start menu under the WINDAQ program group called **Dataq Instruments Hardware Manager**. Access WINDAQ Acquisition software, Upload data from your memory card, check the Status of your memory card, Format your memory card, configure a Stand-alone data acquisition session, setup the Digital I/O, and more in this easy-to-use point and click environment. View the Help files by clicking on View Help in the Help menu or by pressing F1.

Help

All WINDAQ software utilizes context-sensitive help. Help may be accessed through the Help menu or by pressing the F1 key with any feature selected. This will take you directly to the Help topic most relevant to that particular function or feature. Help topics discuss in detail each function available in the software.

2. Specifications

Unless otherwise noted, specifications are for all DI-710 and all DI-715B instruments.

*Analog Inputs**

Number of Channels:	DI-710: 16 DI-715B: 8 configured for signal conditioned inputs and 8 direct connections
Channel Configuration:	DI-710: 16 single ended, 8 differential, programmable per channel DI-715B: Fixed single ended
Input Impedance, single-ended:	1MΩ
Input Impedance, differential:	1MΩ each input to common
Input bias current:	10µA for a 10V input, single channel
Input offset voltage:	Auto-zero
Input offset current:	2nA (single channel)
Maximum normal mode voltage (DI-710):	30V DC or peak AC
Maximum common mode voltage:	30V DC or peak AC
Common mode rejection (DI-710):	80db, gain=1, 1KΩ unbalance
Channel-to-Channel crosstalk rejection:	-75db @ 100Ω unbalance
Gain temperature coefficient:	50ppm/°C
Offset temperature coefficient:	0.25µV/°C
Digital Filtering:	PC-connected models: Conditional over-sampling Stand-alone models: None

Analog measurement range (software selectable per channel), Accuracy, and Resolution:

DI-710-L Models				DI-710-H and DI-715B Models			
Gain	Range	Accuracy**	Resolution	Gain	Range	Accuracy**	Resolution
1	±10V	±.05%FSR ±50µV	±1.22mV	1	±10V	±.05%FSR ±50µV	±1.22mV
10	±1V	±.05%FSR ±50µV	±122µV	2	±5V	±.05%FSR ±50µV	±610µV
100	±100mV	±.05%FSR ±50µV	±12.2µV	4	±2.5V	±.05%FSR ±50µV	±305µV
1000	±10mV	±.05%FSR ±50µV	±1.22µV	8	±1.25V	±.05%FSR ±50µV	±153µV

*DI-715B Models: These specifications are for the unit itself (excluding DI-5B module(s))

**Test Condition: Single channel, 100 S/s, averaging mode. For DI-715B this spec doesn't include 5B or CJC error.

Digital I/O

Channels:	8 bi-directional bits
Configuration:	Each bit is programmable as an input or output
Output voltage levels:	Minimum "1", 3V @ 2.5mA sourcing; Maximum "0", 0.4V @ 2.5mA sinking
Output current:	Maximum source, -2.5mA; Maximum sink, 2.5mA
Input voltage levels:	Minimum required "1", 2V; Maximum allowed "0", 0.8V

A/D Characteristics

Type:	Successive Approximation
Resolution:	14-bit
Monotonicity:	±2 LSB
Conversion Time:	69μs

Scanning Characteristics

Maximum sample throughput rate:*   PC-connected: 4,800 Hz   Stand-alone: 8,000 Hz**

*When acquiring more than one channel at a gain of 100 max throughput is 7200 Hz; When acquiring more than one channel at a gain of 1000 max throughput is 900 Hz.
**Dependent on SD card used. Low speed SD cards can sample up to 2,000 Hz; High speed cards can sample up to 8,000 Hz. Some high speed cards can sample as high at 14,400 Hz but their capability can only be determined by trial and error.

Minimum sample throughput rate:	PC-connected: 0.0034 Hz Stand-alone: 0.0017 Hz
Maximum scan list size:	17 entries
Sample buffer size:	2kb

Calibration

Calibration Cycle:	One year

USB Interface

Connector:	USB
Protocol:	USB 1.1

Ethernet Interface

Type:	10/100Base-T
Connector:	RJ-45
Protocol:	TCP/IP
Server Type:	DHCP

Removable Memory (Stand-alone Models only)

Type:	Standard Secure Digital (not SDHDor SDxC). Sample rates of 2kHz require SD speeds of 133x or higher. Up to 2kHz require speeds of 13x or higher.
Capacity:	16MB to 2GB

Real Time Clock

Type:	Date, hour, minute, second
Resolution:	1 second
Accuracy:	20 ppm

Controls (Stand-alone Models only)

Single push-button:	Provides manual control over Record and Standby modes.

Indicators

Stand-alone models:	Three color LED indicating Record, Standby, and Error conditions.
PC-connected models:	Power LED

Transfer Rate to PC

Real Time:	up to 4,800 samples per second
From SD Memory (Ethernet models only):	up to 2,400 samples per second

General

Panel Indicators:	Mode LED
Panel Controls:	Control push-button (Stand-alone models)
Panel slots:	Accepts SD-type flash memory
Input connectors:	DI-710: Two, removable sixteen position terminal blocks DI-715B: One removable 32 port screw terminal block
Operating Environment:	0°C to 70°C
Enclosure:	DI-710: Aluminum base with steel wrap-around. Aluminum end-panels with plastic bezels. DI-715B: Aluminum base with steel wrap-around. Clear acrylic front panel.
Dimensions:	DI-710: 5.4 D x 4.1 W x 1.5 H in. (13.81D x 10.48W x 3.81H cm.) DI-715B: 9 D x 7.29 W x 2.7 H in. (22.86D x 18.52W x 6.86H cm.)
Weight:	DI-710: 14 oz. (397 grams) DI-715B: 3 lbs. (1.36 kg)
Power Requirements:	DI-710 USB products: 9 to 36 VDC, 2 watts maximum DI-710 Ethernet products: 9 to 36 VDC, 2.5 watts maximum DI-715B USB products: 9 to 36 VDC, 2 watts + 5B modules DI-715B Ethernet products: 9 to 36 VDC, 2.5 watts + 5B modules

3. Installation

Unpacking

The following items are included with each instrument. Verify that you have the following:

- DI-710 Series or DI-715B Series Instrument.

- Communications cable (USB ONLY - Ethernet models do not come with an Ethernet cable).

- Power cable (except DI-710-UL and DI-710-UH).

- The *WINDAQ Resource* CD-ROM.

- DATAQ screwdriver for connecting signal leads to the screw terminal(s).

- Installation Guide pamphlet (included in CD case).

If an item is missing or damaged, call DATAQ Instruments at 330-668-1444. We will guide you through the appropriate steps for replacing missing or damaged items. Save the original packing material in the unlikely event that your unit must, for any reason, be sent back to DATAQ Instruments.

USB Device Installation

1. Disconnect all DATAQ Instruments USB devices from your Computer.

2. Insert the *WINDAQ Resource CD* in your drive. The installation software should start automatically within 20 seconds. If it does not, start it manually by double-clicking the Setup application (setup.exe) located on the root of the *WINDAQ Resource CD*.

3. In the "What do you want to do?" window, select "Install WinDaq Software" and click **OK**.

4. In the "Installing Software" window, select the "Install Software for DI-148, DI-158, DI-710, DI-715B, and DI-718B(x) instruments" option and click **OK**.

5. In the "WinDaq Installation" dialog box, select the "Install Software" option and click **OK** to continue. If you wish to view the hardware documentation you may do so now by clicking on the appropriate radio button. Documentation will be saved to your hard drive during this installation.

6. In the "Welcome!" box, click **OK** to continue.

7. Read the License Agreement. If you accept the terms, click **Accept and Continue**. If you choose not to accept, click on the **Do not accept and stop** button to end the installation.

8. When prompted, enter your registration information (name and company) in the appropriate text boxes and click **OK**. Confirm your registration information before continuing.

9. When prompted, specify the directory where you want to install your WINDAQ software. It is recommended that you accept the default. If you have already successfully installed a DI-148, DI-158, DI-710, DI-715B, or DI-718B instrument be sure to install to the same folder.

10. In the "Select an Interface" box select **USB** and click **OK**.

11. DO NOT connect your USB device or cable to your PC until installation is complete. If your device is currently connected, please disconnect it before continuing with this installation. Once your device is disconnected, click the **OK** button.

12. When prompted to Select a Program Manager Group specify a destination (or group window) in the Start Menu for WINDAQ software icons. It is recommended that you accept the default.

13. In the "Installation Option" dialog box specify whether you want all users to have access to WINDAQ software or just the current User. Click Yes to allow all users to have access, click No to allow just the current user to have access.

14. After WINDAQ Software installs, you will be prompted to install WINDAQ/XL Trial Version and Advanced CODAS Analysis software. If you wish to install either software click on Yes in the appropriate dialog box. Follow the on screen prompts to complete installation.

15. Software installation is complete - you will now see a "Successful Installation" box - click **OK** to exit WINDAQ Installation.

You can now plug the device(s) into your PC and apply power (if required). You do not need to re-install this software when installing more DI- 71x USB devices to your PC.

Click on the appropriate program group (specified above — default is Start > Programs > WINDAQ) and click on "DATAQ Instruments Hardware Manager" to run WINDAQ software. All DATAQ Instruments software is located in the same program group.

Ethernet Device Installation

Install WINDAQ Software and the DATAQ Instruments Hardware Manager.

1. Insert the *WINDAQ Resource CD* in your drive. The installation software should start automatically within 20 seconds. If it does not, start it manually by double-clicking the Setup application (*setup.exe*) located on the root of the *WINDAQ Resource CD*.

2. In the "What do you want to do?" window, select "Install Software" and click **OK**.

3. In the "Installing Software" window, select the "Install Software for DI-148, DI-158, DI-710, DI-715B, and DI-718B(x) instruments" option and click **OK**.

4. In the "WinDaq Installation" dialog box, select the "Install Software" option and click **OK** to continue. If you wish to view the full hardware documentation you may do so now by clicking on the appropriate radio button. Documentation will be saved to your hard drive during installation.

5. In the "Welcome!" box, click **OK** to continue.

6. Read the License Agreement. If you accept the terms, click **Accept and Continue**. If you choose not to accept, click on the **Do not accept and stop** button to end the installation.

7. When prompted, enter your registration information (name and company) in the appropriate text boxes and click **OK**. Confirm your registration information before continuing.

8. When prompted, specify the directory where you want to install your WINDAQ software. It is recommended that you accept the default. If you have already successfully installed a DI-148, DI-158, DI-710, DI-715B, or DI-718B instrument be sure to install to the same folder.

9. In the "Select an Interface" box select the **Ethernet** option and click **OK** to continue.

10. When prompted to Select a Program Manager Group specify a destination (or group window) in the Start Menu for WINDAQ software icons. It is recommended that you accept the default.

11. In the "Installation Option" dialog box specify whether you want all users to have access to WINDAQ software or just the current User. Click **Yes** to allow all users to have access, click **No** to allow just the current user to have access.

12. After WINDAQ Software installs, you will be prompted to install WINDAQ/XL Trial Version and Advanced CODAS Analysis software. If you wish to install either software click on **Yes** in the appropriate dialog box. Follow the on screen prompts to complete installation.

13. Installation is complete - you will now see a "Successful Installation" box - click **OK** to exit WINDAQ Installation.

Ethernet devices can now be connected to your network or PC. Follow the appropriate instructions in "Installing an Ethernet Device Directly Connected to your PC or Connected via a Hub or Switch Where ONLY DI-71x Products are Installed" on page 12 "Installing an Ethernet Device via a Distributed Network Without a DHCP Server" on page 15, or "Installing an Ethernet Device via a Distributed Network with a DHCP Server" on page 16 of this manual for your specific network connections configuration.

Click on the appropriate program group (specified above — default is Start > Programs > WINDAQ) and click on "DATAQ Instruments Hardware Manager" to run WINDAQ software. All DATAQ Instruments software is located in the same program group.

Installing an Ethernet Device Directly Connected to your PC or Connected via a Hub or Switch Where ONLY DI-71x Products are Installed

Installation of an Ethernet device directly connected to the network card on your computer requires you to change the IP address of your network card.
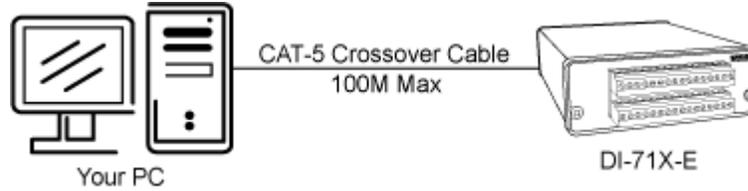
Note: When installing an Ethernet device directly connected to your PC you MUST use a crossover cable (provided).

Installation of an Ethernet device via an Ethernet hub/switch containing ONLY DI-71x products also requires you to change the IP address of your network card.
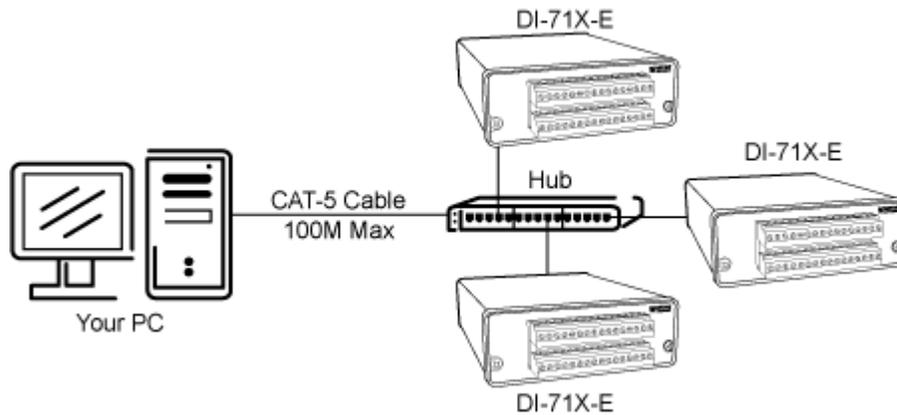
*Note: For hubs that do not have an auto-switching sensor (usually older hubs) you must **not** use a crossover cable.*

1. Install software (see "Ethernet Device Installation" on page 10).

1. Find the **Network Connections** on your computer (usually in the **Control Panel**).

2. Double-click on the **Local Area Connection** icon.

3. Click on the **Properties** button.

4. Select **Internet Protocol (TCP/IP)** in the "This connection uses the following items" window and click on the **Properties** button.
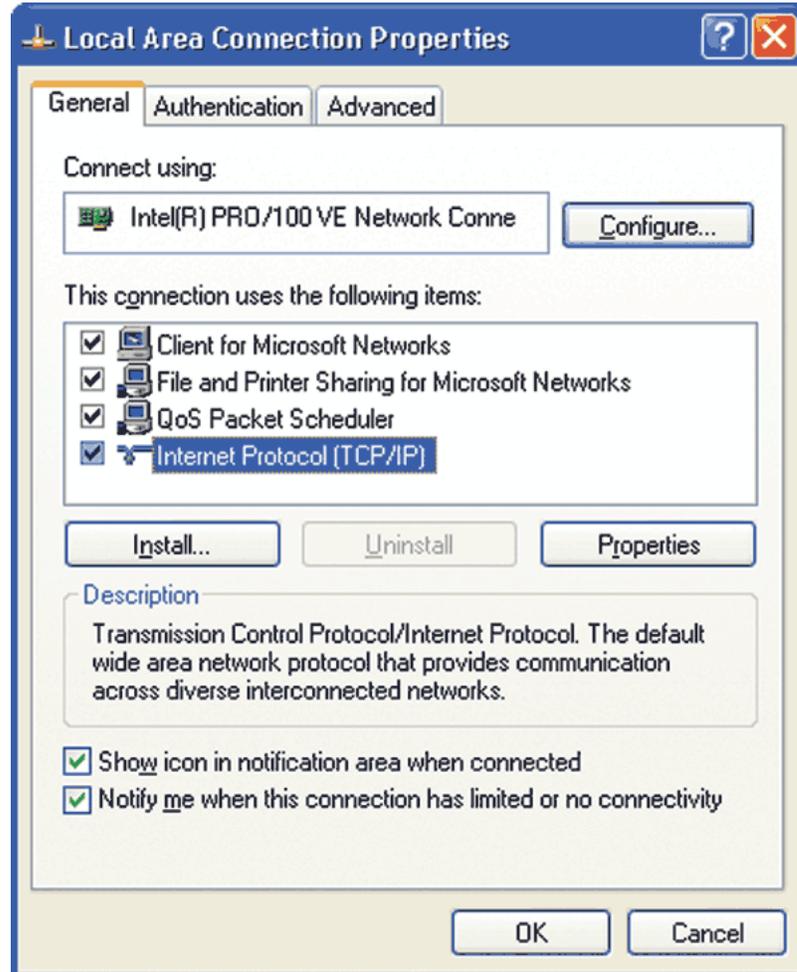
5. Click on the **General** tab.

6. Select the radio button **Use the following IP address**.

7. Enter 169.254.0.1 in the space provided for the IP address.

8.   Enter 255.255.0.0 in the space provided for the Subnet mask.
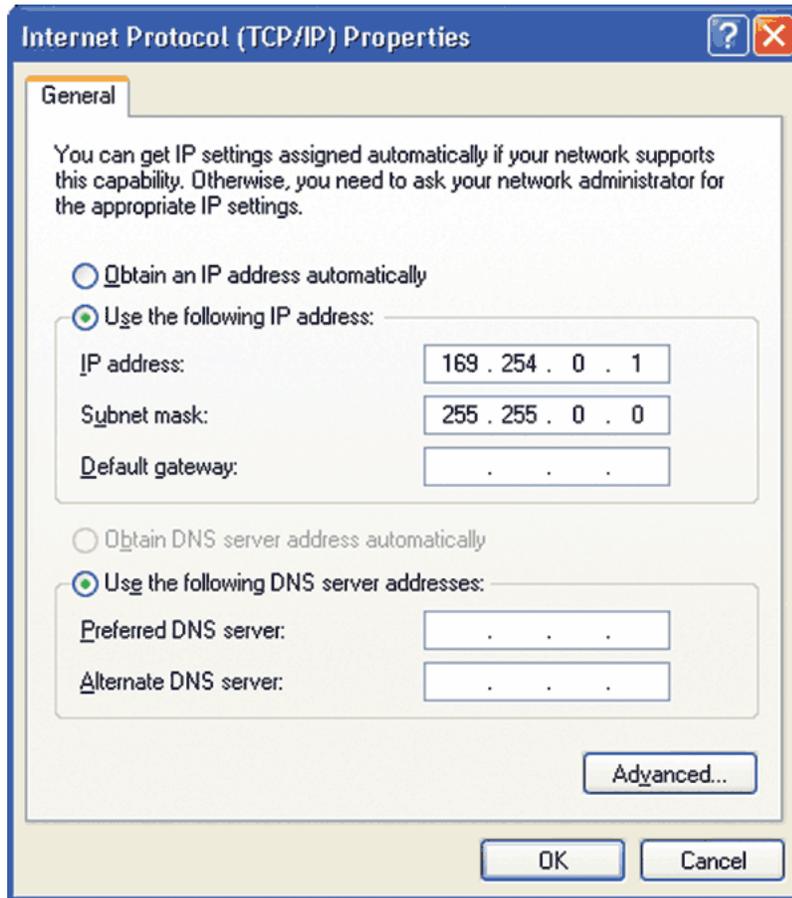
9.   Click on the **OK** button to close the *Internet Protocol (TCP/IP) Properties* dialog box then click on the **OK** button in the *Local Area Connection Properties* dialog box for the changes to take effect.

10. You will now be able to see the device in the DATAQ Instruments Hardware Manager (you may have to click on the **Update List** button).

Installing an Ethernet Device via a Distributed Network Without a DHCP Server

Installation of an Ethernet device connected to a distributed network that does not have a DHCP server or where the DHCP server is turned off requires you to obtain an IP address from your system administrator.
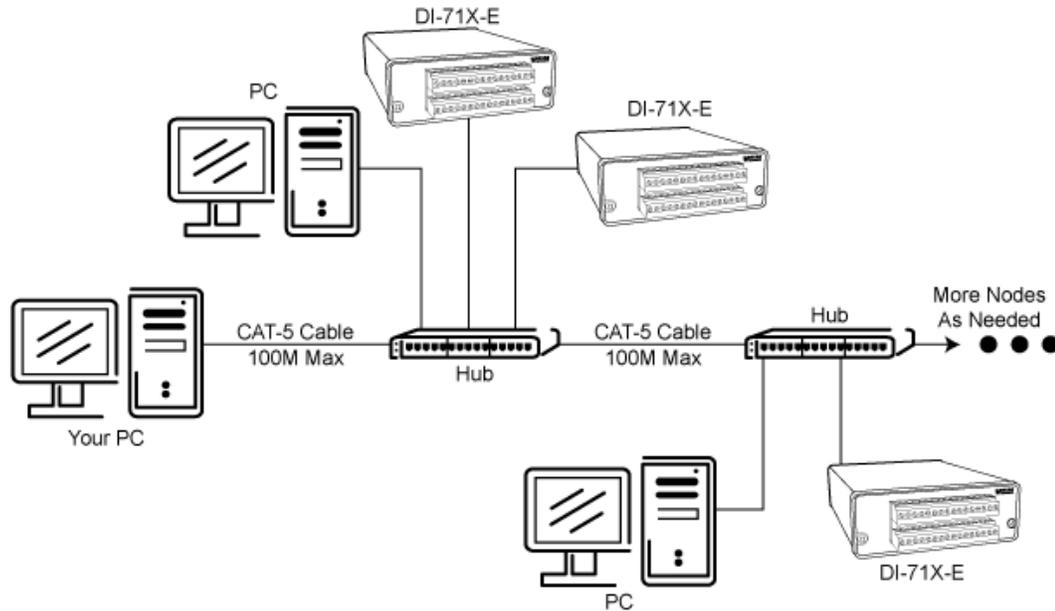
Note: In the illustration above, the Hubs could instead be routers with DHCP turned off (i.e., a static IP assigned network). Contact your system administrator for details about your network.

1. Have the system administrator designate an IP address for your device.

2. Install software (see "Ethernet Device Installation" on page 10).

3. Plug the device into your network and apply power.

4. Open the DATAQ Instruments Hardware Manager software.

5. In the dropdown command list (lower left-hand corner), select **Static IP**. The Manage IP Addresses dialog box will open.

6. Click on the MAC address of your device in the list of displayed MAC addresses (the MAC address of your device can be found on the silver sticker located on the bottom of your device).

7. Enter the IP address your system administrator assigned to you in the **New IP Address** text boxes.

8. Click on the **Set Static** button. Your device will appear in the list of available devices in the main DATAQ Instruments Hardware Manager window. It may take more than 15 seconds for your device to appear in the list. If you get a "No Devices Found" error after following the above instructions, click the **Update List** button until the device appears in the list.

Note: These instructions change the settings inside the device. If you move the device to a DHCP-enabled network (i.e., where IP addresses are assigned automatically by a DHCP server or router) you will need to change the device settings using the DATAQ Instruments Hardware Manager. See the DATAQ Instruments Hardware Manager help file for complete details.

Installing an Ethernet Device via a Distributed Network with a DHCP Server

Installation of an Ethernet device connected to a distributed network that has a DHCP server (i.e., a DHCP router automatically assigns IP addresses to each device connected to the network) requires no extra setup (i.e., it is a "plug and play" device).
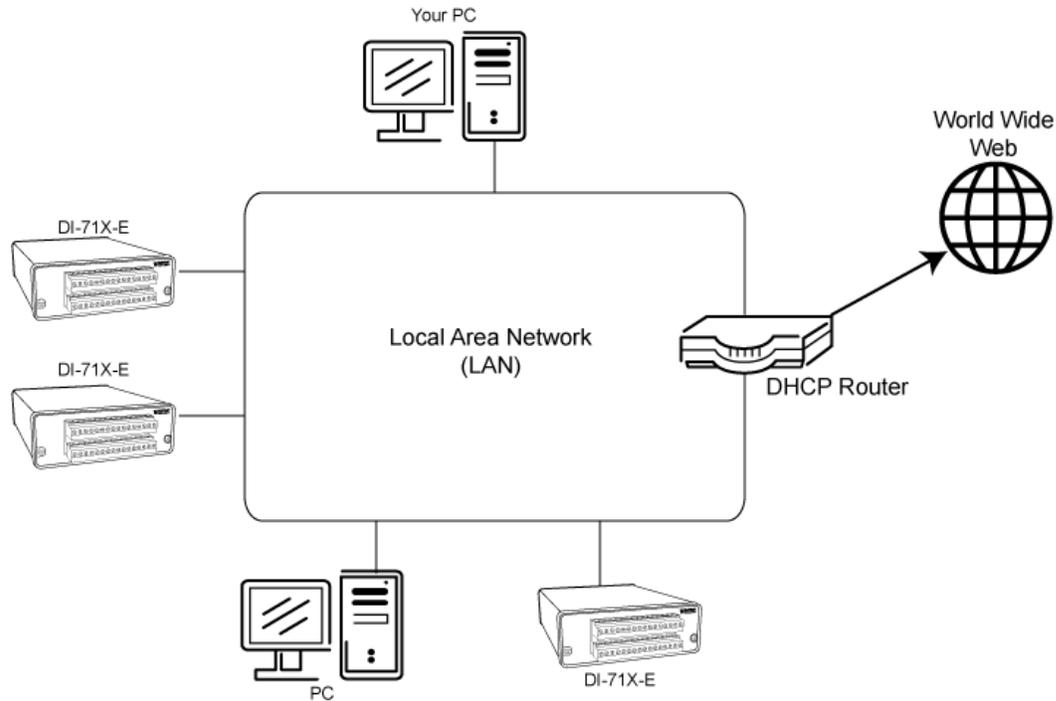
Note: If you are unsure whether your network is DHCP-enabled or not, check with your system administrator before installing WINDAQ.

1. Install software (see "Ethernet Device Installation" on page 10).

2. Connect your Ethernet device to your Local Area Network.

3. Apply power to the device.

4. You will now be able to see the device in the DATAQ Instruments Hardware Manager (you may have to click the **Update List** button).

Activation of WINDAQ/High Speed Option

Activation is required for continued use of WINDAQ/HS (High Speed option) to ensure compliance with the Software License Agreement. The Software License Agreement can be found in the WINDAQ Software manual or in the WINDAQ program group (License.txt). The WINDAQ/HS may be activated through the **Help** menu by clicking on **Unlock WINDAQ/HS** or by waiting for the trial version to expire. Trial versions are good for 40 High Speed (over 1108 Hz throughput) recording sessions. The High Speed version may be purchased after the trial period expires through our online store or by phone. For help or for questions regarding Activation and/or the Software License Agreement, contact DATAQ Instruments Customer Support.

Dataq Instruments Hardware Manager

The Dataq Instruments Hardware Manager is installed when installing any DI-710 or DI-715B instrument. This software allows you to effectively manage and run multiple instruments installed and connected to your PC or your Network—or even over the internet. WINDAQ Data Acquisition Software and the Stand-alone Set Up program are both

accessed through the Dataq Instruments Hardware Manager. The Dataq Instruments Hardware Manager may be accessed through the Windows Program Manager Group as specified during installation (default is *Start > Programs > WINDAQ > Dataq Instruments Hardware Manager*). All available devices will automatically appear in the list box when you run the software. For help with the Dataq Instruments Hardware Manager access the Help Files using either the Help menu item or by pressing the F1 key to access context-sensitive help.

4. Instrument Controls, Indicators, and Connections

Connecting the DI-710 to Ground

! IMPORTANT !

The ground connection on the I/O terminal strip should *always* be connected to a signal ground, if one is not inherently made through analog or digital signal connections. Without this connection, the front end of the DI-710 does not have a return path which could lead to inaccurate measurements. Under no circumstances should the DI-710 be used in a measurement situation where it will experience common mode voltages in excess of ±30 VDC or peak AC (the device's full-scale range without damage).

The ground lug at the rear of the DI-710 should *always* be connected to a solid chassis or earth ground. This connection is mandatory for the unit to meet CE guidelines.

Two Critical DI-710 Ground Connections
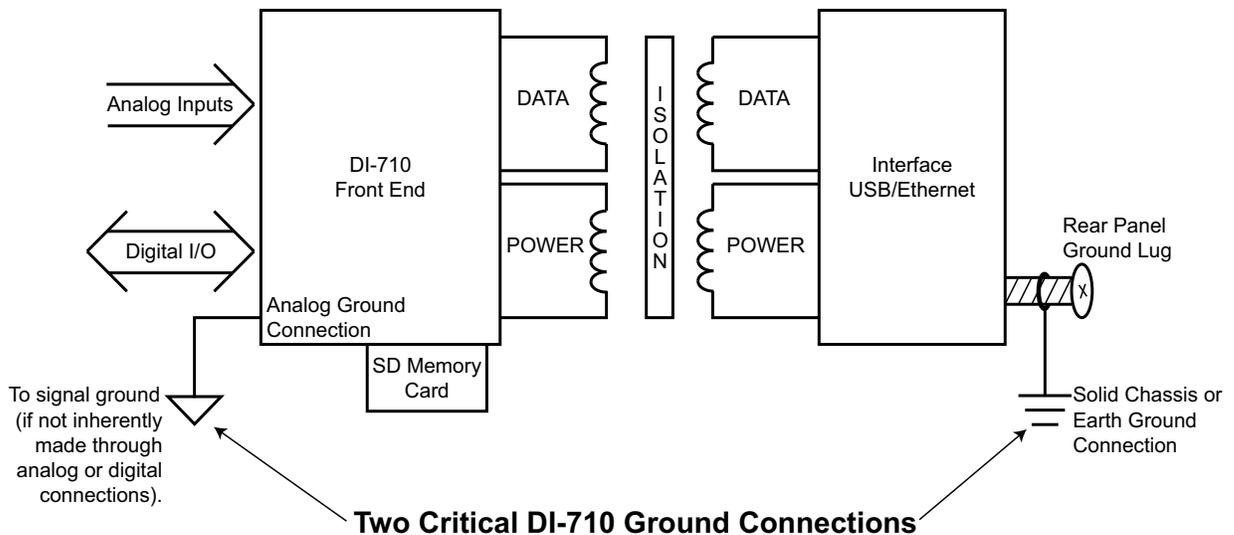
Instrument Front Panel

DI-710 Models

The 32 port screw terminal access connector is used to interface analog input channels 1 through 16 and the eight digital bits. Use the sticker located on the top of your instrument for quick reference to terminal access port designations. Designations are explained in full detail here.

Front Panel DI-710

These two ports are designated Digital Grounds

These two ports are Reserved

Digital Input/Output				DGnd	+5V	R	AGnd	Analog Channels							
0	1	2	3					1	2	3	4	5	6	7	8
4	5	6	7					9	10	11	12	13	14	15	16

+ Diff -

The 8 digital bits may be accessed through these ports. Each port is programmable as Digital In or Digital Out. Use Digital port 0 for Remote Start/Stop and Digital port 1 for Remote Event Markers.

These two ports are designated +5V Power Max Current = 100mA

These two ports are designated Analog Grounds

16 Analog Channel ports (8 differential) for analog input. The top row of channels (1-8) are designated positive differential and the bottom row of channels (9-16) are their negative counterparts.

DI-710 Series instruments can accept 16 analog inputs in single-ended configuration or 8 analog inputs in differential configuration. Single-ended inputs are configured by connecting one signal lead to the desired channel and the other signal lead to analog ground (AG). Be sure to read "CAUTION" on page v before connecting input signals.

Signal Ground

Signal +

Digital Input/Output				DGnd	+5V	R	AGnd	Analog Channels							
0	1	2	3					1	2	3	4	5	6	7	8
4	5	6	7					9	10	11	12	13	14	15	16
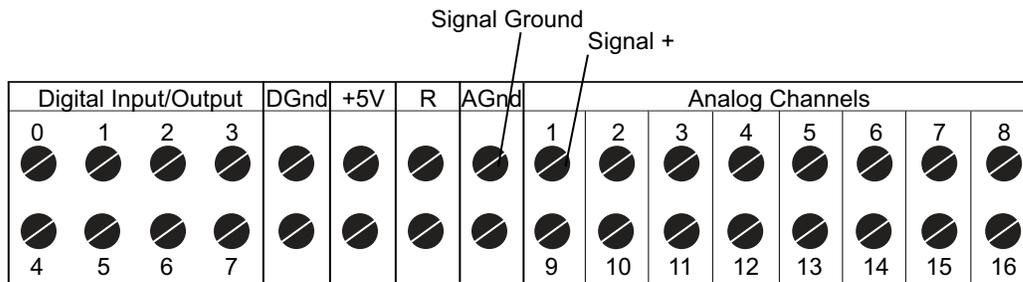
Channel 1 configured for single-ended input

Differential inputs occupy two channels with the lowest numbered channel in the pair assuming the positive (+) input and the channel number. Refer to the following for differential pairs.

differential pairs

positive differential channels

negative differential channels
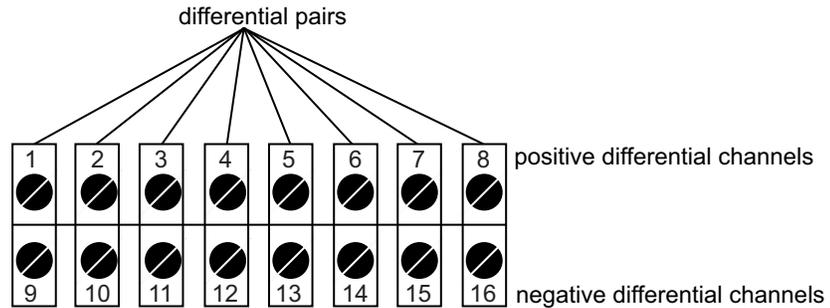
For example, to configure Channel 1 as a differential input: Connect Channel 1 as the positive (+) input and channel 9 as the negative (-) input—the pair is referred to as "channel 1 differential." The following illustration shows channels 1 and 9 configured as channel 1 differential.

Channel 1 configured for differential input
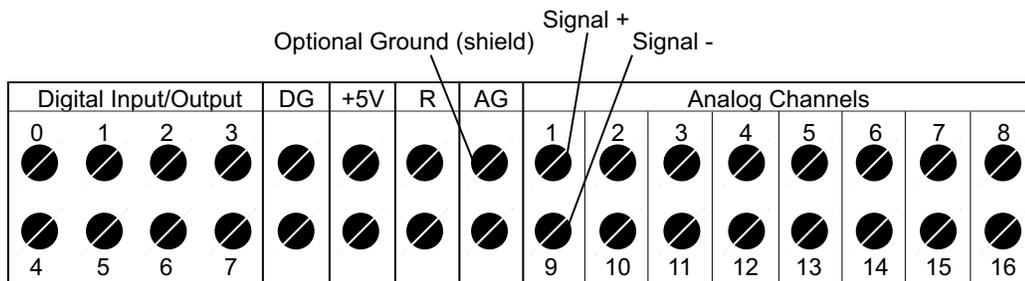
37-pin D sub connector

The two removable 16-port screw terminal blocks may be replaced by a 37-pin D Sub Connector for all DATAQ Instruments DI-710 Series products (add a "D" to the model number). Refer to the following diagram for pin out.
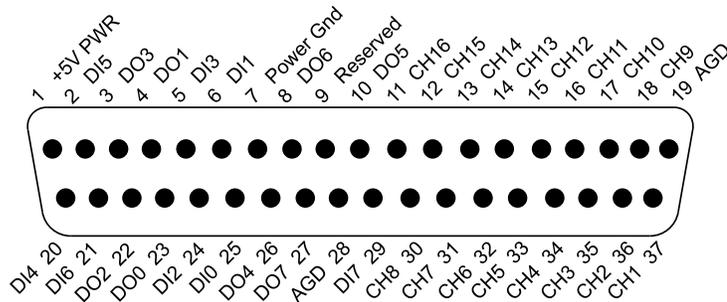
Note: Digital I/O connections cannot be used concurrently. DI0 and DO0 are directly connected inside the DI-710 (as are DI1 and DO1, DI2 and DO2, etc.).

Refer to "7. Accessories" for accessories that can be used with the 37 pin D sub connector.

DI-715B Models

The clear acrylic front panel allows easy identification of all installed DI-5B modules. To access the 5B backplane remove the front panel and bezel by removing the two outside screws. When reattaching the front panel be sure not to overtighten the screws.

1. Remove front panel and bezel by removing the two screws.
2. DI-5B Modules are installed to the 5B backplane using the set screw.

DI-5B modules are installed on (or removed from) the socketed 5B backplane and are secured with a non-removable mounting screw. Each channel position is labeled "CHANNEL 1," "CHANNEL 2," etc. on the socketed backplane. The DI-5B modules can be mixed or matched in any combination suitable for the application and are identical in pinout and size, so it doesn't matter which module gets plugged into which channel position.

Instrument Rear Panel

DI-710 Models

The Rear panel of your DI-710 Model can vary depending on your model. Stand-alone models add a removable storage slot, the LED Mode table, and a Control Button.

Rear Panel of DI-710
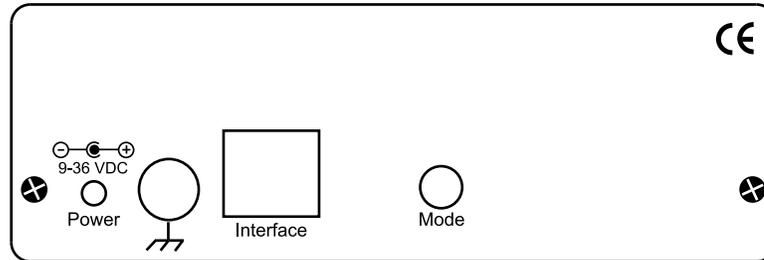
Rear Panel of DI-710 Stand-alone Models

Modes	Static	Slow	Fast
Red	N/A	Record	Close
Green	Stby	Busy	
Orange	Error		
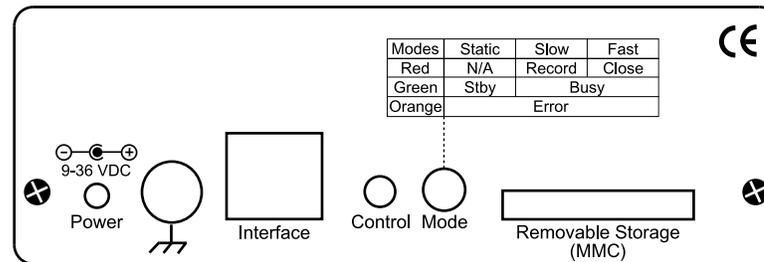
See "Controls and Indicators" on page 25 for a full explanation of each component.

DI-715B Models

The Rear panel of your instrument can vary depending on your DI-715B model. DI-715B stand-alone models add a removable storage slot, the LED Mode table, and a Control Button.

Rear Panel PC-connected
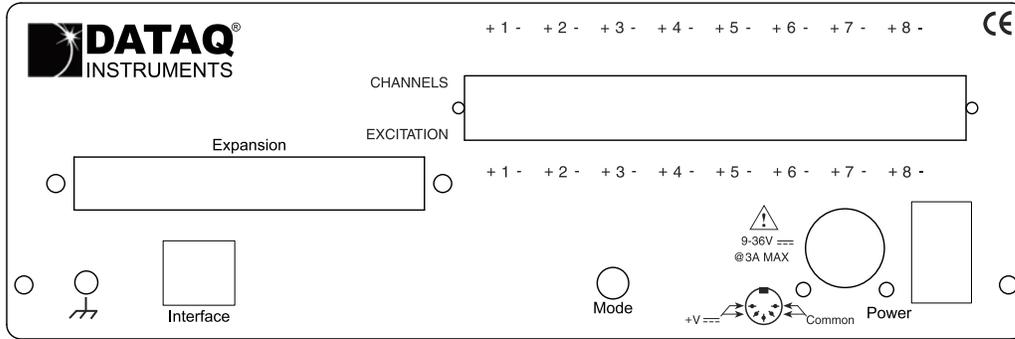
Rear Panel Stand-alone
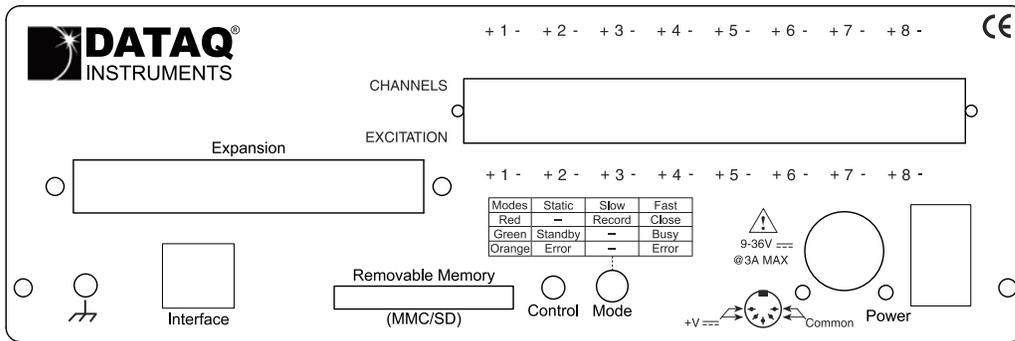
Channels 1-8 and corresponding Excitation connections can be made directly to the removable screw terminal block located on the rear panel of the instrument. All connections are clearly labelled for easy reference. Connect each signal lead to the appropriate screw terminal.
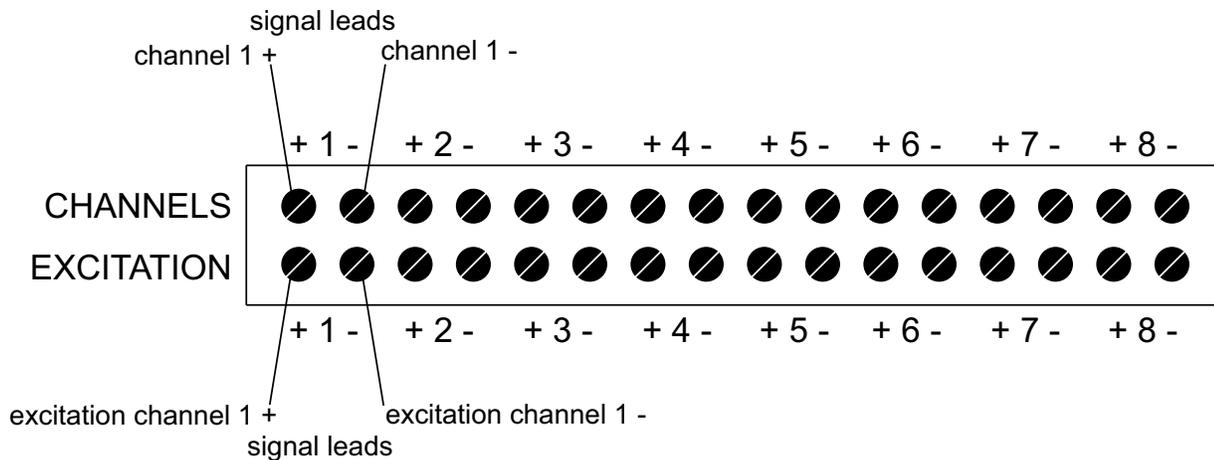
Connecting Signals

Use the removable screw terminal blocks to connect your signals.

1. Insert the stripped end of a signal lead into the desired terminal directly under the screw.

2. Tighten the pressure flap by rotating the screw clockwise with a small screwdriver. Make sure that the pressure flap tightens only against the signal wire and not the wire insulation. **Do not over-tighten.**

3. Tug gently on the signal lead to ensure that it is firmly secured.
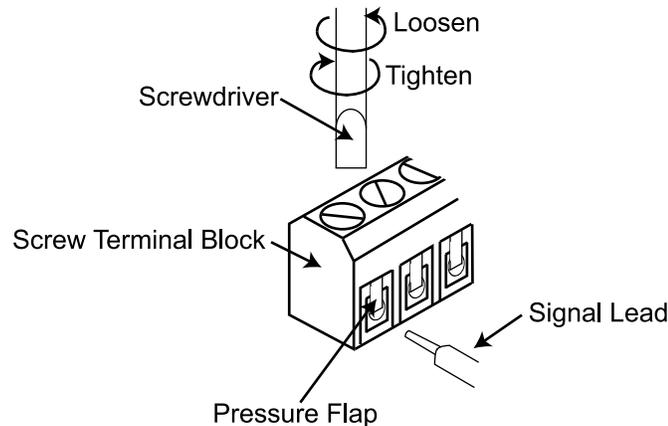
When an input signal is connected and WINDAQ Acquisition software is run, WINDAQ's real time display immediately reveals the input waveform on your computer's monitor.

Controls and Indicators

Expansion (DI-715B Models)

The Expansion connector may be used to access channels 9-16 by connecting either a DI-705 (adds up to 8 direct inputs) or a DI-75B (adds up to 8 5B signal conditioned inputs). The Digital I/O may also be accessed through the Expansion connector using a DI-705. See "The DI-705" on page 40 for more information.

Power Input Jack

For Ethernet models and Stand-alone models. Power must be applied with the included power adapter or with an alternate appropriate source (9-36 VDC, 2 watts max). External power is not required for DI-710-UH and DI-710-UL models—Power is derived through one of your PC's USB ports or through a powered USB hub. If using an alternate power source with the DI-715B refer to the following for pin out.
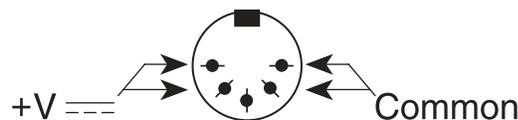
Power Switch (DI-715B Models)

Switches power on/off. If power is on the Mode LED will be on.

Ground

This ground lug should always be connected to a solid chassis or earth ground. This connection is mandatory for the unit to meet CE guidelines.

Interface Port

The Interface port allows you to connect the instrument to your PC via USB or Ethernet cable.

Control Button (Stand-alone Models)

The Control Button can be used to stop or start recording data to your memory card (SD) when using the instrument as a stand-alone data logger. The Control Button can also be used to reconfigure the instrument to factory default settings and to re-format memory card files left open due to power failure or other circumstance. The Control Button is inoperable while running WINDAQ Acquisition software.

Start Recording

To Start recording data to your memory card the Instrument must be in Standby Mode (Mode LED is Green). Press and hold the Control Button until the Mode LED turns off (about 1 second). Release the Control Button. The Mode LED will rapidly blink green to indicate the instrument is creating a new file. When the Mode LED slowly blinks red, data is being recorded. Each subsequent recording session creates a new file (numbered sequentially).

Stop Recording

To Stop recording data to your memory card the Instrument must be in Record mode (Mode LED is flashing red @ 1 Hz). Press and hold the Control Button until the Mode LED turns off (about 1 second). Release the Control Button. Mode LED will rapidly blink red to indicate the instrument is closing the data file for use with playback and/or analysis software. Do not remove the memory card before the instrument completely closes the file. When Mode LED turns green the memory card may be removed. Removing the card before completion will cause Error Mode (Mode LED is orange).

Note: SD cards should be locked before inserting into a card reader. Your PC may try to change the flash card format whenever it reads the data on your SD card (if not locked), causing it to lose the unique formatting required for DI-710 and DI-715B use. If the unique format used by the DI-710 or DI-715B is modified, the data logger may require you to reformat the memory card.

Formatting the Memory Card

Formatting the card completely removes all data. To format your memory card the instrument must be in Standby Mode (Mode LED is Green). Press and hold the Control Button until the Mode LED turns red (about 5 seconds). Release the Control Button. The Mode LED will blink red to indicate the Instrument is formatting the card. When the Mode LED changes back to green, formatting is complete. Mode LED should be green to indicate successful completion. Formatting is for use with the instrument used to format the card. To use a memory card with a different instrument you will have to reformat the card.

Reconfigure Instrument

To configure your instrument to the default factory data acquisition session settings press and hold the Control Button during power up (i.e., while plugging the instrument in). Mode LED will flash bright green then dim to indicate that the instrument is configured. Release the Control Button. The default settings are: 16 channels enabled as single-ended inputs; 300 samples per second per channel sample rate; gain setting of 1 for each channel.

Fix Errors

The Control Button can also be used to fix some common operating errors. When the instrument is in Error mode, some action must be taken to fix the error before you can use it. Generally, the Control Button can be used to make the instrument operational. See the Error mode in "Mode LED Indicator" on page 27 for more information.

Mode LED Indicator

Indicates what mode the instrument is currently in. Use the chart on the rear panel of the instrument for quick reference. Use the table provided below for a more detailed description of each available state.

State	Mode	Description
Stand-alone data logger operation		
Static Green	Standby	Instrument is powered and available for data acquisition operations. Memory card may be safely removed.
Flashing Green	Busy	Indicates the instrument is busy. **Do Not Remove Memory Card.**
Orange	Error	Possible errors include, but are not limited to: **SD removed prematurely:** Memory card removed before the instrument had a chance to close the data file. Reinsert the card and Press the Control button to close the file. When steady green, memory card is closed and can be removed safely. **SD Lock:** After initially pressing the Control button to begin recording data, two series of blinking Orange before reverting back to Green indicates that the memory card is locked. Use another card or unlock the current one. One series of blinking Orange before reverting back to Green indicates that the memory card is incompatible for use with the instrument. Use the recommended memory card available through DATAQ Instruments, Inc. See also "Troubleshooting" on page 33.
Slow Flashing Red (@ 1Hz)	Record	Indicates the instrument is acquiring and recording data to your memory card. **Do Not Remove Memory Card**.
Fast Flashing Red	Close	Indicates the instrument is closing the recording session. **Do Not Remove Memory Card**. Each recording session must be completed before removing the card.
PC-connected operation		
Slow Flashing Red (@ 1Hz)	Record	Indicates the instrument is running and acquiring data for display and/or recording to disk. Occurs when WINDAQ Acquisition is running.
Green	Standby	Indicates WINDAQ has been deactivated and the instrument is in Standby Mode. The Mode LED Indicator will also flash green just before recording to disk to indicate initialization.

Removable Storage Slot (SD) (Stand-alone Models)

Use any standard Secure Digital Card (SD) from 16MB to 2GB. Push card completely into slot. Press to release (eject) memory card when recording is complete. Please note that some memory cards may not be fast enough for the instrument. SD memory cards are available through the DATAQ web site (www.dataq.com) as are SD card readers (manufacturer varies).

Installing a Shunt Resistor in DI-715B Models

To use the Current Input Modules (DI-5B32 and DI-5B42) you must install a shunt resistor (provided with purchase of 5B module) for accurate readings. To install a shunt resistor:

1. Remove the clear front panel and bezel by removing the two screws.

2. Pull the casing apart from the rear panel until the shunt resistor receptacles are exposed.

3.   Insert the shunt resistor to its receptacle by lining up the pegs and pressing it onto the circuit board firmly. The shunt resistor receptacle for each channel is directly behind the slot on the 5B backplane for that channel.

4.   Reassemble the DI-715B. Do not overtighten the front panel screws.

Insert pins into the holes pro-
vided. Press resistor firmly
onto the circuit board.

DI-5B
Backplane

Install Shunt Resistor
for Channel 1 Here

Casing

Rear Panel
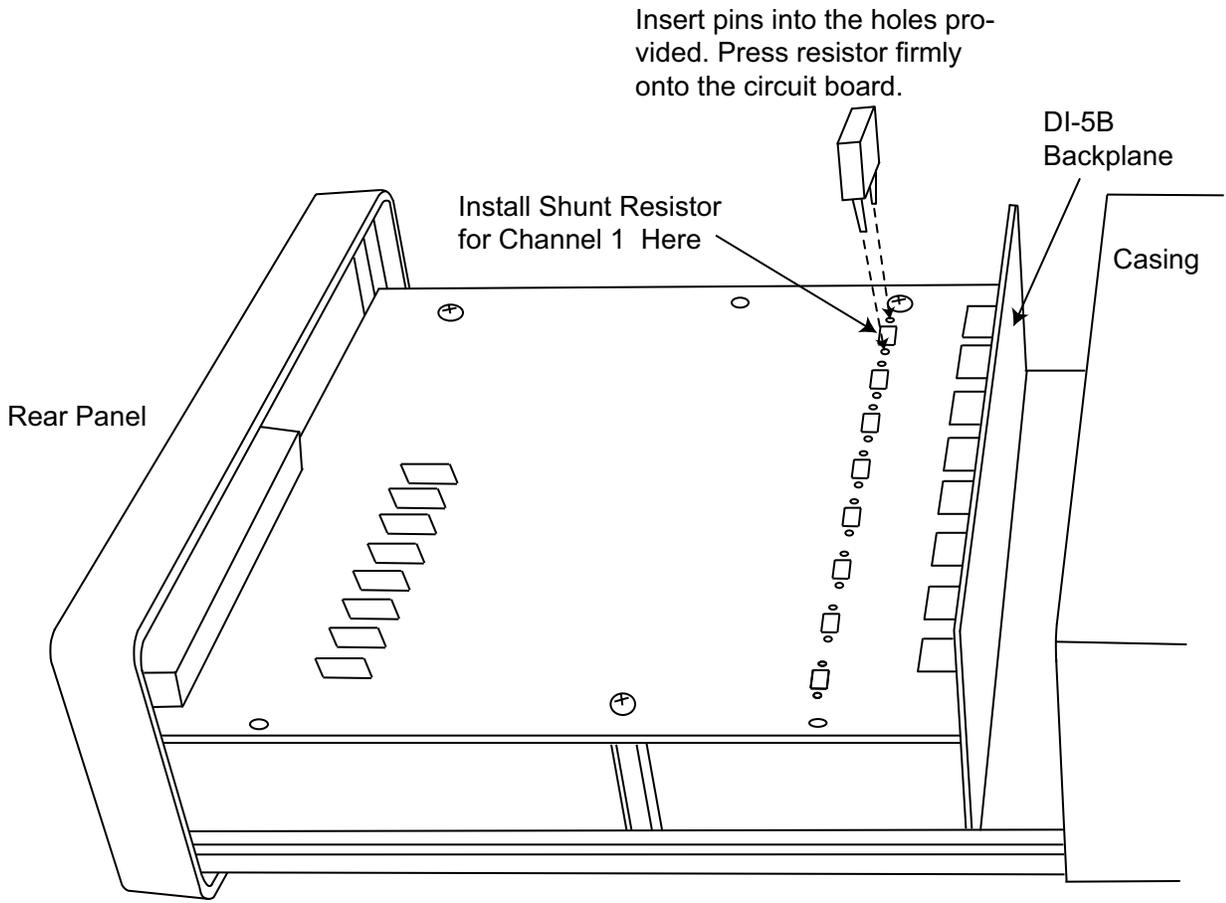
5. Operation

PC-connected Models

PC-based models (non-Stand-alone) are operated and controlled using WINDAQ Software. To begin displaying data on your monitor, make sure all wires and cables are properly connected and start WINDAQ Acquisition by pressing the **Start WINDAQ button** in the Dataq Instruments Hardware Manager (see "Dataq Instruments Hardware Manager" on page 16). After data is recorded, use WINDAQ Waveform Browser to review your data. Consult the context-sensitive help files or your Fast Start WINDAQ Software Manual for directions on using the WINDAQ software package. *Note: If your USB module experiences frequent lock ups connect the Ground Lug to your PC ground. If the problem persists please contact Technical Support.*

### *Enabling/Disabling the Digital I/O and Remote Control*

To use the Remote Control features in WINDAQ Acquisition Software Channel 1 or Channel 17 **must** be enabled as the Digital Input channel. In order to use all 16 analog input channels, Channel 17 may be enabled for general purpose digital I/O functions. The direction of the digital bits must be set in the DATAQ Instruments Hardware Manager using the Digital I/O Setup command. The default state from the factory is that all digital bits are set as Inputs with a High signal (+5V).

Channel Configuration for the DI-715B

Enabling and configuring channels with the DI-715B in WINDAQ Acquisition software is different than enabling channels with other instruments and is not covered in the Help Files.

Enabling Channels

Use the Channel Selection grid to enable and configure channels. Access the channel selection grid by selecting **Channels…** in the **Edit** menu (in the SET-UP operating mode of WINDAQ software). Each box in this grid represents an input channel. An input channel is enabled by clicking in its channel box. The following channel selection grid is typical for a DI-715B. Channels 1 to 8 are the signal conditioned inputs. Channels 9 to 16 are direct inputs accessible only using a DI-705. Channel 17 may be enabled as Digital but must be accessed using a DI-705 as well (see also "The DI-705" on page 40). To use the Remote Control Functions of WINDAQ Acquisition software Channel 17 or Channel 1 *must* be enabled as the Digital Input Channel.
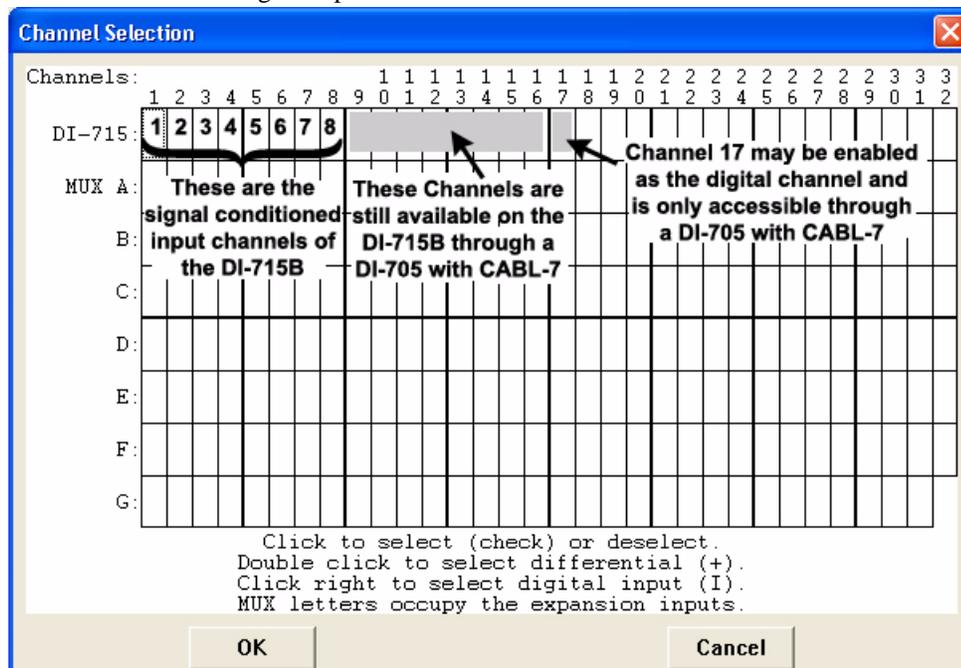
Calibration and Gain Settings

Each DI-5B module has a sticker on it with information regarding Input (Units) and Output (Volts). This information should be used for calibration. For example, if using a DI-5B47K-13, the Input is -100ºC to +1350ºC and the Output is 0V to +5V.

High/Low Calibration

Use the following diagram as a guideline for the High/Low calibration method.
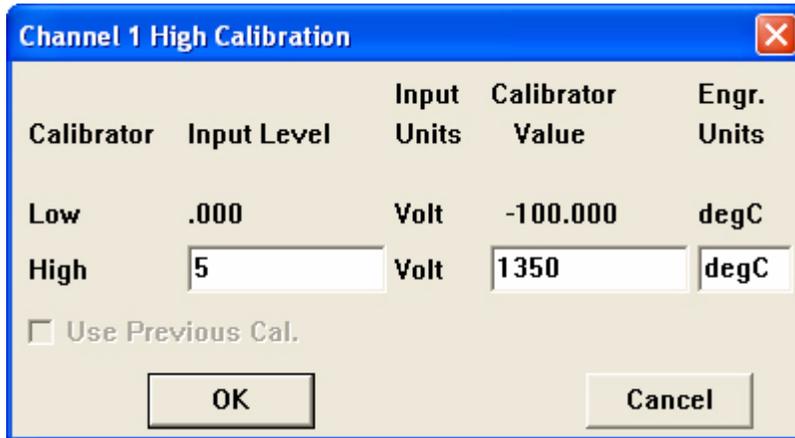
Gain should be set to 2, 4, or 8 for better resolution depending on your actual input range. Note that the Low Calibration information is included in the High Calibration dialog box for easy reference. If the High Calibration is entered first, that information would appear in the Low Calibration dialog box.

Fixed Calibration

Use the following diagram as a guideline for the Fixed calibration method.
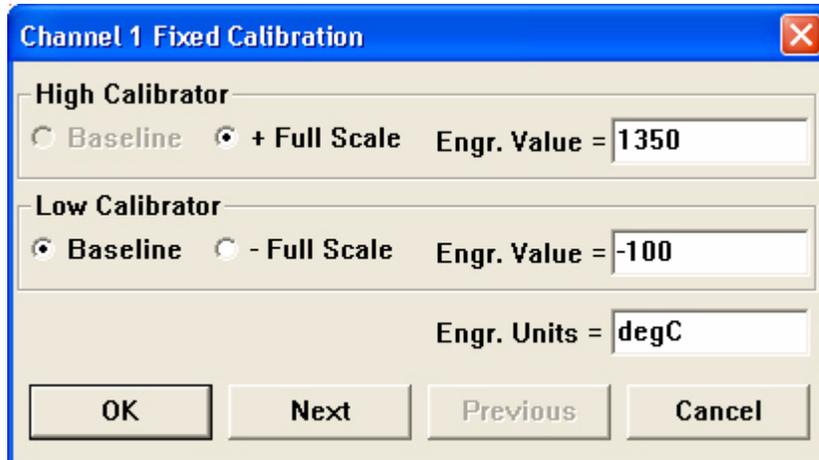
Since the Lowest end of the input range is 0 Volts, select the **Baseline** option for the **Low Calibrator**. Gain should be set to 2, 4, or 8 for better resolution depending on your actual input range.

Gain

DI-5B Modules generally output between -5 and +5 Volts. The DI-715B is designed to accept ±10 Volt signals. A Gain of at least 2 should be set to each signal conditioned input to get the most accurate readings. To change the Gain click on **Channel Settings...** in the **Edit** menu.
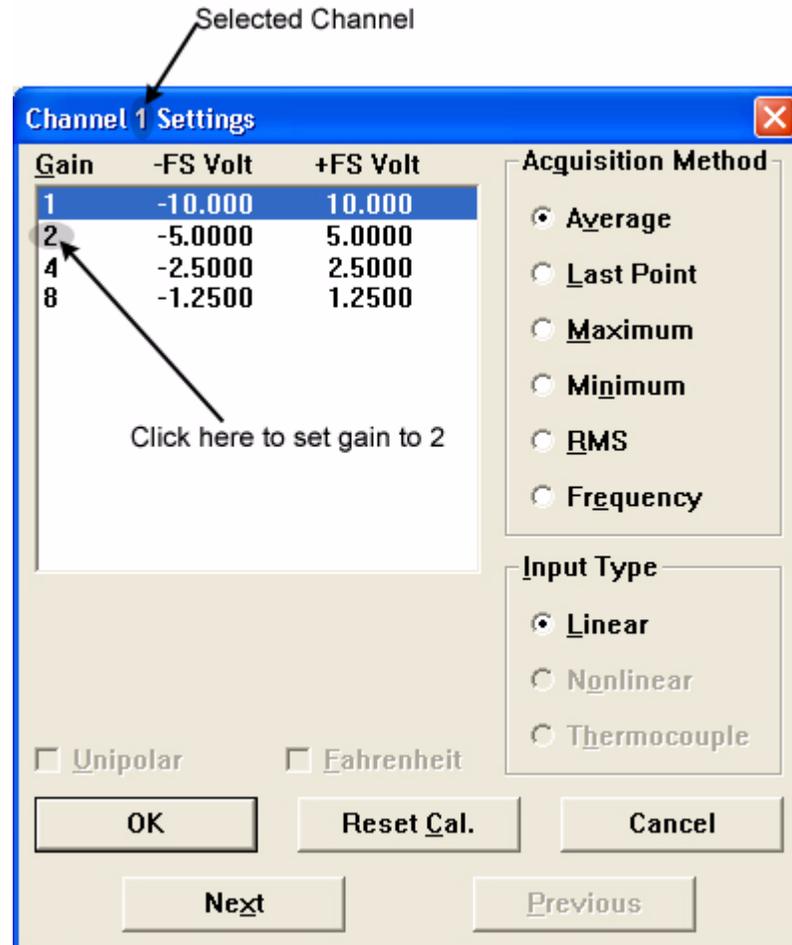
Stand-alone Models

Stand-alone Models can record data directly to a Secure Digital Card (SD) as well as record data to a PC. When connected to a PC, data recording sessions may be configured and data may be acquired using WINDAQ Acquisition software (just the same as if the model were a PC-based instrument). This makes all the features of WINDAQ Acquisition software available including triggering, user annotation, user commented event markers, appending, and stop/pause data recording (stand-alone data logger operation does not support these features).

When taking your stand-alone model out into the field to use as a stand-alone data logger, you can record data to an SD without the use of a PC. Data sessions can be configured for a specific job using the included configuration software (installed when WINDAQ is installed). All data recorded to the memory card is fully WINDAQ compatible and can be converted then reviewed and analyzed with WINDAQ Playback software.

PC-connected operation

The DI-710 or DI-715B Instrument enters PC Operation Mode when the instrument is connected to the PC and the user initiates WINDAQ Acquisition software. As soon as PC Operation Mode is entered, the Control button is deacti-

vated and all the features of WINDAQ Acquisition Software are accessible. Consult the context-sensitive help files or your Fast Start WINDAQ Software Manual for directions on using the WINDAQ software package.

Note: When running WINDAQ Acquisition software over the internet, unpredictable latencies may occur, especially at higher sample rates. The unit generally will continue to acquire data after a latency - but there will be gaps in your data.

Networked operation as a data acquisition server

The Ethernet option allows data access from anywhere on a local area network (LAN) or DHCP server. A DI-710 or DI-715B configured for Stand-alone operation *and* an Ethernet interface transparently becomes like any other computer on the network, able to share data whenever and wherever it is needed. This can be over the LAN to a PC on the other side of the facility, or over the Internet to a PC on the other side of the world. Furthermore, Stand-alone instruments can be easily added to existing networks. Its server functionality means that it does not require a dedicated network to operate efficiently. Data is locally stored to SD memory, where it is available for upload (using the Uploader software) only on demand and as network bandwidth permits. In this manner, Stand-alone instruments with Ethernet interfaces are fully compatible with the intrinsic non-preemptive nature of Ethernet networks.

Stand-alone data logger operation

Use your Stand-alone model as a stand-alone data logger to record a WINDAQ-compatible waveform file onto a Secure Digital Card (SD). After recording, insert the memory card into your card reader to access the data file. The data file can then be opened with WINDAQ Waveform Browser Software for SD allowing analysis and review features. See "WinDaq Waveform Browser for SD" on page 35 for more information regarding WINDAQ Waveform Browser for SD software.

Data may be recorded using a circular FIFO memory configuration allowing you to record data nearly indefinitely or in a non-circular configuration allowing you to stop recording when your memory card is full. Select the desired memory configuration using the Stand-alone Set Up software inside the Dataq Instruments Hardware Manager.

Note: SanDisk SD memory cards have a lifetime expectancy of about 100,000 write actions. Each time data wraps you will use one write action; each singular data file uses two write actions (start and stop). If used properly a memory card will last years. See your memory card's specifications to determine lifetime expectancy.

The Stand-alone Set Up Panel

The Stand-alone Set Up software (installed with WINDAQ—accessible in the WINDAQ program group through the Dataq Instruments Hardware Manager) allows you to customize each data recording session before taking the instrument out into the field. The default settings (i.e., if you do not configure the instrument) are 16 single-ended channels enabled at 300Hz sample rate and a gain of 1. The default configuration can be reset at any time on the instrument by holding the Control button in when applying power. Context-sensitive Help is provided within the configuration software. Press F1 to access Help topics related to the currently displayed feature. You must run the software with the device properly installed and connected to your PC.

Operation

To use your instrument as a stand-alone data logger follow these steps:

1. Configure the Instrument using the Set Up software or by re-setting to the default (See "The Stand-alone Set Up Panel" above).

2. Connect signal leads (See "4. Instrument Controls, Indicators, and Connections" on page 19.).

3. Apply Power to the instrument using the supplied Power Cable.

4. Insert the Secure Digital Card (SD) into the Removable Storage Slot.

5. If the memory card has not been used with your instrument, format the memory card to begin recording data. See "Formatting the Memory Card" on page 26.

6. To Record Data to memory card: Press and hold the Control Button until the LED light turns off; release the Control button to initiate the recording session—initialization could last up to 30 seconds depending on memory card used. For Ethernet models you may also use the Start Recording to SD Memory command in the DATAQ Instruments Hardware Manager. This creates a new file numbered sequentially on the memory card. See also "Start Recording" on page 26.

7. To Stop Recording Data to memory card: Press and hold the Control Button until the LED light turns off; release the Control button to end the recording session and close the data file. It could take up to 30 seconds to close the file depending on the memory card used. For Ethernet models you may also use the Stop Recording to SD Memory command in the DATAQ Instruments Hardware Manager. See also "Stop Recording" on page 26.

8. Access SD data using the uploader software provided in installation (Ethernet models) or by removing the memory card and using a card reader. Data files open in WINDAQ Waveform Browser for SD (see "WinDaq Waveform Browser for SD" on page 35).

Note: To read the data files, SDs should be locked before inserting into a card reader. If the SD is not locked, Windows may modify the file system and the SD will be unreadable to your instrument requiring you to reformat the card. some cards may require you to reformat every time you review the data.

Troubleshooting
Use the following chart for errors and resolution.

Problem	Possible Cause(s)	Resolution
When attempting to initiate a recording session the LED blinks green for about 5-10 seconds then quickly blinks orange then back to green.	Memory card not inserted.	Press memory card firmly into the slot until you hear a slight "click" to indicate proper insertion.
When attempting to initiate a recording session, LED blinks orange, then turns green.	SD is locked (write protected).	Unlock the SD Card
	Memory card is full.	Reformat the memory card.
	Memory card is unusable or damaged.	You need a new memory card
Recording is initiated but only runs for a short time when LED blinks orange and stays orange.	Memory card read/write speed in SPI mode is too slow to record data as specified.	Try lowering the sample rate first. If problem persists purchase a new card (recommended: Lexar Professional 133X 2 Gigabyte Secure Digital Flash Memory).
Recording is initiated in Circular Memory configuration, but when the file attempts to wrap, the LED blinks orange and stays orange.	Memory card read/write speed in SPI mode is too slow to record data in circular memory configuration.	
LED is green but I cannot format a memory card.	The instrument is looking for a file that has not been closed (possible due to power failure).	Reinsert the correct memory card and press the control button for about 1 second (until LED turns off) and release. The instrument gives you three chances to find the correct file, if it does not you must format whatever card is there to begin a new recording session.

Mode LED will not change from error state (orange).	This can be caused by switching memory cards during a power failure without giving the instrument a chance to close the data file.	Remove the memory card and unplug the device. Restore power to the device (LED should turn green). Press and hold the control button for about 1 second (until LED turns off) and release. If LED is orange, press it again. When LED turns green reformat your memory card.
When memory card is inserted into a reader a "not formatted" error is seen.	Dependent upon the reader being used.	Sometimes the driver for an SD card reader appears "dead." Reboot your PC.
When attempting to read the memory card using a card reader, the PC takes an interminably long time to open the data.	Dependent upon the memory card, card reader, and the PC you are using. The amount of time it takes to open the card will vary.	Using the Lock feature on an SD could speed up the process. Be sure to try that before purchasing new equipment.
After viewing data files through a card reader, upon initiating a recording session, the LED blinks orange then turns green.	The instrument has a unique file system. When the data on the memory card opens in Windows, sometimes Windows will modify the file system.	You must reformat the card. To prevent further instances of this error, use the Lock provided on your SD card. Some cards require you to reformat the card with each subsequent use.
When attempting to read the memory card using a card reader, the data file is huge (completely fills up the memory card) and the actual waveform data is difficult to find.	The instrument did not have a chance to properly close the file.	If you have not started using the instrument with a different memory card, reinsert the card and press the LED for about 1 second (until LED turns off) and release. The LED should be green indicating the file is closed and can be read. If you have already configured and used the instrument again, the file can no longer be closed and you will have to search for it and cut/paste the data into a new file.

If power down occurs unexpectedly while recording to SD

The Stand-alone models have a built-in file protection feature. If power is lost while recording, all data—prior to up to 255 samples from the power failure—is available. If power is lost for any reason, the data file will be closed and saved and a new data file will be started when power is restored (Mode LED will flash red @ 1 Hz) if that option is selected in the Hardware Manager Stand-alone setup.

If the memory card is full, the Mode LED will quickly flash orange and then green and will not record new data until reformatted. Circular memory configuration may still be used if the memory card has not started to wrap the data (i.e., as long as the card is not full) and will only wrap data in the available space.

When recording at low sample rates be aware that the memory card must acquire 256 samples before it actually commits them to memory. For example, if you are recording one channel at 1 sample per second and power down occurs

unexpectedly, you could lose up to 255 seconds (4 minutes and 15 seconds) of data (255 samples). Use the following formula to determine the maximum amount of data loss at power failure.

$$\frac{255}{\text{Throughput Rate}} = \text{Seconds of data that COULD be lost}$$

Note: Switching memory cards before power is restored is not suggested because the data logger will automatically attempt to close the file. Leave the memory card in until power is restored, then allow the instrument to close the data file. After a new file has begun, stop recording. The memory card may now be removed and read for analysis.

WINDAQ Waveform Browser for SD

All files recorded in Stand-alone data logger operating mode (data saved to SD—.wdc files) must be reviewed in WINDAQ Waveform Browser for SD. Data files recorded using WINDAQ Acquisition software (PC operation—.wdq files) must be reviewed in the standard WINDAQ Waveform Browser. Even if connected to a PC, WINDAQ Waveform Browser cannot eavesdrop on the data being recorded to your memory card. Recording must be stopped and the file must be closed to review the data.
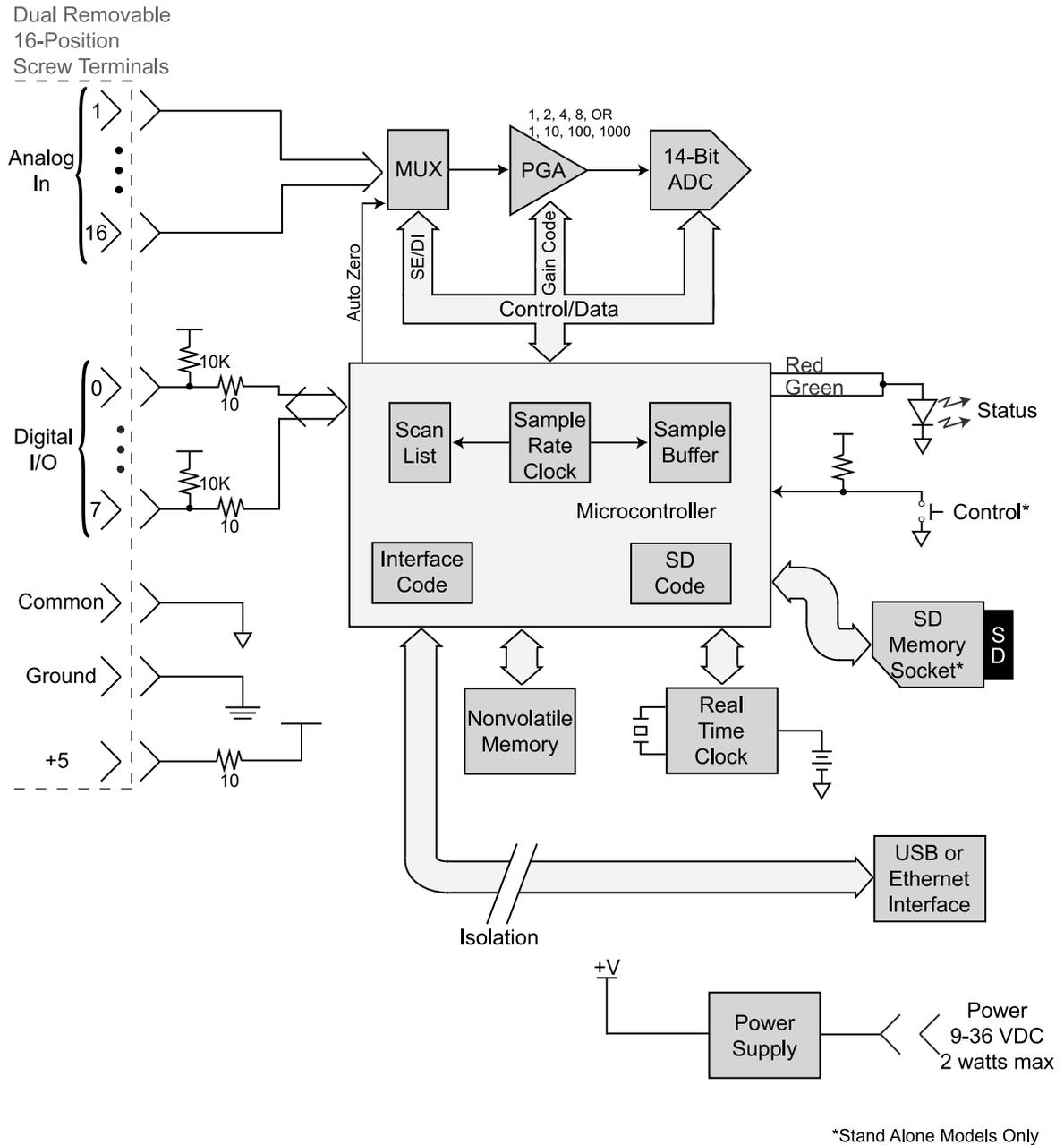
DI-710 and DI-715B stand-alone data loggers place 256 equally-spaced event markers into all data files when recording to SD. This allows easier navigation through larger files. Click on **Event Markers** in the **View** menu to access and "jump to" each of these event markers.

The **Calculate** command in the **File** menu is unavailable in WINDAQ Waveform Browser for SD. Use the **Save As...** command in the **File** menu to save data to another format in order to perform Advanced CODAS calculations (**File** > **Save As...** > option **8) CALC** is still available). Converting data from a .wdc format to a .wdq format is also possible with **File** > **Save As...**. Choose option **2) Binary (with CODAS header)** and enter a file name with .wdq as the extension. For more information regarding the Save As... function, consult your WINDAQ Waveform Browser Help File.

A stand-alone data file acquired with remote events or storage enabled displays an hourglass when opening while it scans for event marks and timestamps in order to construct an Event Marker table. Use File Save or the "Save All" button when changing files or exiting to write the Event Marker table to the file and avoid a delay when the file is opened again.

6. Block Diagram

DI-710 Models

*Stand Alone Models Only

DI-715B Models

7. Accessories

The DI-705

The DI-705 can be used with DI-710 "D" models (see "37-pin D sub connector" on page 21) and with DI-715B instruments.

Using the DI-705 with DI-710 "D" Models

The DI-705 plugs into the 37-pin D sub connector of the front panel of DI-710 "D" models and provides convenient screw terminal access to analog inputs, analog outputs, and the Digital I/O. ***Note:*** *The digital I/O is not available in stand-alone mode.* The screw terminals accept 16-22 gauge wire and each is silk-screened with the corresponding "D" connector pin number (see "37-pin D sub connector" on page 21). The DI-705 also features a 37-pin male "pass-through" connector, which allows you to connect our BNC cable (model number CABL-4), or our 5B back plane cable (model number CABLE-1), or any 37-pin DAS-16 compatible cable to the DI-710 while still allowing screw terminal access.

"Pass through" connector.

Signal connections are made to the screw terminals.

Plugs directly into DI-710 "D" models.
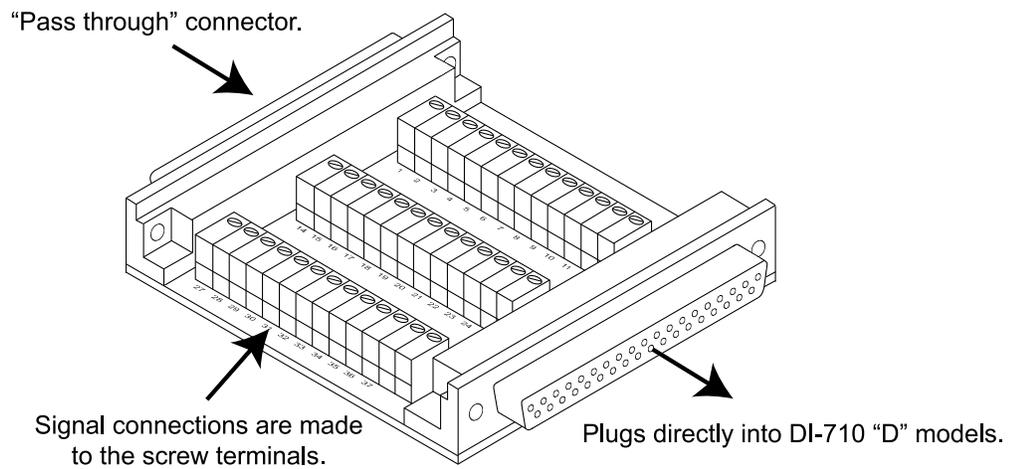
Any combination of single-ended or differential channels may be connected to the DI-705, but keep in mind a differential channel uses two analog inputs. Configure single-ended and differential channels on the DI-705 the same way as on the DI-710. See "Instrument Front Panel" on page 20 for more information.

Using the DI-705 with DI-715B Instruments

Plug the DI-705 into CABL-7 and connect CABL-7 to the EXPANSION port on the rear panel of the DI-715B to access the Digital I/O and analog channels 9-16. Digital I/O may also be accessed through a DI-75B channel expander using the EXPANSION OUT port on the rear panel of the DI-75B-7. The screw terminals accept 16-22 gauge wire and each is silk-screened with a pin number (below).

DI-705

Signal connections are made to the screw terminals.

CABL-7

Connect to EXPANSION on DI-715B or EXPANSION OUT on DI-75B.
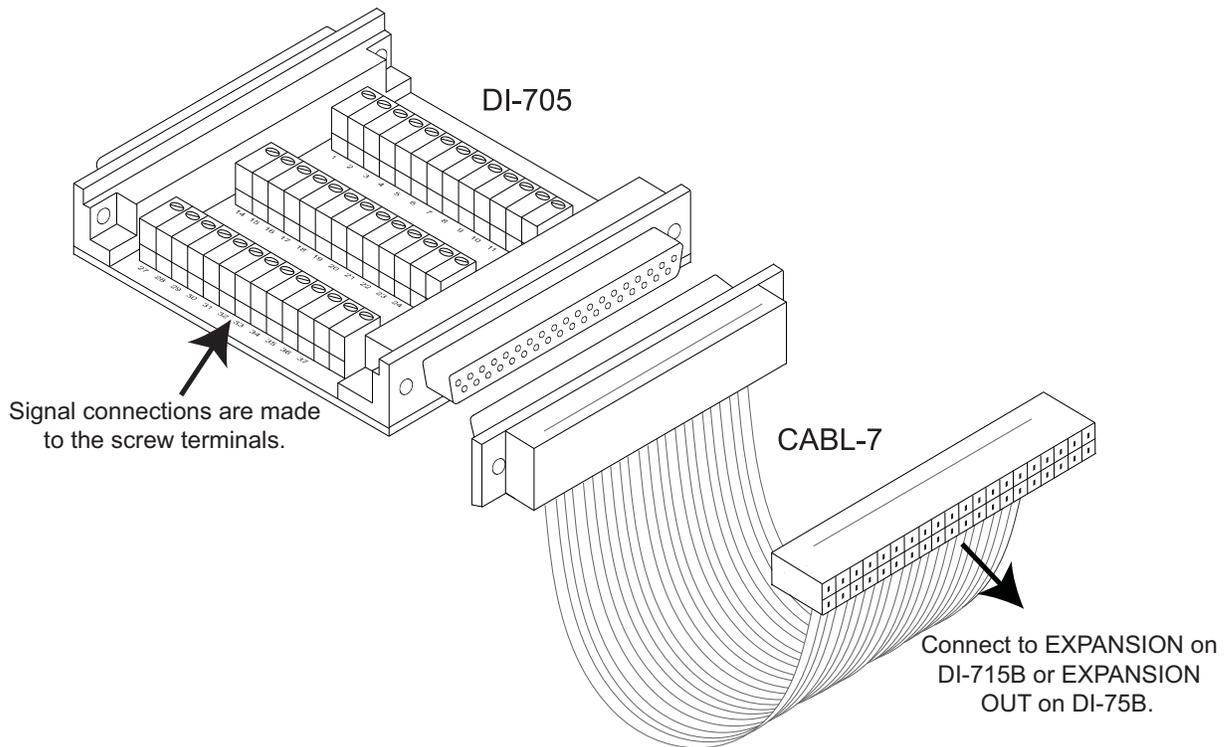
The DI-715B accepts single-ended inputs only. The Digital I/O may be enabled as Channel 17. *Note: The Digital I/O is not available in stand-alone mode.* Pinout for the DI-705 is as follows (screw terminal in **bold**).

1	N.C.	**11**	CH8	**21**	DI6	**31**	CH15
2	DI5	**12**	CH7	**22**	DO2	**32**	CH14
3	DO3	**13**	CH6	**23**	DO0	**33**	CH13
4	DO1	**14**	CH5	**24**	DI2	**34**	CH12
5	DI3	**15**	CH4	**25**	DI0	**35**	CH11
6	DI1	**16**	CH3	**26**	DO4	**36**	CH10
7	Power GND	**17**	CH2	**27**	DO7	**37**	CH9
8	DO6	**18**	CH1	**28**	AGD		
9	N.C.	**19**	AGD	**29**	DI7		
10	DO5	**20**	DI4	**30**	CH16		

Note: Digital I/O connections cannot be used concurrently. DI0 and DO0 are directly connected inside the DI-715B (as are DI1 and DO1, DI2 and DO2, etc.).

The DI-205 (for use with DI-710 "D" models)

The DI-205 is a termination panel for general purpose input and output. The DI-205 along with the supplied cable provides a convenient way to interface the Digital I/O, analog output, and analog input signals to DI-710 Series "D" models (see "37-pin D sub connector" on page 21). Signal connection is via terminal strip for digital and analog output signals, or 5-way binding posts (banana jacks) for analog input signals.

Input/Output Panel Interconnections

Model DI-205
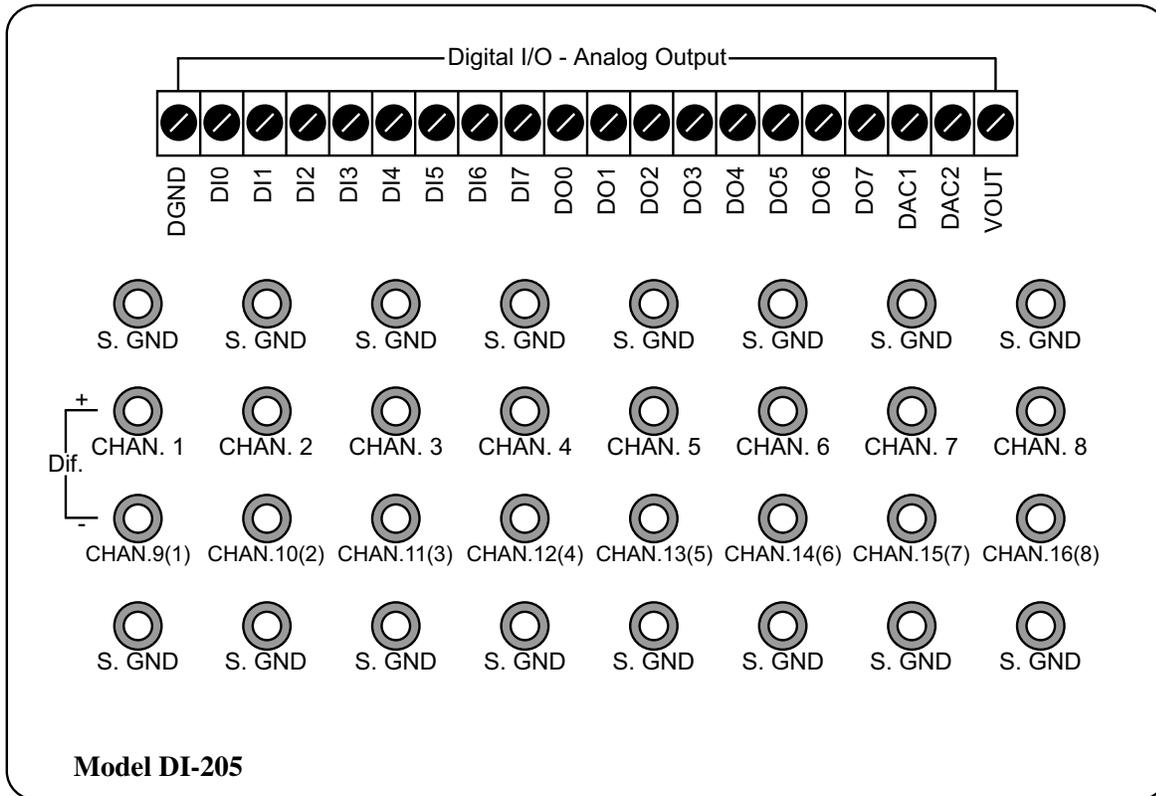
Digital I/O - Analog Output
The 20 position screw terminal block (labelled Digital I/O - Analog Output) provides access to the Digital I/O ports of the 37-pin D sub connector. ***Note: Digital I/O connections cannot be used concurrently. DI0 and DO0 are directly connected inside the DI-710 (as are DI1 and DO1, DI2 and DO2, etc.) The Digital I/O is not available in stand-alone mode.*** See "37-pin D sub connector" on page 21 for pinout.

DAC1 and **DAC2** are Reserved ports and should not be used.

VOUT connects to the +5VPWR pin. See "37-pin D sub connector" on page 21 for pinout.

Input Signal Configuration

Each DI-205 may be configured to connect to 16 single-ended or 8 differential channels. In addition, any combination of single-ended or differential channels may be applied. A differential channel is configured by using two single-ended inputs. Use the following illustration for input connections.
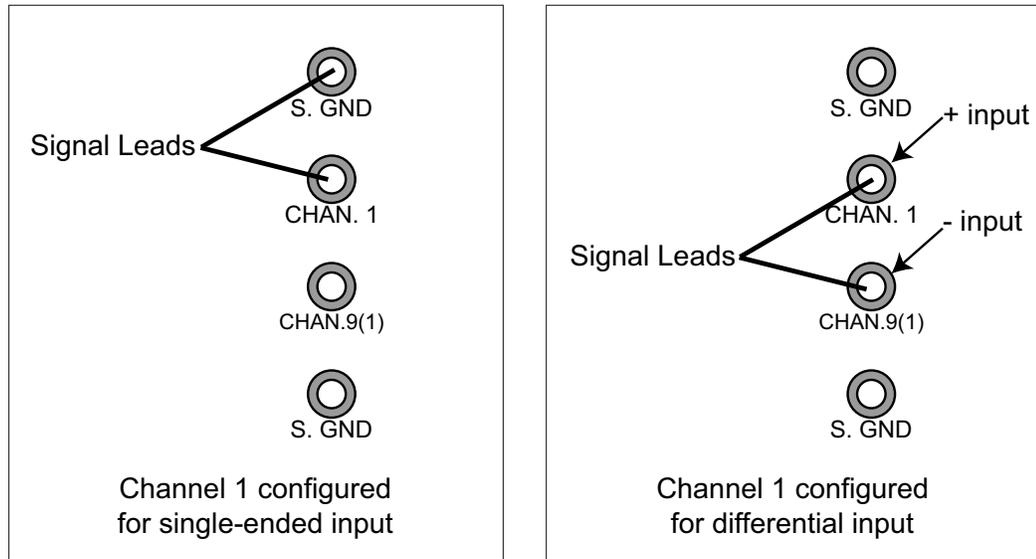
Note that when an input channel is configured for differential operation, the binding post associated with that channel's high (+) input assumes the channel number.

Connecting a Single-ended Amplifier

A single-ended amplifier is the most straightforward approach to connecting signals to the DI-205. However, to derive adequate performance, the use of a single-ended amplifier requires that the signal to be measured is relatively high level (greater than or equal to 1V full scale), and the distance from the signal source to the DI-205 is relatively short (less than 15 feet). Assuming these conditions exist, a single-ended amplifier may be connected according to the diagram below.
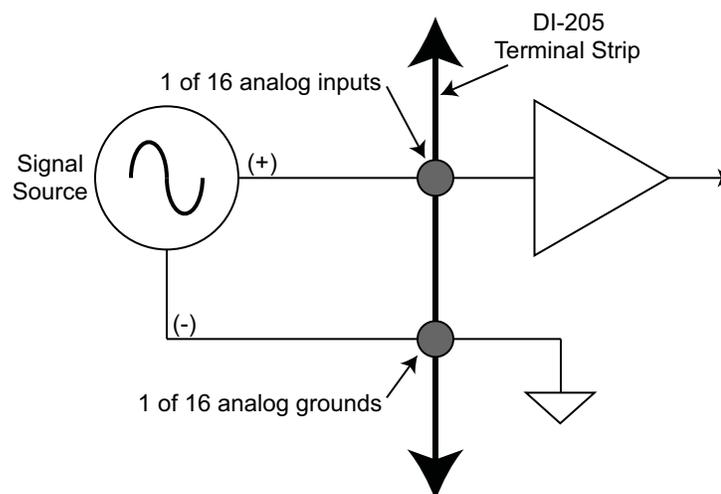
Connecting a Differential Amplifier

A differential channel configuration is a special case approach to signal measurement that should be used with all low-level measurements (less than 1v) or when the signal to be measured is located far away from the DI-205 (greater than 15 feet). When in a differential operating mode, the instrument sees the difference in voltage between the high (+) and low (-) inputs. Differential amplifiers have the advantage of reducing common mode voltages (those appearing simultaneously and in phase on both inputs). This capability may be leveraged to greatly reduce noise riding on a signal of interest.

Two signal measurement conditions govern the configuration of a differential channel input: The signal to be measured is ground-referenced; or the signal to be measured is isolated from ground.

Ground-referenced Signal Sources

A ground-referenced signal source is one with a local ground that may not be (and probably is not) at the same potential as the computer's ground. This potential difference between signal ground and computer ground is referred to as a common mode voltage and is caused by a number of different factors.

Ground Potential Difference
(Common Mode Voltage)
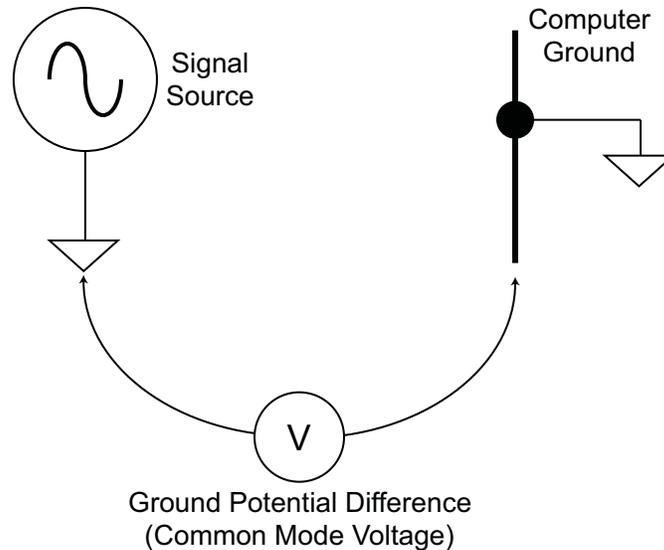
The most common of these is different physical locations of the computer and signal ground points. Since wire is not a perfect conductor (exhibiting zero resistance regardless of length) a voltage drop, however small, will always be

present. The differential amplifier is unique in its ability to measure signals originating from sources with different ground potentials relative to the computer **provided it is connected properly**.

WRONG APPROACH

Circulating currents in signal shield induce noise on signal of interest.

DI-205 terminal strip

Signal Source

Signal Lead Shield

Differential Amplifier

+

-

gnd

Ground loop caused by circulating currents.
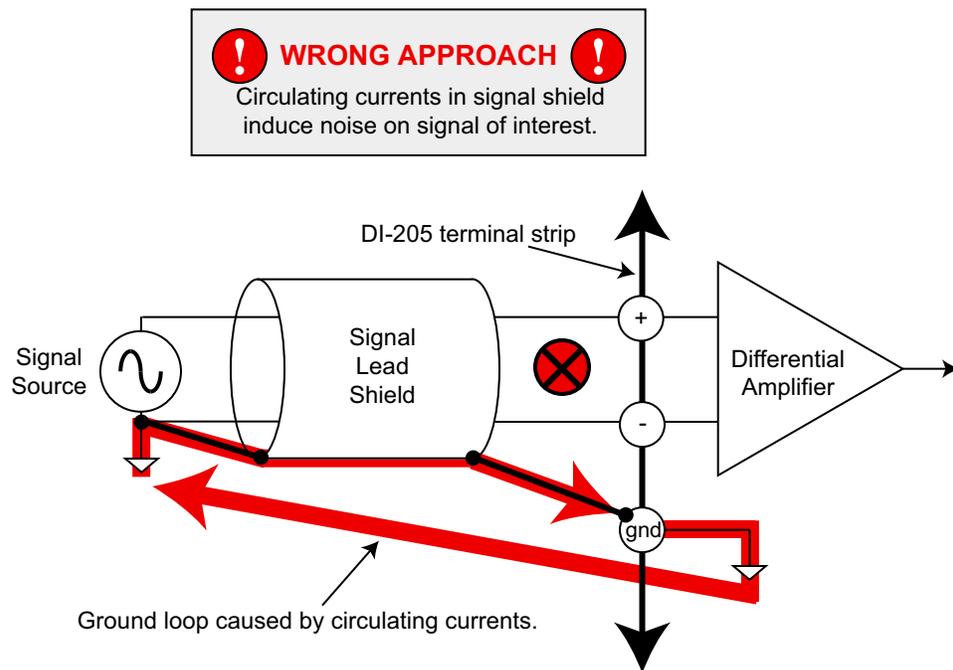
The most common error made in connecting differential amplifiers is the tendency to ground both ends of a signal shield. This causes current to flow through the shield and induces noise on the signal to be measured. Ensuring that only one ground exists on the signal circuit eliminates this problem.

RIGHT APPROACH

One ground on the signal circuit eliminates noise-inducing ground loops.

DI-205 terminal strip

Signal Source

Signal Lead Shield

Differential Amplifier

+

-

gnd

Potential difference
(no path for current to circulate)
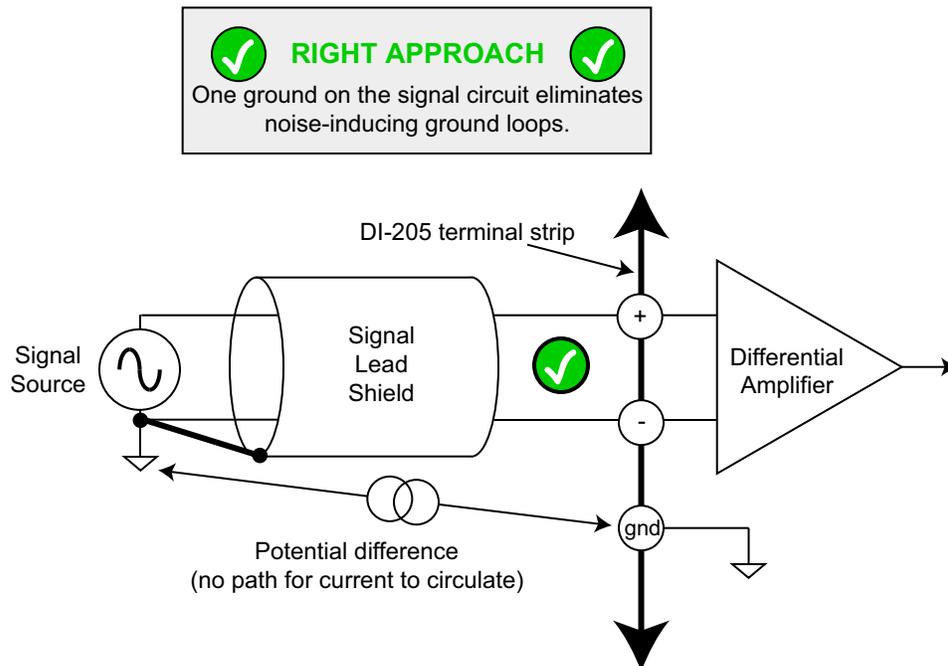
Isolated Signal Sources

There are two considerations when connecting a differential amplifier to an isolated signal source: The elimination of ground loops as described above, and the use of bias resistors to provide bias current for the differential amplifier's positive and negative inputs.

The bias resistors should be chosen to be as low as possible, but the value you use is dependent upon the output impedance of your signal source. Generally, the value of the bias resistor should be 10 times the output impedance of your signal source or higher. Bias resistors greater than $1M\Omega$ are not recommended.
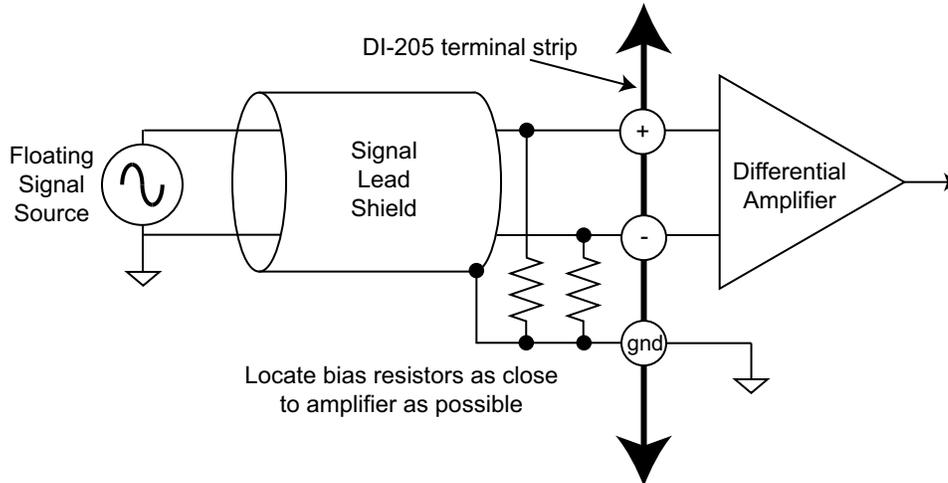
Signal Cable and the Differential Amplifier

Quick rule-of-thumb: Any application requiring a differential amplifier also defines a need for quality signal cable. Four elements combine to ensure adequate quality signal cable: a twisted signal pair with low resistance stranded copper conductors; surrounded by a multiple-folded foil shield; with a copper stranded drain wire; all contained within an insulated outer jacket.
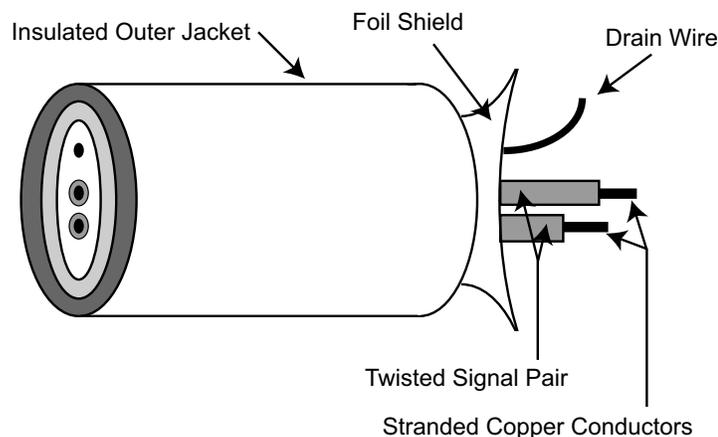
In applications where such signal cable is used, a dramatic decrease in noise pickup will be experienced. The drain wire should be considered as the shield and should be connected as described in "Connecting a Differential Amplifier" on page 44. Signal cable meeting all four criteria for quality is Belden No. 8641.

DI-75B Backpack (for use with DI-715B models)

The DI-75B is an eight-channel, 5B-module expansion device for DI-715B, DI-720, and DI-730 instruments. Each DI-75B accepts up to eight high performance, plug-in signal conditioning modules expanding the measurement capability of its host instrument. Each DI-75B is provided with the appropriate cable to connect it to its host instrument. Power is obtained from the host instrument through the supplied, dual-ended power cable.

Each DI-75B channel consumes one channel from its host instrument in return for the isolated, signal-conditioned input it provides. A maximum of one DI-75B instrument may be connected to any DI-715B instrument to get a total of 16, 5B-conditioned input channels. Signal connections are made to the DI-75B through a removable screw terminal block located on the back panel of the instrument.

Connecting the DI-75B to the Host Instrument

NOTE: The dual-ended power cable is sized to fit when the DI-75B is stacked on top of the host instrument. If these instruments are not in a stacked configuration, do so before proceeding.

1. Connect the appropriate end of the included expansion signal cable to EXPANSION on the rear panel of the host instrument.

2. Connect the other end of the expansion cable to EXPANSION IN on the rear panel of the DI-75B.

Applying Power to the DI-75B

A separate power supply is not required. Power is obtained from the host instrument through the dual-ended power cable supplied with the DI-75B. Apply power using the following procedure:

1. Unplug the five-pin DIN end of the power adapter cable that is currently supplying power to your host instrument and plug it into one of the DI-75B's power input jacks.

2. Now plug one end of the dual-ended power cable into the remaining power jack on the DI-75B and plug the other end into the host instrument power input jack.

Features, Controls, and Indicators

DI-75B Front Panel

The clear acrylic front panel allows easy identification of all installed DI-5B modules. To access the 5B backplane remove the front panel and bezel by removing the two outside screws.

1. Remove front panel and bezel by removing the two screws.
2. DI-5B Modules are installed to the 5B backplane using the set screw.

DI-5B modules are installed on (or removed from) the socketed 5B backplane and are secured with a non-removable mounting screw. Each channel position is labeled "CHANNEL 1," "CHANNEL 2," etc. on the socketed backplane. The DI-5B modules can be mixed or matched in any combination suitable for the application and are identical in pinout and size, so it doesn't matter which module gets plugged into which channel position. Channels 1 through 8 of the DI-75B are designated Channels 9 through 16 consecutively on the DI-715B.

Note: When reattaching the front panel be sure not to overtighten the screws.

DI-75B Rear Panel

EXPANSION OUT can be used to access the Digital I/O
of the DI-715B using a DI-705 and CABL-7.

EXPANSION OUT
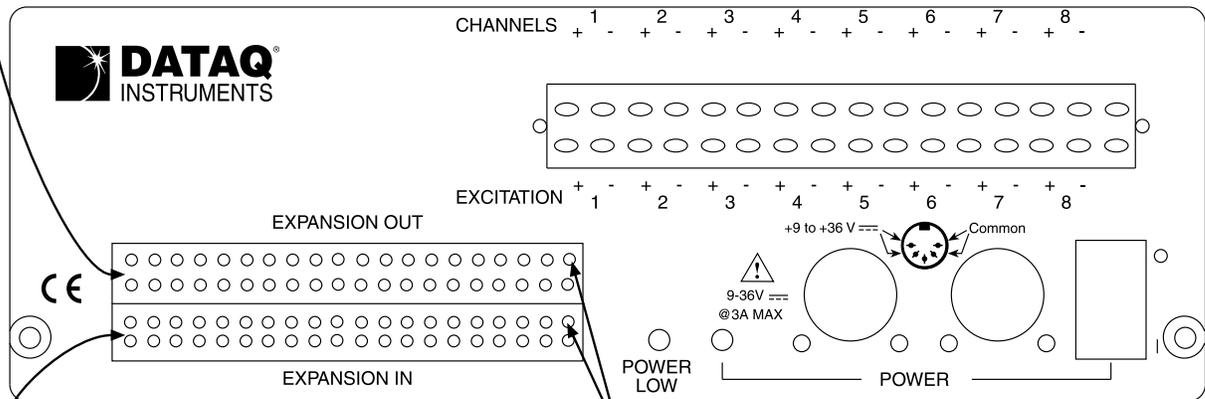
EXPANSION IN

Connect the appropriate end of the expansion cable
to the host instrument, then connect the other end of
the cable to EXPANSION IN.

Pin 1

Expansion IN and Expansion OUT connector pin-out

+5V Power	1	2	Reserved
Reserved	3	4	Reserved
Reserved	5	6	Reserved
Reserved	7	8	Reserved
Reserved	9	10	Reserved
R. Start/Stop	11	12	R. Event Marks
PWR GND	13	14	Reserved
Reserved	15	16	Reserved
DAC 1	17	18	Analog GND
Reserved	19	20	Reserved
CH 16	21	22	CH 8
CH 15	23	24	CH 7
CH 14	25	26	CH 6
CH 13	27	28	CH 5
CH 12	29	30	CH 4
CH 11	31	32	CH 3
CH 10	33	34	CH 2
CH 9	35	36	CH 1
AGND	37	38	Reserved
Reserved	39	40	Reserved

MUX Channels	5B Channels	Input Connector Pin #
CH 1 +	CH 1 +	32
CH 9 +	EX 1 +	31
CH 1 -	CH 1 -	30
CH 9 -	EX 1 -	29
CH 2 +	CH 2 +	28
CH 10 +	EX 2 +	27
CH 2 -	CH 2 -	26
CH 10 -	EX 2 -	25
CH 3 +	CH 3 +	24
CH 11 +	EX 3 +	23
CH 3 -	CH 3 -	22
CH 11 -	EX 3 -	21
CH 4 +	CH 4 +	20
CH 12 +	EX 4 +	19
CH 4 -	CH 4 -	18
CH 12 -	EX 4 -	17
CH 5 +	CH 5 +	16
CH 13 +	EX 5 +	15
CH 5 -	CH 5 -	14
CH 13 -	EX 5 -	13
CH 6 +	CH 6 +	12
CH 14 +	EX 6 +	11
CH 6 -	CH 6 -	10
CH 14 -	EX 6 -	9
CH 7 +	CH 7 +	8
CH 15 +	EX 7 +	7
CH 7 -	CH 7 -	6
CH 15 -	EX 7 -	5
CH 8 +	CH 8 +	4
CH 16 +	EX 8 +	3
CH 8 -	CH 8 -	2
CH 16 -	EX 8 -	1

Removable Screw Terminal Block

Allows signal connections to be made to the DI-75B. The input signal connections are made along the top row while the excitation connections (for those DI-5B modules that require excitation) are made along the bottom row. Note that this screw terminal block can be removed from the DI-75B, thus making signal connections to the screw terminals easy. Note also that the screw terminal block is "keyed," thus difficult to improperly re-insert. Each channel (labeled "CHANNEL 1," "CHANNEL 2," etc. on the socketed backplane) has four corresponding screw terminals for your signal connections: channel +, channel -, excitation +, and excitation -. These terminals satisfy all transducer inputs and provide sensor excitation when necessary.

POWER switch

Controls power to the DI-75B. 1 is on, 0 is off.

POWER input jacks

The DI-75B-7 can be powered by its host instrument through the supplied dual-ended power cable. Simply unplug the five-pin DIN end of the power adapter cable that is currently supplying power to your host instrument and plug it into one of the DI-75B's power input jacks. Now plug one end of the dual-ended power cable into the remaining power jack on the DI-75B and plug the other end into the host instrument power input jack.

POWER status lamp

Glows green when the POWER switch is in the 1 position, indicating power is applied to the DI-75B.

POWER LOW lamp

Glows red when the DI-75B cannot derive adequate power from its host instrument. In this case, an alternate power source is required. Any suitable power source (+9 to +36 volts DC at 3A maximum) may be connected to either power input jack to provide the necessary power.

EXPANSION OUT connector

Used to connect to a DI-705 in order to access the Digital I/O of the DI-715B. Connect the appropriate end of a CABL-7 to this connector and connect the other end of the cable to the DI-705. See "The DI-705" on page 40 for more information.

EXPANSION IN connector

Connects the DI-75B to its host instrument.

Configuring Channels for the DI-75B

In WINDAQ Acquisition software, channels are enabled or configured for acquisition with the channel selection grid. The channel selection grid is accessed by selecting **Edit** > **Channels…** (in the SET-UP operating mode of WINDAQ software).

Each box in this grid potentially represents an input channel. An input channel is enabled by clicking the desired box. Which box you click, which mouse button you click with, and how many times you click the mouse button determines whether the input channel is enabled for single-ended operation, or operation defined by the DI-5B module.

The following channel selection grid is typical when a DI-75B is used with a DI-715B. A total of sixteen signal conditioned inputs are available for data acquisition. Channel 17 may be enabled as Digital but must be accessed using a DI-705 (with CABL-7) through the EXPANSION OUT port.
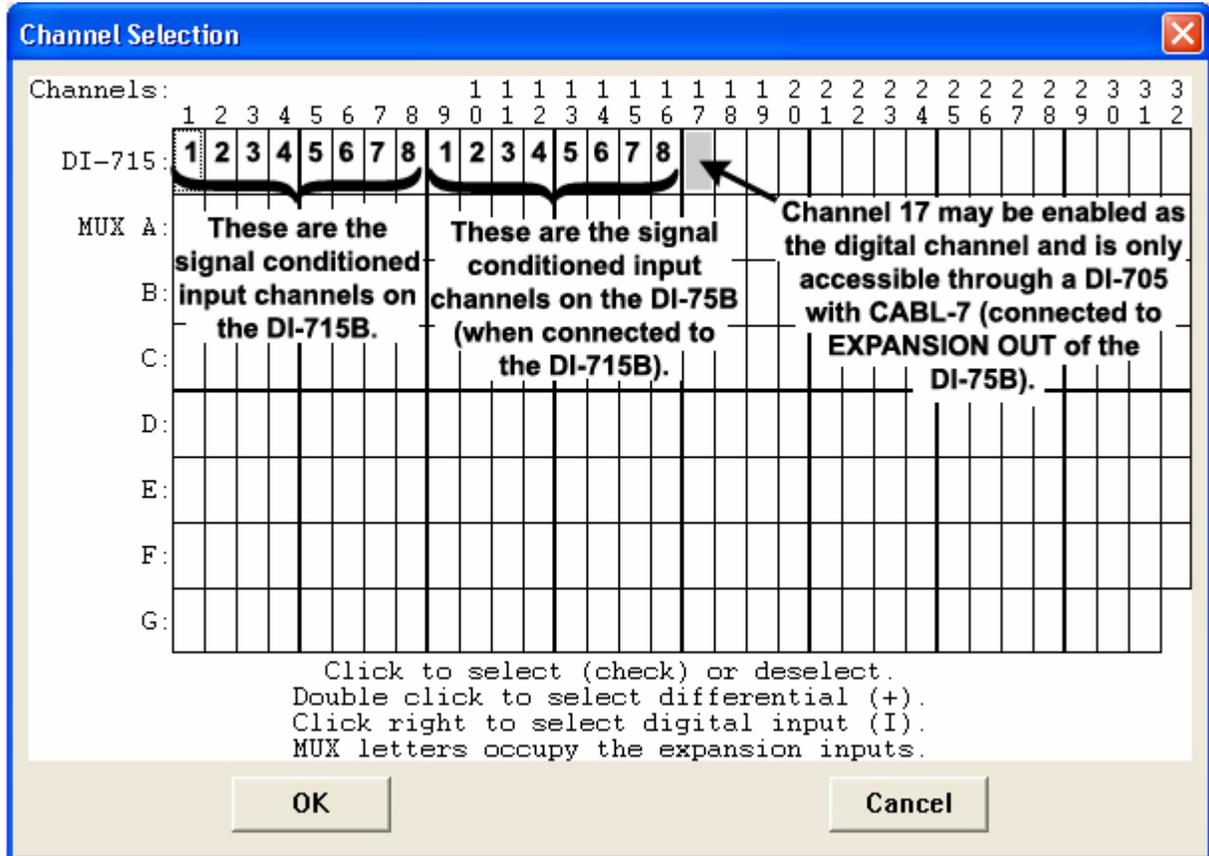
See the Dataq Instruments Hardware Manager Help files to configure channels for DI-75Bs connected to stand-alone models.

Calibration

Each 5B module has an Input and Output equivalent printed on it for calibration purposes. Each channel should be calibrated for its specific 5B module. Calibration for the DI-75B modules is completed exactly the same as for DI-715B modules. See "Calibration and Gain Settings" on page 30 for more information.

Gain

The signal conditioned (or DI-5B module) channels on the DI-75B output ±5 volts to the host instrument. Since the DI-715B is a ±10 volt input device, each DI-75B signal conditioned channel in use should be set to at least a gain of 2 so they have a full scale measurement range of at least ±5 volts. Use the same method described at "Gain" on page 31 to set the gain of the DI-75B signal conditioned inputs.

Installing Shunt Resistors

To use the Current Input Modules (DI-5B32 and DI-5B42) you must install a shunt resistor (provided with purchase of 5B module) for accurate readings. Instructions for the DI-75B are the same as instructions for the DI-715B. See "Installing a Shunt Resistor in DI-715B Models" on page 27 for instructions on installation of shunt resistors.

DI-5B Modules

DI-5B30/31 Analog Voltage Input Modules, Narrow Bandwidth

Each DI-5B30 and DI-5B31 voltage input module provides a single channel of analog input which is filtered, isolated, amplified, and converted to a high level analog voltage output (see block diagram). This voltage output is logic-switch controlled, allowing these modules to share a common analog bus without the requirement of external multiplexers.

The DI-5B modules are designed with a completely isolated computer side circuit which can be floated to ±50V from Power Common, pin 16. This complete isolation means that no connection is required between I/O Common and Power Common for proper operation of the output switch. If desired, the output switch can be turned on continuously by simply connecting pin 22, the Read-Enable pin to I/O Common, pin 19.

Signal filtering is accomplished with a six-pole filter which provides 95dB of normal-mode-rejection at 60Hz and 90dB at 50Hz. Two poles of this filter are on the field side of the isolation barrier, and the other four are on the computer side.

After the initial field-side filtering, the input signal is chopped by a proprietary chopper circuit. Isolation is provided by transformer coupling, again using a proprietary technique to suppress transmission of common mode spikes or surges. The module is powered from +5VDC, ±5%.

A special input circuit on the DI-5B30 and DI-5B31 modules provides protection against accidental connection of power-line voltages up to 240VAC.:
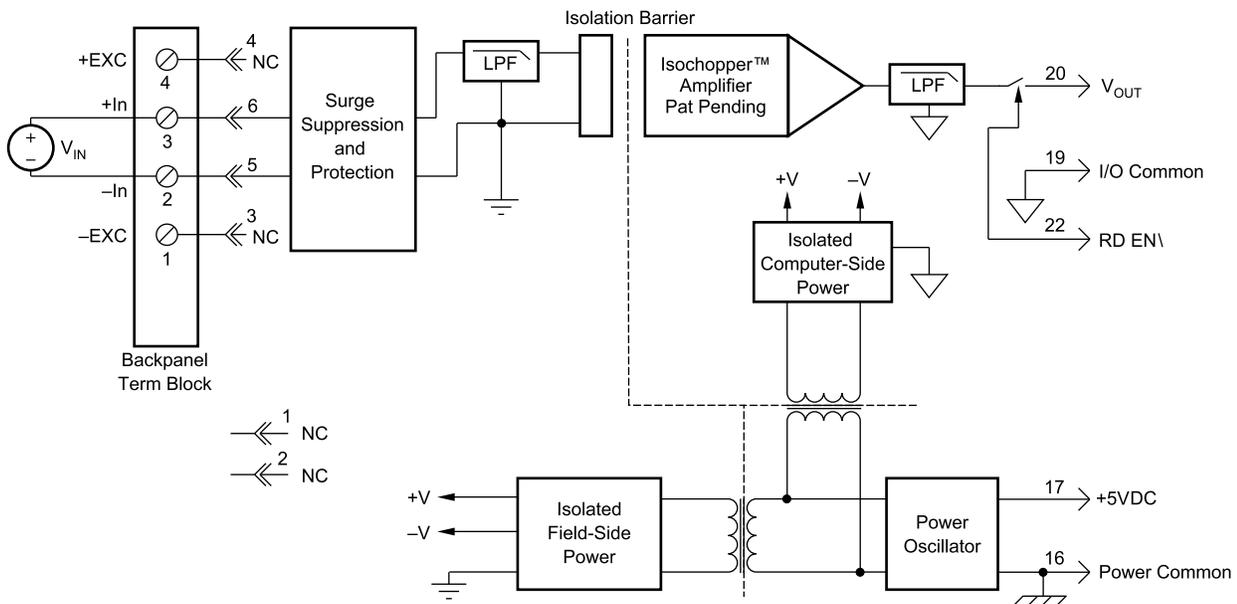
Ordering Information

| MODEL	INPUT RANGE	OUTPUT RANGE
DI-5B30-01	-10mV to +10mV	-5V to +5V
DI-5B30-02	-50mV to +50mV	-5V to +5V
DI-5B30-03	-100mV to +100mV	-5V to +5V
DI-5B31-01	-1V to +1V	-5V to +5V
DI-5B31-02	-5V to +5V	-5V to +5V
DI-5B31-03	-10V to +10V	-5V to +5V
DI-5B31-07*	-20V to +20V	-5V to +5V
DI-5B31-09*	-40V to +40V	-5V to +5V

*CSA certification pending.

DI-5B32 Analog Current Input Modules

Each DI-5B32 current input module provides a single channel of analog input which is filtered, isolated, amplified, and converted to a high level analog voltage output (see block diagram). This voltage output is logic switch controlled, which allows these modules to share a common analog bus without the requirement of external multiplexers.

The DI-5B modules are designed with a completely isolated computer side circuit which can be floated to ±50V from Power Common, pin 16. This complete isolation means that no connection is required between I/O Common and Power Common for proper operation of the output switch. If desired, the output switch can be turned on continuously by simply connecting pin 22, the Read-Enable pin to I/O Common, pin 19.

A precision 20Ω current conversion resistor is supplied with the DI-5B32 module (see block diagram for installation details).
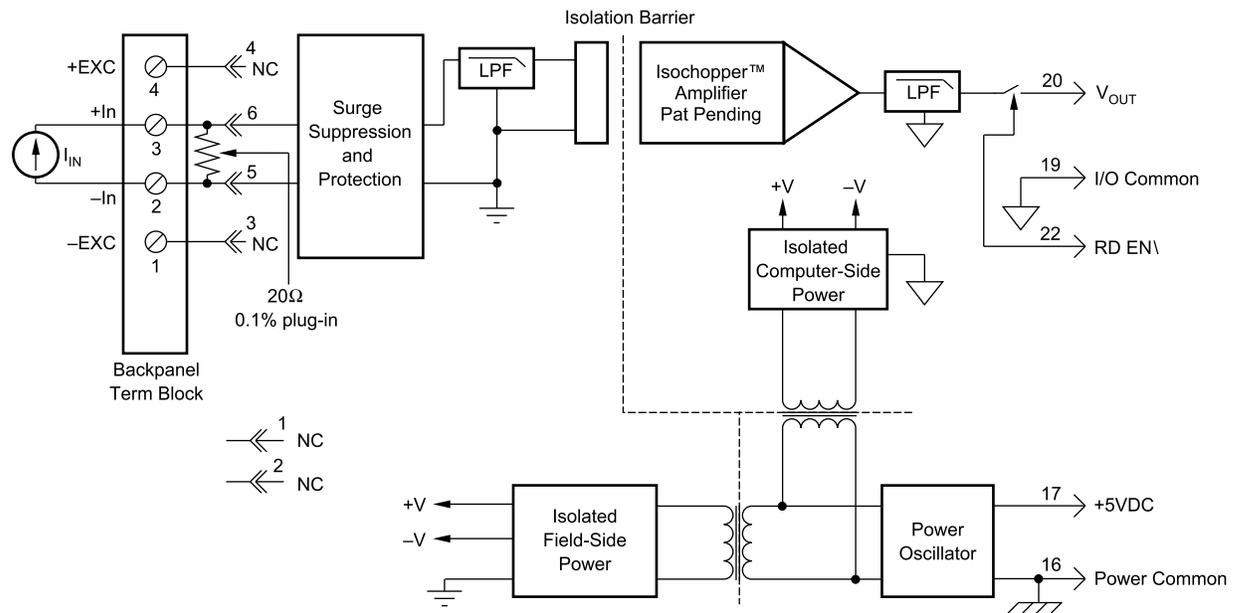
Signal filtering is accomplished with a six-pole filter which provides 95dB of normal-mode rejection at 60Hz and 90dB at 50Hz. Two poles of this filter are on the field side of the isolation barrier, and the other four are on the computer side.

After the initial field-side filtering, the input signal is chopped by a proprietary chopper circuit. Isolation is provided by transformer coupling, again using a proprietary technique to suppress transmission of common mode spikes or surges. The module is powered from +5VDC, ±5%.

A special input circuit on the DI-5B32 modules provides protection against accidental connection of power-line voltages up to 240VAC.

Ordering Information

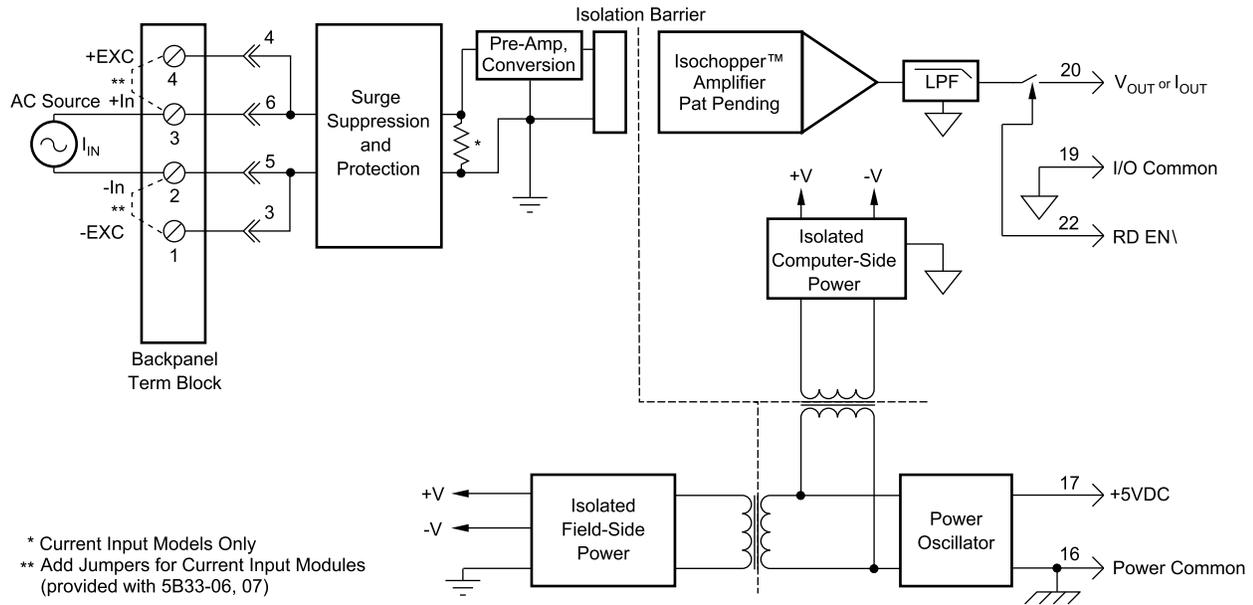| MODEL	INPUT RANGE	OUTPUT RANGE
DI-5B32-01	4mA to 20mA	0V to +5V
DI-5B32-02	0mA to 20mA	0V to +5V

DI-5B33 Isolated True RMS Input Modules

Each DI-5B33 True RMS input module provides a single channel of AC input which is converted to its True RMS dc value, filtered, isolated, amplified, and converted to a standard process voltage or current output (see block diagram).

The DI-5B modules are designed with a completely isolated computer side circuit which can be floated to ±50V from Power Common, pin 16. This complete isolation means that no connection is required between I/O Common and Power Common for proper operation of the output switch. If desired, the output switch can be turned on continuously by simply connecting pin 22, the Read-Enable pin to I/O Common, pin 19.

The field voltage or current input signal is processed through a pre-amplifier and RMS converter on the field side of the isolation barrier. The converted dc signal is then chopped by a proprietary chopper circuit and transferred across the transformer isolation barrier, suppressing transmission of common mode spikes and surges. The computer side circuitry reconstructs, filters and converts the signal to industry standard outputs. Modules are powered from +5VDC, ±5%.

For current output models an external loop supply is required having a compliance voltage of 14 to 48VDC. Connection, with series load, is between Pin 20 (+) and Pin 19 (-).

Ordering Information

MODEL	INPUT RANGE	OUTPUT RANGE
DI-5B33-01	100mV	0V to +5V
DI-5B33-02	1V	0V to +5V
DI-5B33-03	10V	0V to +5V
DI-5B33-04	150V	0V to +5V
DI-5B33-05	300V	0V to +5V

## DI-5B34 Linearized 2- or 3-Wire RTD Input Modules

Each DI-5B34 RTD input module provides a single channel of RTD input which is filtered, isolated, amplified, linearized, and converted to a high level analog voltage output (see block diagram). This voltage output is logic switch controlled, which allows these modules to share a common analog bus without the requirement of external multiplexers.

The DI-5B modules are designed with a completely isolated computer side circuit which can be floated to ±50V from Power Common, pin 16. This complete isolation means that no connection is required between I/O Common and Power Common for proper operation of the output switch. If desired, the output switch can be turned on continuously by simply connecting pin 22, the Read-Enable pin to I/O Common, pin 19.

RTD excitation is provided from the module by two matched current sources. When using a three-wire RTD, this method allows an equal current to flow in each RTD lead, which cancels the effects of lead resistances. The excitation currents are very small (0.25mA for 100Ω Pt and 120Ω Ni, and 1.0mA for 10Ω Cu) which minimizes self-heating of the RTD.

Signal filtering is accomplished with a six-pole filter which provides 95dB of normal-mode-rejection at 60Hz and 90dB at 50Hz. Two poles of this filter are on the field side of the isolation barrier, and the other four are on the computer side. After the initial field-side filtering, the input signal is chopped by a proprietary chopper circuit. Isolation is provided by transformer coupling, again using a proprietary technique to suppress transmission of common mode spikes or surges. The module is powered from +5VDC, ±5%.

A special input circuit on the DI-5B34 modules provides protection against accidental connection of power-line voltages up to 240VAC.
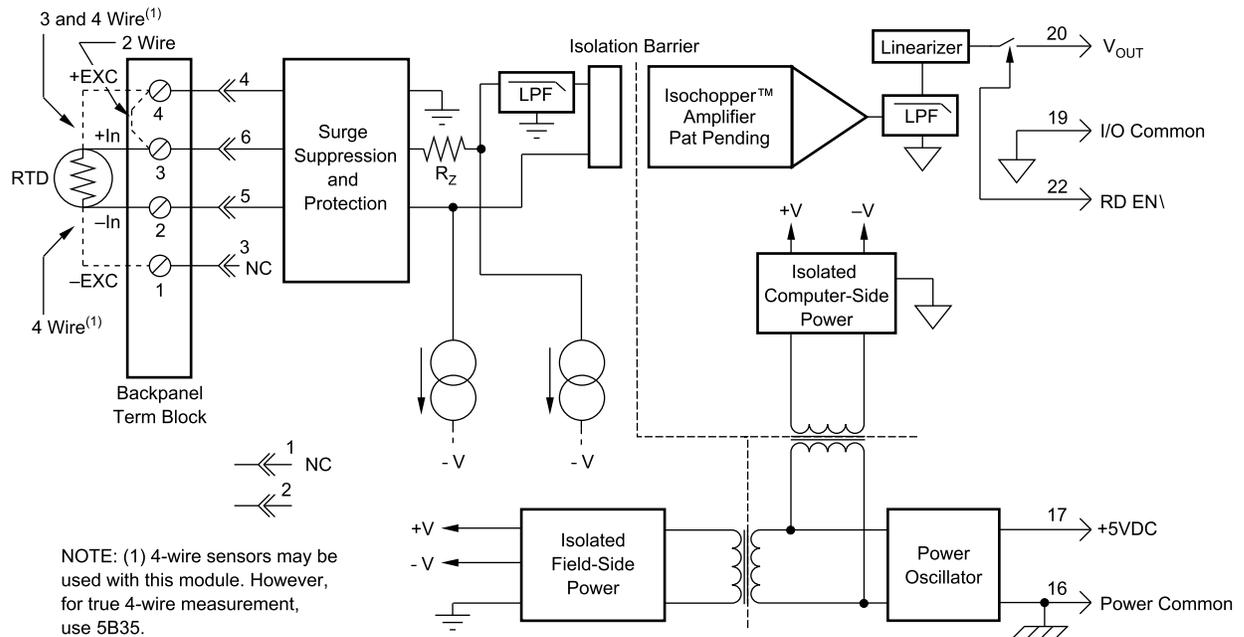
Ordering Information

MODEL	INPUT RANGE	OUTPUT RANGE	ACCURACY*
100Ω Pt, α = 0.00385			
DI-5B34-01	-100°C (-148°F) to +100°C (+212°F)	0V to +5V	±0.46°C
DI-5B34-02	0°C (32°F) to +100°C (+212°F)	0V to +5V	±0.36°C
DI-5B34-03	0°C (32°F) to +200°C (+392°F)	0V to +5V	±0.46°C
DI-5B34-04	0°C (32°F) to +600°C (+1112°F)	0V to +5V	±0.88°C
10Ω Cu, α = 0.004274			
DI-5B34C-01	0°C (32°F) to +120°C (+248°F) (10Ω at 0°C)	0V to +5V	±0.23°C
DI-5B34C-02	0°C (32°F) to +120°C (+248°F) (10Ω at 25°C)	0V to +5V	±0.23°C
DI-5B34C-03**	0°C (32°F) to +160°C (+320°F) (10Ω at 0°C)	0V to +5V	±0.32°C
120Ω Ni, α = 0.00672			
DI-5B34N-01	0°C (32°F) to +300°C (+572°F)	0V to +5V	±0.40°C

* Includes conformity, hysteresis and repeatability.

**CSA certification pending.

DI-5B35 Linearized 4-Wire RTD Input Modules

In RTD temperature measurement applications requiring a very high level of accuracy, the DI-5B35 4-Wire RTD input module offers a significant advantage over 3-wire measurement techniques (see block diagram). The DI-5B35 measures only the voltage dropped across the RTD and almost completely ignores the resistance or length of the RTD lead wires. The DI-5B34 3-Wire RTD module provides lead resistance compensation, but requires equal lead resistances, while the DI-5B35 does not require matched lead resistances.

Each DI-5B35 RTD input module provides a single channel of RTD input which is filtered, isolated, amplified, linearized, and converted to a high level analog voltage output. This voltage output is logic switch controlled, which allows these modules to share a common analog bus without the requirement of external multiplexers.

The DI-5B modules are designed with a completely isolated computer side circuit which can be floated to ±50V from Power Common, pin 16. This complete isolation means that no connection is required between I/O Common and Power Common for proper operation of the output switch. If desired, the output switch can be turned on continuously by simply connecting pin 22, the Read-Enable pin to I/O Common, pin 19.

RTD excitation is provided from the module by a precision current source. The excitation current is available on two leads which are separate from the two input signal measuring leads. The excitation current does not flow in the input signal leads, which allows RTD measurement to be totally independent of lead resistance. The excitation current is very small (0.25mA for 100Ω Pt and 120Ω Ni, and 1.0mA for 10Ω Cu) which minimizes self-heating of the RTD.

Signal filtering is accomplished with a six-pole filter which provides 95dB of normal-mode-rejection at 60Hz and 90dB at 50Hz. Two poles of this filter are on the field side of the isolation barrier, and the other four are on the computer side. After the initial field-side filtering, the input signal is chopped by a proprietary chopper circuit. Isolation is provided by transformer coupling, again using a proprietary technique to suppress transmission of common mode spikes or surges. The module is powered from +5VDC, ±5%.

A special input circuit on the DI-5B35 modules provides protection against accidental connection of power-line voltages up to 240VAC.
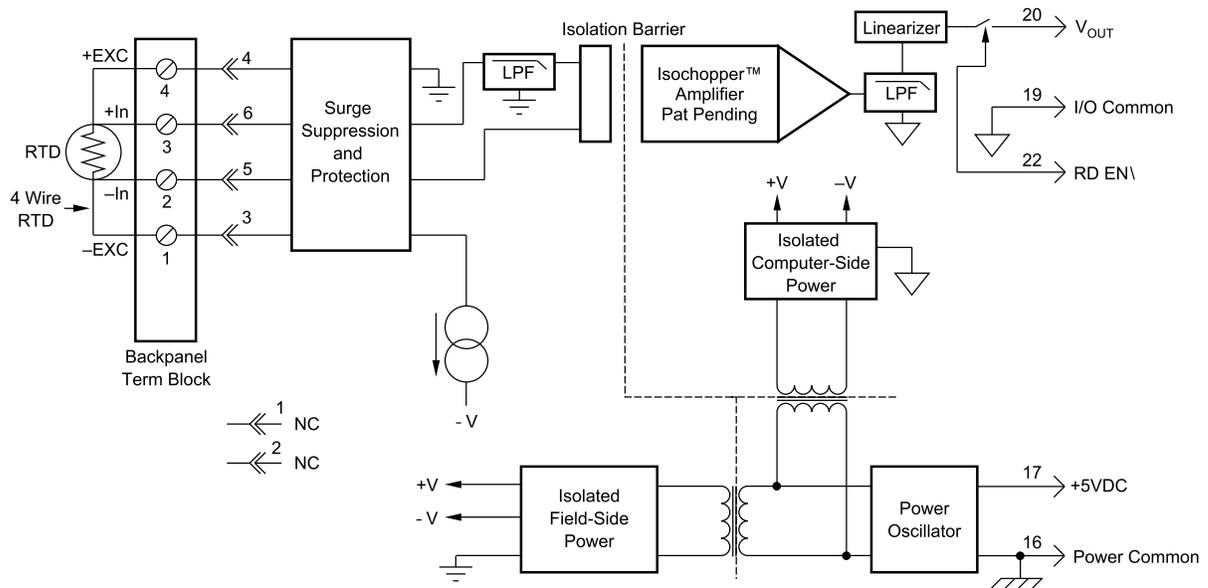
Ordering Information

MODEL	INPUT RANGE	OUTPUT RANGE	ACCURACY*
100Ω Pt, α = 0.00385			
DI-5B35-01	-100°C (-148°F) to +100°C (+212°F)	0V to +5V	±0.46°C
DI-5B35-02	0°C (32°F) to +100°C (+212°F)	0V to +5V	±0.36°C
DI-5B35-03	0°C (32°F) to +200°C (+392°F)	0V to +5V	±0.46°C
DI-5B35-04	0°C (32°F) to +600°C (+1112°F)	0V to +5V	±0.88°C
10Ω Cu, α = 0.004274			
DI-5B35C-01	0°C (32°F) to +120°C (+248°F) (10Ω at 0°C)	0V to +5V	±0.23°C
DI-5B35C-02DI-	0°C (32°F) to +120°C (+248°F) (10Ω at 25°C)	0V to +5V	±0.23°C
5B35C-03**	0°C (32°F) to +160°C (+320°F) (10Ω at 0°C)	0V to +5V	±0.32°C
120Ω Ni, α = 0.00672			
DI-5B35N-01	0°C (32°F) to +300°C (+572°F)	0V to +5V	±0.40°C

* Includes conformity, hysteresis and repeatability.

**CSA certification pending.
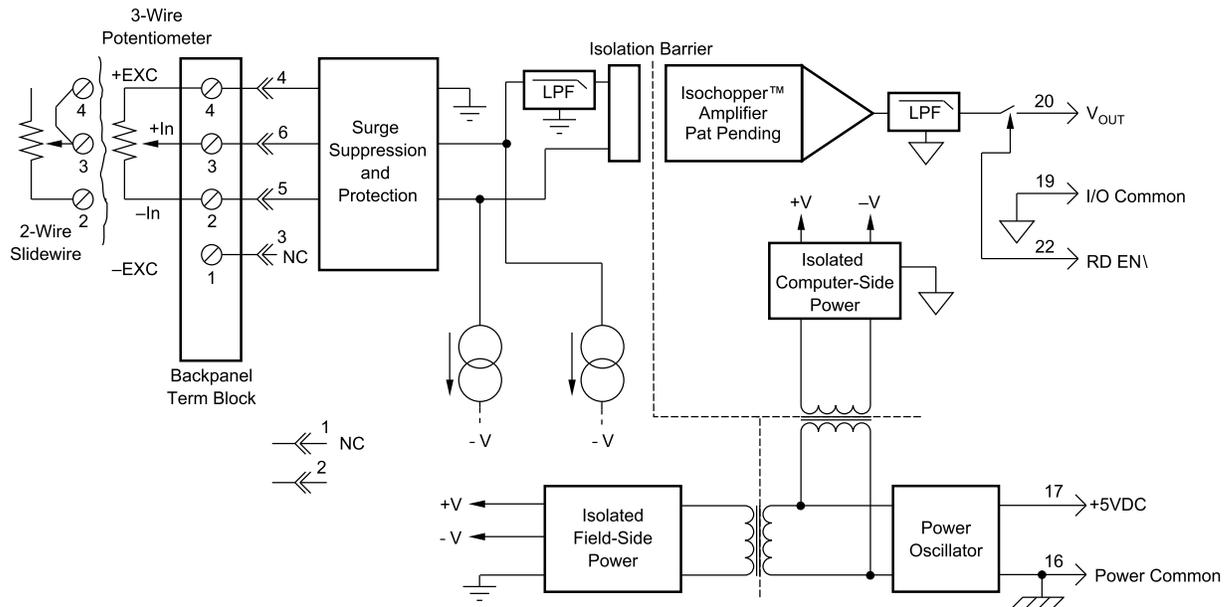
DI-5B36 Potentiometer Input Modules

Each DI-5B36 Potentiometer input module provides a single channel of Potentiometer input which is filtered, isolated, amplified, and converted to a high level analog voltage output (see block diagram). This voltage output is logic switch controlled, which allows these modules to share a common analog bus without the requirement of external multiplexers.

The DI-5B modules are designed with a completely isolated computer side circuit which can be floated to ± 50V from Power Common, pin 16. This complete isolation means that no connection is required between I/O Common and Power Common for proper operation of the output switch. If desired, the output switch can be turned on continuously by simply connecting pin 22, the Read-Enable pin to I/O Common, pin 19.

Excitation for the potentiometer is provided from the module by two matched current sources. When using a three-wire potentiometer, this method allows cancellation of the effects of lead resistances. The excitation currents are very small (less than 1.0mA) which minimizes self-heating of the potentiometer.

Signal filtering is accomplished with a six-pole filter which provides 95dB of normal-mode-rejection at 60Hz and 90dB at 50Hz. Two poles of this filter are on the field side of the isolation barrier, and the other four are in the output stage. After the initial field-side filtering, the input signal is chopped by a proprietary chopper circuit. Isolation is provided by transformer coupling, again using a proprietary technique to suppress transmission of common mode spikes or surges. The module is powered from +5VDC, ±5%.

A special input circuit on the DI-5B36 module provides protection against accidental connection of power-line voltages up to 240VAC.

Ordering Information		
MODEL	INPUT RANGE	OUTPUT RANGE
DI-5B36-01	0 to 100Ω	0V to +5V
DI-5B36-02	0 to 500Ω	0V to +5V
DI-5B36-03	0 to 1kΩ	0V to +5V
DI-5B36-04	0 to 10kΩ	0V to +5V

DI-5B38 Strain Gage Input Modules, Narrow & Wide Bandwidth

Each DI-5B38 Strain Gage input module provides a single channel of Strain Gage input which is filtered, isolated, amplified, and converted to a high level analog voltage output (see block diagram). This voltage output is logic switch controlled, which allows these modules to share a common analog bus without the requirement of external multiplexers.

The DI-5B modules are designed with a completely isolated computer side circuit which can be floated to ±50V from Power Common, pin 16. This complete isolation means that no connection is required between I/O Common and Power Common for proper operation of the output switch. If desired, the output switch can be turned on continuously by simply connecting pin 22, the Read-Enable pin to I/O Common, pin 19.

The DI-5B38 can interface to full- or half-bridge transducers with a nominal resistance of 100Ω to 10kΩ. A matched pair of bridge-completion resistors (to ±1mV at +10V excitation) allows use of low cost half- or quarter-bridge transducers. On wide bandwidth modules, the 10kHz bandwidth allows measurement of high speed processes such as vibration analysis.

Strain Gage excitation is provided from the module by a very stable 10V or 3.333V source. The excitation supply is fully isolated, allowing the amplifier inputs to operate over the full range of the excitation voltage. Full scale sensitivities of 2mV/V, 3mV/V or 10mV/V are offered. With 10V excitation, this results in a ±20mV, ±30mV or ±100mV full scale input range.

On wide bandwidth modules, the input signal is processed through a preamplifier on the field side of the isolation barrier. This preamplifier has a gain-bandwidth product of 5MHz and is bandwidth limited to 10kHz. On all modules, after initial field side filtering, the input signal is chopped by a proprietary chopper circuit. Isolation is provided by transformer coupling, again using a proprietary technique to suppress transmission of common mode spikes or surges. The module is powered from +5VDC, ±5%.

Special input circuits on the DI-5B38 module provide protection of the signal inputs and the isolated excitation supply up to 240VAC.
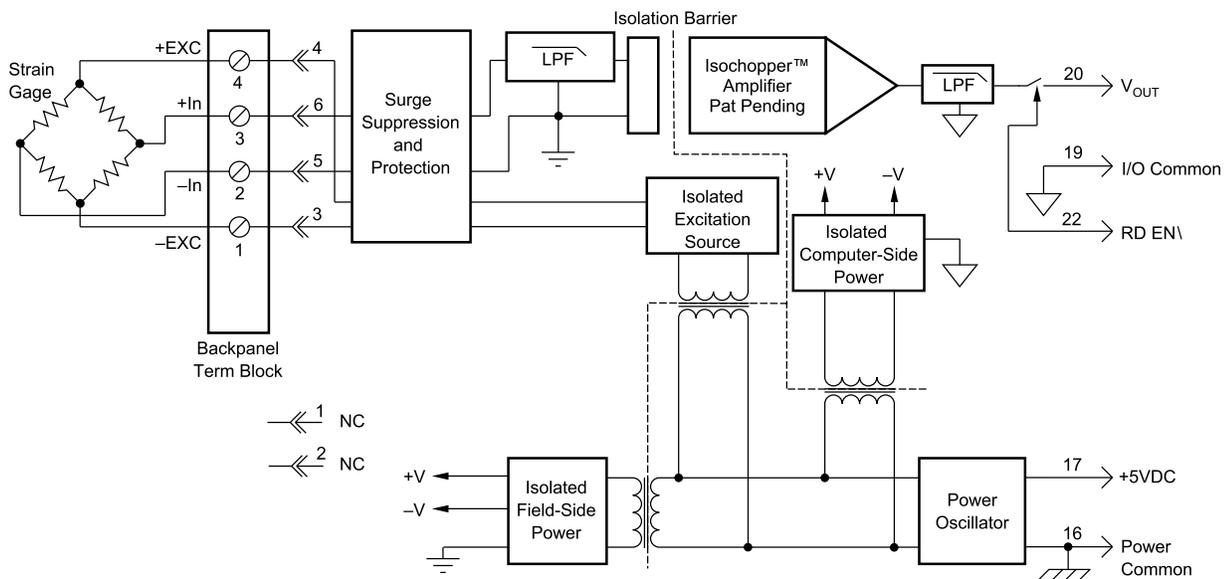
Ordering Information

| MODEL	INPUT BRIDGE TYPE	INPUT RANGE	EXCITATION	OUTPUT RANGE
DI-5B38-31 or DI-5B38-01	Full Bridge	100Ω to 10kΩ	3.333V at 3mV/V Sensitivity	-5V to +5V
DI-5B38-32 or DI-5B38-02	Full Bridge	300Ω to 10kΩ	10.0V at 3mV/V Sensitivity	-5V to +5V
DI-5B38-33 or DI-5B38-03	Half Bridge	100Ω to 10kΩ	3.333V at 3mV/V Sensitivity	-5V to +5V
DI-5B38-34 or DI-5B38-04	Half Bridge	300Ω to 10kΩ	10.0V at 3mV/V Sensitivity	-5V to +5V
DI-5B38-35 or DI-5B38-05	Full Bridge	300Ω to 10kΩ	10.0V at 2mV/V Sensitivity	-5V to +5V
DI-5B38-36 or DI-5B38-06	Full Bridge	100Ω to 10kΩ	3.333V at 10mV/V Sensitivity	-5V to +5V
DI-5B38-37 or DI-5B38-07	Full Bridge	300Ω to 10kΩ	10.0V at 10mV/V Sensitivity	-5V to +5V

DI-5B40/41 Analog Voltage Input Modules, Wide Bandwidth

Each DI-5B40 and DI-5B41 wide bandwidth voltage input module provides a single channel of analog input which is amplified, isolated, and converted to a high level analog voltage output (see block diagram). This voltage output is logic-switch controlled, allowing these modules to share a common analog bus without the requirement of external multiplexers.

The DI-5B modules are designed with a completely isolated computer side circuit which can be floated to ±50V from Power Common, pin 16. This complete isolation means that no connection is required between I/O Common and Power Common for proper operation of the output switch. If desired, the output switch can be turned on continuously by simply connecting pin 22, the Read-Enable pin to I/O Common, pin 19.

The input signal is processed through a preamplifier on the field side of the isolation barrier. This preamplifier has a gain-bandwidth product of 5MHz and is bandwidth limited to 10kHz. After amplification, the input signal is chopped by a proprietary chopper circuit. Isolation is provided by transformer coupling, again using a proprietary technique to suppress transmission of common mode spikes or surges. The module is powered from +5VDC, ±5%.

A special input circuit on the DI-5B40 and DI-5B41 modules provides protection against accidental connection of power-line voltages up to 240VAC.
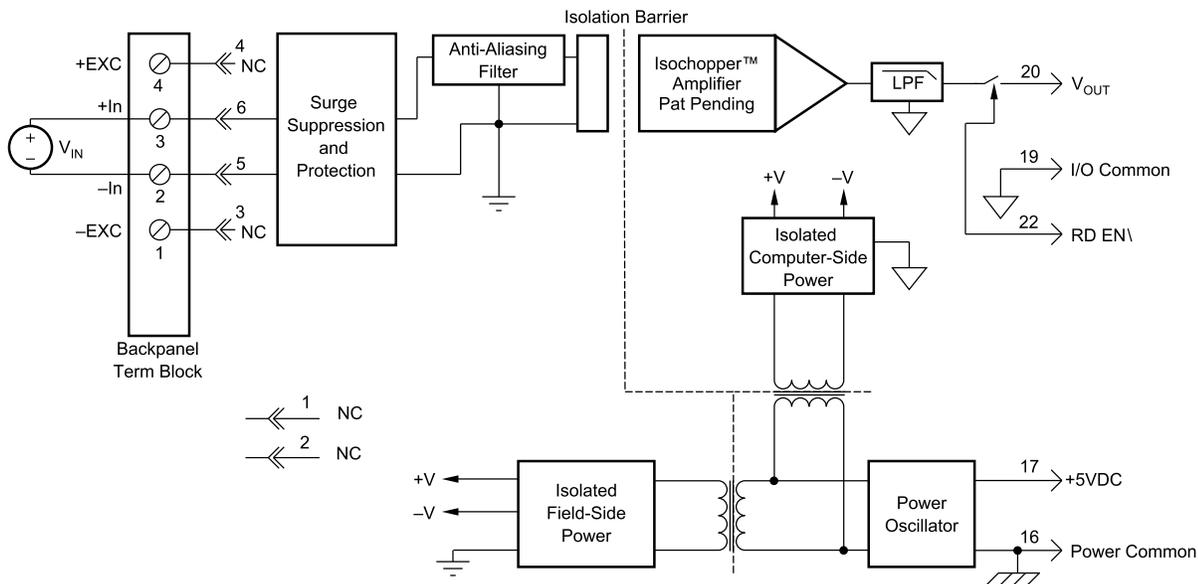
Ordering Information

MODEL	INPUT RANGE	OUTPUT RANGE
DI-5B40-01	-10mV to +10mV	0V to +5V
DI-5B40-02	-50mV to +50mV	0V to +5V
DI-5B40-03	-100mV to +100mV	0V to +5V
DI-5B41-01	-1V to +1V	0V to +5V
DI-5B41-02	-5V to +5V	0V to +5V
DI-5B41-03	-10V to +10V	0V to +5V
DI-5B41-07**	-20V to +20V	0V to +5V
DI-5B41-09**	-40V to +40V	0V to +5V

*Required for DI-500-HV high voltage option.
**CSA certification pending.

## *DI-5B42 2-Wire Transmitter Interface Modules*

Each DI-5B42 2-wire transmitter interface module provides a single channel which accepts a 4 to 20 mA process current input and provides a standard +1 to +5V output signal (see block diagram). An isolated +20VDC regulated power supply is provided to power the current transmitter. This allows a 2-wire loop powered transmitter to be directly connected to the DI-5B42 without requiring an external power supply. The regulated supply will provide a nominal +20VDC at a loop current of 4mA to 20mA.

The DI-5B42 will provide a 1500V isolation barrier for non-isolated 2-wire field transmitters. It can also be used when additional isolation is required between an isolated 2-wire transmitter and the input stage of the control room computer.

The voltage output is logic switch controlled, which allows these modules to share a common analog bus without the requirement of external multiplexers.

The DI-5B modules are designed with a completely isolated computer side circuit which can be floated to ±50V from Power Common, pin 16. This complete isolation means that no connection is required between I/O Common and Power Common for proper operation of the output switch. If desired, the output switch can be turned on continuously by simply connecting pin 22, the Read-Enable pin to I/O Common, pin 19.

A precision 20Ω current conversion resistor is supplied with the module. All field inputs are fully protected from accidental connection of power-line voltages up to 240VAC. The module has a 3dB bandwidth of 100Hz. Signal filtering is accomplished with a six-pole filter, with two poles on the field side of the isolation barrier, and the other four on the computer side.
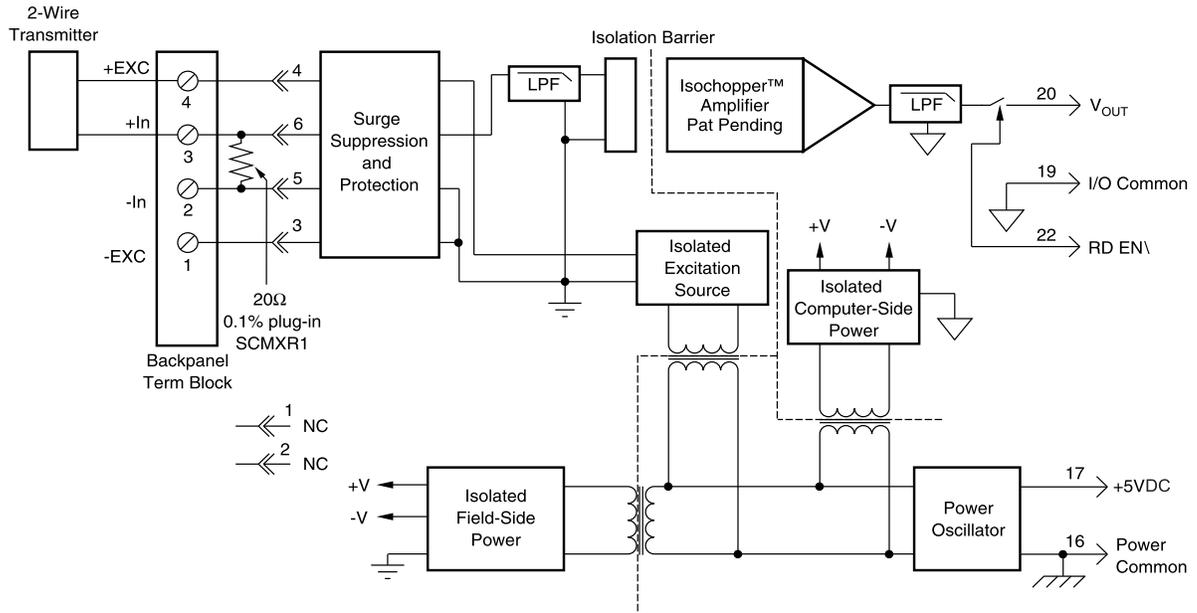
Ordering Information

MODEL	INPUT RANGE	OUTPUT RANGE
DI-5B42-01	4mA to 20mA	+1V to +5V

## *DI-5B43 Isolated DC Transducer Amplifier Input Module*

Each DI-5B43 displacement transducer module provides a single channel of displacement transducer input which is filtered, isolated, scaled, and converted to a high level analog voltage output (see block diagram). This voltage output is logic switch controlled, which allows these modules to share a common analog bus without the requirement of external multiplexers.

The DI-5B modules are designed with a completely isolated computer side circuit which can be floated to ±50V from Power Common, pin 16. This complete isolation means that no connection is required between I/O Common and Power Common for proper operation of the output switch. If desired, the output switch can be turned on continuously by simply connecting pin 22, the Read-Enable pin to I/O Common, pin 19.

The DI-5B43 can interface to DC displacement transducers and other devices which require a precision 10VDC supply and produce a high level output. The 1kHz bandwidth significantly reduces ripple and noise inherent in these devices.

Transducer excitation is provided from the module by a very stable 10V source. The excitation supply is fully isolated, allowing the amplifier inputs to operate over the full range of the excitation voltage. This feature offers significant flexibility in real world applications. Ten full scale input ranges are provided, from ±1V to ±10V, producing ±5V full scale output.

The input signal is processed through a preamplifier on the field side of the isolation barrier. This preamplifier has a gain-bandwidth product of 5MHz and is bandwidth limited to 1kHz. After amplification, the input signal is chopped by a proprietary chopper circuit. Isolation is provided by transformer coupling, again using a proprietary technique to suppress transmission of common mode spikes or surges. The module is powered from +5VDC, ±5%. Special input circuits on the DI-5B43 module provide protection of the signal inputs and the isolated excitation supply up to 240VAC.
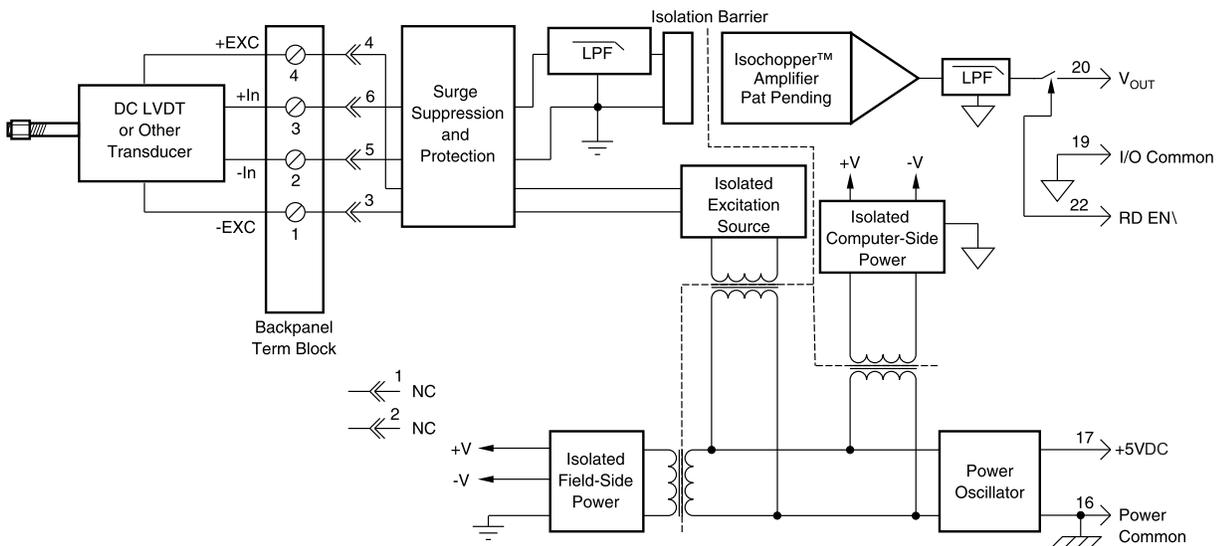
Ordering Information		
MODEL*	MAXIMUM INPUT	EXCITATION
DI-5B43-01	±1V	+10.0Vdc @ 40mA
DI-5B43-02A	±2V	+10.0Vdc @ 40mA
DI-5B43-03	±3V	+10.0Vdc @ 40mA
DI-5B43-04A	±4V	+10.0Vdc @ 40mA
DI-5B43-05	±5V	+10.0Vdc @ 40mA
DI-5B43-06	±6V	+10.0Vdc @ 40mA
DI-5B43-07A	±7V	+10.0Vdc @ 40mA
DI-5B43-08A	±8V	+10.0Vdc @ 40mA
DI-5B43-09	±9V	+10.0Vdc @ 40mA
DI-5B43-10	±10V	+10.0Vdc @ 40mA

*CSA certification pending.

DI-5B45 Frequency Input Modules

Each DI-5B45 frequency input module provides a single channel of frequency input which is isolated and converted to a high level analog voltage output. This voltage output is logic switch controlled, which allows these modules to share a common analog bus without the requirement of external multiplexers (see block diagram).

The frequency input signal can be a TTL level signal or a zero-crossing signal. Terminal 3 (+In) on the field-side terminal block is the "common" or ground connection for input signals. A TTL signal is connected from terminal 2 (-In) to terminal 3 (+In), while a zero-crossing signal is connected from terminal 4 (+EXC) to terminal 3 (+In). Input circuitry for each of the signal types has hysteresis built in. An input signal must cross entirely through the hysteresis region in order to trigger the threshold comparator.

A 5.1V excitation is available for use with magnetic pickup or contact-closure type sensors. The excitation is available on pin 1 (-EXC) and the excitation common is pin 3 (+In).

The DI-5B modules are designed with a completely isolated computer side circuit which can be floated to ±50V from Power Common, pin 16. This complete isolation means that no connection is required between I/O Common and Power Common for proper operation of the output switch. If desired, the output switch can be turned on continuously by simply connecting pin 22, the Read-Enable pin to I/O Common, pin 19.

A special circuit in the input stage of the module provides protection against accidental connection of power-line voltages up to 240VAC.
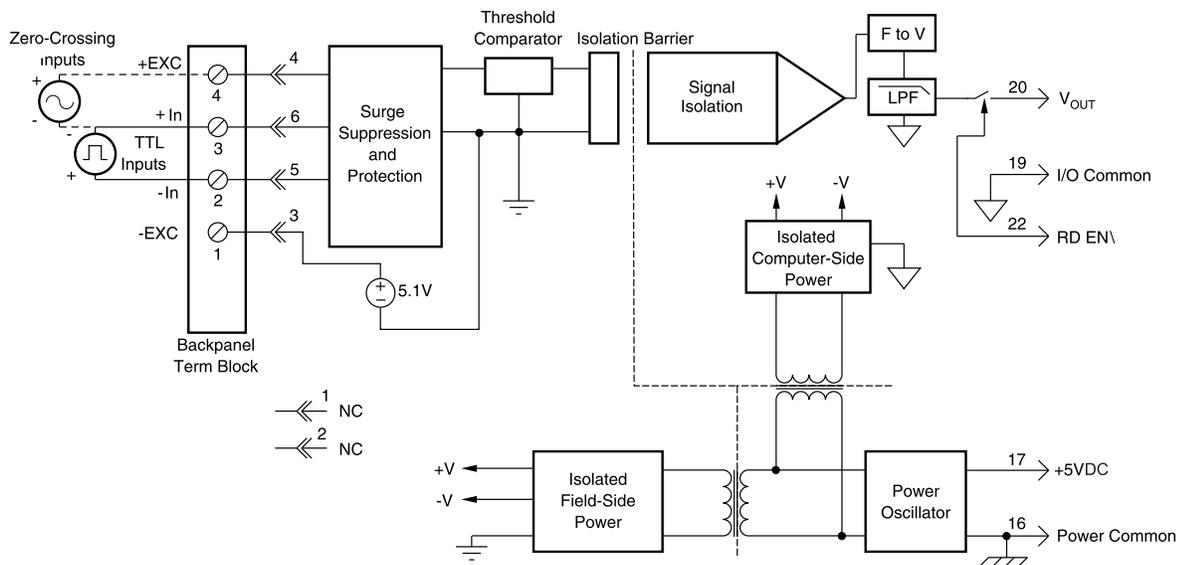
Ordering Information

MODEL	INPUT RANGE	OUTPUT RANGE	EXCITATION
DI-5B45-01	0 to 500Hz	0 to +5V	+5.1Vdc @ 8mA
DI-5B45-02	0 to 1kHz	0 to +5V	+5.1Vdc @ 8mA
DI-5B45-03	0 to 3kHz	0 to +5V	+5.1Vdc @ 8mA
DI-5B45-04	0 to 5kHz	0 to +5V	+5.1Vdc @ 8mA
DI-5B45-05	0 to 10kHz	0 to +5V	+5.1Vdc @ 8mA
DI-5B45-06	0 to 25kHz	0 to +5V	+5.1Vdc @ 8mA
DI-5B45-07	0 to 50kHz	0 to +5V	+5.1Vdc @ 8mA
DI-5B45-08	0 to 100kHz	0 to +5V	+5.1Vdc @ 8mA

DI-5B47 Linearized Thermocouple Input Modules

Each DI-5B47 thermocouple input module provides a single channel of thermocouple input which is filtered, isolated, amplified, linearized and converted to a high level analog voltage output (see block diagram). This voltage output is logic switch controlled, which allows these modules to share a common analog bus without the requirement of external multiplexers.

The DI-5B modules are designed with a completely isolated computer side circuit which can be floated to ±50V from Power Common, pin 16. This complete isolation means that no connection is required between I/O Common and Power Common for proper operation of the output switch. If desired, the output switch can be turned on continuously by simply connecting pin 22, the Read-Enable pin to I/O Common, pin 19.

The DI-5B47 can interface to eight industry standard thermocouple types: J, K, T, E, R, S, N, and B. Its corresponding output signal operates over a 0 to +5V range. Each module is cold-junction compensated to correct for parasitic thermocouples formed by the thermocouple wire and screw terminals on the mounting hardware. Upscale open thermocouple detect is provided by an internal pull-up resistor. Downscale indication can be implemented by installing an external 47MΩ resistor, ±20% tolerance, between screw terminals 1 and 3.

Signal filtering is accomplished with a six-pole filter which provides 95dB of normal-mode-rejection at 60Hz and 90dB at 50Hz. Two poles of this filter are on the field side of the isolation barrier, and the other four are on the computer side.

After the initial field-side filtering, the input signal is chopped by a proprietary chopper circuit. Isolation is provided by transformer coupling, again using a proprietary technique to suppress transmission of common mode spikes or surges. The module is powered from +5VDC, ±5%.

A special circuit in the input stage of the module provides protection against accidental connection of power-line voltages up to 240VAC.
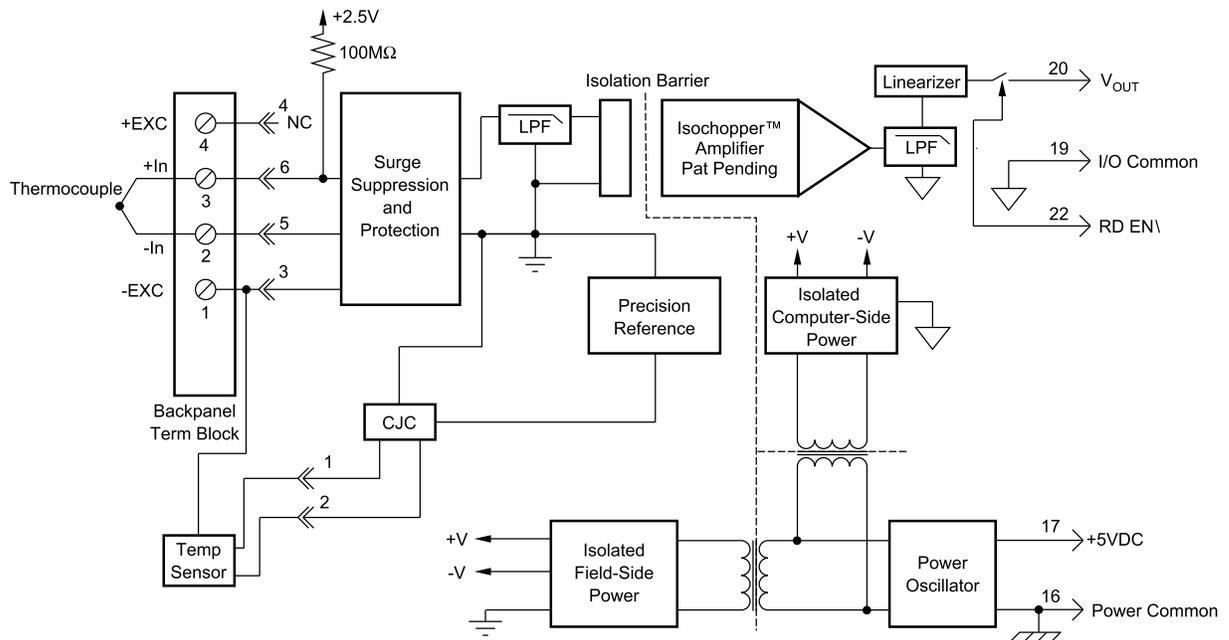
Ordering Information

MODEL	TYPE	INPUT RANGE	ACCURACY*
DI-5B47J-01	Type J	0°C to +760°C (+32°F to +1400°F)	±0.61°C
DI-5B47J-02	Type J	-100°C to +300°C (-148°F to +572°F)	±0.32°C
DI-5B47J-03	Type J	0°C to +500°C (+32°F to +932°F)	±0.36°C
DI-5B47J-12**	Type J	-100°C to +760°C (-148°F to +1400°F)	±0.70°C
DI-5B47K-04	Type K	0°C to +1000°C (+32°F to +1832°F)	±0.80°C
DI-5B47K-05	Type K	0°C to +500°C (+32°F to +932°F)	±0.38°C
DI-5B47K-13**	Type K	-100°C to +1350°C (-148°F to +2462°F)	±1.20°C
DI-5B47K-14**	Type K	0°C to +1200°C (+32°F to +2192°F)	±0.96°C

*Includes conformity, hysteresis and repeatability. Does not include CJC accuracy.

**CSA certification pending.

DI-5B48 Accelerometer Input Modules

The DI-5B48 provides excitation to piezoelectric sensors with built-in microelectronic amplifiers, commonly known as ICP®* or IEPE or LIVM sensors. The module provides a constant current excitation to the sensor, then isolates, filters, and amplifies the sensor output, yielding a high-level analog voltage output. The excitation current, signal gain, and filter high-pass and low-pass cutoff frequencies are field-configurable through a set of slide switches.

Six poles of signal filtering in the DI-5B48 module result in greater than 100dB of normal-mode rejection for signal frequencies above the cutoff frequency. One pole of filtering is on the field side of the isolation barrier for anti-aliasing purposes and the remaining five-pole programmable Bessel filter is located on the system side. High-pass filtering is achieved through a second order passive filter, located on the field side. If desired, the output switch can be turned on continuously by simply connecting pin 22, the Read-Enable pin, to I/O Common, pin 19.

The DI-5B48 offers the option of setting the constant current source for sensor excitation to common values of 4mA or 9mA with a compliance voltage of 24VDC. Programmable gains of 1, 10 and 100 are selectable and the module offers a ±10V output. The required supply level is +5VDC, ±5%.

To ensure protection of expensive data acquisition equipment, the DI-5B48 module signal inputs and sensor excitation outputs are protected against accidental connection of voltages up to 240Vrms.
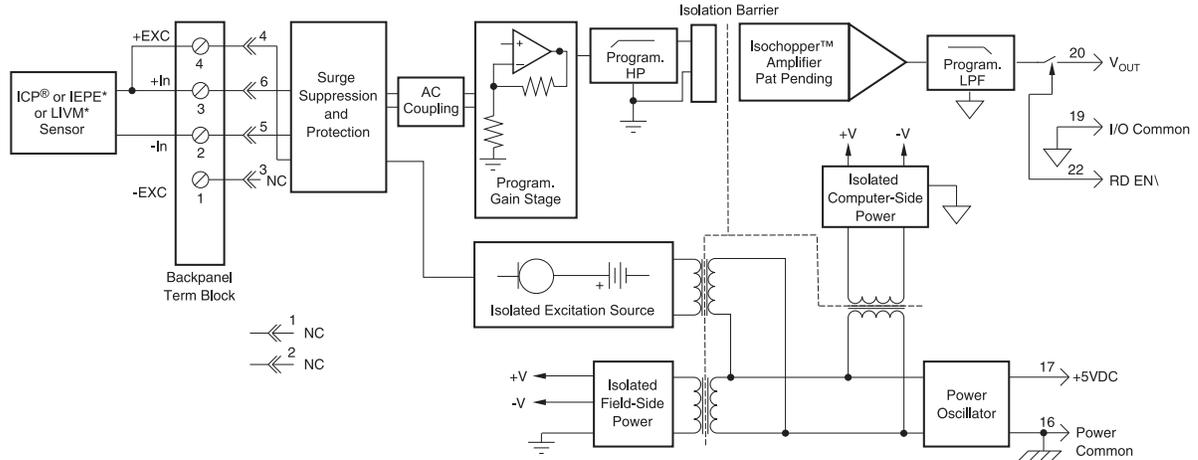
Ordering Information

MODEL	INPUT RANGE	OUTPUT RANGE	BANDWIDTH	ISOLATION VOLTAGE
DI-5B48-01	±10V max	±10V	2.5kHz to 20kHz	1500

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