# PCB PIEZOTRONICS INC.

**Model 482C27**

**Bridge/Differential, ICP®/Voltage Sensor Signal Conditioner**

**Installation and Operating Manual**

For assistance with the operation of this product,
contact PCB Piezotronics, Inc.

Toll-free: 800-828-8840
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Total Customer Satisfaction
PCB PIEZOTRONICS

**The information contained in this document supersedes all similar information that may be found elsewhere in this manual.**

**Total Customer Satisfaction** – PCB Piezotronics guarantees Total Customer Satisfaction. If, at any time, for any reason, you are not completely satisfied with any PCB product, PCB will repair, replace, or exchange it at no charge. You may also choose to have your purchase price refunded in lieu of the repair, replacement, or exchange of the product.

**Service** – Due to the sophisticated nature of the sensors and associated instrumentation provided by PCB Piezotronics, user servicing or repair is not recommended and, if attempted, may void the factory warranty. Routine maintenance, such as the cleaning of electrical connectors, housings, and mounting surfaces with solutions and techniques that will not harm the physical material of construction, is acceptable. Caution should be observed to insure that liquids are not permitted to migrate into devices that are not hermetically sealed. Such devices should only be wiped with a dampened cloth and never submerged or have liquids poured upon them.

**Repair** – In the event that equipment becomes damaged or ceases to operate, arrangements should be made to return the equipment to PCB Piezotronics for repair. User servicing or repair is not recommended and, if attempted, may void the factory warranty.

**Calibration** – Routine calibration of sensors and associated instrumentation is

recommended as this helps build confidence in measurement accuracy and acquired data. Equipment calibration cycles are typically established by the users own quality regimen. When in doubt about a calibration cycle, a good "rule of thumb" is to recalibrate on an annual basis. It is also good practice to recalibrate after exposure to any severe temperature extreme, shock, load, or other environmental influence, or prior to any critical test.

PCB Piezotronics maintains an ISO-9001 certified metrology laboratory and offers calibration services, which are accredited by A2LA to ISO/IEC 17025, with full traceablility to N.I.S.T. In addition to the normally supplied calibration, special testing is also available, such as: sensitivity at elevated or cryogenic temperatures, phase response, extended high or low frequency response, extended range, leak testing, hydrostatic pressure testing, and others. For information on standard recalibration services or special testing, contact your local PCB Piezotronics distributor, sales representative, or factory customer service representative.

**Returning Equipment** – *Following these procedures will insure that your returned materials are handled in the most expedient manner.* Before returning any equipment to PCB Piezotronics, contact your local distributor, sales representative, or factory customer service representative to obtain a Return

Materials Authorization (RMA) Number. This RMA number should be clearly marked on the outside of all package(s) and on the packing list(s) accompanying the shipment. A detailed account of the nature of the problem(s) being experienced with the equipment should also be included inside the package(s) containing any returned materials.

A Purchase Order, included with the returned materials, will expedite the turn-around of serviced equipment. It is recommended to include authorization on the Purchase Order for PCB to proceed with any repairs, as long as they do not exceed 50% of the replacement cost of the returned item(s). PCB will provide a price quotation or replacement recommendation for any item whose repair costs would exceed 50% of replacement cost, or any item that is not economically feasible to repair. For routine calibration services, the Purchase Order should include authorization to proceed and return at current pricing, which can be obtained from a factory customer service representative.

**Warranty** – All equipment and repair services provided by PCB Piezotronics, Inc. are covered by a limited warranty against defective material and workmanship for a period of one year from date of original purchase. Contact PCB for a complete statement of our warranty. Expendable items, such as batteries and mounting hardware, are not covered by warranty. Mechanical damage to equipment due to improper use is not covered by warranty. Electronic circuitry failure caused by the introduction of unregulated or improper excitation power or electrostatic discharge is not covered by warranty.

**Contact Information** – International customers should direct all inquiries to their local distributor or sales office. A complete list of distributors and offices can be found at www.pcb.com. Customers within the United States may contact their local sales representative or a factory customer service representative. A complete list of sales representatives can be found at www.pcb.com. Toll-free telephone numbers for a factory customer service representative, in the division responsible for this product, can be found on the title page at the front of this manual. Our ship to address and general contact numbers are:

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# SIGNAL CONDITIONER

## Model 482C27

## GENERAL OPERATION
## MANUAL

For powering ICP®, and bridge sensors, this signal conditioner provides an effective method for managing small numbers of sensor channels. A simple command set, entered through industry standard interface, allows the user to generate powerful application-specific programs to automate system testing. A front panel interface is also provided for standalone operation.

43265
Rev. B
ECO-40715

## ◉*PCB PIEZOTRONICS* ᴵᴺᶜ·

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# Table of Contents

## 1-0.    INTRODUCTION AND SPECIFICATIONS

## 1-1.    Introduction: Safety Considerations
### WARNING SYMBOLS AND TERMS

The following symbols and terms may be found on the equipment described in this manual.

⚠ This symbol on the unit indicates that the user should refer to the operating instructions located in the manual.

⚡ This symbol on the unit indicates that high voltage may be present. Use standard safety precautions to avoid personal contact with this voltage.

⏚ This symbol indicates that the test fixture, Model 482C, must be connected to earth ground via the power cord.

The **WARNING** heading used in this manual explains dangers that might result in personal injury or death. Always read the associated information very carefully before performing the indicated procedure.

The **Caution** heading used in this manual explains hazards that could damage the instrument.

**WARNING 1:** *The power supply/signal conditioner should not be opened by anyone other than qualified service personnel.* This product is intended for service by qualified personnel who recognize shock hazards and are familiar with the safety precautions required to avoid injury.

**WARNING 2:** This equipment is designed with user safety in mind; however, the protection provided by the equipment may be impaired if the equipment is used in a manner not specified by PCB Piezotronics, Inc.

**Caution 1:** *Cables can kill your equipment.* High voltage Electro Static Discharge (ESD) can damage electrical devices. Similar to a capacitor, a cable can hold a charge caused by triboelectric transfer, such as that which occurs in the following:
- Laying on and moving across a rug.
- Any movement through air.
- The action of rolling out a cable.
- Contact to a non-grounded person

The solution for product safety: 1) Connect the cables only with the AC power off. 2) Temporarily "short" the end of the cable before attaching it to any signal input or output.

**Caution 2:** *ESD considerations should be made prior to performing any internal adjustments on the equipment.* Any piece of electronic equipment is vulnerable to ESD when opened for adjustments. Internal adjustments should therefore be done ONLY at an ESD-safe work area. Many products have ESD protection, but the level of protection may be exceeded by extremely high voltage that is typically present in normal situations.

EQUIPMENT RATINGS

For complete specifications, please refer to the enclosed Specification Sheet.  This equipment operates optimally at +32 to +120°F (0 to +50°C), in an environment having <85% relative humidity.  Its line power frequency range is 50/60 Hz.

The Model 482C requires 10-15 VDC with 500 mA to operate.  In turn, it supplies 24 VDC, 2 to 20 mA excitation voltage to connected ICP® or in-line charge converters sensors. The unit gets its power via AC power adaptor, 12 VDC battery pack, 28 VDC or a car adapter which plugs into the receptacle on the rear panel.

## 1-2.    Model 482C System Description

The model 482C27 is a four-channel, bench top signal conditioner that offers low noise operation and simplicity of use.  Each channel is selectable between two input types: Bridge/MEMS or ICP®/Voltage.

For the bridge inputs, this model offers up to 12 VDC unipolar or bipolar excitation voltage for use with differential, single-ended, MEMS and bridge sensors like load cells and reaction torque sensors.  This mode features incremental gain of x0.1 to x2000, normalization, shunt calibration and AC/DC coupling.  In dc coupled mode, auto-balance and auto-zero functions automatically compensate the internal circuitry to provide a zero based output.

The bridge inputs are compatible with full bridge sensors as well as ½ and ¼ bridge sensors with internal switchable bridge completion resistors. The maximum current available is 30mA, with a current limit set at 40mA to prevent damage from inadvertent shorting.

For the ICP® inputs, the model offers 1 to 20 mA of constant current excitation to power ICP sensors or in-line ICP® charge converters.  This model features incremental gain of x.1 to x200, normalization, and AC/DC coupling. In dc coupled mode, an auto-zero function is available to automatically compensate the internal circuitry to provide a zero based output. In Voltage input mode current excitation is set to 0 mA (off).

The base unit of this model is powered from 9 to 18 VDC but is supplied with a universal voltage, AC power adapter.  An optional auto lighter adapter (488A13) is also available.

Model 482C27 offers the following:
• Provides Sensor Excitation Voltage or ICP® Power
• Compatible with Full, ½, and ¼ Bridge Sensors
• Suitable for Conditioning Any Voltage Input Signals
• AC/DC Coupling
• Auto Zero and Auto Balance Functions
• Digital Data Output
• Gain of 0.1 to 2000 for bridge inputs
• Gain of 0.1 to 200 for ICP®/voltage inputs
• Menu-driven Dot Matrix Display
• Keypad, RS-232, and Ethernet Control
• Remote control via either RS-232 or Ethernet using the supplied software
• compatible with PCB's line of dc accelerometers, such as models 3901 and 3741

## 1-2.1   Model 482C ICP® Input/Output Mode, All Models

The Model 482C contains a regulated 24 VDC power supply that provides constant current for up to 4 individual channels.  Both the output and input connections utilize BNC connectors and are brought out through the rear panel.

## 1-3.    Block Diagram
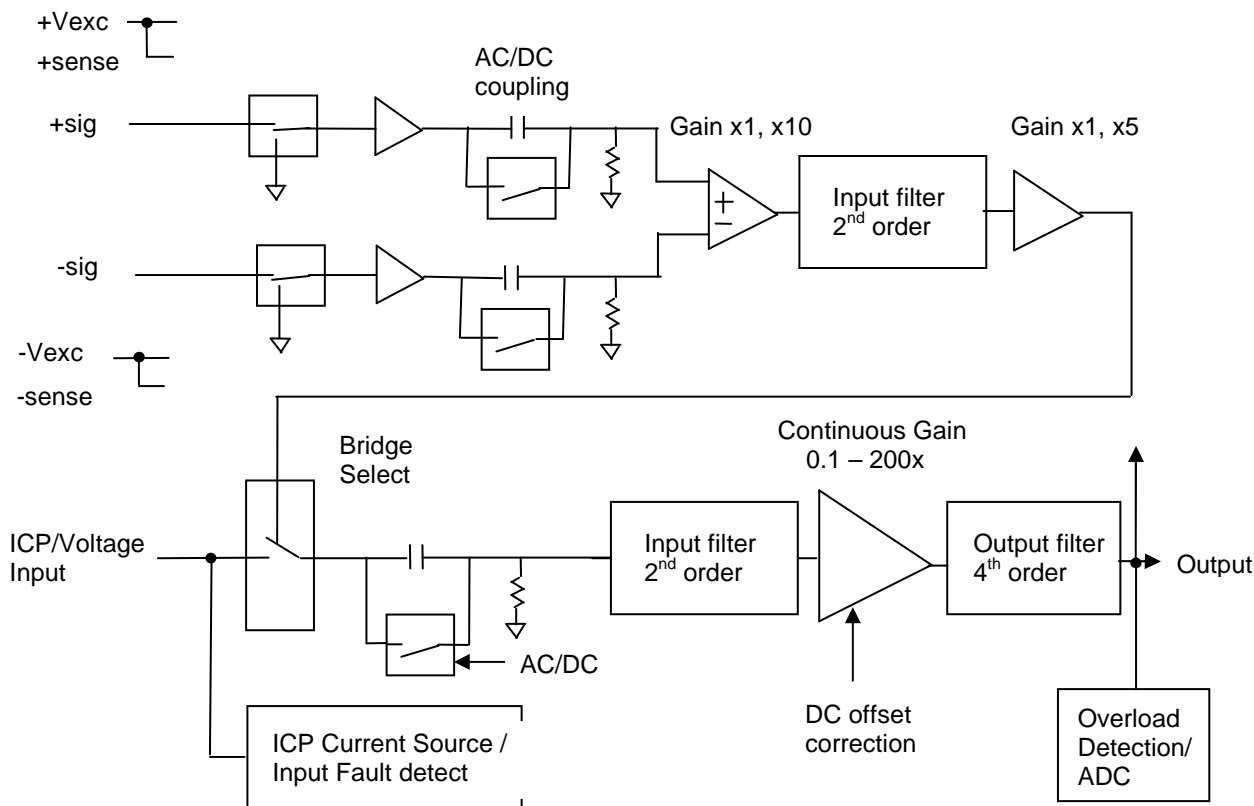


**Figure 1 Typical Block Diagram of Model 482C27**

## 1-4    Installation

Model 482C comes in the form of a standard box. The box should be located in such a way as to allow convenient access to the power outlet for disconnect purposes. Since these units have low power consumption, they can be located in confined environments.

### 1-4.1.  Grounding Techniques

Integrating the Model 482C unit into an application that links the outputs to other test equipment powered by line voltages may lead to errors or loss of signal-to-noise ratio due to ground loops. The evidence of ground loops is easily seen whenever the fundamental frequency (50 or 60 Hz) or a multiple of the fundamental frequency is present in the system when the sensors are "at rest." In order to maintain the operating specification of noise and reduce the effects of line interference, proper grounding techniques should be used. The following procedure may be helpful:

1. Make sure the signal ground lines of all equipment are tied together. The signal grounds of the channels are typically tied together via the case of the input and output BNC connectors. The individual channels of the Model 482C have their signal ground line tied together internally at the power supply.

2. Insure that the sensor does not pick up line noise from the body under test.  The case of the sensor should be isolated from the body under (ground) using an isolation pad.  The isolation pad breaks the loop formed by the signal path of the sensor to the Model 482C and the return (ground) from the Model 482C back to the sensor.

3. Make sure that all equipment signal grounds of the test system are tied to the Earth ground at a single point and the connections linking the equipment ground are made using a wire that can provide a very low impedance connection.

## 1-4.2   Quick Set-up Instructions

**1-4.2a Front Panel Introduction**
The following illustration shows the front panel module as it appears on the Model 482C27.

PCB 482C27

FW VER 1.0
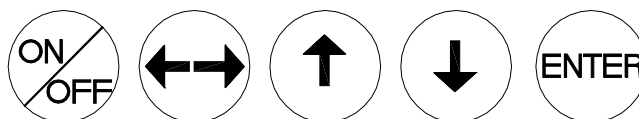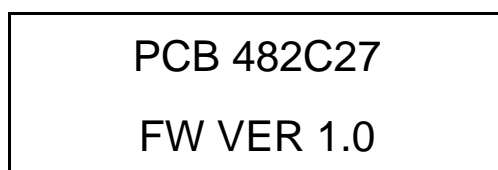


▼   This button is used to scroll DOWN through the options in the menus. In the submenus, this button can be used to change the channel and increments.

▲   This button is used to scroll UP through the options in the menus. In the submenus, this button can be used to change the channel and increments.

◄  ►   This button moves you in the right direction through the menus and submenus.

ENTER: This button applies the setting of the option just set, while exiting the user out of the submenu.

**NOTE:** Please refer to section 1-4.1b and 1-4.2c for instructions on how to set the mode and gain options. The settings for these options should be considered before unit is used to collect data

**NOTE:** In the Submenus a flashing cursor represents a menu that will accept user input. A non- flashing cursor represents a status menu, no input needed.

**1-4.2b   Input Type Option**

The Input type option lets the user switch between ICP®, voltage or Bridge / Differential modes. The factory default for all channels is ICP®. To change the input type select the **INPT** option from the main menu use the down ↓ arrow button to scroll down and the left / right ←→ button until the cursor is over the **INPT** option, and hit the <ENTER> key.

```
GAIN    SENS    INPT

FSOT    FSIN    FLTi
```

The submenu will appear. Choose the channel you wish to change by using the up ↑ or down ↓ arrows. Once that is done use the left / right ←→ button to move the cursor over to the **INPT** column. To change the **INPT**, use either the up ↑ or down ↓ arrow to scroll through the options. You can set the channel to be in either; **ICP®, voltage, Full Bridge, Half Bridge, Quarter Bridge, Non Referenced Single-Ended (NRSE) or Referenced Single-Ended (RSE) mode.** Once you have it set, you can either scroll back to the channel column; to change the mode on another channel; or hit **ENTER** to save the changes.

Ex: If you want to change channel 2 to be in Full Bridge mode you would perform the following steps:

Scroll and select **INPT** from the main menu, and hit enter. Once in the submenu, the flashing cursor will be in the channel column, hit the up ↑ arrow button until the channel column reads 2

```
Chan      Input Type

 █          ICP
```

Hit the left / right ←→ arrow key once so that the cursor is over the **INPT** column. Use the up ↑ or down ↓ arrow keys until the mode says BRG FULL.

```
Chan      Input Type

 2         BRG FULL
```

Once you have hit enter, your changes will be saved.  Other

**NOTE:** To make a global change (set all the channels to the same mode) set the channel to ALL.


**1-4.2c   Programmable Gain Option**

To enter the submenu for the variable gain option, place the cursor over the word "Gain" in the main menu.  This is shown as:

```
GAIN    SENS    INPT

FSOT    FSIN    FLTi
```

By pressing the ENTER button, the submenu for changing the gain of any channel appears on the display.  The submenu pertaining to the "Gain" selection appears as:

```
┌─────────────────────────────┐
│   Channel        Gain        │
│                              │
│      1          001.0        │
└─────────────────────────────┘
```

Example: To set the gain of Channel 2 to x10

The flashing cursor appears over the channel selection. Choose the channel you wish to change by using the up↑ or ↓ arrows. Once you have selected the channel, use the left/right ←→ arrow key to move the flashing cursor over to the gain column.

```
┌─────────────────────────────┐
│   Channel        Gain        │
│                              │
│     ▮           001.0        │
└─────────────────────────────┘
```

To change the gain, use the up ↑ and down ↓ arrow keys to scroll through the options. If your unit has decimal gain you may choose between x1, x10 or x100. If your unit has incremental gain you can choose between .1 and 200.0 by using the left/right ←→ arrow key to move the flashing cursor over any digit in the gain column to select an appropriate value In this example, a gain of 10 is selected; (see example below). As with all setting changes, the actual gain internal to the unit is changed when the 'ENTER' button is pushed.

```
┌─────────────────────────────┐
│   Channel        Gain        │
│                              │
│      2          ▬▬▬▬▬        │
└─────────────────────────────┘
```

To set the next channel, press the left right ←→ arrow key to resume channel control, then press the up↑ or down ↓ arrow keys to select a different channel. Continue making selections with the directional keys until all desired channels are set, then press the ENTER key to return to the option menu.

**NOTE:** To make a global change (set all the channels to the same gain) set the channel to ALL.

### 1-5.    Operation: Standard AC Line

Plug the adapter into a 120V/60 Hz or 230V/50 Hz power source and press the "ON/OFF" button.

### 1-5.1 Using the Power Adapter

When using a power adapter to power the unit, make sure to observe the correct pinout, as indicated on the rear panel of the unit.

**CAUTION: Refer to the rear panel for proper input voltage and currents.**

## 1-7.    Maintenance and Repair

**It is not recommended that the customer attempt repair of the Model 482C in the field.  Should trouble occur, contact the factory for assistance.**  If the unit becomes dusty and dirty, it may be wiped off with a soft cloth.

### 2-0. FRONT PANEL MODULE CONTROL

### 2-1. Introduction

The Model 482C is equipped with the capability of controlling functions through the front panel module. This module consists of a display and five (5) push buttons. The display shows various menus in which all of the available options are given. The user may scroll through the menu, and choose any option to change the settings.

### 2-2. Unit Initialization

Upon pressing the ON/OFF button, the unit will turn on and display the following:

```
┌─────────────────────────┐
│                         │
│     PCB 482C27          │
│                         │
│     FW Ver n.n          │
│                         │
└─────────────────────────┘
```

The unit is initialized, with the factory default settings.

**NOTE:** Reference Section 4-10 for memory default settings.

### 2-3. Main Menu Format

Initially, pressing any button will cause the first two menu lines to be displayed and the cursor will blink on the 'Gain' option.

```
┌─────────────────────────┐
│                         │
│  GAIN   SENS   INPT     │
│                         │
│  FSOT   FSIN   FLTi     │
│                         │
└─────────────────────────┘
```

The cursor may be moved around the main menu by using the arrow keys. To show the other selections of the main menu, press the down ↓ arrow key. This action scrolls vertically to the subsequent lines on the menu. Theses lines are shown below.

| EXCi | EXCv | FLTo |
|------|------|------|
| ACDC | ZERO | ARNG |
| SWOT | CLMP | Bias |
| CHRD | Cal | LEDS |
| Ver? | Unit | Reset |
| Disp | Res | Res |

Pressing the down ↓ arrow key button once again shows:

| GAIN | SENS | INPT |
|------|------|------|
| FSOT | FSIN | FLTi |

## 2-4.    Submenu Format and Command Selections

**1) Gain Options:**

The 482C27 includes the Incremental Gain Option which provides has the ability to automatically adjust the gain of each channel based on three other channel values. These values are; the Sensitivity of the sensor, the Full Scale value of the input (FSI) in engineering units (g's for instance) and the Full Scale Output (FSO) of the amplifier expressed in Volts (this is the output that a signal at an FSI level will produce). The amplifier will always force the gain equation to be true by adjusting either the gain, if one of FSI, FSO or SENS changes, or FSI if the Gain is set directly. The Gain equation is as follows:

**Gain = (FSO \*1000) / (FSI\*SENS).**

**Gain Limits:**
The 482C27 has different gain limits based on the input type. ICP & Voltage input modes have a maximum gain of **200**. Bridge/Differential input settings have a maximum gain of **2000.**

**Setting the Gain:**
To enter the submenu for the variable gain option, place the cursor over the word "**GAIN**" in the main menu.  This is shown as:

```
GAIN    SENS    INPT

FSOT    FSIN    FLTi
```

By pressing the ENTER button, the submenu for changing the gain of any channel appears on the display.  The submenu pertaining to the "Gain" selection appears as:

```
Channel        Gain

   1          0001.0
```

Example: To set the gain of Channel 2 to x10
The flashing cursor appears over the channel selection.  Choose the channel you wish to change by using the up↑ or ↓ arrows. Once you have selected the channel, use the left/right ←→ arrow key to move the flashing cursor over to the gain column.

```
Channel        Gain

   ▮           0001.0
```

To change the gain, use the up ↑ and down ↓ arrow keys to scroll through the options. You can choose between .1 and 200.0 (2000.0 in Bridge input mode) by using the left/right ←→ arrow key to move the flashing cursor over any digit in the gain column to select an appropriate value. In this example, a gain of 10 is selected; (see example below).  As with all setting changes, the actual gain internal to the unit is changed when the 'ENTER' button is pushed.

```
Channel        Gain

   2           ████
```

To set the next channel, press the left arrow key to resume channel control, then press the up ↑ or down ↓ arrow keys to select a different channel.  Continue making selections with the directional keys until all desired channels are set, then press the ENTER key to return to the option menu.

**NOTE:** To do a global change (set all the channels to the same gain) set the channel to ALL. If the global method of changing channel gains is employed and one or more channels are set to input types that do not support the selected gain setting then those channels will be set to their maximum value. For instance, if channels 1 & 2 are set to Full Bridge and 3 & 4 are set to ICP and the user sets the gain channel option to 'ALL' with a value of 1000, then the Bridge channels will be set to 1000 but the ICP channels will be set to 200 because that input type has a limit of 200 and cannot be set to 1000.

**2) Sensitivity Value**

Entering a Sensitivity value will cause the gain of the unit to be changed based on the equation shown above. Sensitivity is set in the same way that the incremental Gain value is set, using the left/right ←→ arrow key to move the flashing cursor over any digit in the SENS column to select an appropriate value As with all setting changes, the actual gain internal to the unit is changed when the 'ENTER' button is pushed.

```
GAIN    ████    INPT

FSOT    FSIN    FLTi
```

The sub-menu of the "SENS" selection shows the current value for sensor sensitivity (assumed to be mV/EU):

```
Channel       SENS

   2        ██████0
```

**3) Full Scale Input Value**

Entering a Full Scale Input value will cause the gain of the unit to be changed based on the equation shown above. The FSI value is set in the same way that the incremental Gain value is set, using the left/right ←→ arrow key to move the flashing cursor over any digit in the FSIN column to select an appropriate value As with all setting changes, the actual gain internal to the unit is changed when the 'ENTER' button is pushed.

```
GAIN    SENS    INPT

FSOT    ████    FLTi
```

The sub-menu of the "FSIN" selection shows the current value for Full Scale Input (assumed to be EU):

```
Channel      FS_IN

   2        ███████
```

**4) Full Scale Output Value**

Entering a Full Scale Output value will cause the gain of the unit to be changed based on the equation shown above. The FS0 value is set in the same way that the incremental Gain value is set, using the left/right ←→ arrow key to move the flashing cursor over any digit in the FSOT column to select an appropriate value As with all setting changes, the actual gain internal to the unit is changed when the 'ENTER' button is pushed.

```
GAIN    SENS    INPT

  ▮▮▮      FSIN    FLTi
```

The sub-menu of the "FSOT" selection shows the current value for Full Scale Output in Volts. The range is 0.5 to 10.0

```
Channel      FSOT

   2          ▮▮▮
```

**5) INPT:**

The 482C27 allows the user to switch between ICP®, voltage, Full Bridge, Half Bridge, Quarter Bridge, Referenced Single-Ended (RSE) or Non Referenced Single-Ended (NRSE) mode. The factory default for all channels is ICP®. To change the mode select the INPT option from the main menu using the left / right ←→ arrow keys until the cursor is over the INPT option, and then press the Enter button.

```
Gain    SENS    ▮▮▮

FSOT    FSOT    FLTi
```

The following submenu will appear. Choose the channel you wish to change by using the up ↑ and down ↓ arrow keys. Next, use the left / right ←→ arrow key to move the flashing cursor over to the Mode column. To change the INPT, use either the up ↑ or down ↓ arrow key to scroll through the options, once you have the desired setting selected hit ENTER to apply it.

```
Chan    INPUT TYPE

  2         ICP
```

**NOTE**: Setting a channel to Voltage or Bridge Input will cause the ICP current source for that channel to be turned off. Conversely, If ICP is set from Voltage or Bridge then the ICP current source will be set to 4mA. Also exiting a Bridge mode will cause the Voltage Excitation to be set to 0V

**6) Input Filter option:**

Each channel's Input filter setting can be set independently of the other channels. To change the Input Filter setting from the main menu, use the left / right ←→ arrow keys until the cursor is over the FLTi option, and then press the Enter button.

```
GAIN    SENS    INPT

FSOT    FSIN    ████
```

The following submenu will appear. Choose the channel you wish to change by using the up ↑ and down ↓ arrow keys. Next, use the left / right ←→ arrow key to move the flashing cursor over to the INP Filter column. To change the Filter setting, use either the up ↑ or down ↓ arrow key to select either 'On' or 'Off', once you have the desired setting selected hit ENTER to apply it.

```
Chan        INP Filter

2             Off
```

**7) Output Filter option:**

Each channel's Output filter setting can also be set independently of the other channels. To change the Output Filter setting from the main menu, use the left / right ←→ arrow keys until the cursor is over the FLTo option, and then press the Enter button.

```
EXCi    EXCv    ████

ACDC    ZERO    ARNG
```

The following submenu will appear. Choose the channel you wish to change by using the up ↑ and down ↓ arrow keys. Next, use the left / right ←→ arrow key to move the flashing cursor over to the Out Filter column. To change the Filter setting, use either the up ↑ or down ↓ arrow key to select either 'On-nn.nk' or 'Off', once you have the desired setting selected hit ENTER to apply it.
**Note**: the ON setting also indicates the filter corner, in kHz, implemented by the filter for the channel.

```
Chan        Out Filter

2           ON-10.0k
```

**8) ICP® Current Adjustment:**

The Current excitation value can be set from 0 – 20 mA. Where 0 = Off.  To set the current excitation value, move the cursor to the 'EXCi' location, as shown below.

```
┌─────────────────────────────┐
│  ███████   EXCv    FLTo      │
│                              │
│  ACDC    ZERO    ARNG        │
└─────────────────────────────┘
```

Pressing the ENTER button, will cause the following submenu to appear.  The ICP® current may be altered by using the up ↑ or down ↓ arrow keys.

```
┌─────────────────────────────┐
│  Chan      ICP Current       │
│                              │
│   4          02 mA           │
└─────────────────────────────┘
```

The 482C27 will turn off the current excitation signal if the unit is not in ICP input mode and will not allow it to be set while unless it is in ICP mode. If a channel is selected from the Iexc menu that is inappropriate then **NA** will appear as shown below in place of the ICP current settings. Also, because of this limitation, the 'ALL' channel selection is not allowed for this setting.

```
┌─────────────────────────────┐
│  Chan      ICP Current       │
│                              │
│   2           NA             │
└─────────────────────────────┘
```

**NOTE-** The factory default setting for the ICP® current is 4 mA.

**9) Voltage Excitation:**

The Voltage excitation value can be set from -12.0 to +12.0 V. A positive entry forces a unipolar setting and a negative entry forces a bipolar entry. 0 = Off.  To set the voltage excitation value, move the cursor to the 'EXCv' location, as shown below.

```
┌─────────────────────────────┐
│  EXCi    ███████    FLTo     │
│                              │
│  ACDC    ZERO    ARNG        │
└─────────────────────────────┘
```

Pressing the ENTER button, will cause the following submenu to appear. The Bridge input module voltage excitation may be altered by using the up ↑ or down ↓ arrow keys to adjust the voltage value. Traversing the menu once more provides the option to select UNI – unipolar or BI – bipolar settings. Changing these will also force the sign of the voltage excitation value to the appropriate value.

| Ch | Vexc | Polarity |
|----|------|----------|
| 4  | 10.0 | UNI      |

The 482C27 will turn off the voltage excitation signal if the unit is in ICP or voltage input mode and will not allow it to be set while in those modes. If a channel is selected from the Vexc menu that is inappropriate then **NA** will appear as shown below in place of the voltage and polarity settings. Also, because of this limitation, the 'ALL' channel selection is not allowed for this setting.

| Ch | Vexc | Polarity |
|----|------|----------|
| 2  | NA   | NA       |

**NOTE-** The factory default setting for Voltage Excitation is 0.

**10) Input Coupling:**

The Model 482C provides an option for AC or DC coupling. The AC coupled mode passes the signal through a DC blocking capacitor or high pass filter to remove the sensor bias voltage. By moving the cursor on the "COUPL" location, the display shows:

| EXCi | EXCv | FLTo |
|------|------|------|
| ▮▮▮  | ZERO | ARNG |

When the ENTER button is pressed, the submenu for the coupling options will include; **AC, DC**. The selection can be changed by using the up ↑ or down ↓ buttons.

| Chan | Coupling |
|------|----------|
| 1    | DC       |

The coupling options are AC or DC. In DC coupling mode the Auto Zero and Auto Balance functions become available. Auto Zero for all input types and Auto Balance for the Bridge /Differential input types.

**11) Auto Zero/ Auto Balance:**

The Model 482C provides functions for automatically zeroing the channels output for any input type in DC coupling mode and a Balance function for Bridge / Differential input channels in DC coupling mode. These functions are not available when a channel is AC coupled. The Zero function disconnects the input and uses a DAC to reduce the channel output to close to 0V. The Balance option does the same but leaves the input connected.

```
 EXCi    EXCv    FLTo

 ██████  ZERO   ARNG
```

When the ENTER button is pressed, the submenu for the coupling options will include; **Cancel, AUTOBAL, AUTOZERO**.  The selection can be changed by using the up ↑ or down ↓ buttons.

```
 Chan      AUTOZERO

  1        AUTOBAL
```

**Note**: If the zero function fails either the message "Error Removing MainBd DC Offset" or "Error Removing Bridge DC Offset" will be displayed depending on the situation. For Gains<500 the function tries to get below 2mV output and gains >=500 50mV is the limit.

**12) Auto-Range**

The auto-range (also referred to as auto-scale) feature provides an automatic scaling of the output signal. Please refer to section 3-7.1 for further description. With this command, the programmable gain is implemented to give .8 of the Full Scale Output.  The signals are checked internally using the onboard A/D. To use this feature, place the cursor over the word "ARNG" on the display and press the enter key, the following submenu will appear.

```
 EXCi    EXCv    FLTo

 ACDC    ZERO   ██████
```

Use the up ↑ or down ↓ arrow  keys to toggle between the 'OFF', 'ON' or 'IMED' options. Once you have set the Auto-scale option, hit the ENTER key to return to the main menu.  ON turns the auto scale function ON and it will continue scaling the gain until it is manually turned off. The 'IMED' option runs through the auto-scale algorithm once and then turns it off automatically.

```
┌────────────────────────────────┐
│   Chan        Autoscale         │
│                                 │
│    2            Off             │
└────────────────────────────────┘
```

**NOTE-** Auto-scale option should NOT be left on while measurements are being taken. It is strictly to be used during the setting of the gain, and then the option should be turned off.

**13) Switched Output**

The user may select the Switched Output (if installed) by pressing the ENTER key on the front panel when the cursor is located on the SWOT option. This function allows the user to send the selected channel's output to the auxiliary BNC (if Installed) in addition to its normal output BNC

```
┌────────────────────────────────┐
│  █████     CLMP     Bias        │
│                                 │
│  CHRD      Cal      LEDS        │
└────────────────────────────────┘
```

The following submenu will appear. Choose the channel you wish to change by using the up ↑ and down ↓ arrow keys. Next, use the left / right ←→ arrow key to move the flashing cursor over to the Switching column. To change the Switched setting, use either the up ↑ or down ↓ arrow key to select either 1-4 or 'Output Off', once you have the desired setting selected hit ENTER to apply it.

```
┌────────────────────────────────┐
│  Output       Switching         │
│                                 │
│  Route Ch:        3             │
└────────────────────────────────┘
```

**14) Clamped**

The user may select the Clamp function by pressing the ENTER key on the front panel when the cursor is located on the CLMP option.

```
┌────────────────────────────────┐
│  SWOT      █████     Bias       │
│                                 │
│  CHRD      Cal       LEDS       │
└────────────────────────────────┘
```
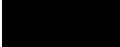
The following submenu will appear. Choose the channel you wish to change by using the up ↑ and down ↓ arrow keys. Next, use the left / right ←→ arrow key to move the flashing cursor over to the CLAMP column. To change the Clamp setting, use either the up ↑ or down ↓ arrow key to select either 'On' or 'Off', once you have the desired setting selected hit ENTER to apply it.

```
┌─────────────────────────┐
│   Chan        Clamp      │
│                          │
│    1           On        │
└─────────────────────────┘
```

**Note:** When Clamped, the conditioner is internally set to automatically keep pulsating output signals ground based (within 20mV negative undershoot) and positive polarity. This clamp is useful in stabilizing output signals when interfacing with instrumentation that requires repetitive pulse train signals be ground based and of one polarity (usually positive). When the output signal is not clamped, a repetitive pulse train will gradually drift downward and stabilize in time with equal areas above and below signal ground.

**15) Bias Measurement:**
The 482C27 is capable of measuring the bias voltage present on each of its channels. By moving the cursor upon the "Bias" location, the display appears as follows:

```
┌─────────────────────────┐
│  SWOT   CLMP     ▉       │
│                          │
│  CHRD   Cal    LEDS      │
└─────────────────────────┘
```

Using the ENTER button, the submenu appears as shown in the following diagram. Choose the channel you wish to change by using the up ↑ and down ↓ arrow keys. The bias reading for the channel will be displayed automatically when the channel is selected.

```
┌─────────────────────────┐
│   Chan        Bias       │
│                          │
│    2         0023.7      │
└─────────────────────────┘
```

If unit had a short circuit, the bias voltage would be <2.0V. Proper bias voltage is between 2.0V and 22V. Anything over 22V would indicate an open circuit.

**16) Channel Output Measurement:**
The 482C27 is capable of digitizing the channel output and displaying it on the front panel.. By moving the cursor upon the "CHRD" location, the display appears as follows:

```
┌─────────────────────────┐
│  SWOT   CLMP    Bias     │
│                          │
│   ▉      CAL    LEDS     │
└─────────────────────────┘
```

Using the ENTER button, the submenu appears as shown in the following diagram. Choose the channel you wish to change by using the up ↑ and down ↓ arrow keys. The output reading for the channel will be displayed automatically when the channel is selected.

```
+----------------------------------+
|                                  |
|   Chan          Output           |
|                                  |
|    1            005.3            |
|                                  |
+----------------------------------+
```

**17) Cal.**

The user may select the Bridge Calibration setting by pressing the ENTER key on the front panel when the cursor is located on the CAL option.

```
+----------------------------------+
|                                  |
|  CHRD        ████      LEDS      |
|                                  |
|  Ver?        Unit      Reset     |
|                                  |
+----------------------------------+
```

The following submenu will appear. Choose the channel you wish to change by using the up ↑ and down ↓ arrow keys. Next, use the left / right ←→ arrow key to move the flashing cursor over to the Oscillator column. To change the Oscillator setting, use either the up ↑ or down ↓ arrow key to select either 'Off', 'EShunt-', 'EShunt+', 'IShunt-', 'IShunt+', once you have the desired setting selected hit ENTER to apply it. Eshunt stands for External Shunt and IShunt is Internal Shunt. For internal operations a resistor can be inserted in the R17 connector on the Bridge input module internal to the unit.

```
+----------------------------------+
|                                  |
|   Chan        Cal Mode           |
|                                  |
|    1          IShunt+            |
|                                  |
+----------------------------------+
```

**18) LED Test:**

The LED test provides a mechanism to check the functionality of the LEDS.  To test them, place the cursor over the word "LEDS" on the display and press enter.

```
+----------------------------------+
|                                  |
|  CHRD      Cal       ████        |
|                                  |
|  Ver?      Unit      Reset       |
|                                  |
+----------------------------------+
```

The screen shown below will be displayed

```
┌─────────────────────────────┐
│       LED     Test          │
│                             │
│              CANCEL         │
└─────────────────────────────┘
```

Use the up or down arrow keys to select 'Execute' or 'Cancel'. Both options return control to the main menu. If 'Execute' is selected then the LED's will blink 3 times if 'Cancel' is selected then no action is taken.

**19) Firmware Version:**

To determine the firmware version of the unit select the 'Ver?' menu option.

```
┌─────────────────────────────┐
│  CHRD    Cal     LEDS       │
│  ████    Unit    Reset      │
└─────────────────────────────┘
```

A screen similar to the one shown below will be displayed

```
┌─────────────────────────────┐
│       PCB 482C27            │
│                             │
│       FW Ver 1.0            │
└─────────────────────────────┘
```

**20) Unit Id.**

The user may change the Unit Id setting by pressing the ENTER key on the front panel when the cursor is located on the Unit option.

```
┌─────────────────────────────┐
│  CHRD    Cal     LEDS       │
│  Ver?    ████    Reset      │
└─────────────────────────────┘
```

The following submenu will appear. Use the up ↑ or down ↓ arrow key to change the Unit Id setting to a new value. Once you have the desired setting selected hit ENTER to apply it.

```
┌─────────────────────────────┐
│      Current Unit #         │
│                             │
│           1                 │
└─────────────────────────────┘
```

Note: Changing the Unit Id is only necessary if you have the Ethernet or RS-232 communication option installed and you are communicating with more than one unit. If this is the case then all units in the network MUST have a unique Id.

**21) Reset to Factory Default Settings:**

The reset option provides a mechanism to reset the unit to its factory default settings. To do this select the reset option from the menu by placing the cursor over the Reset option and hitting enter.

```
┌─────────────────────────────┐
│  CHRD     Cal      LEDS      │
│                              │
│  Ver?     Unit     █████     │
└─────────────────────────────┘
```

Pressing the ENTER brings up a submenu that allows the operator to continue by selecting 'Execute' or cancel the function by selecting 'Cancel'. Both options return control to the main menu. If 'Execute' is selected then the defaults are restored.

```
┌─────────────────────────────┐
│      Factory Defaults        │
│                              │
│         Execute              │
└─────────────────────────────┘
```

**22) Display Content Options:**

The Display option allows the user to choose from 3 selections of front panel content. To enter this mode, select the 'DISP' option from the menu by placing the cursor over the Reset option and hitting enter.

```
┌─────────────────────────────┐
│  Ver?     Unit     Reset     │
│  █████    Res      Res       │
└─────────────────────────────┘
```

Pressing the ENTER brings up a submenu that allows the operator to continue by selecting either 'Gain', 'Bias' or 'Output'. If 'Gain' is selected then each channel's current Gain setting will be displayed on the 2nd line of the front panel display to the nearest integer. If the gain is greater than two significant digits then it is displayed in terms of thousands (i.e. 100 = 0.1k, 2000 = 2.0k). Additionally, directly above the Gain on the 1st line of the display will be up to 3 characters representing the channels input mode ;'B' for Full Bridge, 'b' for ¼ or ½ Bridge, 'R' for Referenced Single Ended, 'I' for ICP, or 'V' for Voltage. Next to the Input mode indicator is the Input Filter setting; '*' for On, blank for Off and '-' if the option is not installed. Next to the Input Filter indicator is the Output Filter setting indication which has the same markings as the input filter.

```
┌─────────────────────────┐
│      Display Opts        │
│                          │
│         Gain             │
└─────────────────────────┘
```

Following is what the screen will look like if the Display was set to show 'Gain' and channel 1 has a gain of 2000 and is in Full Bridge mode with the input filter 'On' with no Output Filter option installed. Similarly, channel 2 has a gain of 10 and is in ICP mode; channel 3 has a gain of 20 and is in ½ bridge mode and channel 4 has a gain of 100 and is in Voltage mode.

```
┌─────────────────────────┐
│  B*-   I*-   b*-   V*-   │
│                          │
│  2.0k  010  020  0.1k    │
└─────────────────────────┘
```

The 'Bias" display option is the same as the Gain option except the channels bias reading replaces the Gain setting. Also the Bias reading will be refreshed periodically.

Following is what the screen will look like if the Display was set to show 'Bias'.

```
┌─────────────────────────┐
│  B*-   B*-   I*-   I*-   │
│                          │
│  B15  B15  B23  B23      │
└─────────────────────────┘
```

The 'Output" display option is the same as the Bias option except the channels Output is digitized and displayed. As with the Bias reading it will be refreshed periodically.

Following is what the screen will look like if the Display was set to show 'Output'.

```
┌─────────────────────────┐
│  B*-   B*-   B*-   I*-   │
│                          │
│  +0.0 -9.9  +5.0  +1.0   │
└─────────────────────────┘
```
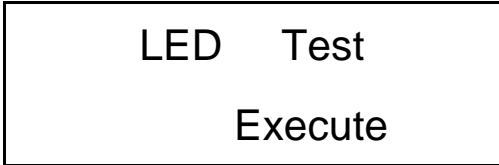
.
**Note**: Due to the limited screen size values less than or equal to -9.9 are displayed as -9.9 and values greater than or equal 9.9 are displayed as 9.9.

**23) Res**
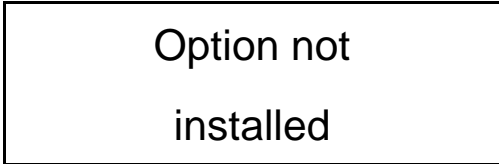 No operation. These menu items are reserved for future use.

```
┌─────────────────────────┐
│  Ver?    Unit    Reset   │
├─────────────────────────┤
│  Disp    ███     Res     │
└─────────────────────────┘
```

Pressing the ENTER brings up a submenu that allows the operator to continue the test by selecting 'Execute' or cancel the function by selecting 'Cancel'. Both options return control to the main menu. If 'Execute' is selected then all LEDs on the front panel will flash three times.

```
LED    Test

       Execute
```

For any selected option not actually included in a particular unit, a message is shown on the display. This occurs on the main menu. The cursor is placed over a selected option not included in the model purchased. When the ENTER button is pressed, the following is shown:

```
       Option not

       installed
```

# <u>Reference</u>

## 3-0. THEORY OF OPERATION

## 3-1. Sensor Excitation

ICP$^®$ refers to a low output impedance voltage mode sensor combining an integrated circuit and a piezoelectric sensing element in a single housing to provide a voltage output. This sensor is powered by a +24 VDC power supply having a constant current, variable from 2 to 20 mA.

Sensor excitation occurs as the constant current of all channels are set. Model 482C allows the constant current to be adjusted between 2 and 20 mA to provide the required excitation for most applications. Special situations, such as driving extra-long cables (more than 1000 ft) with high frequency or fast rise time pulses, may require increasing the drive current to 12 mA or higher. See Figure 3-1.1.
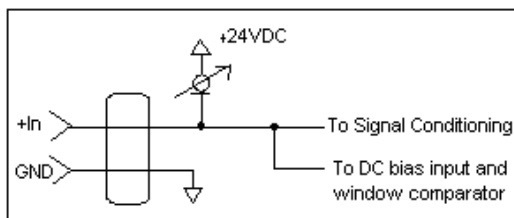


**Figure 2 ICP$^®$ Sensor Excitation**

When driving fast rise time pulses over long lines, system performances can be optimized by "tuning" the drive current to the line; i.e. by finding the best current setting for the particular test of physical parameters. To determine the optimal current setting, experiment with your particular test set up. To insure optimal accuracy in constant-current adjustment, make sure all channels have sensors or simulated loads, similar to the one provided by the Model 401A04 Sensor Circuit, consisting of a voltage amplifier similar to those found in ICP® sensors.

## 3-2. Input Protection

The input section has protection to limit the amplitude of the incoming signal to within +24 volts to ground. Maximum allowable input voltage without distortion is ±10 volts, relative to the sensor bias voltage.

## 3-3.   Input Fault Detection

Model 482C monitors two input fault conditions, "short" and "open," which indicate problems with sensor input and is displayed through the front panel LEDs.  Either case implies that the sensor is NOT functioning properly.  An input is **shorted** when it has a ground path for the sensor excitation and **open** when the sensor fails to draw the excitation.

Two voltage comparators consist of a window comparator that has two reference voltages ($V_{ref}$) representing thresholds for "short" and "open."  When the sensor's bias voltage ($V_{bias}$) exceeds the comparator range, the front panel input fault LED lights.

**NOTE:** Red LED implies input fault.
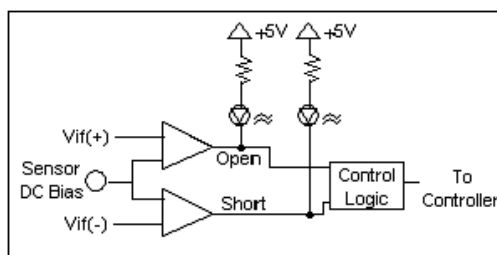


**Figure 3 Input Fault Window Comparator with LED Indicator**

## 3-4.   Input Interface

The input signal conditioning for each channel provides a unity gain buffer with high-input impedance amplifiers.  With the AC coupled option it also eliminates the DC bias from the input signal with a 10-second time constant.
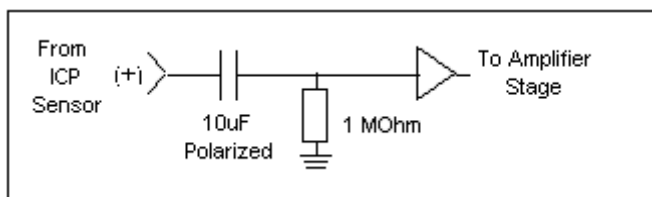


**Figure 4 Input Amplifier Configuration**

## 3-5.   Gain

The Programmable Gain Amplification (PGA) block consists of a decimal gain amplifier.  See Figure 3-5.1.
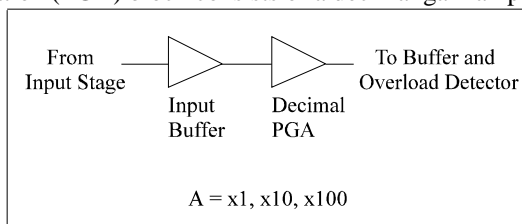


**Figure 5 Selectable Gain Amplifier Configuration**

### 3-5.1   Programmable Gain

With the two available programmable gain options, the user can adjust the gain as needed. Adjustable gain with three discrete settings (x1, x10, x100) or incremental gain (from 0.1 to 200) are available. The steps in the incremental gain option is 0.1.  These options are particularly useful in the standardization of groups of sensors.  Consider the following example, wherein the user desires to normalize sensitivities to 1 V/unit for each channel.

| Channel | Sensor Sensitivity | Gain Setting of 482C | Actual Gain Needed |
|---------|--------------------|----------------------|--------------------|
| 1st | 10.10 $^{mV}/_{unit}$ | 99.00 | 99.01 |
| 2nd | 101.32 $^{mV}/_{unit}$ | 9.9 | 9.869 |
| 3rd | 22.30 $^{mV}/_{unit}$ | 44.8 | 44.84 |

These results may be accomplished by using either of two techniques.  First, the user may set the gain via the computer interface command set (See the command strings in Section 4-9 in the Computer Interface Programming Guide.) or the user may set the gain by using the front panel control.

### 3-6.   Normalized Output Sensitivity

The definition of normalized output sensitivity is the calculation of the individual channel's gain, depending on the sensitivity of the sensor attached and the desired output sensitivity. This is simply a function of the desired output sensitivity (in Volts/ unit) divided by the sensor's sensitivity.

$$\text{Gain} = {}^{1 \text{ Volt}}/_{\text{Sensitivity (mV/unit)}}$$

Additionally, a feature to improve flexibility allows changing the output level to a value of 5 Volts/ unit instead of normalized 1 Volt/ unit. Some users request the ability calculate the gain using a known input signal along with the sensor sensitivity, and desired output level. The result of the request impacts the formula:

$$\text{Gain} = {}^{1 \text{ Volt}/}/_{[\text{Sensitivity (mV/unit)} * \text{Full Scale Input (units)}]}$$

Adding some simple error checking to insure the limits of the sensor and gain limits of the signal conditioner are not exceeded completes the normalization process.

$$\text{Gain}_{\text{normalized}} = {}^{\text{FSOT (V)}}/_{\text{SENS} * \text{FSIN}}$$

**Additional Considerations:**
The storage of individual channel gains is stored in non-volatile memory locations. The new variables for each channel's sensitivity, Full Scale Output level, and Full Scale Input are stored in non-volatile memory locations when the unit is powered down.

The error checking should provide a flag if the desired normalized output level is not feasible due to gain limitations. The gain required may be too large given the sensor sensitivity defined, or too small which implies the sensor will not be capable measure the expected value. The typical sensor will output a signal up to ±5 Volts. The maximum swing may be used in the error checking.

The 482C has the capability to provide signal conditioning for charge mode sensors in addition to the standard ICP® type. The sensitivity (mV/ pC) of the in-line charge converters (422M) will be stored at final calibration to allow charge mode sensors (pC/ unit) to be normalized.

## 3.7    Overload Detection and Autorange

### 3-7.1   Autorange

To avoid overload, the Model 482C27 features autorange for automatic gain adjustment. This function utilizes the channel output A/D to monitor the input signal and adjust the channel's gain until 0.8 of the Full Scale Output setting is observed. The correct procedure for using the autorange feature is as follows:

1. Excite the structure under test.
2. Enable autorange (AUTR on).
3. Wait several seconds, until the unit is stabilized.
4. Disable autorange (AUTR off).
5. Read the gains of all channels.
6. Begin test run.

### 3-7.2   Overload

The overload feature uses the same window comparator principle previously discussed. The $+V_{ref}$ is equal to the default overload value of ±10 volts. When the input voltage (Vsignal of Figure 3-7.1) to the window comparator exceeds the reference voltage limits, overload has occurred, and the comparator's output, which is normally "high," becomes "low." This "low" state illuminates the overload LED and triggers the latch of overload detection circuitry. During regular measuring time, the latch holds the occurrence of overloads until the user reads its status through the computer interface.
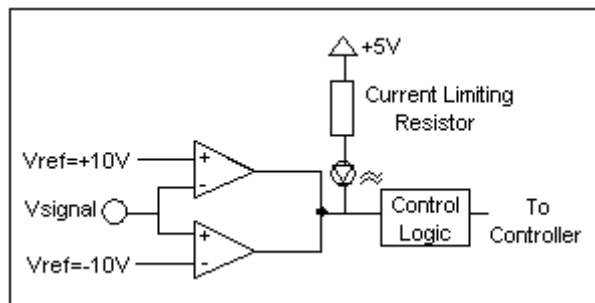


**Figure 6  Autoscale/Overload Window Comparator**

### 3-8. Filtering

The Model 482C can be ordered with low pass, or high pass filters installed in any or all channels for the removal of unwanted noise.  The available filter modules are second and fourth-order Butterworth low pass (-12, -24 dB/octave) filters. High pass filters are available upon request. The filters have a master enable/disable control. In models equipped with a second and forth order filter, the second order filters may be disabled by individual channel.  Typical cutoff frequencies include:

| Option Number | Cutoff Frequency (-3 dB) |
| --- | --- |
| 01 | 100 Hz |
| 02 | 200 Hz |
| 03 | 500 Hz |
| 04 | 1 kHz |
| 05 | 2 kHz |
| 06 | 5 kHz |
| 07 | 10 kHz |
| 08 | 20 kHz |
| 09 | 50 kHz |
| 10 | 100 kHz |

The user may also define a specific cutoff frequency that satisfies a specific need using the Filter Option.  Contact the factory regarding individual requirements.

### 3-9. RMS - DC Conversion Every Channel

This option converts the input AC signal to an equivalent DC signal to provide a cost-efficient, approximate measure of diagnostic information. The effective voltage or current value, when combined with the circuit resistance, determines the average power for a cycle.  For example, if the sensed sinusoidal signal is 2 volts peak-to-peak, 1 volt peak, the RMS value may be obtained by multiplying the peak value (1 volt) by 0.707.  Maximum output $V_{rms}$ is 5 volts, which corresponds to ±14.2 volts peak-to-peak, 7 volts peak for a sinusoidal signal.

### 3-10. Connector Configuration

The base model 482C27 provides BNC inputs for ICP®-type sensors or voltage inputs and an 8 pin DIN connector for Bridge / Differential sensor inputs. The Output connector is a BNC.

### 3-10.1 ICP®, Voltage or Bridge Input per Channel

This setting allows the user to select the input mode of each channel.  The selection is made via RS-232 connection or through the keypad.  The functionality of a channel in ICP® or voltage mode is identical except the bias current does not flow in voltage mode.  Accordingly, when voltage mode is selected, the unit will automatically set the current to zero (0) mA for the specified channel.  With no ICP® excitation present on the input connector, the channel is simply a voltage amplifier.

The factory default is ICP® input mode for all channels in the unit.  The user must reconfigure the channels to accept a voltage input signal.

### 3-11 ICP®, Voltage Sensor Connection:

The BNC connectors are used to accept ICP® and Voltage mode input signals. The ICP® excitation will be present on the input BNC only when the ICP® current is turned on. The voltage input mode allows bipolar, positive and negative (above and below ground) signals.

### 3-12    Bridge/Differential Sensor Connection

The following diagram illustrates the proper connections for bridge or differential sensors.
Note: If the Sense lines are not used they should be tied to the excitation lines.
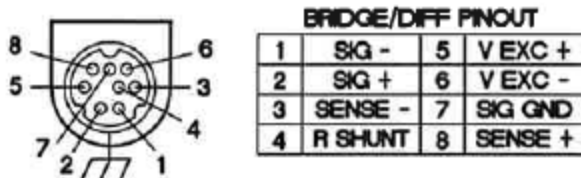


## 3-13   RS-232 & Ethernet connections

See section 4 for remote control interface details

## 3-14    Non-Volatile Memory

This feature keeps the programmed configurations stored when the unit is powered down.  When the unit is turned on, all programmable features (e.g., gains, filter status, switched output settings, overload levels, integration level) active at last use are preserved.  When the unit is powered down the non-volatile memory is updated with the current channel settings. The unit's non-volatile memory may be reset to the factory default settings by using the reset menu option.

## 3-15    Transducer Electronic Data Sheet (TEDS) Interface:

The TEDS sensors attach to the input connectors the same way a traditional ICP® sensor is attached to the 482C. The TEDS interface requires both the RS-232 or Ethernet computer interface option, and the input mode option. The digital control and input mode features automatically perform the TEDS read or write function. After the communication with the TEDS sensor is complete the input mode returns to the input mode (charge or ICP®) prior to the communication.

The current TEDS function will perform a read of the "raw" TEDS data and return the 32 bytes of TEDS sensor EEPROM data and the 8 byte Application register contents, if it was programmed, and returns the data in an ASCII Hex representation.

## 4-0.   COMPUTER INTERFACE PROGRAMMING GUIDE

## 4-1.   Introduction

The RS-232 Interface enables the Model 482C27 to be remotely controlled.  With this interface, the unit is able to become part of a fully automated system.

## 4-2   RS-232

The RS-232 provides total control of the unit except for hardware RESET.  The rest of the options described previously are computer-controllable.

## 4-3.   RS-232 Host Set-Up

Before any serial interface is used to communicate with the host computer, a specific set-up must be followed.  These parameters must be set for the host computer.  The full list of parameters is shown below:  (EOL = End of Line.)

| Parameter | Setting |
|---|---|
| Transmission Rate | 19,200 BPS (bits per second) |
| Parity | None |
| Number of data bits | 8 |
| Number of stop bits | 1 |
| Handshaking | None |
| Echo | None |
| Transmit EOL | Carriage Return and Line Feed, <CR><LF> |
| Receive EOL | Carriage Return and Line Feed, <CR><LF> |

## 4-4.   RS-232 Rear Panel Pinout Listing

| Number of 9-Pin Connector | Function | Notes |
|---|---|---|
| 1 | N.C. | Not Connected |
| 2 | TXD | From 482C |
| 3 | RXD | To 482C |
| 4 | N.C. | Not Connected |
| 5 | Ground | Ground |
| 6 | N.C. | Not Connected |
| 7 | N.C. | Not Connected |
| 8 | N.C. | Not Connected |
| 9 | N.C. | Not Connected |

## 4-5.   Ethernet Communication

If the 482 unit is equipped with the Ethernet option then the unit's IP address must be set up before any remote communication can commence.

The steps to set the IP address of a 482 Unit are as follow:

- Connect, either directly with a crossover CAT5 cable or through a hub, to a single unit. This unit is presumed to have a Unit ID of 1,
- Set the IP address using an independent utility from Lantronix called DeviceInstaller™. To download the Lantronix DeviceInstaller™ application go to:
  http://www.lantronix.com/device-networking/utilities-tools/device-installer.html

- After the DeviceInstaller™ application is installed, run it and the following screen will appear. Click on the Search icon and the program will search for the Ethernet device internal to the 482 unit. When found, as shown below, details about the device show in the list. You can verify it is the correct unit but comparing the Hardware (MAC) Address displayed to the one listed on the side of the 482 unit.
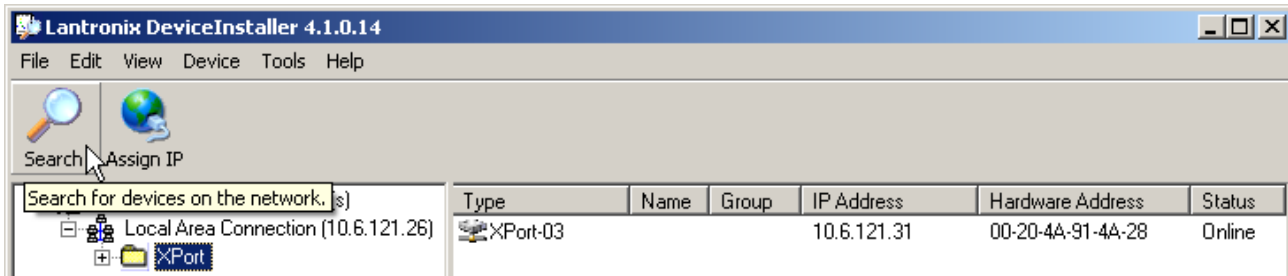


- Selecting an item from the list, shown below, highlights the item in the list and enables more icons.
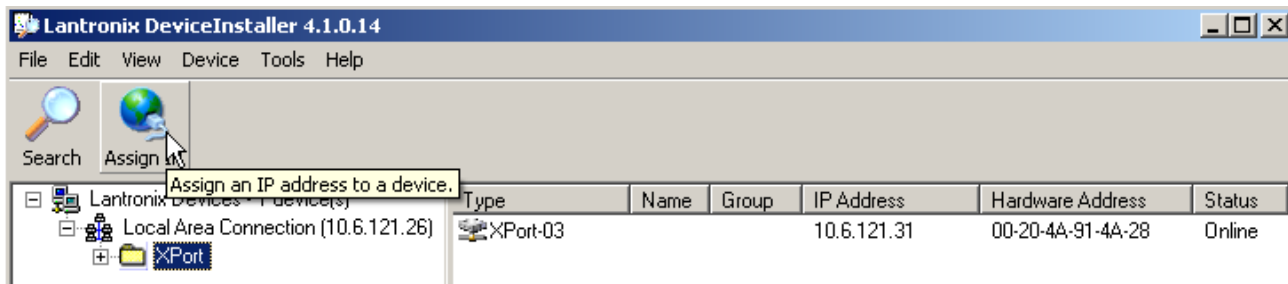


- Select **Assign IP** and the following screen will appear. Select whether you want to assign a static IP address that is appropriate for your network or have it assigned from a network server. Subsequent steps are self-explanatory.
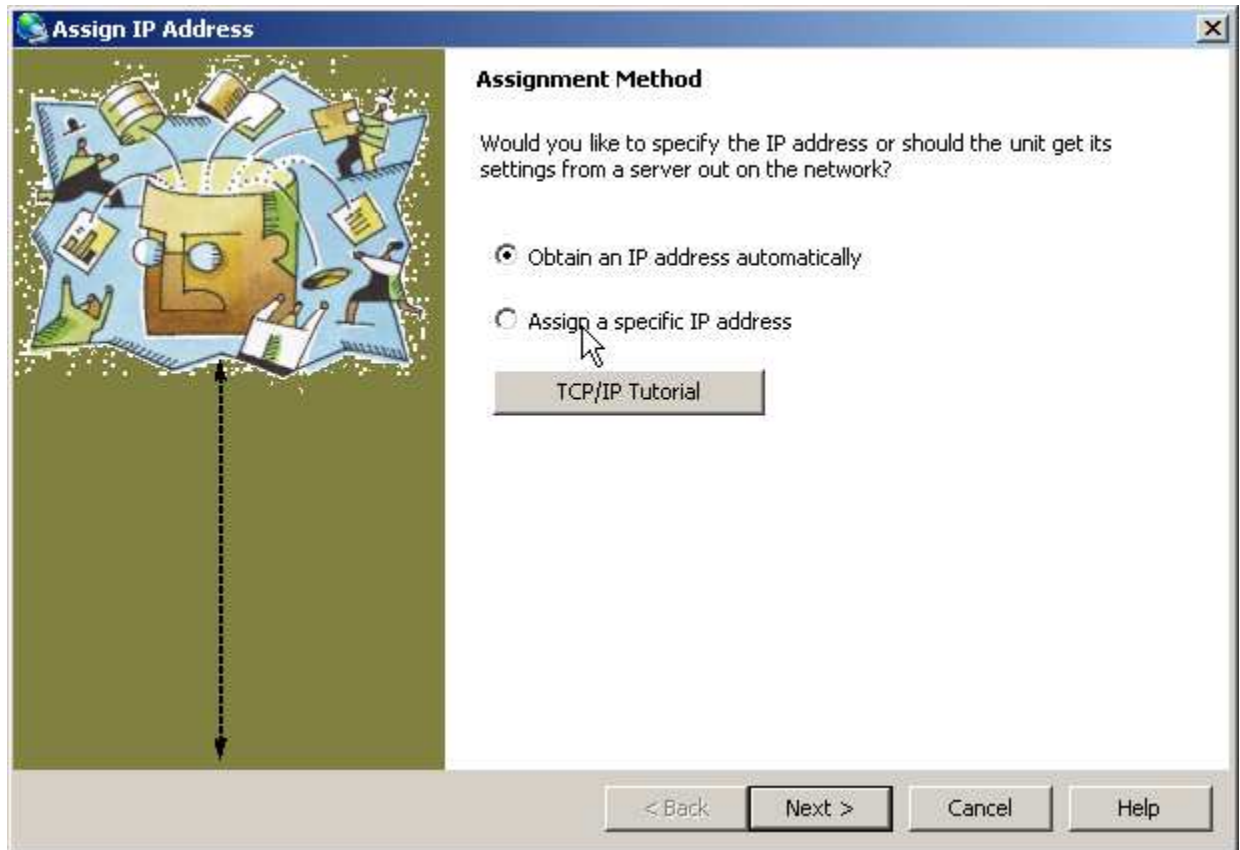
- Now you can use the assigned IP address to address the unit.

**Important Note:  The communication protocol requires a unit id as part of the command header. The unit id is not the IP address. To send commands to the unit Via Ethernet you must address the TCP-IP packets with the proper IP address and ensure the packet payload contains the correct Unit Id in the command header.**

The Lantronix device will be PCB factory set with the proper communication parameters. Some of these parameters though are not the default parameters of this device. In the screens below the fields pointed to with arrows are the modified parameters. Should you need to change them or want to check them if you are experiencing communications problems the following screens will show how it is done.

Note: Port 10001 is the port selected for remote Ethernet communications

To gain access to the Ethernet and serial parameters click on an IP address in the left pane and then on the Web Configuration tab in the right pane as shown below. Then click on the *GO* button.

This will cause the Login Dialog screen to appear (also below). No entries are required since the units are not factory protected, click *OK*.
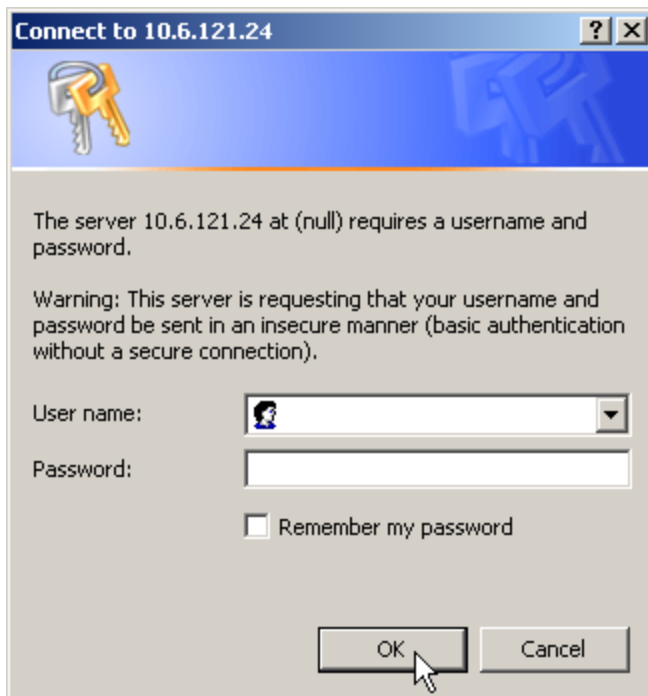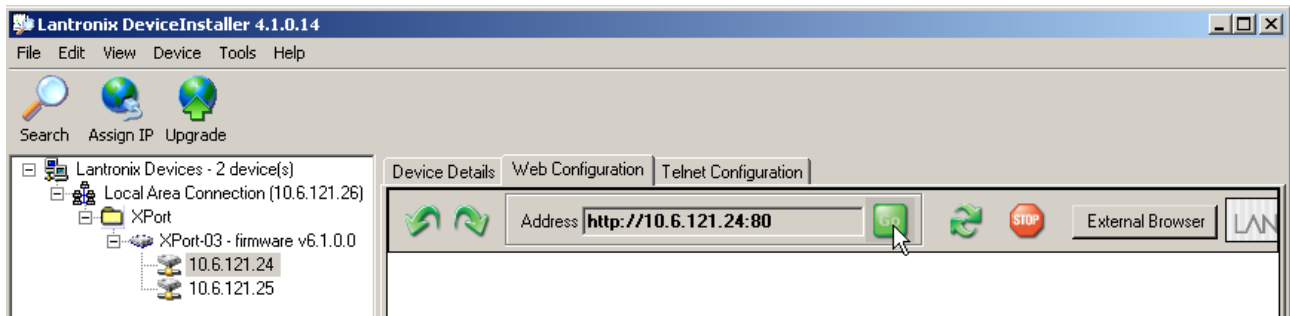
After the Login dialog the Settings pane will appear on the left as shown below, click on *Connection*. Make sure the parameters are set as shown. If you need to change the Port # do it here.

When finished click *OK* and then activate the *Apply Settings* option
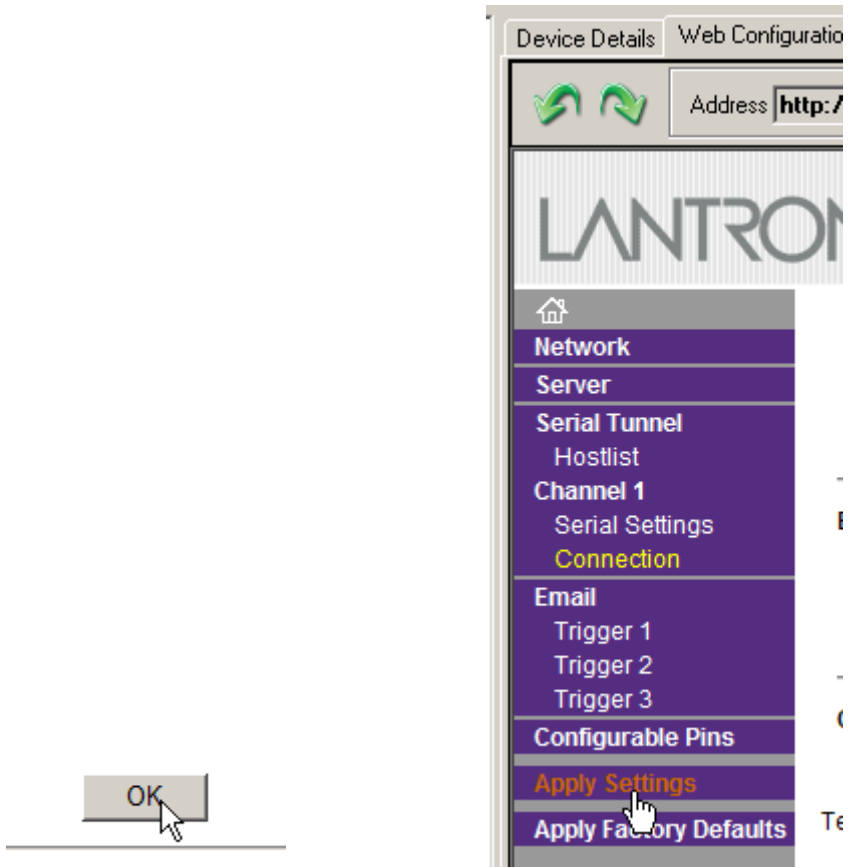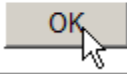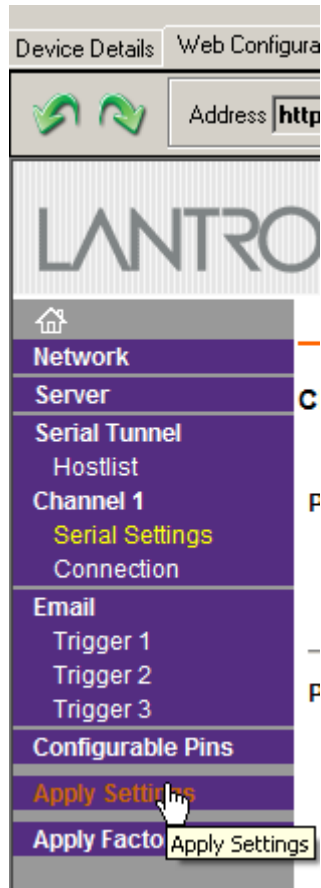
## 4-6.    Model 482C Communication Guidelines

1) Data transfer from the host terminal to the unit must contain an ending delimiter of <CR><LF>.

     Example:             <CR><LF>           -Carriage Return and Line feed.  (In ASCII,
                                                       <CR> is 13; <LF> is 10.)

2) The number of characters for any command string, from the first character to the <CR>, may not exceed 255.
3) Status request commands, i.e., commands ending with a "?", may only be sent within one transmission.
     Example:             7:0:GAIN?<CR> <LF>
                                          -Reads the gain setting of all channels.

## 4-7.    Model 482C Unit Initialization Procedure

1) To begin, plug 9-pin female DSUB connector of given cable into RS-232 port of Model 482C.  Plug the other end of the cable into the COM port of the terminal or computer.
2) Turn on power to Model 482C.  The display or power indicator should light up to indicate the power is on.
3) With the terminal or computer that is set up to transmit data, according to the host set-up discussed in Section 3-3, send the command:

     "1:0:LEDS=0"  <CR><LF>

This command flashes the front panel LEDs three times.

## 4-8.    Command Summary

The table below is a summary of the 482x command set. The 482 is highly configurable and, as such, Some commands may not be valid in all units. The 482x commands are sent and received from/to the host computer in ASCII text format.

| Command | Type | Scope | Meaning |
|---------|------|-------|---------|
| GAIN | R/W | Channel | Set or read gain |
| SENS | R/W | Channel | Sensor Sensitivity |
| FSCI | R/W | Channel | Expected Full Scale Input Value |
| FSCO | R/W | Channel | Full Scale Output |
| INPT | R/W | Channel | Input Signal Mode Selection |
| FLTR | R/W | Channel | Enable/disable input filters |
| IEXC | R/W | Channel | Read/Adjust ICP® current setting |
| OFLT | R/W | Channel | Enable/disable output filters |
| CPLG | R/W | Channel | Select AC or DC coupling |
| CLMP | R/W | Channel | Enable/disable Clamp |
| CALB | R/W | Channel | Select Internal/External Cal setting |
| VEXC | R/W | Channel | Read/Adjust Bridge Voltage Excitation Setting |
| SWOT | R/W | Unit | Switched output  (4 to 1 mux) |
| RTED | R | Channel | Read TEDS data (DS2430A) |
| ALLC | R | Channel | Read majority of channel settings |
| RBIA | R | Unit | Measure Bias (returns all channels) |
| CHRD | R | Unit | Read Channel output (returns all channels) |
| STUS | R | Unit | input fault / overload status, for all channels |
| UNIT | R | Unit | Read Unit Configuration information |
| UNID | R/W | Unit | Set Unit ID |

| AZZR | FCN | Channel | AutoZero/Auto Balance |
|------|-----|---------|----------------------|
| LEDS | FCN | Unit | Front panel LED test function |
| RSET | FCN | Unit | Restores factory default channel settings |
| AUTR | FCN | Channel | Enable/disable auto-scaling function |
| SAVS | FCN | Unit | Saves the current settings to NVRAM |

Command type definitions;
- R/W – the setting can be read from or written to the unit or channel.
- R – The information can only be read from the unit or channel.
- FCN – The command invokes a function in the unit.

## 4-9.   Command Format

The 482x communication protocol incorporates the concept of 'Directed' and 'Global' commands at both the Unit and Channel level with the following characteristics;
- Unit or Channel numbers =0 are global commands that affect either all units or all channels of a particular unit or both.
- Directed commands that set a unit parameter are always acknowledged (ACK) with an ASCII message that indicates '<Unit#>:<CMD>:ok' if implemented with no errors or NAK with; <Unit#>:<CMD>:=<error#>' if an error was encountered.
- Directed commands that request a particular parameters setting (query) result in a query response being returned
- No response is ever given to a Global Unit command.
- All messages must be terminated with a <CR> (\r) and <LF> (\n) combination.

**Command Format**:
> 'Unit#:Ch#:Cmd[=|?]{<value1 >{,< value2 >}}{;Ch#:Cmd[=|?]{<value1>{,< value2>}}}\n\r

- Each message must be preceded by a Unit# & Channel# (both of which could be 0)
- Messages may contain multiple commands separated by a semicolon ';'.
- The second and subsequent commands in a message shall not contain a unit number but shall contain a channel number.
- Each command in a message will evoke a response message if one is warranted (not global)
- Query's ('?') can only be directed to one unit but if the channel=0 then each channel's setting will be returned in the order 0-MAXCHANNELS separated by a ':'

## Command examples:

| | |
|---|---|
| 1:0:GAIN=100.2\r\n | unit 1,all channels gain set to 100.2 |
| 1:1:GAIN=100.2;2:GAIN=120.3\r\n | unit 1, channel 1 gain = 100.2; channel 2 gain = 120.3 |
| 1:3:GAIN=100.2;0:FLTR=1\r\n | unit 1, channel 3 gain = 100.2; all channel's filter = ON |

General Query Response Format
Unit#:Cmd:Ch#=<value>{; Ch#=<value>}…>{; Ch#=<value>}…\r\n

Responses to a query with a channel number=0 will return the setting of each channel in a list separated by semicolons ';'.
If the target of the query is a unit setting (ex. current excitation) then the channel number returned is the 1st channel of the board that processed the command.

## 4-10 Multiple Board Models

Some 482x models (ex. 482M179) have multiple main boards installed which will appear as a contiguous set of channels, when in fact, physically, they are completely separate and operate somewhat independently. This presents some interesting communication challenges. For instance, a global channel command to set 8 channels on a 482M179 unit will be handled by each internal board simultaneously. However only the board with the channels designated as 1-4 will ACK the command, the other board will remain silent.

Likewise, a global Query command will be responded to by the channel 1-4 board but will be ignored by the channel 5-8 board. However, In order to facilitate efficient communications with the second board, the concept of a second unit address was introduced. A user's control application can direct global channel setting queries to the second board of a unit by addressing the query to the secondary unit address of the unit. This secondary unit address is defined to be the normal unit address *plus 128* (i.e. if a units address is 1 then the 2$^{nd}$ board's address would be 129)

## 4-11.  Commands

## GAIN

SET GAIN: This command sets the programmable gain of a channel.  The gain may be set to x1, x10, or x100 for the variable gain option or to any setting within the 0.1 to 200 range for the incremental option.

> *Setting*:
> The amplifier gain can be set directly by sending a Gain command:
>
> **1:0:GAIN=100.2\r\n**                 *(unit 1,all channels gain set to 100.2)*
>
> When a channels gain is set directly the unit will adjust the FSI parameter of the gain equation using the following equation; FSI = (((FSO*1000)/Gain)/Sens) to ensure it remains valid.
>
> **Setting Response: 1:GAIN:ok**
>
> *Query*:
> The Gain query returns all of the parameters used to determine it in a single response
>> Query Format: Unit#:Ch#:CMD?
>> Response format: Unit#:Cmd:Ch#:=Gain:SENS:FSO:FSI;
>> Query: 1:5:GAIN?
>> Response: 1:GAIN:5=  5.0:  10.0:  10.0: 200.0;
>>
>> Global Query: 1:0:GAIN?
>> Global Response: **1:GAIN:1**=  5.0:  10.0:  10.0:  200.0;**2**=  5.0:  10.0:  10.0:  200.0;**3**=  5.0:  10.0:

10.0:  200.0;**4**=  5.0:  10.0:  10.0:  200.0;

## SENS

The SENS command provides a mechanism to have the transducer Sensitivity influence the Gain setting of the channel. Channel Gain is calculated using the equation;

Gain = FSO*1000/(FSI*SENS). If a Sensitivity is entered that caused the gain to exceed the amplifiers capability the FSI component will be adjusted to keep the equation valid.

> *Setting*:
> **1:0:SENS=20.2\r\n**        *(unit 1,all channels transducer sensitivity set to 20.2)*

**Setting Response: 1:SENS:ok**

*Query*:

> The Sens query returns the channels transducer sensitivity
> > Query Format: Unit#:Ch#:CMD?
> > Response format: Unit#:Cmd:Ch#:= SENS;
> > Query: 1:1:SENS?
> > Response: 1:SENS:1=  6.0;
> >
> > Global Query: 1:0:SENS?
> > Global Response: 1:SENS:**1**=  6.0;**2**=  10.0;**3**=  10.0;**4**=  10.0;

# FSCI

The FSCI command provides a scaling mechanism to automatically set the gain based on a known input level (in EU) and what output level (in Volts) you would like that Full Scale input level to be represented by. For instance 1000g's = 10Volts. These 2 values along with the transducer sensitivity set the gain. Channel Gain is calculated using the equation: Gain = FSO*1000/(FSI*SENS).

> *Setting*:
> > *1:1:FSCI=1000.000\r\n    (unit 1, channel 1 FSI set to 1000.0)*
> **Setting Response: 1:FSCI:ok**
>
> *Query*:
> The FSCI query returns the channels Full Scale Input value in engineering units
> > > Query Format: Unit#:Ch#:CMD?
> > > Response format: Unit#:Cmd:Ch#:= <fsci>;
> > > Query: 1:1: FSCI?
> > > Response: 1:FSCI:1=1000.0;
> > >
> > > Global Query: 1:0:FSCI?
> > > Global Response: 1:FSCI:1=1000.0;2=1000.0;3=1000.0;4=1000.0;

# FSCO

> The FSCO command provides a scaling mechanism to automatically set the gain based on a known input level (in EU) and what output level (in Volts) you would like that Full Scale input level to be represented by. For instance 1000g's = 10Volts. These 2 values along with the transducer sensitivity set the gain. Channel Gain is calculated using the equation:
> Gain = FSO*1000/(FSI*SENS).
> *Setting*:
> > *1:1:FSCO=10.000\r\n      (unit 1, channel 1 FSO set to 10.0)*
> **Setting Response: 1:FSCO:ok**
>
> *Query*:
> The FSCO query returns the channels Full Scale Output Value in volts
> > > Query Format: Unit#:Ch#:CMD?
> > > Response format: Unit#:Cmd:Ch#:= <fsci>;
> > > Query: 1:1: FSCO?
> > > Response: 1:FSCO:1=10.0;
> > >
> > > Global Query: 1:0:FSCO?

Global Response: 1:FSCO:1=10.0;2=10.0;3=10.0;4=10.0;

## INPT

The INPT command sets the input mode for a given channel. The mode selection is sent as an integer value. All possible input modes for the 482/483 family are listed below. The **bold** items are valid input settings for the 482C27 and 483C28.

- CHARGE          0
- **VOLTAGE      1**
- **ICP              2**
- Multi-Charge option of 10mV/pc sensitivity          3
- Multi-Charge option of 1.0mV/pc sensitivity          4
- Multi-Charge option of 0.1mV/pc sensitivity          5
- Isolated ICP                                                             6
- Isolated Multi-Charge option of 10mV/pc sensitivity  7
- Isolated Multi-Charge option of 1.0mV/pc sensitivity  8
- Isolated Multi-Charge option of 0.1mV/pc sensitivity  9
- **¼ Bridge        10**
- **½ Bridge        11**
- **Full Bridge      12**
- **Referenced Single Ended 13**

*Setting*:
> *1:1:INPT= 12\r\n*          *(unit 1, channel 1 input mode set to Full Bridge)*
> **Setting Response: 1:INPT:ok**

*Query*:
The INPT query returns the channels input mode selection
> Query Format: Unit#:Ch#:CMD?
> Response format: Unit#:Cmd:Ch#:= <inpt>;
> Query: 1:1:INPT?
> Response: 1:INPT:1=  12;
>
> Global Query: 1:0:INPT?
> Global Response: 1:INPT:1=  12.0;2=  2.0;3=  2.0;4=  2.0;

**Note**: Programmatic setting of Input mode should be followed with queries of IEXC, VEXC and GAIN since the unit will set IEXC to 0 if a Bridge input is selected and likewise will set VEXC to 0 if ICP or Voltage input is selected. Additionally, Bridge gain can be as high as 2000 but the ICP/Voltage mode maximum is 200 so switching from Bridge to ICP/Voltage will reset the Gain to the ICP maximum if the current Bridge setting is higher than the ICP maximum.

## IEXC

The IEXC command sets the current excitation level for ICP mode. The current excitation value is sent as an integer value from 0 (off) to 20mA.

*Setting*:
> *1:1:IEXC= 2\r\n (unit 1, channel 1, set to 2mA)*
> **Setting Response: 1:IEXC:ok**

*Query*:
The IEXC query returns the units excitation value.
> Query Format: Unit#:Ch#:CMD?

Response format: Unit#:Cmd:Ch#:= <IEXC>;
Query: 1:1:IEXC?
Response: 1:IEXC:1=2;

Global Query: 1:0: IEXC?
Global Response: 1:IEXC:1=2;2=4;3=4;4=4;

# VEXC

The VEXC command sets the voltage excitation level for bridge and differential mode inputs.
The voltage excitation value is sent as a floating point number from 0.0 (off) to ±12.0 Volts. If the value is sent as a negative number then the minus (-) Bridge Excitation will track the plus (+) Bridge Excitation setting. If it is sent as a Positive value then the minus (-) Bridge Excitation will be set to 0.

*Setting*:
   *1:1:VEXC= -10.0 \r\n*   *(unit 1, channel 1, sets minus (-) Bridge Excitation and plus (+)Bridge* Excitation to 10.0 volts*)*
   *1:1:VEXC= 10.0 \r\n*   *(unit 1, channel 1, sets minus (-) Bridge Excitation to 0 and plus (+)Bridge* Excitation to 10.0 volts*)*

**Setting Response: 1:VEXC:ok**

*Query*:
The VEXC query returns the voltage excitation value.
    Query Format: Unit#:Ch#:CMD?
    Response format: Unit#:Cmd:Ch#:= <VEXC>;
    Query: 1:1:VEXC?
    Response: 1:VEXC:1=-10.0;

    Global Query: 1:0: VEXC?
    Global Response: 1:VEXC:1=-10.0;2=10.0;3=0.0;4=0.0;

# FLTR

The FLTR command enables or disables the Input Filter.
The Input Filter value is sent as an integer value of either 0 -Disable or 1-Enable.

*Setting*:
   *2:1:FLTR= 1\r\n ( unit 2, channel 1, Input Filter Enabled )*
**Setting Response: 2: FLTR:ok**

*Query*:
The FLTR query returns the channels Input Filter selection
    Query Format: Unit#:Ch#:CMD?
    Response format: Unit#:Cmd:Ch#:= <0|1>;
    Query: 2:1: FLTR?
    Response: 2:FLTR:1=1;

    Global Query: 1:0: FLTR?
    Global Response: 1:FLTR:1=1;2=0;3=0;4=0;

## OFLT

The OFLT command enables or disables the Output Filter.
The Output Filter value is sent as an integer value of either 0 -Disable or 1-Enable.

*Setting*:
      **2:1:OFLT= 1\r\n ( unit 2, channel 1, Output Filter Enabled )**
**Setting Response: 2: OFLT:ok**

*Query*:
The FLTR query returns the channels Output Filter.
      Query Format: Unit#:Ch#:CMD?
      Response format: Unit#:Cmd:Ch#:= <0|1>;
      Query: 2:1: OFLT?
      Response: 2: OFLT:1=1;

      Global Query: 1:0: OFLT?
      Global Response: 1: OFLT:1=1;2=0;3=0;4=0;

## CLMP

The CLMP command enables or disables the Clamp feature. When Clamp is disabled the channel is 'Buffered'
The Clamp value is sent as an integer value of either 0 –Disable (buffered) or 1-Enable.

*Setting*:
      **2:1:CLMP= 1\r\n**       **( unit 2, channel 1, Clamp Enabled )**
**Setting Response: 2: CLMP:ok**

*Query*:
The CLMP query returns the channels Clamp setting.
      Query Format: Unit#:Ch#:CMD?
      Response format: Unit#:Cmd:Ch#:= <0|1>;
      Query: 1:1:CLMP?
      Response: 1:CLMP:1=0;

      Global Query: 1:0:CLMP?
      Global Response: 1:CLMP:1=0;2=0;3=0;4=0;

## CLPG

The CLPG command sets the channel coupling to AC or DC mode.
The coupling value is sent as an integer value: 0 –AC, 1-DC.

*Setting*:
      **1:1:CLPG= 1\r\n ( unit 1, channel 1, DC Coupled )**
**Setting Response: 2: CLPG:ok**

*Query*:
The CLPG query returns all channels coupling setting.
      Query Format: Unit#:Ch#:CMD?
      Response format: Unit#:Cmd:Ch#:= <0|1>;
      Query: 1:1:CLPG?
      Response: 1:CPLG:1=1;2=0;3=0;4=0;

> Global Query: 1:0:CPLG?
> Global Response: 1:CPLG:1=1;2=0;3=0;4=0;

### Notes on DC Coupling

If the Coupling setting is set to DC then the Auto Zero function becomes available. Additionally, if the Input mode is set to any Bridge or differential setting then Auto Balance is also available. These functions remove the DC offset from the output.

# SWOT

The Switched Output (SWOT) command selects which channel is switched to the switched output BNC for monitoring purposes as well as its normal analog output. This is a unit command so the channel designation in the command protocol is ignored

> The switched output value is sent as an integer value: 0-OFF; or 1-MAX Channels to designate which channel is switched.
>
> *Setting*:
>       *1:0:SWOT= 4\r\n*       *( unit 1, channel NA, Channel 4 is switched to the switched output BNC )*
> **Setting Response: 1: SWOT:ok**
>
> *Query*:
> The SWOT query returns all channels coupling setting.
> > Query Format: Unit#:Ch#:CMD?
> > Response format: Unit#:Cmd:Ch#:= <channel # or 0=OFF>;
> > Query: 1:1:SWOT?
> > Response: 1:SWOT:1=4;

# CALB

> The Calibration mode (CALB) command selects the calibration setting. For the 482C27 the options are OFF, Internal Shunt + or Internal Shunt -. For other models External Cal and Internal Cal using internally generated 100Hz or 1kHz  sine wave signals are available.
>
> The CALB value is sent as an integer value of either 0 –Disable, 1-1000 Hz Enable, 2-100 Hz Enable, 3- External Cal, 4 -Internal Shunt +, 5 – Internal Shunt -
>
> *Setting*:
>       *1:1: CALB= 4\r\n*       *( unit 1, channel 1, Internal Shunt Cal + )*
> **Setting Response: 1:CALB:ok**
>
> *Query*:
> The CALB query returns the channels calibration setting.
> > Query Format: Unit#:Ch#:CMD?
> > Response format: Unit#:Cmd:Ch#:= <0|1>;
> > Query: 1:1: CALB?
> > Response: 1: CALB:1=4;
> >
> > Global Query: 1:0:CALB?
> > Global Response: 1:CALB:1=4;2=0;3=0;4=0;

## RTED

The Read TEDS (RTED) command returns the TEDS information that is stored in the sensor or other, TEDS capable, in-line module attached to a selected channel. The 482x devices are 1451.4 compliant in that they will read the DS2430A Application Register Status to see if it indicates the 64 bit Application Register has data in it. If so it will read the Application register contents and return it followed by the contents of the TEDS EEPROM.

NOTE: The 1$^{st}$ byte of the DS2430A EEPROM data should contain the checksum of both the Application Register contents and the EEPROM contents if the TEDS is 1451.4 compliant. No attempt is made to validate or interpret the TEDS data.

*Setting*:
**N/A – Command is Read only**

*Query*:
The RTED query returns the TEDS data associated with the specified channel. This command must be directed to a specific channel. It will return an indicator that specifies if the DS2430A Application register has been used to store the basic TEDS data and up to 40 bytes in ASCII Hex format (8 bytes of Application register content if it was burned and 32 bytes of the EEPROM content).

> Query Format: Unit#:Ch#:CMD?
> Response format: Unit#:Cmd:Ch#= <APP Reg Status>:<APP Reg Contents (8 bytes if APP Reg Status=1)><DS2430A EEPROM Contents (32 bytes)>
> > Where: APP Reg Status=1 if the APP Register had data or 0 if it did not
>
> Query: 1:1:RTED?
> Response: (for TEDS chip (DS3430A) on channel 1 with valid app register data)
> 1:RTED:1=1:168010a00975000012648016a88ae8e112801f2000f60ec4046dd18737f3206a380555e7 65390800

## ALLC

The ALLC command is used to read several channel settings at once.

*Setting*:
**N/A – Command is Read only**

*Query*:
This command must be a directed command use of the global channel indicator is not allowed.

> Query Format: Unit#:Ch#:CMD?
> Response format: Unit#:Cmd:Ch#:= GAIN:<Gain value>; SENS:< SENS value>; FSCI:< FSCI value>; FSCO:< FSCO value>; INPT:< INPT value>; FLTR:< FLTR value>; IEXC:< IEXC value>; OFLT:< OFLT value>; CPLG <CLPG value>; CLMP:< CLMP value>; CALB:< CALB value>; VEXC:< VEXC value>; SWOT:< SWOT value>;
>
> Query: 1:1:ALLC??
> Response: 1:ALLC:1=GAIN:  2.7;SENS: 10.0;FSCI: 187.7;FSCO:  5.0;INPT:  2.0;FLTR:0;IEXC :2;OFLT:0;CPLG:1;CLMP:0;CALB:0;VEXC:  0.0;SWOT:0;

## RBIA

The RBIA command is used to read all channels Bias Levels.

*Setting*:
**N/A – Command is Read only**

*Query*:
This command is a global command and will return all channel bias readings regardless of the channel id in the command.

> Query Format: Unit#:Ch#:RBIA?
> Response format: Unit#:Cmd:Ch#:=CH1 bias;… CHn#:=CHn bias;
> Query: 1:1:RBIA?
> Query Response: 1:RBIA:1= 12.5;2= 25.5;3= 25.5;4= 25.5;

## CHRD

The CHRD command is used to read all channels output levels.

*Setting*:
**N/A – Command is Read only**

*Query*:
This command is a global command and will return all channel A/D readings regardless of the channel id in the command.

> Query Format: Unit#:Ch#:CHRD?
> Response format: Unit#:Cmd:Ch#:=CH1 A/D;… CHn#:=CHn A/D;
> Query: 1:0:CHRD?
> Query Response 1:CHRD:1= 4.049;2=5.338;3=2.137;4=10.373;

## STUS

The STUS command is used to read the unit and all channel status indicators.

*Setting*:
**N/A – Command is Read only**

*Query*:
This command is a global command and will return all channel bias readings regardless of the channel id in the command.

> Query Format: Unit#:Ch#:STUS?
> Response format: Unit#:Cmd:Ch#:<unit status bit map>;<CH1 status bit map>;…;<CHn status bit
map>;
> Query: 1:1:STUS?
> Query Response: 1:STUS:1:0;1;5;5;5;
>
> Where :
> > Unit Bit 0 = 1= BAD EEPROM read for channel settings on power up
> > Unit Bit 1 = 1= BAD EEPROM read for Unit options on power up
> > Unit Bit 2 = 1= BAD EEPROM read for cal factors on power up

For Unit bit map 0=no errors
Channel Bit 0= Short input fault (0=Fault; 1 = no fault)
Channel Bit 1= Open input fault (0=Fault; 1 = no fault)
Channel Bit 2= Overload condition  (0=Overload; 1 = no Overload)
For channel bit map 7=no errors

## UNIT

*Query*:
The UNIT query returns the unit configuration information which includes the installed options, unit number, Model id and starting channel number
Query Format: Unit#:Ch#:CMD?
Response format: Unit#:Cmd:Model string:Firmware Ver string: Serial Number:Cal Date:Filter Corner: Unit#:#channels:Starting Ch#: Gain Option byte, Input Option Byte, Filter option byte,Misc1 option byte,Misc2 option byte<cr><lf>
Query: 1:1:UNIT?
Response: 1:UNIT:482C27\s\s\s\s\s\s\s\s\s:FW\sVer\s1.0:12345:09-27-2006:10.000:1:4:1:16,37,1,143,0\r\n

Model & Firmware version strings are self-explanatory. Following are:
Serial Number (U16): Cal Date (10 character string): Filter corner (kHz)
Unit Id: Number of Channels: Starting Channel Number
Followed by the 5 option bytes:

**Gain Options**

| | | |
|---|---|---|
| OPT_GAIN_x1 | 0x01 | Fixed x1 |
| OPT_GAIN_x5 | 0x02 | Fixed x5 |
| OPT_GAIN_x10 | 0x04 | Fixed x10 |
| OPT_GAIN_VAR | 0x08 | Variable Fixed (x1,x10,x100) |
| OPT_GAIN_INC | 0x10 | incremental .1-200 |
| OPT_GAIN_FINE2h | 0x20 | Fine Gain .0025-200 |
| OPT_GAIN_FINE1k | 0x40 | Fine Gain .0025-1000 |

**Input Options**

| | | |
|---|---|---|
| OPT_INP_ALLCHG | 0x01 | All charge |
| OPT_INP_ICPVOLTCHG | 0x02 | ICP\|VOLT\|CHG |
| OPT_INP_ICPVOLT | 0x04 | ICP\|VOLT |
| OPT_INP_INTCAL | 0x08 | Internal Cal |
| OPT_INP_EXTCAL | 0x10 | External Cal |
| OPT_INP_ISOLATION | 0x20 | Isolation |
| OPT_INP_BRIDGE | 0x40 | Bridge Modules Installed |

**Filter Options**

| | | |
|---|---|---|
| OPT_FILTER_IN | 0x01 | Input filter (time constant) |
| OPT_FILTER_OUT | 0x02 | Output filter |
| OPT_FILTER_FIXLP | 0x04 | Fixed LP filter |
| OPT_FILTER_PGMELP | 0x08 | Prgm LP Elliptical filter |
| OPT_FILTER_PGMBTR | 0x10 | Prgm LP Butterworth filter |

**Miscellaneous Options**

| | | |
|---|---|---|
| OPT_MISC_COUPLING | 0x01 | AC/DC coupling |
| OPT_MISC_CLAMP | 0x02 | Clamp |
| OPT_MISC_TEDS | 0x04 | TEDS |
| OPT_MISC_IEXC | 0x08 | current excitation |
| OPT_MISC_SINTG | 0x10 | Single Integration |

| OPT_MISC_DINTG | 0x20 | Double Integration |
|---|---|---|
| OPT_MISC_MUX | 0x40 | Mux /Switch-out |
| OPT_MISC_DISPLAY | 0x80 | FP Display |

**Miscellaneous Options 2**

| OPT_MISC2_OLDISO | 0x01 | Reserved |
|---|---|---|
| OPT_MISC2_A2D | 0x02 | Digital Output available |

## UNID

The UNID command is used to set the units ID number. The Unit Id number is critical to remote communications since it indicates which commands a unit should accept and respond to. Units are typically shipped with a unit id of 1. If more than one unit is in the system and they will be communicated with remotely the user must set a unique id in each unit. This can be done through the front panel interface, if one exists, or by connecting to each unit individually and sending this command.

*Setting*:
　　　　1:1:UNID= 2\r\n ( unit 1, channel 1, New ID=2 )

**Setting Response: 2:UNID:ok**
NOTE: The new Unit Id becomes effective immediately

*Query*:
This command can be sent as a query but its usefulness is marginal being as it is a directed command and as such it is necessary to include the Unit Id in the command and the response will simply validate the commands unit id parameter.
　　　　Query Format: Unit#:Ch#:UNID?
　　　　Response format: Unit#:Cmd:Ch#:=unit id
　　　　Query: 2:1:UNID?
　　　　Query Response: 2:UNID:1=2;

## AZZR

The AZZR command is used to Auto Zero (input shorted) or Auto Balance (input connected) a channel that is DC coupled. This command invokes a function and therefore has no query capability. The function parameters are: 1=Auto Zero, 2=Auto Balance. (Auto Balance is only valid if the channel has a bridge input type selected)

*Setting*:
　　　　2:1:AZZR= 1\r\n ( unit 2, channel 1, Auto Zero)

**Setting Response: 2:AZZR:ok**

*Query*:
N/A

Note: the following error codes could be reported by the auto zero/balance function;

- -11 Bridge DC Offset ERR - Illegal Setting
- -12 Bridge DC Offset ERR - Too Many iterations
- -13  ICP DC Offset ERR - Bad RDG
- -14  ICP DC Offset ERR - Too Many iterations
- -15  Balance Request, channel not in Bridge mode - Illegal Setting

- -16 Zero Request, channel not in Bridge mode or ICP/volt - Illegal Setting
- -17 Current Excitation Setting not allowed in Bridge input modes – Illegal Setting
- -18 Voltage Excitation Setting not allowed in non-Bridge input modes – Illegal Setting

## LEDS

The LEDS command is used to test the LED functionality of the front panel. When sent as a command the LED's on the front panel will flash 3 times. This command invokes a function and therefore has no query capability.

*Setting*:
> **2:1:LEDS= 0\r\n ( unit 2, channel 1, Any value )**

**Setting Response: 2:LEDS:ok**

*Query*:
N/A

## RSET

The RSET command is used to restore the factory default channel settings for every channel in the specified unit. This command invokes a function and therefore has no query capability.

*Setting*:
> **2:0:RSET = 1\r\n          ( unit 2, channel 0, RSET cmd, 1(TRUE) )**

**Setting Response: 2:RSET:ok**

*Query*:
N/A

**The factory Defaults are:**
- Gain= 1.0
- Sensitivity=10.0
- Full Scale input= 1000.0
- Full Scale output= 10.0
- Input Mode = ICP
- Input Filter=Disabled
- Current excitation=4.0mA
- Voltage Excitation=0 volts
- Output Filter=Disabled
- Coupling =AC
- Clamp=OFF
- Calibration=OFF
- Switched Output =OFF

## AUTR

The AUTR command invokes the Auto-Range function. This function (also referred to as auto-scale) provides an automatic scaling of the output signal by adjusting the programmable gain to give .8 of the Full Scale Output setting.

The signals are checked internally using the onboard channel output A/D. Possible settings are: **0=off, 1-on, 2=immediate**. The Immediate option causes the auto scale function to execute one time and then turns off the function automatically. When Auto scale is 'ON' the unit will continue to invoke the function, adjusting the gain for the current input level, until the function is turned OFF with a subsequent command.

> *Setting*:
> > **2:1:AUTR =1\r\n**           *( unit 2, channel 1, Auto Scaling ON )*

**Setting Response: 2:AUTR:ok**

> *Query:*
> > Query Format: Unit#:Ch#: AUTR?
> > Response format: Unit#:Cmd:Ch#:=current state (0=off,1-on,2=immediate)
> > Query:  2:1:AUTR?
> > Query Response:  2:AUTR:1=0;

## SAVS

> The SAVS command is used to store the current channel setting as the default settings that will be restored on power up. This command is available primarily for units without a front panel display and keypad. Units with a soft key power button will save the channel settings automatically at power down because the units firmware handles the power button processing. Units without the soft key have power removed abruptly and don't not have the opportunity to save the settings automatically. This command invokes a function and therefore has no query capability.

> *Setting*:
> > **2:1:SAVS = 1\r\n( unit 2, channel 1, Any value )**

**Setting Response: 2:SAVS:ok**

> *Query*:
> N/A

## Communication Responses

Typically the unit will return **<Unit>:<Cmd String>:OK**  when the command is successful. Errors are indicated with negative numbers. The unit may return one of the following:

> **<Unit>:<Cmd String>:OK<CR> <LF>**
> > Represents that the last command was entered in the correct format and was performed properly.

> **<Unit>:<Cmd String>:-1<CR> <LF>**
> > Option Error. The unit is not equipped with the option necessary to implement the command sent

> **<Unit>:<Cmd String>:-2<CR> <LF>**
> > Channel Error. The channel number in the command is invalid.

> **<Unit>:<Cmd String>:-3<CR> <LF>**
> > Command Error. The command is not recognized.

> **<Unit>:<Cmd String>:-4<CR> <LF>**
> > Unit Error. The unit number in the command is invalid.

**<Unit>:<Cmd String>:-5<CR> <LF>**

> Unit Error. The function invoked by the command encountered an error or a query only command (ex. RBIA) was sent as a setting.

**<Unit>:<Cmd String>:-6<CR> <LF>**

> Command Parameter Error. A channel setting parameter was found to be out of range.

## 5-0    Wiring Information

Each BRIDGE/DIFF input may be configured for use with full bridge, half bridge, or quarter bridge sensors. Full bridge mode can also be used to accept a differential voltage signal from any source. Two additional modes, RSE (Referenced Single Ended), and NRSE (NOT Referenced Single Ended) accommodate voltage inputs, such as 3 wire sensors with a voltage output. In all cases the SENSE and EXC lines must be connected. The figures below illustrate the connections in each of these modes. Note: the shell of the DIN connector is connected as shown to earth ground internally.

## 5-1    Full Bridge Mode

Figure 7 and Figure 8 show how the unit should be wired to a full bridge sensor. For optimum performance, the V EXC and SENSE lines should be connected at the sensor as shown in Figure 7 below.
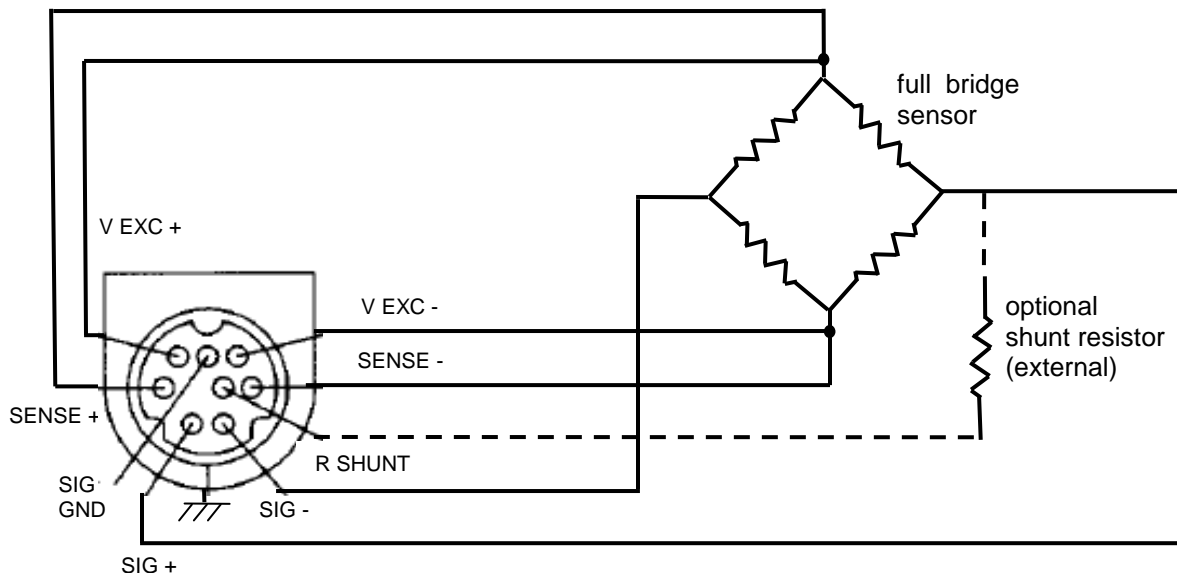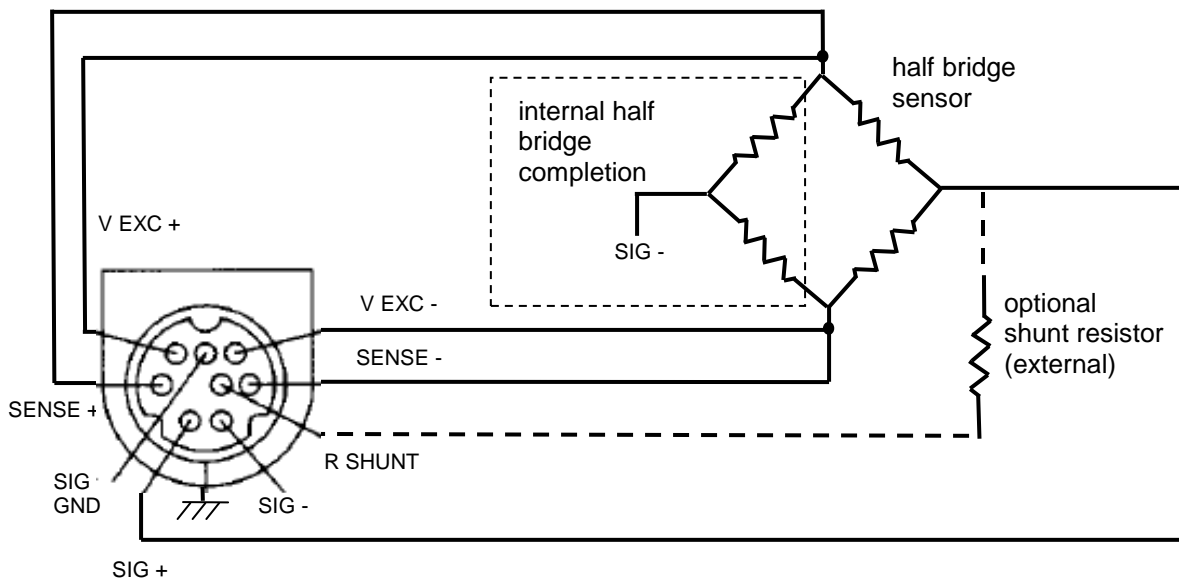


**Figure 7 Recommended Connections for Full Bridge Type Sensors**

**(sense leads wired for optimum performance)**
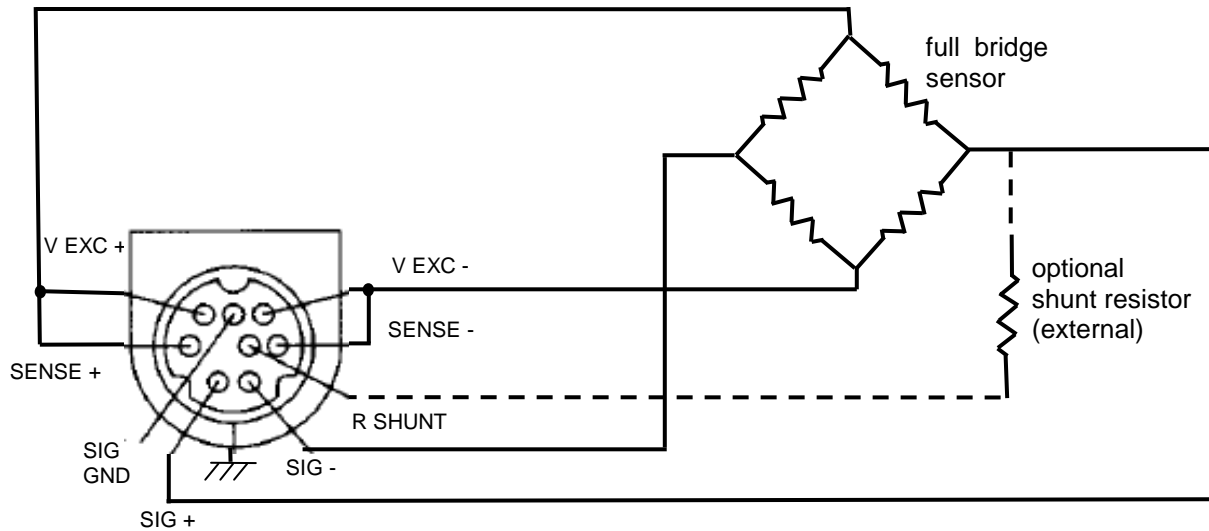
**Figure 8 Alternate Connections for Full Bridge Type Sensors**

**(sense leads connected at the signal conditioner)**

## 5-2    Half Bridge Mode



**Figure 9 Recommended Connections for Half Bridge Type Sensors**

**(sense leads wired for optimum performance)**
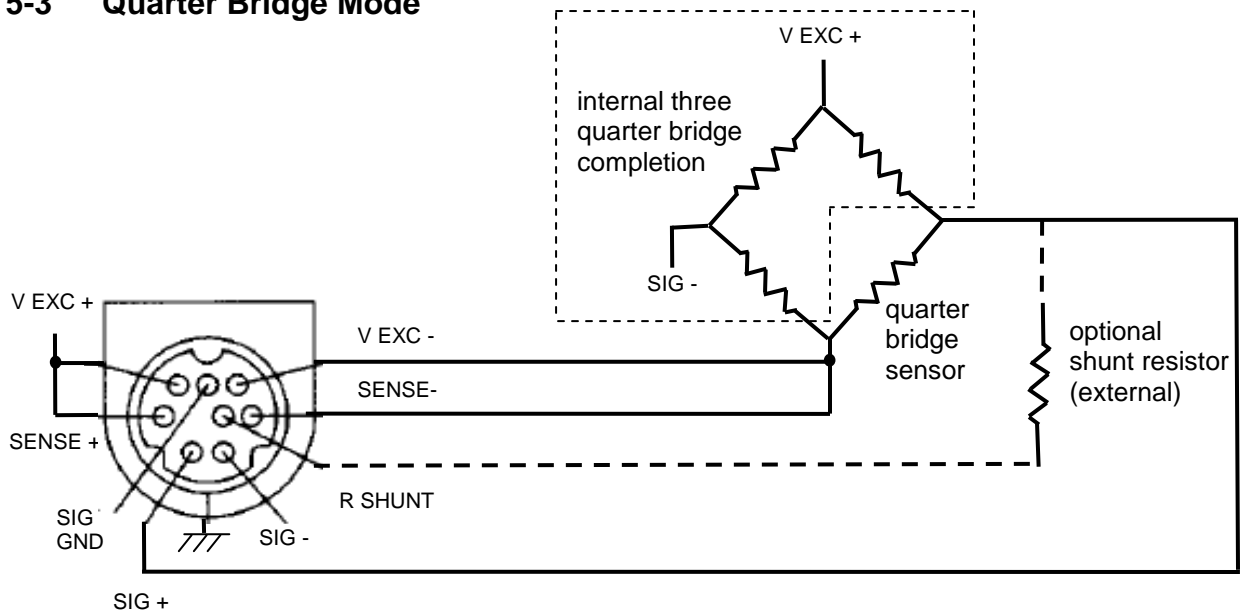
## 5-3    Quarter Bridge Mode



**Figure 10 Recommended Connections for Quarter Bridge Type Sensors**

**(sense lead wired for optimum performance)**

## 5-3    RSE / NRSE Mode for 3 Wire Sensors

Three wire sensors having a power connection, a ground connection, and a voltage output may be connected as shown in Figure 11 below.  The channel should be set to RSE mode which internally grounds the SIG-input.  The voltage output from the sensor (or other source) may then be applied to the SIG+ (non-inverting) input.  Set V EXC to unipolar at a voltage appropriate to power the sensor, and ensure that the V EXC lines are tied to the respective SENSE lines.

If an inversion is desired, use NRSE mode which internally connects SIG+ to ground.  The voltage output from the sensor may then be applied to the SIG- (inverting) input.
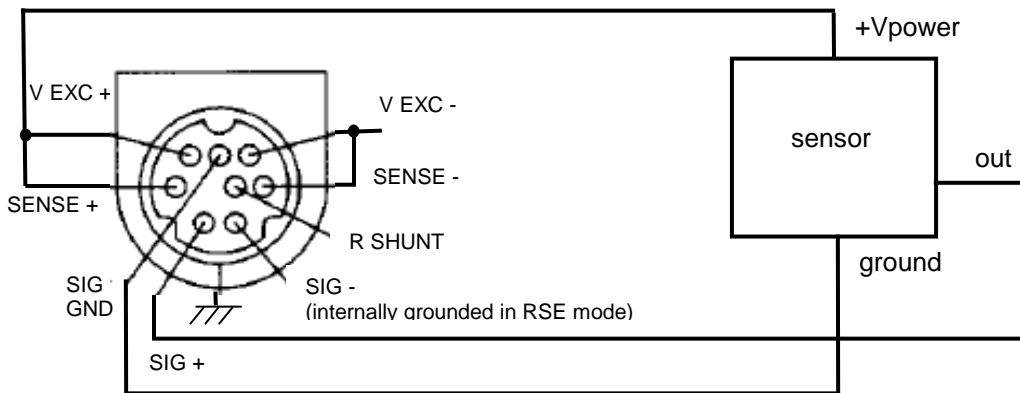


**Figure 11 Recommended Connections for 3 Wire Type Sensor**

**(channel in RSE mode)**

## 5-4     Connection of Triaxial Sensors

Many triaxial resistive bridge sensors have shared excitation lines, and other types of sensors may have shared power and ground lines. The V EXC, SENSE, or SIG GND lines for each channel may be tied together, however it is recommended that when doing so the excitation settings for each channel be identical for optimum performance.
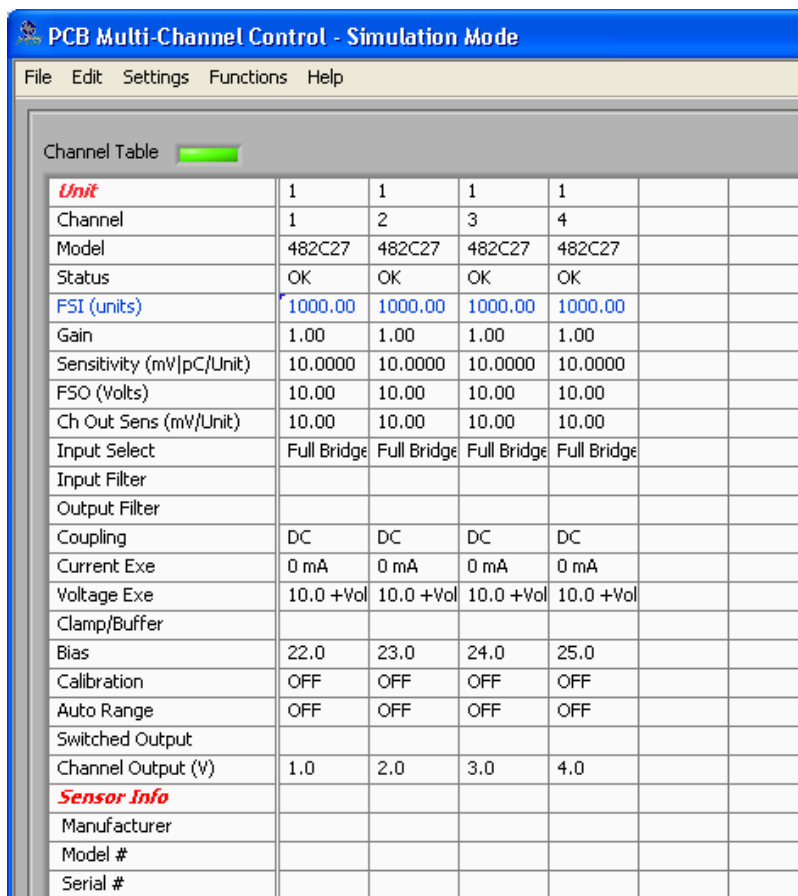
## Appendix A: Differential MEMS Sensor Set Up Guide for PCB Models 482C27 and 483C28

In order to setup the signal conditioner models 482C27 (4-channel) and 483C38 (8-channel) for use differential MEMS sensors (such as PCB 3741 and 3501 series accelerometers) apply the following settings:

1. **Gain:** Set signal conditioner channel gain to "**1**"
2. **Input Select:** Set sensor input type to "**Full Bridge**"
3. **Coupling:** Set signal conditioner input coupling to "**DC**"
4. **Voltage Exe:** Set excitation voltage to sensor to "**10**" and "**Unipolar**"

All other settings can be ignored.  These setting are shown in figure A1 for the MCSC Control Software supplied with these signal conditioner models.

With these settings, the output scale factor on each channel will be equal to the sensor's calibrated sensitivity, which can be read directly from the calibration certificate for that differential MEMS sensor.  Other scale factors can be achieved by adjusting the gain.

### PCB Multi-Channel Control - Simulation Mode

File   Edit   Settings   Functions   Help

Channel Table

| Unit | 1 | 1 | 1 | 1 | | |
|------|---|---|---|---|---|---|
| Channel | 1 | 2 | 3 | 4 | | |
| Model | 482C27 | 482C27 | 482C27 | 482C27 | | |
| Status | OK | OK | OK | OK | | |
| FSI (units) | 1000.00 | 1000.00 | 1000.00 | 1000.00 | | |
| Gain | 1.00 | 1.00 | 1.00 | 1.00 | | |
| Sensitivity (mV|pC/Unit) | 10.0000 | 10.0000 | 10.0000 | 10.0000 | | |
| FSO (Volts) | 10.00 | 10.00 | 10.00 | 10.00 | | |
| Ch Out Sens (mV/Unit) | 10.00 | 10.00 | 10.00 | 10.00 | | |
| Input Select | Full Bridge | Full Bridge | Full Bridge | Full Bridge | | |
| Input Filter | | | | | | |
| Output Filter | | | | | | |
| Coupling | DC | DC | DC | DC | | |
| Current Exe | 0 mA | 0 mA | 0 mA | 0 mA | | |
| Voltage Exe | 10.0 +Vol | 10.0 +Vol | 10.0 +Vol | 10.0 +Vol | | |
| Clamp/Buffer | | | | | | |
| Bias | 22.0 | 23.0 | 24.0 | 25.0 | | |
| Calibration | OFF | OFF | OFF | OFF | | |
| Auto Range | OFF | OFF | OFF | OFF | | |
| Switched Output | | | | | | |
| Channel Output (V) | 1.0 | 2.0 | 3.0 | 4.0 | | |
| Sensor Info | | | | | | |
| Manufacturer | | | | | | |
| Model # | | | | | | |
| Serial # | | | | | | |

**Figure A1 Settings for Differential MEMS Sensors**

| Performance | **ENGLISH** | **SI** | |
|---|---|---|---|
| Channels | 4 | 4 | |
| Sensor Input Type(s) | ICP®, Voltage, Bridge/Differential | ICP®, Voltage, Bridge/Differential | |
| Voltage Gain(ICP/Voltage Mode) | 0.1 to 200 | 0.1 to 200 | |
| Voltage Gain(Bridge/Differential Mode) | 0.1 to 2000 | 0.1 to 2000 | |
| Accuracy(Gain, x0.1 to x0.4) | ± 5 % | ± 5 % | |
| Accuracy(Gain, x0.5 to x0.99) | ± 1 % | ± 1 % | |
| Accuracy(Gain, x1.0 to x2000) | ± 0.5 % | ± 0.5 % | |
| Accuracy(Excitation) | ± 1 % | ± 1 % | |
| Input Range(Differential) | ± 0 to 10 V | ± 0 to 10 V | |
| Output Range(Minimum) | ± 10 V | ± 10 V | |
| Frequency Range(-5 %)(<100 Gain) | 0.05 to 100,000 Hz | 0.05 to 100,000 Hz | [5] |
| Frequency Range(-5 %)(≥100 Gain) | 0.05 to 50,000 Hz | 0.05 to 50,000 Hz | [5] |
| Phase Response(at 1 kHz) | ± 1 ° | ± 1 ° | |
| Cross Talk(maximum @ 10kHz) | -72 dB | -72 dB | |
| Calibration(Shunt) | Internal/External | Internal/External | |
| TEDS Sensor Support | Yes | Yes | |
| Fault/Bias Monitor/Meter(LED) | Open/Short/Overload | Open/Short/Overload | |
| **Control Interface** | | | |
| Human Interface | Keypad | Keypad | |
| Display | 2 rows, 16 columns | 2 rows, 16 columns | |
| Digital Control Interface | RS-232 | RS-232 | |
| Digital Control: Data Rate | 19,200 bps | 19,200 bps | |
| Digital Control: Start, Data, Stop, Parity | 1, 8, 1, No | 1, 8, 1, No | |
| Digital Control: Handshaking | RTS/CTS | RTS/CTS | |
| Digital Control: Cable Length(Maximum) | 50 ft | 50 ft | |
| Digital Control Interface | Ethernet | Ethernet | |
| **Environmental** | | | |
| Temperature Range(Operating) | +32 to +120 °F | 0 to +50 °C | |
| **Electrical** | | | |
| Power Required(for supplied AC power adaptor) | AC Power | AC Power | |
| AC Power(50 to 60 Hz) | 100 to 240 VAC | 100 to 240 VAC | |
| AC Power | 1.6 amps | 1.6 amps | |
| Excitation Voltage(To Sensor) | >+24 VDC | >+24 VDC | |
| Excitation Voltage(Positive) | +0 to 12 V | +0 to 12 V | [1] |
| Excitation Voltage(Negative) | -0 to 12 V | -0 to 12 V | [1][2] |
| Input Imbalance Adjustment(Maximum, Gain <10) | ± 2 V | ± 2 V | |
| Input Imbalance Adjustment(Maximum, Gain ≥10) | ± 0.2 V | ± 0.2 V | |
| Common Mode Voltage(Maximum) | ± 10 V | ± 10 V | |
| DC Offset(Stability, Maximum RTI) | 5 µV/°C | 5 µV/°C | |
| DC Offset(AC Coupled) | ≤ 50 mV | ≤ 50 mV | |
| DC Offset(DC Coupled, Gain <100) | <10 mV | <10 mV | |
| DC Offset(DC Coupled, Gain ≥100) | <20 mV | <20 mV | |
| DC Power | +9 to 18 VDC | +9 to 18 VDC | |
| DC Power | ≤ 2.5 amps | ≤ 2.5 amps | |
| Current Output(Excitation, Maximum) | 30 mA | 30 mA | |
| Constant Current Excitation(To Sensor) | 0 to 20 mA | 0 to 20 mA | |
| Output Impedance | ≤ 50 Ohm | ≤ 50 Ohm | |
| Impedance(Input) | >1 MOhm | >1 MOhm | |
| Overload Threshold(± 0.2 Vpk) | ± 10 Vpk | ± 10 Vpk | |
| Broadband Electrical Noise(1 to 10,000 Hz)(Gain x1) | 50 µV rms | 50 µV rms | [3] |
| Spectral Noise(1 Hz)(Gain x1) | 6.0 µV/√Hz | 6.0 µV/√Hz | [3] |
| Spectral Noise(10 Hz)(Gain x1) | 1.5 µV/√Hz | 1.5 µV/√Hz | [3] |
| Spectral Noise(100 Hz)(Gain x1) | 1.0 µV/√Hz | 1.0 µV/√Hz | [3] |
| Spectral Noise(1 kHz)(Gain x1) | 1.0 µV/√Hz | 1.0 µV/√Hz | [3] |
| Spectral Noise(10 kHz)(Gain x1) | 1.0 µV/√Hz | 1.0 µV/√Hz | [3] |
| Broadband Electrical Noise(1 to 10,000 Hz)(Gain x10) | 75 µV rms | 75 µV rms | [3] |
| Spectral Noise(1 Hz)(Gain x10) | 20 µV/√Hz | 20 µV/√Hz | [3] |
| Spectral Noise(10 Hz)(Gain x10) | 1.5 µV/√Hz | 1.5 µV/√Hz | [3] |
| Spectral Noise(100 Hz)(Gain x10) | 1.0 µV/√Hz | 1.0 µV/√Hz | [3] |
| Spectral Noise(1 kHz)(Gain x10) | 1.0 µV/√Hz | 1.0 µV/√Hz | [3] |
| Spectral Noise(10 kHz)(Gain x10) | 1.0 µV/√Hz | 1.0 µV/√Hz | [3] |
| Broadband Electrical Noise(1 to 10,000 Hz)(Gain x100) | 350 µV rms | 350 µV rms | [3] |
| Spectral Noise(1 Hz)(Gain x100) | 140.0 µV/√Hz | 140.0 µV/√Hz | [3] |
| Spectral Noise(10 Hz)(Gain x100) | 14.0 µV/√Hz | 14.0 µV/√Hz | [3] |
| Spectral Noise(100 Hz)(Gain x100) | 8.0 µV/√Hz | 8.0 µV/√Hz | [3] |
| Spectral Noise(1 kHz)(Gain x100) | 4.0 µV/√Hz | 4.0 µV/√Hz | [3] |
| Spectral Noise(10 kHz)(Gain x100) | 4.0 µV/√Hz | 4.0 µV/√Hz | [3] |
| Broadband Electrical Noise(1 to 10,000 Hz)(Gain x1000) | 3000 µV/rms | 3000 µV/rms | [4] |
| **Physical** | | | |
| Electrical Connector(ICP® Sensor Input) | BNC Jack | BNC Jack | |
| Electrical Connector(Bridge/Differential) | 8-socket mini DIN | 8-socket mini DIN | |
| Electrical Connector(Output) | BNC Jack | BNC Jack | |
| Electrical Connector(DC Power Input) | 6-socket mini DIN | 6-socket mini DIN | |
| Electrical Connector(RS-232 Digital Control) | DB-9 Connector | DB-9 Connector | |
| Electrical Connector(Ethernet) | RJ45 | RJ45 | |
| Size (Height x Width x Depth) | 3.20 in x 8.00 in x 5.90 in | 8.10 cm x 20 cm x 15 cm | |
| Weight | 2.50 lb | 1134 gm | |

**OPTIONAL VERSIONS**

Optional versions have identical specifications and accessories as listed for the standard model except where noted below. More than one option may be used.

**NOTES:**
[1] Adjustable in 0.1V steps.
[2] Negative excitation can be set to 0V or to track the positive excitation votage.
[3] Typical, AC Coupled.
[4] Bridge/Differential Mode, DC Coupled with 350 ohm bridge
[5] AC coupled mode (low frequency response is 0Hz in DC Coupled mode.)
[6] See PCB Declaration of Conformance PS023 for details.

**SUPPLIED ACCESSORIES:**
Model 017AXX Power Cord (1)
Model 100-7103-50 (02711) Multi-conductor cable, 6-ft, 9-pin female to 9-pin male. (1)
Model 488B14/NC POWER CONVERTOR (1)
Model EE75 PCB MCSC Control Software. (1)

CE [6]

*All specifications are at room temperature unless otherwise specified.*
*In the interest of constant product improvement, we reserve the right to change specifications without notice.*

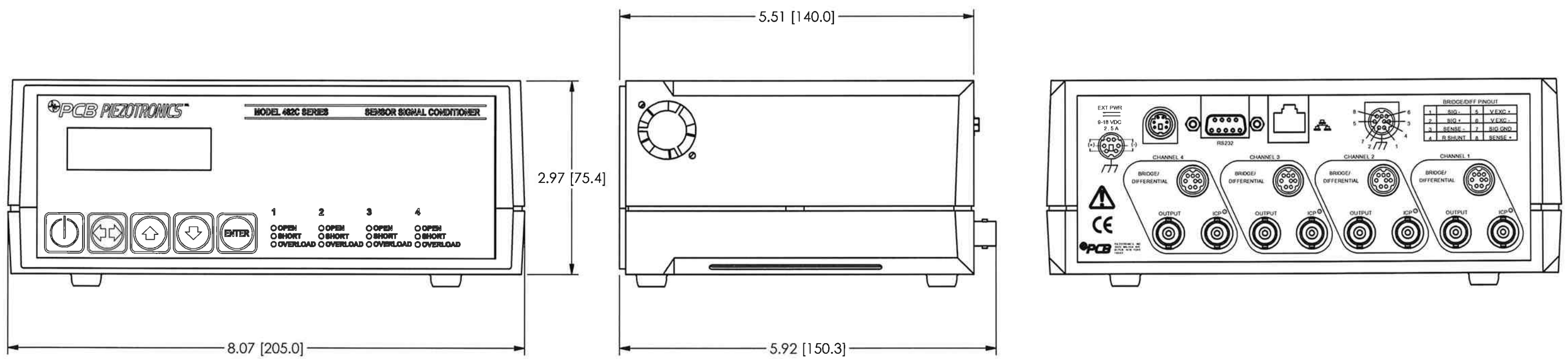ICP® is a registered trademark of PCB Group, Inc.

**PCB PIEZOTRONICS**™
3425 Walden Avenue, Depew, NY 14043

**Phone: 716-684-0001**
**Fax: 716-684-0987**
**E-Mail: info@pcb.com**

4     3     2     1

43176

REVISIONS

| REV | DESCRIPTION | ECO |
|---|---|---|
| NR | RELEASED TO DRAFTING | |
| A | ADD TRADEMARK TO "ICP" | 31293 |



5.51 [140.0]

8.07 [205.0]

2.97 [75.4]

5.92 [150.3]

PCB PIEZOTRONICS™
MODEL 482C SERIES    SENSOR SIGNAL CONDITIONER

ENTER

1 2 3 4
OPEN OPEN OPEN OPEN
SHORT SHORT SHORT SHORT
OVERLOAD OVERLOAD OVERLOAD OVERLOAD

EXT PWR
9-18 VDC
2.5 A
RS232

BRIDGE/DIFF PINOUT
SIG -   V EXC -
SIG +   V EXC
SENSE -   SIG GND
R SHUNT   SENSE +

CHANNEL 4   CHANNEL 3   CHANNEL 2   CHANNEL 1

BRIDGE/ DIFFERENTIAL

OUTPUT   ICP   OUTPUT   ICP   OUTPUT   ICP   OUTPUT   ICP

CE

PCB

| UNLESS OTHERWISE SPECIFIED TOLERANCES ARE: | | DRAWN | CHECKED | ENGINEER | | PCB PIEZOTRONICS™ |
|---|---|---|---|---|---|---|
| DIMENSIONS IN INCHES | DIMENSIONS IN MILLIMETERS [ IN BRACKETS ] | MDF 9/2/09 | ECB 9/2/09 | PH 9/2/09 | | 3425 WALDEN AVE. DEPEW, NY 14043 (716) 684-0001 E-MAIL: sales@pcb.com |
| DECIMALS XX ±.03 XXX ±.010 | DECIMALS X ±0.8 XX ±0.25 | TITLE | | | | |
| ANGLES ± 2 DEGREES | ANGLES ± 2 DEGREES | OUTLINE DRAWING MODEL 482C27 SIGNAL CONDITIONER | | | CODE IDENT. NO. 52681 | DWG. NO. 43176 |
| FILLETS AND RADII .003 - .005 | FILLETS AND RADII 0.07 - 0.13 | | | | SCALE: .625X | SHEET 1 OF 1 |