

# **CIO-EXP16 and CIO-EXP32**

## **User's Manual**

Revision 8  
August, 2001

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## 1.0 INTRODUCTION

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The CIO-EXP is available in two versions; a 16-channel and a 32-channel board. It is a signal conditioning accessory board that expands the number of analog inputs and the range of amplification of the DAS08 and DAS16 family of boards. If a CIO-EXP16 is used with an 8 channel A/D board, the expansion is up to 128 inputs. If a CIO-EXP32 is used with a 16 channel A/D board, the expansion is up to 256 inputs.

The CIO-EXP board is mounted external to the PC. It can be placed in the open on your benchtop or in a case.

## 2.0 SOFTWARE INSTALLATION

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In order to easily test your installation, it is recommended that you install *InstaCal*, the installation, calibration and test utility that was supplied with your board. Refer to the *Extended Software Installation Manual* for information on the initial setup, loading, and installation of *InstaCal* and the optional Universal Library software.

*InstaCal* will guide you through hardware settings and allow you to easily test for conflicts. In addition to the information provided in *InstaCal*, review the information provided in the following sections before powering up your board.

# 3.0 HARDWARE INSTALLATION

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Before using the CIO-EXP, there are switches and jumpers to set, and one or more cables to install. Please turn the PC power OFF before proceeding.

A CIO-EXP is shipped from the factory as follows:

|                                  |                                                                                                 |
|----------------------------------|-------------------------------------------------------------------------------------------------|
| EXP Output to DAS channel jumper | EXP 0-15: 0<br>EXP 16-31 (EXP32 only): 1<br>CJC: 7<br>DAS08<br>Gain = 1 (All gain switches OFF) |
| A/D Board Type Jumper            |                                                                                                 |
| GAIN                             |                                                                                                 |
| +5V Power Switch                 | INT                                                                                             |
| Solder Bridges                   | All open                                                                                        |

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## 3.1 POWER OPTIONS

The +5VDC power to the CIO-EXP board can be supplied via the 37-conductor cable from the A/D board in the PC (internal) or via a separate optional power cable connected directly to the PC power supply (external). The internal method is adequate for powering up to two CIO-EXP32 boards or five CIO-EXP16 boards. The external power method (separate power cable) is required when

- More than two CIO-EXP32 or more than five CIO-EXP16 boards are used with one A/D board.
- The A/D board in use does not supply +5V to its connector (such as the PCM-DAS16S/12)

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## 3.2 SETTING UP THE POWER SOURCE

If you have determined that the INTERNAL power method is adequate for your configuration , leave the +5V Power switch set to INT and continue to the next section.

If you have determined that the EXTERNAL power method is required for your configuration , leave set the +5V Power switch (S3) to EXT and connect the separate power cable as follows:

If you have purchased a C-PCPOWER-10 cable, open your PC (after turning OFF the power) and connect the black cable with the white MOLEX type connectors to one of the unused PC expansion power connectors from the PC power supply. They are

keyed so the cable will plug into the expansion connector easily when they are aligned (See Figure 3-1).

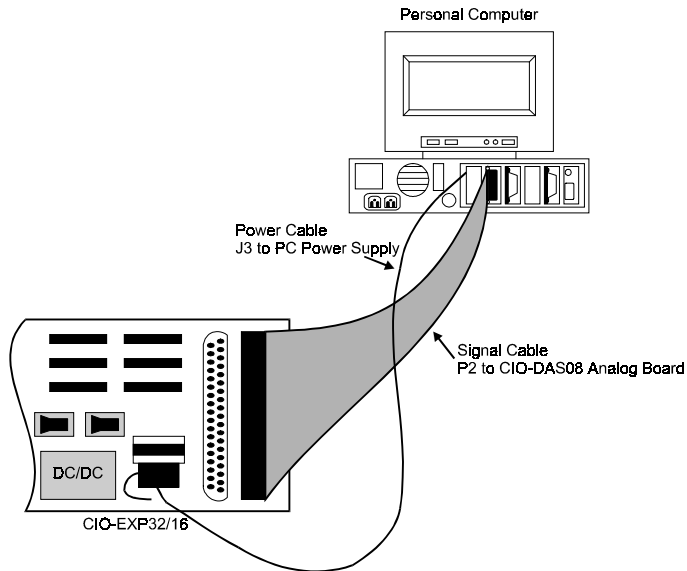


Figure 3-1. Cable Installation

Run the power cable out the back of the PC through an expansion slot or other opening. *DO NOT pinch the cable when the case is closed. If this cable is cut, the resulting short circuit can damage the computer.*

Connect the other end of the black cable to the CIO-EXP connector labeled “OPTIONAL EXTERNAL +5V POWER. This end is keyed also. Put the CIO-EXP board +5V switch (S3) in the EXT position.

The power source select switch is shown in Figure 3-2 in both positionss

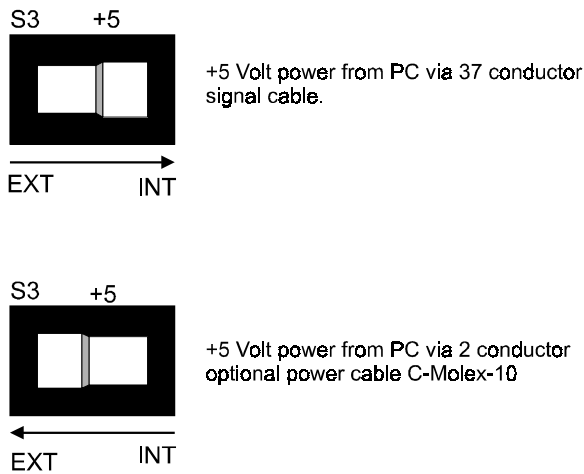


Figure 3-2. INTERNAL / EXTERNAL Power Switch

### 3.3 CONNECTING THE CIO-EXP TO THE A/D BOARD

Signals may be connected from the CIO-EXP board to the A/D board through one of two types of cables. The cable used depends upon the type of A/D board you are connecting to.

#### 3.3.1 SIGNAL CABLE

The CIO-EXP signal connector is nearly a mirror of the CIO-DAS08 signal cable.

There are two 37D connectors on the CIO-EXP, P1 and P2. They are wired 1:1. The second D37, P1, is provided to daisy chain additional CIO-EXP boards. A C37FF series cable is used to daisy chain the CIO-EXP boards together. Do not exceed 50 feet in length.

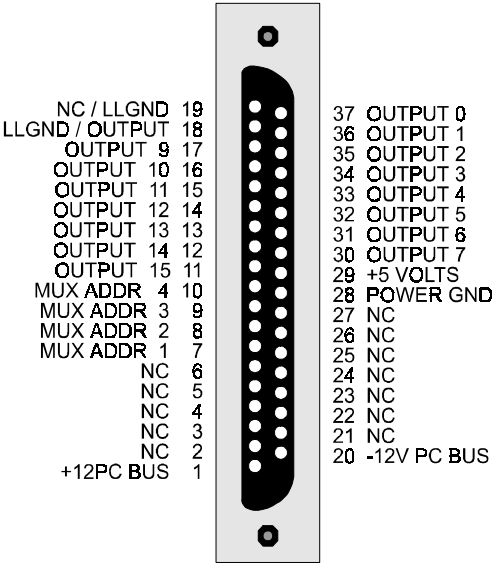


Figure 3-3. CIO-EXP32/16 Connector P2/P1

**3.3.2 CONNECTING TO A DAS08 SERIES A/D BOARD**

DAS08 series boards may be connected directly through a C37FF series cable. The A/D BOARD TYPE jumper may be left in the DAS08 position as set at the factory. Connection to CIO-DAS16 or PCM-DAS16 series boards requires additional steps. A special cable must be used and the A/D BOARD TYPE jumper must be set in the DAS16 position (see the following sections).

**3.3.3 CONNECTING TO A DAS16 SERIES A/D BOARD**

The CIO-EXP can be used with DAS16 series boards, expanding the DAS16's 16 inputs to 256 inputs. The connection requires a special 37-conductor cable (CEXP2DAS16-10) since pin relationship of CIO-EXP and DAS16 signals is not 1:1 (refer to Table 3-1 below). Install the CEXP2DAS16-10 cable connector labeled “MUX” (P1 in the table) into the P2 connector of the CIO-EXP board and the other end into the DAS16 series board’s analog connector.

NOTE: Order the cable only by the (catalog) number given here .

Table 3-1 CEXP2DAS16-10 Cable Pin Out

| P1 (MUX) | P2           |
|----------|--------------|
| 7        | 23           |
| 8        | 4            |
| 9        | 22           |
| 10       | 3            |
| 11       | 11           |
| 12       | 12           |
| 13       | 13           |
| 14       | 14           |
| 15       | 15           |
| 16       | 16           |
| 17       | 17           |
| 18       | 18           |
| 19       | 19           |
| 28       | 7            |
| 29       | 1            |
| 30       | 30           |
| 31       | 31           |
| 32       | 32           |
| 33       | 33           |
| 34       | 34           |
| 35       | 35           |
| 36       | 36           |
| 37       | 37           |
| N/C      | Shell Shield |

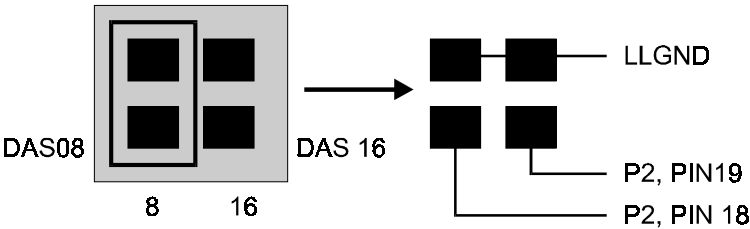
3.3.4 CONNECTING TO A PCM-DAS16 SERIES BOARD

The CIO-EXP can be used with PCM-DAS16S series or PCM-DAS16/330 boards, expanding the 16 inputs to 256 inputs. The connection requires a special 37-conductor cable (PCM-CD16S/EXP16) since the pin relationship of CIO-EXP and PCM-DAS16 signals is not 1:1.

The PCM-DAS series boards cannot supply the +5V power required by the CIO-EXP so you must use the EXTERNAL power option (see SETTING UP THE POWER SOURCE above).

3.3.5 A/D BOARD TYPE JUMPER

There is one 4-pin jumper located just above the 37-pin signal connectors on the CIO-EXP. This jumper configures the CIO-EXP for use with the DAS08 family of boards or the DAS16 family of boards. Place the jumper in the position for the type of A/D board you are using with the CIO-EXP (see Figure 3-4).



A/D BOARD TYPE SELECT - Shown with CIO-DAS08 selected.

Figure 3-4. Board Type Select Jumper

3.4 SELECTING THE A/D CHANNEL FOR EXP OUTPUT

A separate A/D channel must be selected for each signal to be acquired from the CIO-EXP board(s). Each CIO-EXP16 has two potential signals (the output of the 16 multiplexed inputs and the output of the CJC circuit). Each CIO-EXP32 has three potential signals (the outputs of each of the two banks of 16 multiplexed inputs and the output of the CJC circuit).

A group of two or three rows of 16 jumper pairs located near the 37-pin connectors are labeled with A/D board channel numbers. Any CIO-EXP signal to be acquired must be exclusively assigned to an A/D channel using these jumpers. In other words, for all CIO-EXP boards attached to an A/D board, only one jumper on any of the jumper blocks should be assigned to a particular channel.

The CIO-EXP32 has 32 input channels. These are treated as two banks of 16 channels each. Bank 1 is connected to the jumper block labeled “EXP 0 - 15”. Bank 2 is connected to the jumper block labeled “EXP 16 - 31”.

The CIO-EXP16 has 16 input channels in one bank. This bank is connected to the jumper block labeled “EXP OUTPUT TO DAS”

On each CIO-EXP, each bank of 16 inputs are multiplexed into one output channel. This output from the CIO-EXP board is connected to one analog input of the A/D board in the computer.

Both CIO-EXP boards also have a semiconductor temperature sensor on board to measure the temperature of the board in the region of the screw terminals. The temperature at the screw terminals is needed when thermocouples are used with the CIO-EXP. The temperature at the screw terminals is called the Cold Junction temperature and is needed to accurately calculate thermocouple temperature. This is known as Cold Junction Compensation.

When a CIO-EXP channel is used with a thermocouple, install the INPUT CJC jumper in the desired channel location. If you are not using thermocouples, do not install it.

Figure 3-5 is a block diagram of one bank of 16 CIO-EXP inputs. One of sixteen inputs is selected by the four MUX address lines that are controlled by the A/D board.

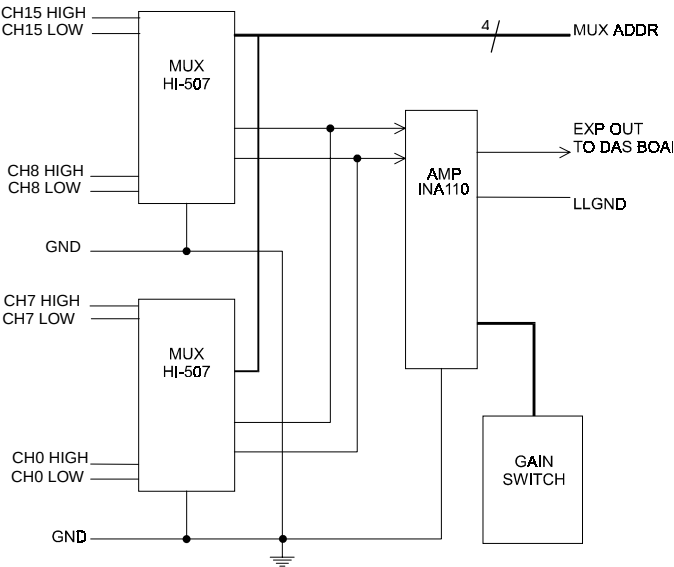


Figure 3-5. Inputs - CIO-EXP Block Diagram

The output of the CIO-EXP selected channel is an input to the A/D board.

The CIO-EXP is typically configured at the factory as follows:

- CIO-EXP16 & CIO-EXP32 channels 0-15 are connected to A/D board channel 0.
- CIO-EXP32 channels 16-31 are connected to A/D channel 1.
- CIO-EXP CJC is connected to A/D channel 7.

Figure 3-6 shows the layout of the jumper blocks on the CIO-EXP32. The CIO-EXP16 lacks the second row (Ch 16-31).

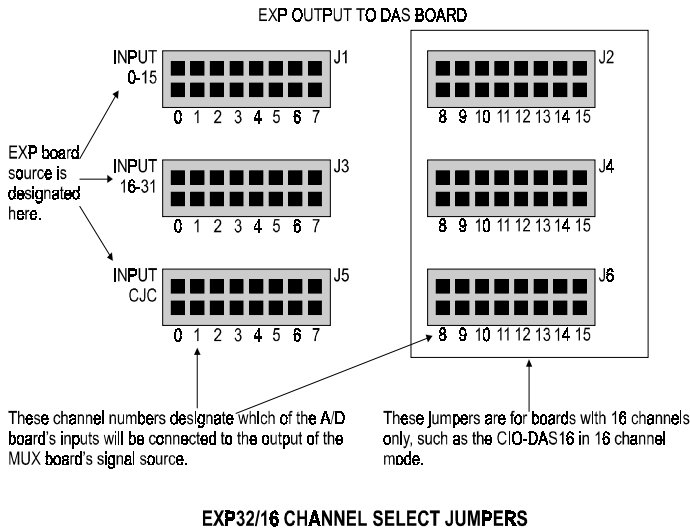


Figure 3-6. Channel Select and CJC Select Jumper Locations

### 3.4.1 CHANNEL SELECTION FOR THE DAS08 FAMILY

The DAS08 family of boards has eight channels of input so only CIO-EXP outputs 0-7 are valid.

Many boards in the DAS08 family of boards have single ended inputs which is the correct type to connect to a CIO-EXP. If the inputs on the board type you are using are differential, they must be converted to single-ended inputs (see information supplied with your A/D board).

Up to eight banks of 16 CIO-EXP inputs can be connected to a DAS08 family of boards for a total of 128 inputs.

3.4.2 CHANNEL SELECTION FOR THE DAS16 FAMILY

The CIO-EXP outputs 0-7 and 8-15 can be used with the CIO-DAS16. Up to 16 banks of 16 CIO-EXP channels can be connected to a DAS16 family board for a total of 256 inputs.

Most of the DAS16 family of A/D is switch-selectable for either 8 differential or 16 single-ended channels. Set the switch for 16-channel, single-ended mode.

The PCM-DAS16 family is available in either single ended or differential configuration. Only the single-ended version can be used with the CIO-EXP.

3.5 SETTING THE EXP GAIN

The CIO-EXP has a bank of four DIP switches per each bank of 16 inputs. It is located in the center of the bank it is associated with. The four switches control the gain of the differential amplifier. The gains are additive so a total of 16 different gains are possible.

The gain associated with a switch is 'ON' when the switch is to the left and 'OFF' when the switch is to the right. See Figure 3-7 for an example. (If all are "OFF", the gain is one.)

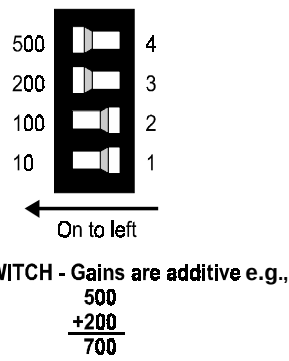


Figure 3-7. Gain Switch

For most thermocouple applications, the gain should be set to at least 100. Refer to tables in Section 4 for data on setting optimum amplifier gains when using thermocouples.

For most other applications, the gain should be set to result in output signal levels as close to ±5V or ±10V (depending on the range setting on the A/D board) as possible.

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## 3.6 CONFIGURING CIO-EXP INPUTS

Each channel of the CIO-EXP can be configured for:

- 7 Hz filtered input (C pad)
- Open thermocouple detect (V pad)
- Reference to ground through 100k ohm resistor (G pad)

Each of these options is selected by adding a solder bridge (or “jumper”) to three 'connect pads' on the etch side (under side) of the CIO-EXP board. The pads, labeled “V”, “C” and “G”, connect resistors and capacitors to the input signals for purposes described below.

Figure 3-8 is a simplified schematic of an input channel. The etch pads 'C', 'V' and 'G' are all open when the board is shipped. If bridged, they do the following:

- Bridging the 'C' pad connects a 1  $\mu$ F capacitor across the signal high and low inputs forming a low-pass filter having a 7 Hz cutoff.
- The V pad is for Open Thermocouple Detection. Open thermocouple detection means that if a thermocouple should open, the input for that channel is driven to full-scale negative volts. Negative FS corresponds to the lowest minus degree reading of the thermocouple, which in the real world is not likely or even possible. Software uses the presence of a lowest minus degree reading to alert the operator that a thermocouple has opened.
- The G pad provides a reference to ground through a 100K resistor. A thermocouple is a floating source. Without the G pad's reference, the reading from the thermocouple would float. Refer to the section of this manual on differential inputs.

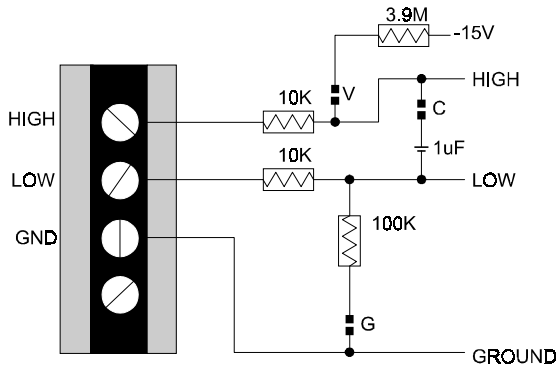
It is recommended that you bridge the V, G, and C pads for any channels on which you will be using thermocouples.

To bridge the pads, place a drop of solder on a pad then pull the soldering iron perpendicular to the pads from the center of the two pads.

To remove a solder bridge, slide the soldering iron toward one pad or the other.

### CAUTION

Do not overheat the solder or the pads may lift.



**CIO-EXP INPUT - One channel. C = Filter capacitor, pad open. V = Open TC detect, pad open. G = Ref to ground, pad open. Pads are located on circuit side.**

Figure 3-8. Channel Configuration Jumper Pads - Simplified Schematic

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## **3.7 CONFIGURING THE A/D BOARD**

### **3.7.1 DAS08 FAMILY SETUP**

The input mode of the A/D board must be single-ended to be compatible with the CIO-EXP outputs. Some of the boards in the DAS08 series have differential inputs that can be converted to single-ended inputs. See the information shipped with your A/D board for conversion to single-ended inputs.

### **3.7.2 DAS16 FAMILY SETUP**

The input mode of the A/D board must be single-ended to be compatible with the CIO-EXP outputs. Most of the DAS16 series is switch selectable for either 8 differential or 16 single ended inputs. When used with the CIO-EXP, set the switch to 16 channel, single-ended mode.

### **3.7.3 ALL A/D BOARDS**

If the range of your A/D board is switch selectable and you are using thermocouples, set the range of the A/D board to  $\pm 5V$ , if available, or  $\pm 10V$  if not. Some software packages base the calculation of temperature on these ranges only.

If you are not using thermocouples, set the range of the A/D board to accommodate the maximum output expected from the CIO-EXP board.

If your A/D board has a UNI / BIP switch (for setting the range to either unipolar or bipolar), the preferred setting is BIP (bipolar).

If the range on your A/D board is fully programmable, the software you use for temperature measurement will determine the correct range to use.

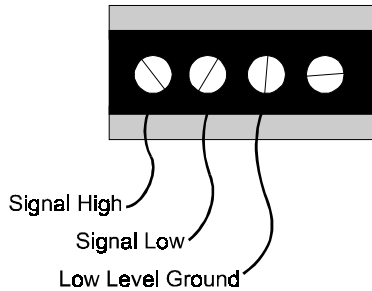
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### 3.8 CIO-EXP INPUT CONNECTOR DIAGRAM

The CIO-EXP inputs are screw terminals which will accept 12-22 AWG wire.

Each channel has a screw terminal for signal high, signal low and ground.

The CIO-EXP inputs are differential. Differential inputs require three connections be made from the signal source to the CIO-EXP. These are SIGNAL HIGH, SIGNAL LOW & GROUND (Figure 3-9).



**TYPICAL CHANNEL - Differential Input**

Figure 3-9. Differential Channel Connections

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## 4.0 TESTING THE INSTALLATION

You can test the installation with *InstaCal*, supplied with your data acquisition board. Refer to the *Software Installation Manual* for full installation instructions. For program control of your EXP board, refer to Universal Library functions which work in combination with the DAS board installed in your computer to which the EXP board is connected.

The CIO-EXP should be calibrated after initial installation, after changing the gain of any CIO-EXP bank and at 6 month intervals. Use the *InstaCal* software for calibration. Refer to the *Software Installation Manual* for full instructions regarding the installation of *InstaCal*.

## 5.0 SIGNAL CONNECTION

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Signal connection can be one of the most challenging aspects of applying a data acquisition board. If you are an Analog Electrical Engineer then this section is not for you, but if you are like most PC data acquisition people these simple examples should get you started. The objective here is to present 'how to connect' common signals while avoiding discussion of electrical theory and special symbols.

---

### 5.1 ANALOG INPUTS

Analog inputs to the CIO-EXP can be connected in two different configurations. In order of complexity, these are Floating Differential and Differential.

#### **WARNING - PLEASE READ**

*Measure the voltage between the signal ground at the signal source and ground at the PC. If there is a difference of more the 10 volts, do not connect the CIO-EXP to this signal source because you will not be able to make any reading. If the voltage is more than 30 volts, DO NOT connect this signal to the CIO-EXP because it will damage the board and possibly the computer.*

---

### 5.2 FLOATING DIFFERENTIAL

A floating differential input is two wires from the signal source and a 100K ground reference resistor installed at the CIO-EXP input. The two signals from the signal source are Signal High (CH# HI) and Signal Low (CH# LO).

The reference resistor is connected between the CIO-EXP CH# LO and LLGND pins.

A floating differential hookup is handy when the signal source is floating with respect to ground, such as a battery, 4-20 mA transmitter or thermocouple and the lead lengths are long or subject to EMI.

A thermocouple is an example of a floating differential. Instead of using an external 100K resistor, add a solder bridge between the 'G' pads.

The floating differential input will reject up to 10V of EMI.

#### **WARNING!**

*Is the signal source really floating? Check it with a voltmeter before risking the CIO-EXP and PC!*

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---

## 5.3 DIFFERENTIAL INPUTS

A differential signal uses three wires from the signal source. The signals are Signal High (CH# HI), Signal Low (CH# LO) and Signal Ground (LLGND).

A differential connection allows you to connect the CIO-EXP to a signal source with a ground that different than the PC ground, but less than 10V difference, and still make a true measurement of the signal between CH# HI and CH# LO.

### EXAMPLE:

A laboratory instrument with its own wall plug. There are sometimes differences in wall grounds between outlets.

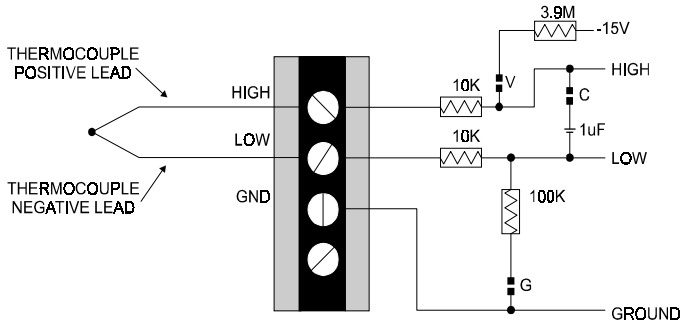
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## 5.4 THERMOCOUPLES

The CIO-EXP32 and CIO-EXP16 are ideal for thermocouple signal processing. The card provides cold junction compensation (CJC), open thermocouple detect (OTD) and stable amplification for accurate temperature measurements.

In the drawing below, a thermocouple is connected to one channel of the CIO-EXP. Note that the thermocouple has a positive and a negative lead. If you're not sure which is which, make a test hookup and use a match to heat the thermocouple. If the temperature reading goes down, switch the leads.



**CIO-EXP INPUT - One channel. Typical thermocouple hookup. C = Filter capacitor, pad open. V = Open TC detect, pad open. G = Ref to ground, pad open. Pads are located on circuit side. All pads must be closed when thermocouples are used.**

Thermocouple connection methods are described below.

### 5.4.1 COLD JUNCTION COMPENSATION

A thermocouple is two dissimilar wires that react electrically when in contact with each other. The reaction produces a voltage which is dependent on the temperature at the point where the two metals touch. There is a reaction at every point where dissimilar metals (the thermocouple wire) touch including the screw terminal where the thermocouple wire is connected to the CIO-EXP board.

A semiconductor temperature sensor located on the CIO-EXP board provides a stable, accurate and linear output which is temperature dependent. This output must be mapped into one of the A/D boards inputs via the CJC jumper block. The CJC temperature reference is universally used by software to compensate for the voltage induced at the 'cold junction' (the screw terminal). Failure to supply a CJC reference will result in inaccurate temperature readings.

All software programs use a CJC reference. Labtech Notebook defaults to channel 7. The example programs default to channel 7. Failure to supply

the CJC reference by installing the jumper plug on the correct channel will result in inaccurate temperature calculations in the software. See Figure 3-6 for the CJC jumper locations.

#### **5.4.2 OPEN THERMOCOUPLE DETECT**

Open thermocouple detect (OTD) for a channel is done by closing the associated 'V' pad with a solder bridge. OTD applies a full scale negative voltage the high side of the thermocouple signal. If a thermocouple opens, the OTD voltage drives the signal on that channel to full minus. Most software is set up to alarm for an open thermocouple when a temperature falls to full scale minus. The CIO-EXP will accurately measure thermocouples without the 'V' pad closed but you lose OTD protection.

#### **5.4.3 LOW PASS FILTER**

A low pass filter is implemented by closing the 'C' pad. The bandwidth of this filter is 7 Hz. Signals changing at rates greater than 7 times per second will be damped. This low pass filter helps to reject noise picked up along the thermocouple wire. Since temperature measurement is generally a 'low frequency' application, use of this filter will have little affect on the temperature measurement itself. The CIO-EXP will accurately measure thermocouples without the 'C' pad closed but the measurements can appear to fluctuate a few degrees from reading to reading as the result of noise on the thermocouple wire.

#### **5.4.4 GROUND REFERENCE**

The CIO-EXP inputs are fully differential which help reject noise on thermocouple wires. In most applications, the 'G' pad should be closed for thermocouples to work properly. The 'G' pad provides a reference from ground to the analog low input via a 100K resistor. Only enough current passes through the resistor to provide a reference to ground. The analog high and low inputs are still able to float within the common mode range.

## 5.5 AMPLIFICATION & THERMOCOUPLES

The voltage from a thermocouple is very low and must be amplified to take advantage of the A/D board's full resolution. The amplification of each bank of 16 inputs is set by a switch on the CIO-EXP board.

Table 4-1 lists the theoretical amplifier output voltage at maximum temperature for each gain. In most cases, the range on the A/D board will be set to  $\pm 5V$ . You can see by the table below that the maximum voltage for some thermocouple / gain combinations can exceed the maximum A/D input range (typically 5V) or even the maximum output voltage of the CIO-EXP board ( $\pm 10V$ ). Table 4-2 lists the maximum readable temperatures for each gain and thermocouple type for an A/D range of  $\pm 5V$ .

Table 4-1. Output Voltage Vs Gain at Maximum Temperature

| Type | Min Temp<br>Deg C | Max Temp<br>Deg C | mV at<br>Max | Gain / Output Volts @ Max Temp |      |      |      |      |
|------|-------------------|-------------------|--------------|--------------------------------|------|------|------|------|
|      |                   |                   |              | 100                            | 200  | 300  | 500  | 800  |
| J    | 0                 | 750               | 42.28        | 4.2                            | 8.5  | 12.7 | 21.1 | 33.8 |
| K    | -200              | 1250              | 50.63        | 5.1                            | 10.1 | 15.2 | 25.3 | 40.5 |
| T    | -200              | 350               | 17.82        | 1.8                            | 3.6  | 5.3  | 8.9  | 14.3 |
| E    | -200              | 900               | 68.78        | 6.9                            | 13.8 | 20.6 | 34.4 | 55.0 |
| S    | 0                 | 1450              | 14.97        | 1.5                            | 3.0  | 4.5  | 7.5  | 12.0 |
| R    | 0                 | 1450              | 16.74        | 1.7                            | 3.3  | 5.0  | 8.4  | 13.4 |

Table 4-2. Gain Vs Maximum Readable Temperatures

| Type | Gain / Max. Readable Temps. with A/D Range = $\pm 5V$ |         |        |        |        |       |
|------|-------------------------------------------------------|---------|--------|--------|--------|-------|
|      | 10                                                    | 100     | 200    | 300    | 500    | 800   |
| J    | MAX                                                   | 750°C   | 457°C  | 307°C  | 186°C  | 117°C |
| K    | 1250°C                                                | 1232 °C | 602°C  | 406°C  | 246°C  | 152°C |
| T    | MAX                                                   | MAX     | 350°C  | 330°C  | 214°C  | 140°C |
| E    | 900°C                                                 | 661°C   | 350°C  | 244°C  | 152°C  | 98°C  |
| S    | MAX                                                   | MAX     | MAX    | 1450°C | 1035°C | 697°C |
| R    | MAX                                                   | MAX     | 1450°C | 1445°C | 961°C  | 658°C |

As you can see, in order to read the maximum usable temperature for type K and E thermocouples, the CIO-EXP gain you select must be X10 or less.

## 6.0 SPECIFICATIONS

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### POWER CONSUMPTION

+5V

CIO-EXP16

120 mA typical, 155 mA max

CIO-EXP32

300 mA typical, 390 mA max

### ANALOG INPUT SECTION

Number of channels

CIO-EXP16

16 differential (1 bank)

CIO-EXP32

32 differential (2 banks of 16)

Input range

±10V

Gain

Switch selectable by bank, additive values of X1, X10, X100, X200 and X500

Calibration

One offset and gain potentiometer per bank (16 channels) and one Cold Junction Compensation adjustment potentiometer per board.

Gain Error

Gain = 1

0.002% typical, 0.02% max

Gain = 10

0.005% typical, 0.05% max

Gain = 100

0.01% typical, 0.1% max

Gain = 200

0.02% typical, 0.2% max

Gain = 500

0.05% typical, 0.5% max

Non-linearity

Gain = 1

0.0005% typical, 0.005%

Gain = 10

0.001% typical, 0.01% max

Gain = 100

0.002% typical, 0.01% max

Gain = 200

0.003% typical, 0.01% max

Gain = 500

0.005% typical, 0.02% max

Temperature Coefficient

Gain = 1

± 20 ppm / °C

Gain = 10

± 20 ppm / °C

Gain = 100

± 40 ppm / °C

Gain = 200

± 60 ppm / °C

Gain = 500

± 100 ppm / °C

Offset

± 15mV / °C

Common Mode Range

±10V

CMRR @ 60 Hz

90 dB

|                                            |                                                                                              |
|--------------------------------------------|----------------------------------------------------------------------------------------------|
| Input filter                               | 7 Hz, selectable through solder bridge (C pad)                                               |
| Open thermocouple detect                   | –50 mV at positive input when thermocouple is open, selectable through solder bridge (V pad) |
| Input ground reference                     | 10k ohms to ground, selectable through solder bridge (G pad)                                 |
| Input leakage current<br>V and G pads open | 2 nA typical, 6 nA max                                                                       |
| Input impedance<br>V and G pads open       | >100 MegOhms min                                                                             |
| V and G pads shorted                       | 100k Ohms min                                                                                |
| Absolute maximum input voltage             |                                                                                              |
| Power on                                   | ±35V                                                                                         |
| Power off                                  | ±20V                                                                                         |

## COLD JUNCTION COMPENSATION

|                    |             |
|--------------------|-------------|
| CJC Output Voltage | 24mV / °C   |
| CJC Zero Crossing  | 0 mV at 0°C |

## ANALOG OUTPUT

|                    |              |
|--------------------|--------------|
| Number of channels |              |
| CIO-EXP32          | 2            |
| CIO-EXP16          | 1            |
| Output voltage     | ±10V         |
| Configuration      | Single-ended |
| Current Drive      | ±5 mA        |
| Output coupling    | DC           |
| Output impedance   | 0.1 Ohms max |

## DIGITAL INPUT

|                    |                                                          |
|--------------------|----------------------------------------------------------|
| Digital Input:     | 74LS14                                                   |
| Configuration      | Four bits for selecting multiplexer channel 0 through 15 |
| Number of channels | 4 input                                                  |
| Input High         | 2.0 volts min, 7 volts absolute max                      |
| Input Low          | 0.8 volts max, –0.5 volts absolute min                   |

## ENVIRONMENTAL

|                             |                         |
|-----------------------------|-------------------------|
| Operating temperature range | 0 to 60°C               |
| Storage temperature range   | –40 to 100°C            |
| Humidity                    | 0 to 90% non-condensing |

**For your notes.**

**For your notes.**

## EC Declaration of Conformity

The product:

|             |                              |
|-------------|------------------------------|
| CI0-EXP16   | 16 channel multiplexer board |
| CI0-EXP32   | 32 channel multiplexer board |
| Part Number | Description                  |

to which this declaration relates, meets the essential requirements, is in conformity with, and CE marking has been applied according to the relevant EC Directives listed below using the relevant section of the following EC standards and other normative documents:

**EU EMC Directive 89/336/EEC:** Essential requirements relating to electromagnetic compatibility.

**EU 55022 Class B:** Limits and methods of measurements of radio interference characteristics of information technology equipment.

**EN 50082-1:** EC generic immunity requirements.

**IEC 801-2:** Electrostatic discharge requirements for industrial process measurement and control equipment.

**IEC 801-3:** Radiated electromagnetic field requirements for industrial process measurements and control equipment.

**IEC 801-4:** Electrically fast transients for industrial process measurement and control equipment.