



**Model 483C40**

**Eight-Channel ICP®/Voltage/Charge Sensor Signal Conditioner**

**Installation and Operating Manual**

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

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**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.

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

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PCB Piezotronics maintains an ISO-9001 certified metrology laboratory and offers calibration services, which are accredited by A2LA to ISO/IEC 17025, with full traceability 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.

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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](http://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](http://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 483C40**

## **GENERAL OPERATION MANUAL**

For powering ICP<sup>®</sup>, and charge sensors, this signal conditioner provides an effective method for managing large 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.

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## 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 483C40, 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 ElectroStatic 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.

This model requires 100 to 240 VAC / 47 to 63 Hz to operate. In turn, it supplies 2 to 20 mA of constant current excitation at 24 VDC to any connected ICP® sensors or in-line charge converters.

## 1-2. System Description, Basic Configuration

The 483C40 is an eight channel signal conditioner designed to interface measurement signals to readout or recording devices. This model also serves to provide excitation power for ICP® sensors and in-line charge converters.

The following are the features of the 483C40:

- Selectable Input Signal Modes per channel including:
  - ICP® with variable 2 to 20 mA source current
  - Charge mode.
  - Voltage mode
- 8<sup>th</sup> order low pass Butterworth input filter with cutoff frequencies of: 0.1, 0.3, 1.0, 3.0, 10, and 30kHz (-10% point)
- Internal oscillator for 0.1 Vpk or 100 pCpk signal at 100 or 1000 Hz
- Incremental gain, x0.1 to x200 in 0.1 increments
- Input fault and overload LED
- Illuminator lights and a power button on the front panel
- Rear panel BNC jack input/output connectors
- Non-volatile memory
- Ethernet interface
- Normalized Output
- Capable of reading TEDS

### 1-2.1. ICP® Input/Output Mode

This model contains a regulated 24 VDC power supply that provides constant current for up to 8 individual channels. Both the output and input connections utilize BNC jack connectors and are brought out through the rear panel.

## 1-3. Block Diagram

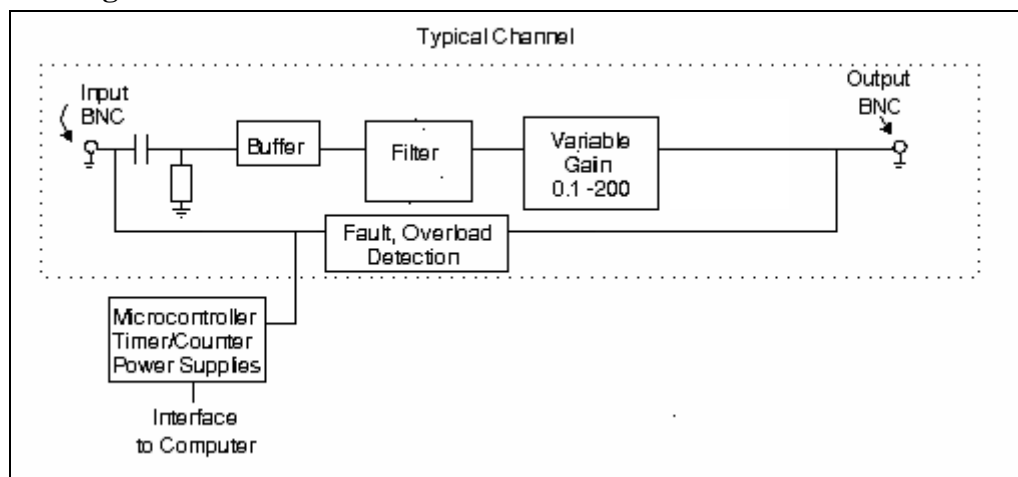


Figure 1 Typical Block Diagram



## 1-4. Installation

This signal conditioner model comes in a standard 19-inch rack mount enclosure with a 1U (1.75") height. The enclosure should be located in such a way as to allow convenient access to the power outlet for disconnect purposes. Since these models have low power consumption, they can be located in confined environments.

### 1-4.1. Grounding Techniques

Integrating this model 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 these models 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 signal conditioner and the return (ground) from the signal conditioner 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.

## 1-5. Operation: Standard AC Line

Plug the line cord into a 120V/60 Hz or 230V/50 Hz power source and toggle the "ON/OFF" switch.

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

## 1-6. Maintenance and Repair

**It is not recommended that the customer attempt repair of this model 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. THEORY OF OPERATION

### 2-1. Sensor Excitation

ICP<sup>®</sup> 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. This model 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.

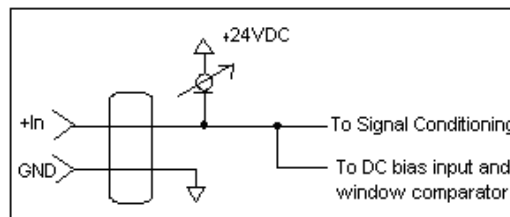


Figure 2 ICP<sup>®</sup> Sensor Excitation

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 401B04 Sensor Simulator, consisting of a voltage amplifier similar to those found in ICP<sup>®</sup> sensors.

### 2-2. Input Protection

The input section has protection to limit the amplitude of the incoming signal to within +24 volts to ground. [Reference spec sheet for maximum input signal.](#)

### 2-3. ICP<sup>®</sup> Input Fault Detection

This model monitors two input fault conditions in ICP<sup>®</sup> mode, “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.

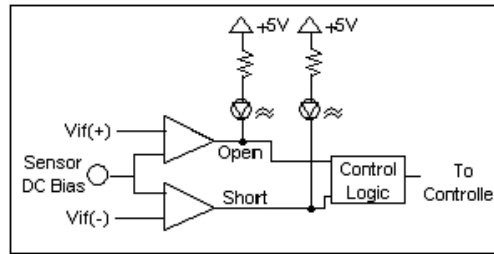


Figure 3 Input Fault Window Comparator with LED Indicator

## 2-4. Input Interface

The input signal conditioning for each channel in ICP<sup>®</sup> mode 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.

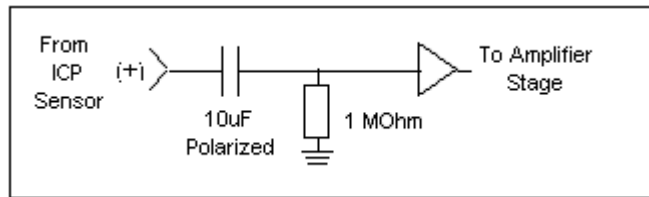


Figure 4 Input Amplifier Configuration

Voltage mode is similar to ICP mode, except the excitation current is 0 mA. In charge mode, the signal from the charge sensor is routed into a charge amplifier with a gain of 0.1, 1.0, or 10 mV/pC, followed by incremental voltage gain.

## 2-5. Gain

The Programmable Gain Amplification (PGA) block consists of a decimal gain amplifier. See Figure 5.

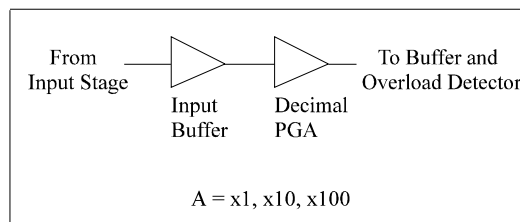


Figure 5 Selectable Gain Amplifier Configuration

### 2-5.1. Programmable Gain

The 483C40 has incremental gain. This is 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.

<u>Channel</u>	<u>Sensor Sensitivity</u>	<u>Gain Setting of Unit</u>	<u>Actual Gain Needed</u>
1 <sup>st</sup>	10.10 mV/unit	99.0	99.01
2 <sup>nd</sup>	101.32 mV/unit	9.9	9.869
3 <sup>rd</sup>	22.30 mV/unit	44.8	44.84

The gain is set via the computer interface command set (See the command strings in Section 3-0 in the Computer Interface Programming Guide.)

## 2-6. 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 SAVS command is sent to the unit.

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  $\pm 5$  Volts. The maximum swing may be used in the error checking.

The 483C40 has the capability to provide signal conditioning for charge mode sensors in addition to the standard ICP® type. The sensitivity (mV/ pC) of the charge conversion will allow charge mode sensors (pC/ unit) to be normalized.

## 2.7. Low Pass Input Filter

The 483C40's 8 pole low pass input filter is useful for attenuating signals above the user's band of interest, and for anti-aliasing of signals before digitization. High quality components are used to achieve 6 cutoff frequencies: 0.1, 0.3, 1.0, 3.0, 10.0, and 30.0 kHz (-10%). The Butterworth topology provides a maximally flat response in the passband and is critically damped. Continuous-time stages are employed so that the clock noise associated with switched capacitor elements is not an issue. This is especially significant because the filter is located prior to the gain stages.

## 2.8. Overload Detection

### 2-8.1. Overload

The overload feature uses the same window comparator principle previously discussed. The  $+V_{\text{ref}}$  is equal to the default overload value of  $\pm 10$  volts. When the input voltage ( $V_{\text{signal}}$  of Figure 6) 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.

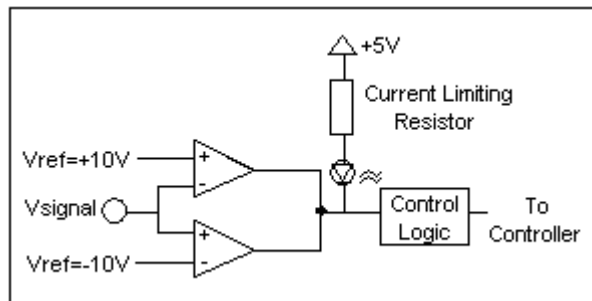


Figure 6 /Overload Window Comparator

## 2-9. Connector Configuration

This model has eight BNC jack output connectors, located on the rear panel, which are used regardless of the input mode being used. The rear panel also includes eight BNC jack input connectors that are used for all input modes.

## 2-10. Non-Volatile Memory

This feature provides a mechanism to save and restore a programmed configuration. The programmable settings are saved when the unit receives a SAVS command and restored when the unit powers up. The unit's non-volatile memory may be reset to the factory default settings by using the RSET Command.

## 2-11. Transducer Electronic Data Sheet (TEDS) Interface:

TEDS sensors attach to the input connectors the same way a traditional ICP® sensor is attached to the signal conditioner. The TEDS interface requires the Ethernet computer interface, 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.

## 3-0. COMPUTER INTERFACE PROGRAMMING GUIDE

### 3-1. Introduction

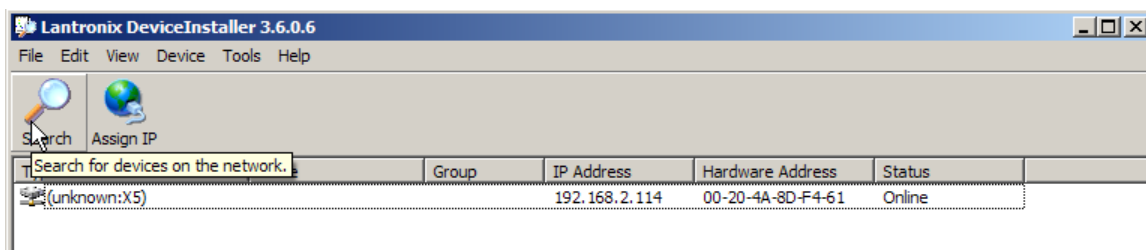
The Ethernet Interface enables these models to be fully controlled by a computer or laptop controller. With this interface, the unit is able to become part of a fully automated system.

### 3-2. Ethernet Communication

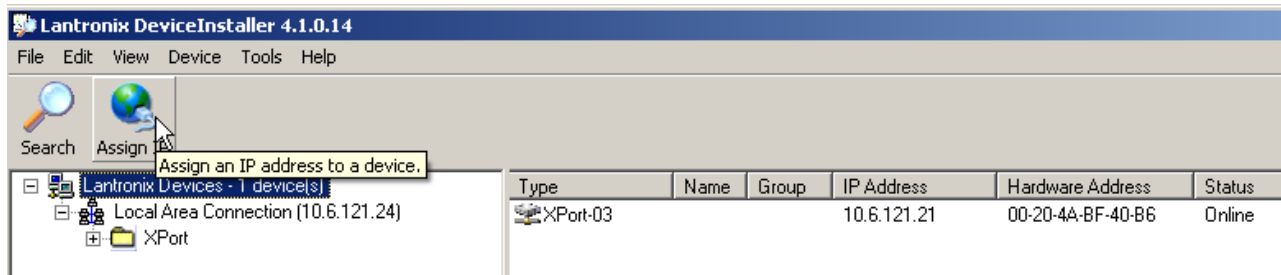
This signal conditioner is equipped with an Ethernet Interface so the unit's IP address must be set up before any remote communication can commence.

The steps to set the IP address 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™. This utility is provided on the PCB MCSC application software installer CD and also available for download at the Lantronix website: <http://www.lantronix.com/device-networking/utilities-tools/device-installer.html> Once installed it can be accessed from the MCSC software from the 'Help | Configure Ethernet Devices' menu item.
- 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 signal conditioner unit. When found, as shown below, details about the device show in the list. You can verify it is the correct unit by comparing the Hardware (MAC) Address displayed to the one listed on the side of the signal conditioner unit.



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



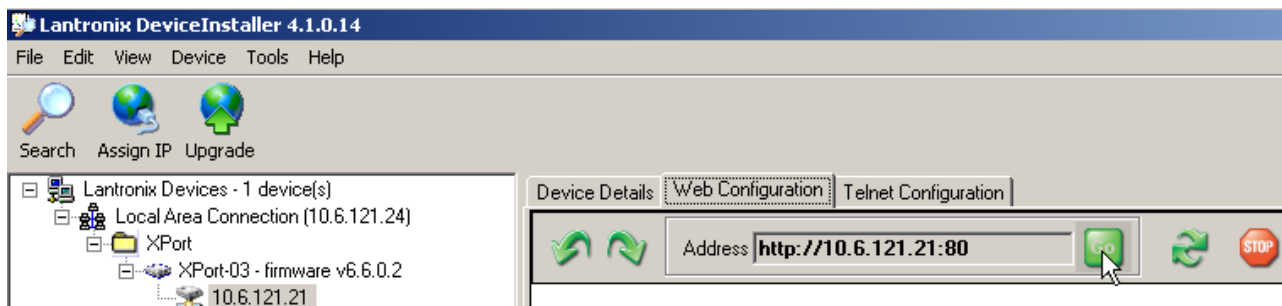
- Select **Assign IP** and the following screen will appear. Select whether you want to assign a static IP address that is appropriate for your network or have it assigned from a network server. Subsequent steps are self-explanatory.



- 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 XPort device should be configured properly for communication with the signal conditioner. If problems occur please check the communication parameters of the device as shown below.



Navigate to the actual device as shown in the left panel above and then click on the 'Web Configuration' tab and click on the 'Go' button. This will cause the following screen to appear, just select 'OK'. There are no login parameters defined.



Following this screen the right panel will appear as shown below. Click on the 'Connection' item and check to see that the parameters are shown as below and pay particular attention to the 'Active Connection' and 'Endpoint' Port items. They should be set as shown below.

**Active Connection:**

Active Connect:

**Endpoint Configuration:**

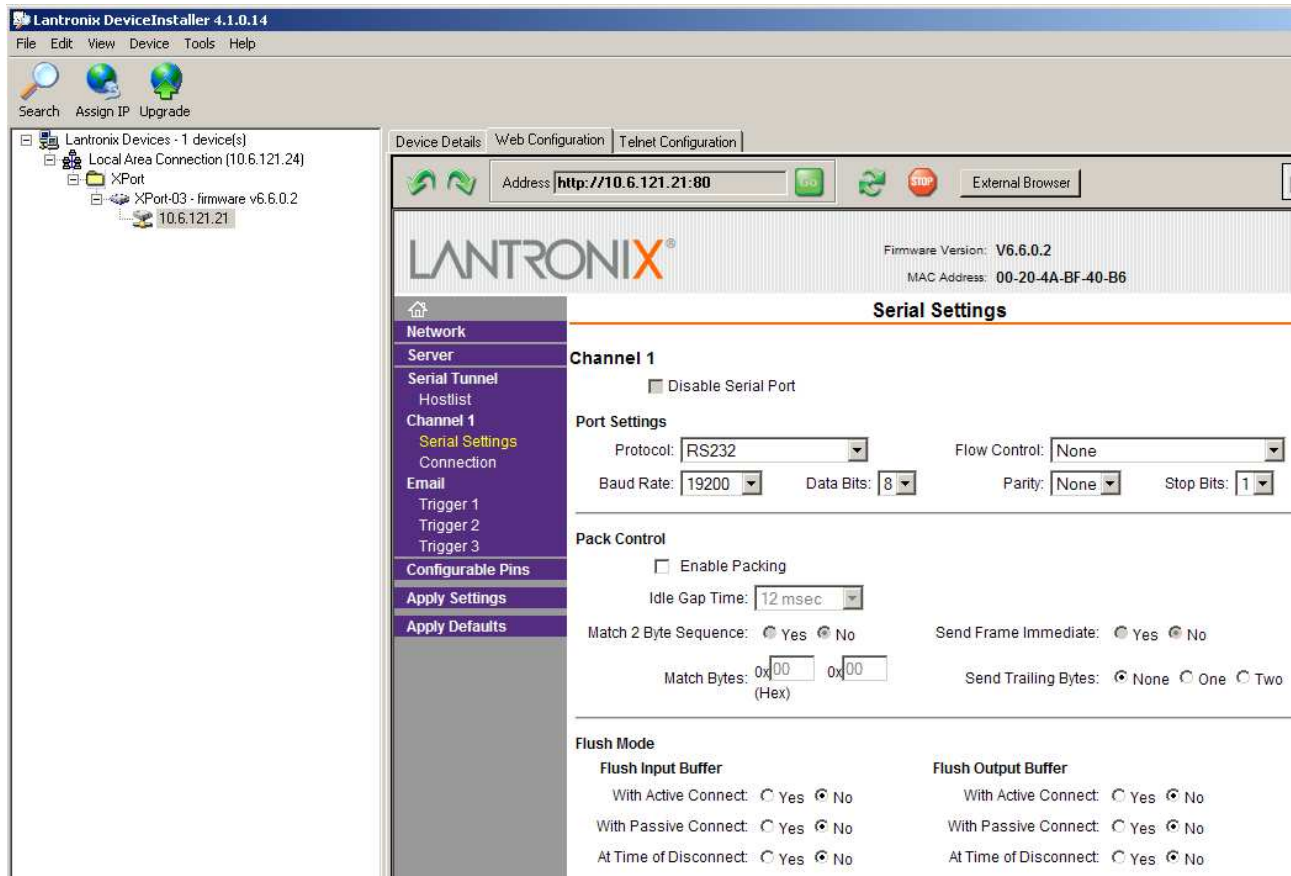
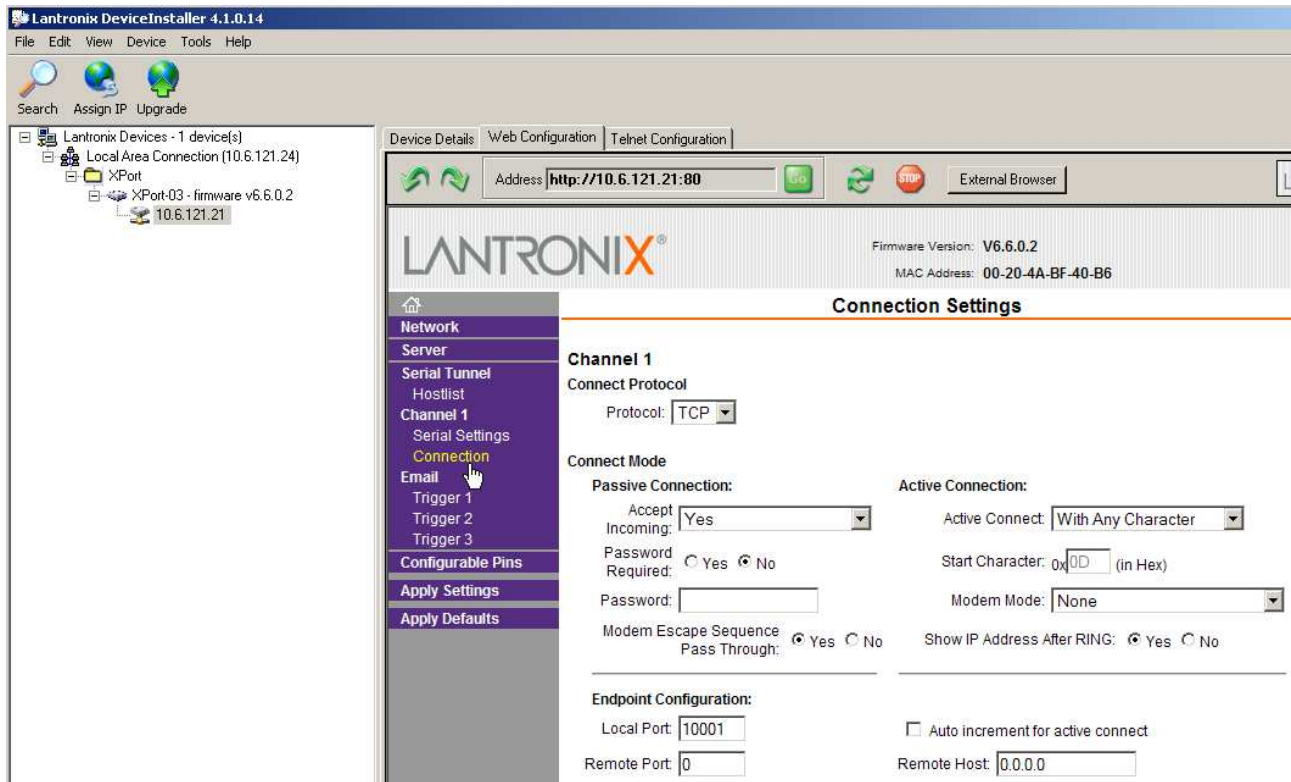
Local Port:

Next, check the Serial Settings. They should be 19200 baud, 8 data bits, no parity, 1 stop bit. And no flow control.

If any setting is changed click 'Ok' on the page and then activate the 'Apply Settings' item on the left side of the right panel.







### 3-3. 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.

### 3-4. Unit Initialization Procedure

1) To begin, connect the signal conditioner to the network using the RJ-45 connector on the back of the unit.

2) Turn on power to the signal conditioner. The power indicator should light up to indicate the power is on.

3) With the terminal or computer that is set up to transmit data, send the command:

“1:0:LEDS=0” <CR><LF>

This command flashes the front panel LEDs three times.

### 3-5. Command Summary

The table below is a summary of the command set. Some commands may not be valid in all units. The 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
IEXC	R/W	Channel	Read/Adjust ICP® current setting
FLTR	R/W	Channel	Disable or Select Input Filter Corner
OFLT	R/W	Channel	Enables/Disables Output Filter (optional)
CALB	R/W	Channel	Selects the Calibration Mode
RTED	R	Channel	Read TEDS data (DS2430A)
ALLC	R	Channel	Read majority of channel settings
RBIA	R	Unit	Measure Bias (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
LPCR	R	Channel	Returns the programmable input filter corners
LEDS	FCN	Unit	Front panel LED test function
RSET	FCN	Unit	Restores factory default channel settings
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.

### 3-6. Command Format

The 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.

#### 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 1<sup>st</sup> channel of the board that processed the command.

### 3-7. Multiple Board Models

The 483C40 has multiple main boards which appear as a contiguous set of channels; they are physically separate and operate somewhat independently. A global channel command to set 8 channels on a 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, a second unit address was used to query the second board. 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. The secondary unit address is defined to be the normal unit address *plus 128* (ex. If a unit's address is 1 then the 2<sup>nd</sup> board's address would be 129)

### 3-8. Commands

#### GAIN

SET GAIN: This command sets the programmable gain of a channel.

**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 Gain Query: 1:0:GAIN?

Global Gain 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 Gain Query: 1:0:SENS?

Global Gain 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 FSCI Query: 1:0:FSCI?

Global FSCI 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:

$$\text{Gain} = \text{FSO} * 1000 / (\text{FSI} * \text{SENS}).$$

**Setting:**

*1:1:FSCO=10.000\r\n (unit 1, channel 1 FSI 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 FSCO Query: 1:0:FSCO?

Global FSCO 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. The possible input modes and their associated values are:

- CHARGE 0
- VOLTAGE 1
- ICP<sup>®</sup> 2

**Setting:**

*1:1:INPT= 2\r\n (unit 1, channel 1 input mode set to ICP)*

**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= 2;

Global INPT Query: 1:0:INPT?

Global INPT Response: 1:INPT:1= 2.0;2= 2.0;3= 2.0;4= 2.0;

## IEXC

The IEXC command sets the current excitation level for a channel in ICP mode. The current excitation value is sent as an integer value from 0 (off) to 20mA. If a channel's input mode changes to Voltage mode then this value will be forced to 0 automatically.

### Setting:

*1:1:IEXC= 2\r\n (unit 1, channel 1 is 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;\r\n

Global IEXC Query: 1:0: IEXC?

Global IEXC Response: 1:IEXC:1=2;2=4;3=4;4=4;

## FLTR

The FLTR command selects the Input Filter corner (1-6) or Disables the Filter (0). The standard factory installed corner selections are:

- 0= OFF
- 1=30 kHz
- 2=10 kHz
- 3=3 kHz
- 4=1 kHz
- 5=300 Hz
- 6=100 Hz

### Setting:

*1:1:FLTR= 1\r\n ( unit 1, channel 1, Input Filter Enabled; Corner=30 kHz)*

**Setting Response: 2: FLTR:ok**

### Query:

The FLTR query returns the channels Output Filter.

Query Format: Unit#:Ch#:CMD?

Response format: Unit#:Cmd:Ch#:= <0-6>;

Query: 1:1:FLTR?;

Response: 1:FLTR:1=1;\r\n

Global FLTR Query: 1:0:FLTR?

Global FLTR Response: 1:FLTR:1=1;2=0;3=0;4=0;\r\n

## OFLT (optional)

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 OFLT Query: 1:0: OFLT?

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

## CALB

The CALB command selects the Internal Calibration Reference Oscillator setting. When either the 100 or 1k Hz setting is selected the channel is forced into a charge mode, if necessary, and an internal 100pC signal is generated. This signal is then converted to a voltage after which the channels gain is applied to provide an internal cal signal.

The CALB value is sent as an integer value of either 0 –Disable, 1-1000 Hz Enable, 2-100 Hz Enable

### Setting:

*1:1: CALB= 1|r\n (unit 1, channel 1, Oscillator=1 kHz)*

**Setting Response: 1:CALB:ok**

### Query:

The CALB query returns the channels Internal Reference Oscillator setting.

Query Format: Unit#:Ch#:CMD?

Response format:

Unit#:Cmd:Ch#:= <0|1>;

Query: 1:1: CALB?

Response: 1:CALB:1=1;\r\n

Global CALB Query: 1:0:CALB?

Global CALB Response: 1:CALB:1=1;2=0;3=0;4=0;\r\n

## RTED

The RTED query returns the TEDS information that is stored in the sensor or other, TEDS capable, in-line module attached to a specific channel. The signal conditioners are IEEE 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<sup>st</sup> byte of the DS2430A EEPROM data should contain the checksum of both the Application Register contents and the EEPROM contents if the TEDS is IEEE 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 on channel 1 with valid app register data)

1:RTED:1=1:168010a00975000012648016a88ae8e112801f2000f60ec4046dd18737f3206a380555e765390800

## 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:< CPLG value>; CLMP:< CLMP value>; CALB:< CALB value>; VEXC:< VEXC value>; SWOT:< SWOT value>

Query: 1:1:ALLC??

Response:

1:ALLC:1=GAIN:\s\s1.0;SENS:\s\s10.0;FSCI:1000.0;FSCO:\s\s10.0;INPT:\s\s2.0;FLTR:1;IEXC:2;OFLT:0;CPLG:0;CLMP:0;CALB:1;VEXC:\s\s0.0;SWOT:0;\r\n

NOTE: Some items returned may not be applicable for every model

## 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= 25.5;2= 25.5;3= 25.5;4= 25.5;

## 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= Open input fault (0=Fault; 1 = no fault)
- Channel Bit 1= Short 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:

Unit#:#channels:Starting Ch#: Gain Option byte, Input Option Byte, Filter option byte,Misc1 option byte,Misc2 option byte: fixed or 1<sup>st</sup> option of input Filter corners: output filter corners<cr><lf>

Query: 1:1:UNIT?

Response : 1:UNIT:483C40\s\s\s\s\s\s\s\s\s\s:FW\sVer\s4.00\s\s\s\s\s:12345:06-28-2011:1:4:1:16,10,16,140,132:30.00000:30.00000:30.00000:30.00000:0.00000:0.00000:0.00000:0.00000:\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 option bytes:

<b>Gain Options</b>		
OPT_GAIN_INC	0x10	Incremental Gain
<b>Input Options</b>		
OPT_INP_CIM	0x02	ICP VOLT CHG
OPT_INP_INTCAL	0x08	Internal Cal
<b>Filter</b>		
OPT_FILTER_OUT	0x02	Output filter (optional)
OPT_FILTER_PGM_BTR	0x10	Programmable Butterworth LP filter
<b>Miscellaneous Options</b>		
OPT_MISC_TEDS	0x04	TEDS
OPT_MISC_IEXC	0x08	current excitation
<b>More Miscellaneous Options</b>		
OPT_MISC2_NOPWR	0x80	No Soft (logical) Power Button

**UNID**

The UNID command is used to set the units ID number. The Unit Id number is critical to remote communications since it indicates to the unit which commands it 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;

**LPCR****Query:**

The LPCR query returns the unit low pass filter corners

Query Format: Unit#:Ch#:CMD?

Response format: Unit#:Cmd:,<num corners>< n filter corners> <cr><lf>

Query: 1:1:LPCR?

Response: 1:LPCR:6.000:30.000:10.000:3.000:1.000:0.300:0.100:\r\n

Global Query: 1:0:LPCR?

Global Response 1:LPCR:6.000:30.000:10.000:3.000:1.000:0.300:0.100:

6.000:30.000:10.000:3.000:1.000:0.300:0.100:6.000:30.000:10.000:3.000:1.000:0.300:0.100:

6.000:30.000:10.000:3.000:1.000:0.300:0.100:\r\n

CAUTION! Query only - The user should NEVER send this as a setting command as these values depend on the HW installed and will be set at the factory.

**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. This command invokes a function and therefore has no query capability.

**Setting:**

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

**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
- Current excitation=4.0mA
- Output Filter=Disabled
- Internal Reference Oscillator=OFF

## 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 invokes a function and therefore has no query capability.

**Setting:**

*2:1:SAVS = 0|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.

Performance	ENGLISH	SI
Channels	8	8
Sensor Input Type(s)	ICP®, Voltage, Charge	ICP®, Voltage, Charge
Gain(ICP®/ Voltage Input)	0.1 to 200	0.1 to 200
Gain(mV/pC)(Charge Input)	0.01 to 2000	0.01 to 2000
Gain Increment(minimum)(ICP®/ Voltage Input)	0.1	0.1
Gain Increment(minimum)(Charge Input)	0.01	0.01
Accuracy(ICP®/ Voltage Input)(Gain, 0.1 to 0.4)	± 5 %	± 5 %
Accuracy(ICP®/ Voltage Input)(Gain, 0.5 to 200)	± 1 %	± 1 %
Accuracy(Charge Input)(Gain, 0.01 to 0.04)	± 6 %	± 6 %
Accuracy(Charge Input)(Gain, 0.05 to 2000)	± 1 %	± 1 %
Input Range(maximum)(Charge Input)	100,000 pC pk	100,000 pC pk
Input Range(maximum)(ICP® Input)	10 Vpk	10 Vpk
Input Range(maximum)(Voltage Input)	5 Vpk	5 Vpk
Low Frequency Response(-5 %)(ICP®/ Voltage Input)	≤ 0.05 Hz	≤ 0.05 Hz
Low Frequency Response(-5 %)(Charge Input)	0.5 Hz	0.5 Hz
High Frequency Response(-3 dB)(Gain from 0.01 to 99.9)	>100 kHz	>100 kHz
High Frequency Response(-3 dB)(Gain from 100 to 2000)	>80 kHz	>80 kHz
Filter Type(8-pole Butterworth)	Low Pass	Low Pass
Electrical Filter Corner Frequency(-10 %)	0.1-0.3-1-3-10-30 kHz	0.1-0.3-1-3-10-30 kHz
Electrical Filter Roll-off	160 dB/decade	160 dB/decade
Electrical Filter Pass Band Amplitude Accuracy	1 %	1 %
Phase Response(at 1 kHz)	± 2 °	± 2 °
Non-Linearity	1 %	1 %
Cross Talk	<-72 dB	<-72 dB
TEDS Sensor Support	Yes	Yes
Fault/Bias Monitor LEDs	Open/Short/Overload	Open/Short/Overload
<b>Control Interface</b>		
Digital Control Interface	Ethernet	Ethernet
<b>Environmental</b>		
Temperature Range(Operating)	+32 to +120 °F	0 to +50 °C
<b>Electrical</b>		
Power Required(direct input to unit)	AC Power	AC Power
AC Power(47 to 63 Hz)	100 to 240 VAC	100 to 240 VAC
AC Power	≤ 0.7 Amps	≤ 0.7 Amps
Excitation Voltage(To Sensor)	>24 VDC	>24 VDC
DC Offset	<50 mV	<50 mV
Constant Current Excitation(To Sensor)	2 to 20 mA	2 to 20 mA
Output Voltage(minimum)	10 V	10 V
Output Current(minimum)	10 mA	10 mA
Output Impedance	<50 Ohm	<50 Ohm
Overload Threshold(± 0.5 Vpk)	± 10 Vpk	± 10 Vpk
Broadband Electrical Noise(1 to 10,000 Hz)(Gain x1)	50 µV/rms	50 µV/rms
Spectral Noise(1 Hz)	8 µV/√Hz	8 µV/√Hz
Spectral Noise(10 Hz)	2 µV/√Hz	2 µV/√Hz
Spectral Noise(100 Hz)	0.7 µV/√Hz	0.7 µV/√Hz
Spectral Noise(1 kHz)	0.7 µV/√Hz	0.7 µV/√Hz
Spectral Noise(10 kHz)	0.6 µV/√Hz	0.6 µV/√Hz
Broadband Electrical Noise(1 to 10,000 kHz)(Gain x10)	75 µV rms	75 µV rms
Spectral Noise(1 Hz)	18 µV/√Hz	18 µV/√Hz
Spectral Noise(10 Hz)	1.5 µV/√Hz	1.5 µV/√Hz
Spectral Noise(100 Hz)	1.0 µV/√Hz	1.0 µV/√Hz
Spectral Noise(1 kHz)	1.0 µV/√Hz	1.0 µV/√Hz
Spectral Noise(10 kHz)	1.0 µV/√Hz	1.0 µV/√Hz
Broadband Electrical Noise(1 to 10,000 Hz)(Gain x100)	350 µV rms	350 µV rms
Spectral Noise(1 Hz)	100 µV/√Hz	100 µV/√Hz
Spectral Noise(10 Hz)	10 µV/√Hz	10 µV/√Hz
Spectral Noise(100 Hz)	6 µV/√Hz	6 µV/√Hz
Spectral Noise(1 kHz)	5 µV/√Hz	5 µV/√Hz
Spectral Noise(10 kHz)	5 µV/√Hz	5 µV/√Hz
Broadband Electrical Noise(1 to 10,000 Hz)(0.1 mV/pC)	52.0 µV/rms	52.0 µV/rms
Spectral Noise(1 Hz)	10.0 µV/√Hz	10.0 µV/√Hz
Spectral Noise(10 Hz)	1.5 µV/√Hz	1.5 µV/√Hz
Spectral Noise(100 Hz)	0.6 µV/√Hz	0.6 µV/√Hz
Spectral Noise(1 kHz)	0.6 µV/√Hz	0.6 µV/√Hz
Spectral Noise(10 kHz)	0.6 µV/√Hz	0.6 µV/√Hz
Broadband Electrical Noise(1 to 10,000 Hz)(1.0 mV/pC)	52.0 µV/rms	52.0 µV/rms
Spectral Noise(1 Hz)	14.0 µV/√Hz	14.0 µV/√Hz
Spectral Noise(10 Hz)	2.0 µV/√Hz	2.0 µV/√Hz
Spectral Noise(100 Hz)	0.7 µV/√Hz	0.7 µV/√Hz
Spectral Noise(1 kHz)	0.7 µV/√Hz	0.7 µV/√Hz
Spectral Noise(10 kHz)	0.7 µV/√Hz	0.7 µV/√Hz
Broadband Electrical Noise(1 to 10,000 Hz)(10.0 mV/pC)	56.0 µV/rms	56.0 µV/rms
Spectral Noise(1 Hz)	15.0 µV/√Hz	15.0 µV/√Hz
Spectral Noise(10 Hz)	2.0 µV/√Hz	2.0 µV/√Hz
Spectral Noise(100 Hz)	0.6 µV/√Hz	0.6 µV/√Hz
Spectral Noise(1 kHz)	0.6 µV/√Hz	0.6 µV/√Hz
Spectral Noise(10 kHz)	0.6 µV/√Hz	0.6 µV/√Hz
Oscillator(+/- 2%)(Internal Generator - ICP®/ Voltage Mode)	0.1 V pk	0.1 V pk
Oscillator(+/- 2%)(Internal Generator - Charge Mode)	100 pC pk	100 pC pk
Oscillator(+/- 2%)	100/1000 Hz	100/1000 Hz

**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] Use T1.6A fuse.
  - [2] User adjustable, factory set at 4 mA (± 1.0 mA). Each channel individually adjustable.
  - [3] Typical.
  - [4] Max input signal is dependant on sensor bias.
  - [5] The low frequency tolerance is accurate within ±25% of the specified frequency.
  - [6] The high frequency tolerance is accurate within ±5% of the specified frequency.
  - [7] See PCB Declaration of Conformance PS024 for details.

Physical		
Electrical Connector(Input, sensor)	BNC Jack	BNC Jack
Electrical Connector(Output)	BNC Jack	BNC Jack
Electrical Connector(Ethernet)	RJ-45	RJ-45
Size (Height x Width x Depth)(nominal)	1.75 in x 19 in x 13.7 in	44.5 mm x 482.6 mm x 348 mm
Weight	8 lb	3.6 Kg

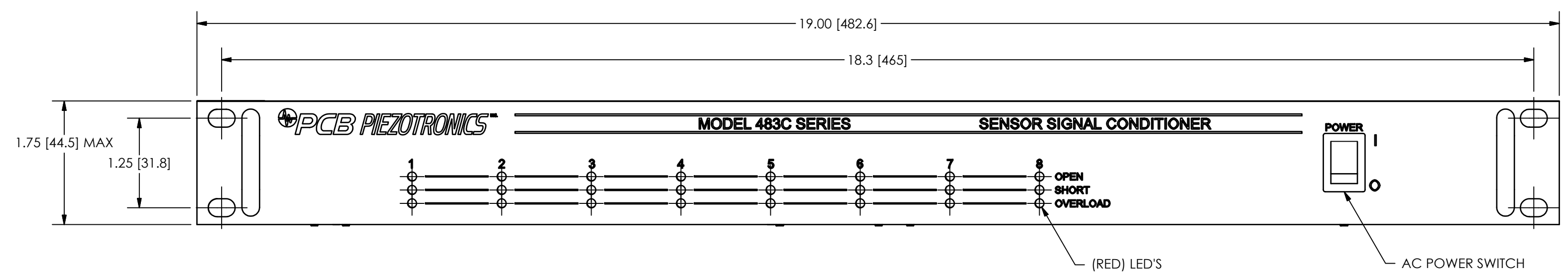
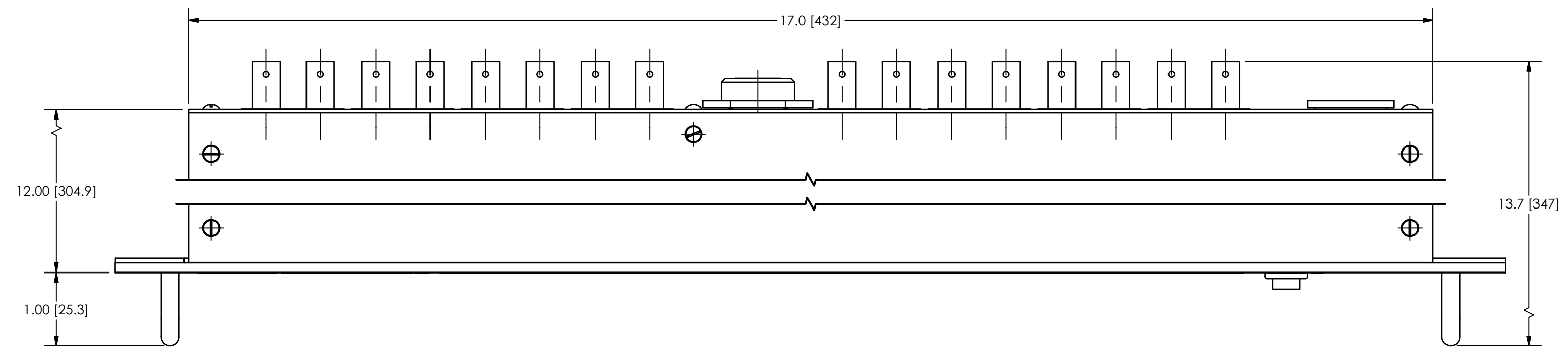
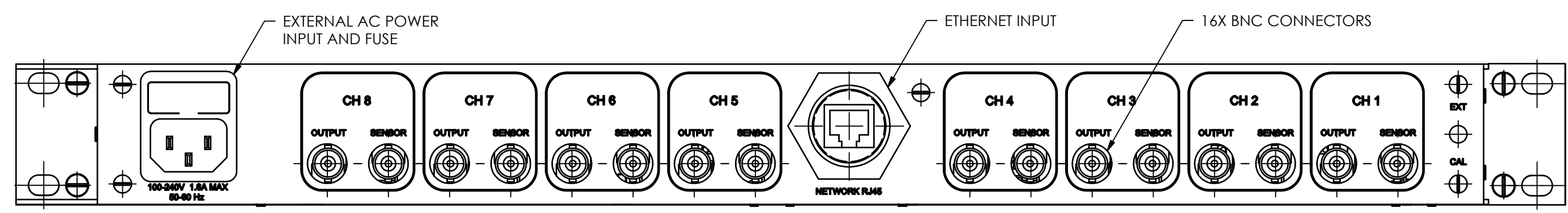
**SUPPLIED ACCESSORIES:**  
 Model 017AXX Power Cord (1)  
 Model EE75 PCB MCSC Control Software. (1)

Entered: AP	Engineer: AJP	Sales: JJM	Approved: JWH	Spec Number:
Date: 3/25/2013	Date: 3/25/2013	Date: 3/25/2013	Date: 3/25/2013	<b>46076</b>

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45992

REVISIONS		
REV	DESCRIPTION	DIN
B	REMOVED EXT CAL INPUT CONNECTOR	42318



UNLESS OTHERWISE SPECIFIED TOLERANCES ARE:		DRAWN	CHECKED	ENGINEER	
DIMENSIONS IN INCHES	DIMENSIONS IN MILLIMETERS [IN BRACKETS]	JDM	JDM	HK	
DECIMALS .XX ±0.03 XXX ±0.10	DECIMALS X ±0.8 XX ±0.25	TITLE			CODE IDENT. NO. 52681
ANGLES ± 2 DEGREES	ANGLES ± 2 DEGREES	PRELIMINARY OUTLINE DRAWING MODEL 483C40 SENSOR SIGNAL CONDITIONER			DWG. NO. 45992
FILLETS AND RADII .003 - .005	FILLETS AND RADII 0.07 - 0.13	SCALE: .75X			SHEET 1 OF 1