



Model 483C41

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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Service, Repair, and Return Policies and Instructions
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The information contained in this document supersedes all similar information that may be found elsewhere in this manual.

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 ensure 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 traceability to SI through 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 ensure 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 **Warranty, Service, Repair, and Return Policies and Instructions** 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.

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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PCB工业监视和测量设备 - 中国RoHS2公布表
PCB Industrial Monitoring and Measuring Equipment - China RoHS 2 Disclosure Table

部件名称	有害物质					
	铅 (Pb)	汞 (Hg)	镉 (Cd)	六价铬 (Cr(VI))	多溴联苯 (PBB)	多溴二苯醚 (PBDE)
住房	O	O	O	O	O	O
PCB板	X	O	O	O	O	O
电气连接器	O	O	O	O	O	O
压电晶体	X	O	O	O	O	O
环氧	O	O	O	O	O	O
铁氟龙	O	O	O	O	O	O
电子	O	O	O	O	O	O
厚膜基板	O	O	X	O	O	O
电线	O	O	O	O	O	O
电缆	X	O	O	O	O	O
塑料	O	O	O	O	O	O
焊接	X	O	O	O	O	O
铜合金/黄铜	X	O	O	O	O	O
本表格依据 SJ/T 11364 的规定编制。						
O：表示该有害物质在该部件所有均质材料中的含量均在 GB/T 26572 规定的限量要求以下。						
X：表示该有害物质至少在该部件的某一均质材料中的含量超出 GB/T 26572 规定的限量要求。						
铅是欧洲RoHS指令2011/65/ EU附件三和附件四目前由于允许的豁免。						

CHINA RoHS COMPLIANCE

Component Name	Hazardous Substances					
	Lead (Pb)	Mercury (Hg)	Cadmium (Cd)	Chromium VI Compounds (Cr(VI))	Polybrominated Biphenyls (PBB)	Polybrominated Diphenyl Ethers (PBDE)
Housing	O	O	O	O	O	O
PCB Board	X	O	O	O	O	O
Electrical Connectors	O	O	O	O	O	O
Piezoelectric Crystals	X	O	O	O	O	O
Epoxy	O	O	O	O	O	O
Teflon	O	O	O	O	O	O
Electronics	O	O	O	O	O	O
Thick Film Substrate	O	O	X	O	O	O
Wires	O	O	O	O	O	O
Cables	X	O	O	O	O	O
Plastic	O	O	O	O	O	O
Solder	X	O	O	O	O	O
Copper Alloy/Brass	X	O	O	O	O	O

This table is prepared in accordance with the provisions of SJ/T 11364.

O: Indicates that said hazardous substance contained in all of the homogeneous materials for this part is below the limit requirement of GB/T 26572.

X: Indicates that said hazardous substance contained in at least one of the homogeneous materials for this part is above the limit requirement of GB/T 26572.

Lead is present due to allowed exemption in Annex III or Annex IV of the European RoHS Directive 2011/65/EU.

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DOCUMENT REVISION: **D**

ECN: 46162

SIGNAL CONDITIONER

Model 483C41

GENERAL OPERATION MANUAL

For powering ICP[®], 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.

Manual Number: 46953

Manual Revision: B

ECO Number: 47035



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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 483C41, 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 up to 20 mA of constant current excitation at 24 VDC to any connected ICP[®] sensors or ICP[®] in-line charge converters.

1-2. System Description

The 483C41 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 483C41:

- Selectable input signal modes per channel including:
 - ICP® with variable 2 to 20 mA source current
 - Charge mode
 - Voltage mode
- 8th order low pass Butterworth input filter with cutoff frequencies of: 0.1, 0.3, 1.0, 3.0, 10, and 30 kHz (-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 for computer control with PCB supplied software (part number EE75)
- Front panel display and keypad
- 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

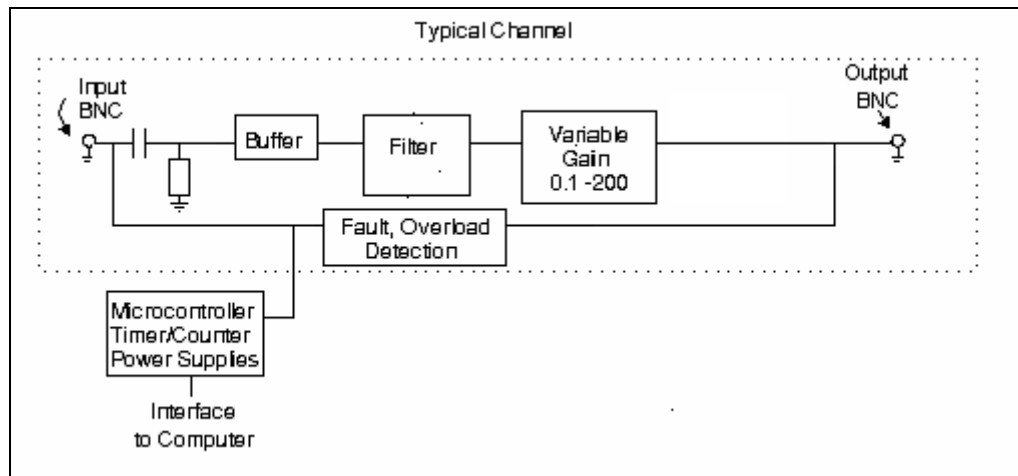


Figure 1 Typical Block Diagram

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[®] refers to a low impedance voltage mode sensor with an integrated circuit and a piezoelectric sensing element in a single housing that provides a voltage output. The 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. 483C41 allows the constant current to be adjusted up to 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.

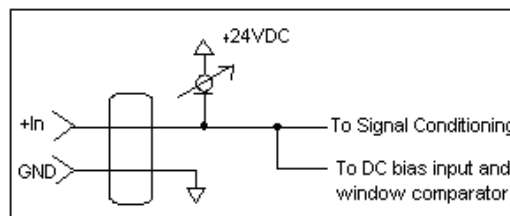


Figure 2 ICP[®] Sensor Excitation

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[®] 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[®] Input Fault Detection

483C41 monitors two input fault conditions in ICP[®] 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.

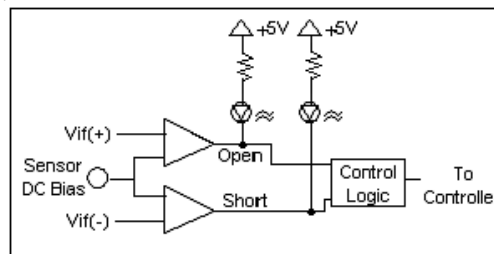


Figure 3 Input Fault Window Comparator with LED Indicator

2-4. Input Interface

The input signal conditioning for each channel in ICP[®] mode provides a unity gain buffer with high-input impedance amplifiers. AC coupling eliminates the DC bias from the input signal unless DC coupling is enabled (483C41 is AC coupled ONLY).

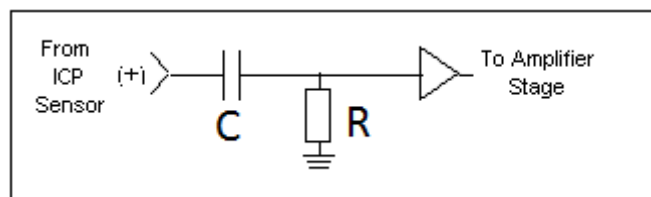


Figure 4 Input Amplifier Configuration

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.

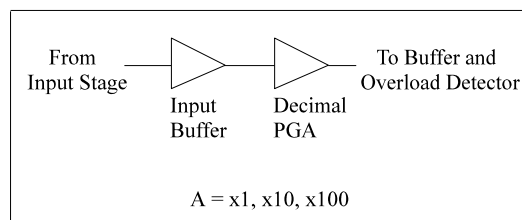


Figure 5 Selectable Gain Amplifier Configuration

2-6. 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 ± 5 Volts. The maximum swing may be used in the error checking.

The 483C41 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 483C41'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

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

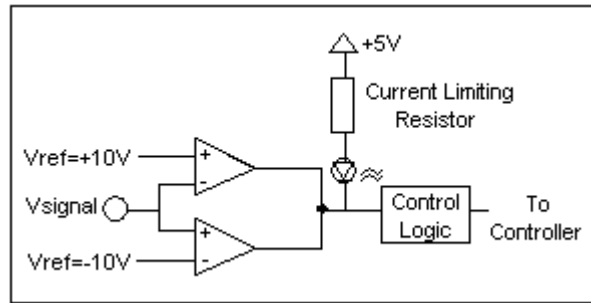


Figure 6 /Overload Window Comparator

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. FRONT PANEL MODULE CONTROL

3-1. Introduction

483C41 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.

3-2. Unit Initialization

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

PCB 483C41

FW Ver n.n

The unit is initialized with the factory default settings.

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 = 4.0 mA
- Output Filter = Disabled
- Coupling = AC
- Clamp = OFF
- Gain Type = Gain

3-3. 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	FLT _i

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 ↓ or up ↑ arrow key. This action scrolls vertically to the subsequent lines on the menu. These lines are shown below.

EXC _i	EXC _v	FLT _o
ACDC	ZERO	ARNG
SWOT	CLMP	Bias
CHRD	Cal	LEDS
Ver?	Unit	Reset
Disp	Savs	Res

3-4. Submenu Format and Command Selections

1) Gain Functionality – Includes five menu selections

The following menu options all pertain to how the gain functionality operates in the 483C41.

Gain Type (GType on front panel): Allows the user to choose how the gain of each channel can be set. The selections in the submenu are Gain and Normalize (Gain is the factory default setting). Pressing ENTER brings up the submenu shown below. The up ↑ and down ↓ arrow key can be used toggle between the two options.

Gain Set Option
Gain

Both options return control to the main menu after a selection is made. If Gain is selected then only the **GAIN** menu item can be used to set the gain of a channel. If Normalize is selected then the **GAIN** menu item is disabled and **SENS**, **FSOT** and **FSIN** will be used to set the gain using this equation: **Gain** = (FSOT * 1000) / (FSIN * SENS).

If the user attempts to use a menu selection (SENS, FSOT, FSIN, GAIN) that conflicts with the GType setting the message 'Invalid Item for Gain Entry Type' will be displayed.

Gain (GAIN on front panel): Directly sets the gain value of each channel. For ICP®/voltage input modes: .1 to 200.0. For charge mode: .01 to 2000.0. GType must be set to the Gain selection. See section 1-4.2c for instructions on setting the gain directly. The gain step is .1.

NOTE: A microprocessor inside the conditioner transparently sets the charge and voltage gains when in charge mode. This is done so sub-optimum values cannot be selected (ie – setting a low charge gain with a high voltage gain). Highest resolution is achieved if the charge gain is set as high as possible.

Sensitivity (SENS on front panel): The sensor sensitivity is entered here using the \longleftrightarrow and $\uparrow\downarrow$ arrow keys and then hitting Enter. GType must be set to the Normalize selection.

Full Scale Input (FSIN on front panel): The estimated full scale mechanical input (ex – engineering units, g's, psi, bar, etc.) is entered here using the \longleftrightarrow and $\uparrow\downarrow$ arrow keys and then hitting Enter. GType must be set to the Normalize selection.

Full Scale Output (FSOT on front panel): The desired full scale output voltage is entered here using the \longleftrightarrow and $\uparrow\downarrow$ arrow keys and then hitting Enter. GType must be set to the Normalize selection.

The submenus for SENS, FSIN and FSOT appear like this:

Chan	Sensitivity	Chan	FS In	Chan	FSOT
2	00100.000	2	01000.000	2	0010.0

The 483C41 has the ability to automatically normalize the output sensitivity of each channel based on the sensitivity of the sensor (SENS), the full scale value of the input (FSIN) in engineering units (g's for example) and the full scale output (FSOT) of the amplifier expressed in volts (this is the output that a signal at an FSIN level will produce). As stated previously, the gain equation is:

$$\text{Gain} = (\text{FSOT} * 1000) / (\text{FSIN} * \text{SENS})$$

Normalized Output Example: A full scale output of 5 volts is desired and a full scale input of 380 engineering units is expected. The sensor sensitivity is 9.96 mV/g. These values should be entered into FSOT, FSIN and SENS respectively. The gain will be automatically set to 1.3 to give a 5 volt full scale output based on the expected input and sensor sensitivity.

$$\text{Gain} = (5 * 1000) / (380 * 9.96) = 1.3$$

Normalization is useful when standardizing the output of channels with sensors of different sensitivities. Consider the following example where 1V/unit standardization on each channel is desired:

<u>Channel</u>	<u>Sensor Sensitivity</u>	<u>Gain Setting</u>	<u>Actual Gain Needed</u>
1	10.10 mV/unit	99.00	99.01
2	101.32 mV/unit	9.9	9.869
3	22.30 mV/unit	44.8	44.84

NOTE: The GAIN menu selection will not show what the gain is set at when in the Normalize GType setting.

2) Sensor Input Mode (INPT on front panel):

The 483C41 allows the user to switch between ICP®, Voltage, Charge modes. 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	INPT
FSOT	FSOT	FLT _i

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 Charge Input will cause the ICP® current source for that channel to be turned off. Conversely, If ICP® is set from Voltage or Charge then the ICP® current source will be set to 4mA.

3) Input Filter (FLT_i on front panel):

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 key until the cursor is over the FLT_i option, and then press the Enter button.

GAIN	SENS	INPT
FSOT	FSIN	FLT _i

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 from the following options; **0.100 kHz (100 Hz), 0.300 kHz (300 Hz), 1.000 kHz, 3.000 kHz, 10.000 kHz, 30.000 kHz, OFF**, once you have the desired setting selected hit ENTER to apply it.

Chan	INP Filter
2	ON-0.100 k

4) Output Filter (FLT_o on front panel):

A screen stating 'This Option is Not Installed' will appear. The 483C41 does not come standard with an output filter, but the option is available. Contact the factory for more information.

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

EXCi	EXCv	FLTo
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

5) ICP® Current Adjustment (EXCi on front panel):

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.

EXCi	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 483C41 will turn off the current excitation signal if the unit is not in ICP® input mode and will not allow it to be set 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.

6) Voltage Excitation (EXCv on front panel):

The Voltage excitation option is not applicable to the 483C41 units.

EXCi	EXCv	FLTo
ACDC	ZERO	ARNG

The following message will show if it is activated.

This Option is
Not Installed

7) Input Coupling (ACDC on front panel):

The input coupling option is not applicable to the 483C41 units. 483C41 is AC coupled only.

EXCi	EXCv	FLTo
ACDC	ZERO	ARNG

The following message will show if it is activated.

This Option is
Not Installed

8) Auto zero/ Auto balance (ZERO on front panel):

The Auto Zero/Auto Balance option is not applicable to the 483C41 units.

EXCi	EXCv	FLTo
ACDC	ZERO	ARNG

The following message will show if it is activated.

This Option is
Not Installed

9) Auto Range (ARNG on front panel):

The auto-range option is not applicable to the 483C41 units.

EXCi	EXCv	FLTo
ACDC	ZERO	ARNG

The following message will show if it is activated.

This Option is Not Installed

10) Switched Output (SWOT on front panel):

The Switched Output option is not applicable to the 483C41 units.

SWOT	CLMP	Bias
CHRD	Cal	LEDS

The following message will show if it is activated.

This Option is Not Installed

11) Clamp (CLMP on front panel):

The Clamp option is not applicable to the 483C41 units.

SWOT	CLMP	Bias
CHRD	Cal	LEDS

The following message will show if it is activated.

This Option is Not Installed

12) Bias Measurement (Bias on front panel):

The 483C41 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	Bias
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.

13) Channel Output Measurement (CHRD on front panel):

The Channel Output Measurement option is not applicable to the 483C41 units.

SWOT	CLMP	Bias
CHRD	CAL	LEDS

The following message will show if it is activated.

<p>This Option is Not Installed</p>

14) Calibration (CAL on front panel):

The user may select the Internal Calibration setting by pressing the ENTER key on the front panel when the cursor is located on the CAL option. When either the 100 or 1k Hz setting is selected the channel is forced into a charge mode, if it isn't set that way already, and an internal 100pC signal is generated. This signal is then converted to a voltage based on the selected charge sensitivity (1mV/pC if the ICP setting was selected) after which the channels gain is applied to provide an internal cal signal.

CHRD	CAL	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 Cal Mode column. To change the Cal Mode setting, use either the up ↑ or down ↓ arrow key to select either 'Off', '100Hz', or '1kHz'. Once you have the desired setting selected select ENTER to apply it.

Chan	Cal Mode
1	100Hz

15) LED Test (LEDS on front panel):

The testing of the front panel LEDs allows checking whether or not they are functioning properly. To test them, place the cursor over the word “LEDS” on the display and press enter.

CHRD	Cal	LEDS
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.

16) Firmware Version (Ver? on front panel):

To determine the firmware version of the unit select the ‘Ver?’ menu option and hit enter.

CHRD	Cal	LEDS
Ver?	Unit	Reset

A screen similar to the one shown below will be displayed

PCB 483C41
FW Ver 1.6

17) Unit ID (Unit on front panel):

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?	Unit	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.

18) Reset to Factory Default Settings (Reset on front panel):

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	Reset

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

19) Display Content Options (Disp on front panel):

The Display option allows the user to Lock or Unlock the display. To enter this mode, select the 'DISP' option from the menu by placing the cursor over the display option and hitting enter.

Ver?	Unit	Reset
Disp	Res	Res

Pressing the ENTER brings up a submenu with two options: Lock or Unlock.

Display Opts
Lock

If Lock is selected the any attempt to change another setting will cause the message "Unlock Display to Proceed" to be displayed. The user must then reset the display option to UNLOCK to change any other setting.

20) Save Current Settings (Savs on front panel):

When activated the save settings command forces the units current settings to become the default power up settings. These new settings will be implemented the next time the unit is powered on.

Ver?	Unit	Reset
Disp	Savs	Res

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 set.

Save Settings
Execute

21) Reserved (Res on front panel):

No operation. These menu items are reserved for future use.

Ver?	Unit	Reset
Disp	Savs	Res

4-0. COMPUTER INTERFACE PROGRAMMING GUIDE**4-1. Introduction**

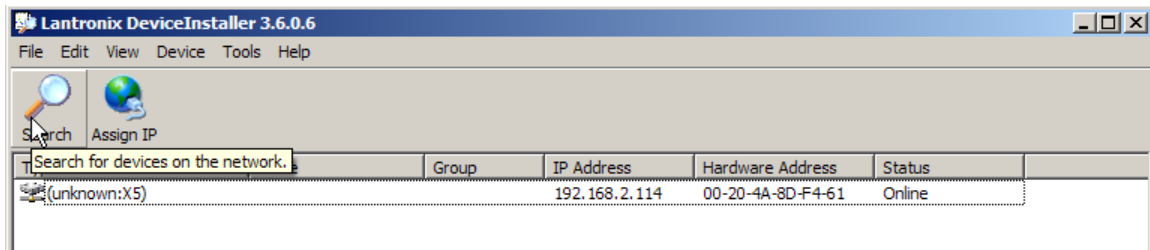
The Ethernet Interface enables the 483C41 to be fully controlled by a computer or laptop controller. With this interface, the unit is able to become part of a fully automated system.

4-2. Ethernet Communication

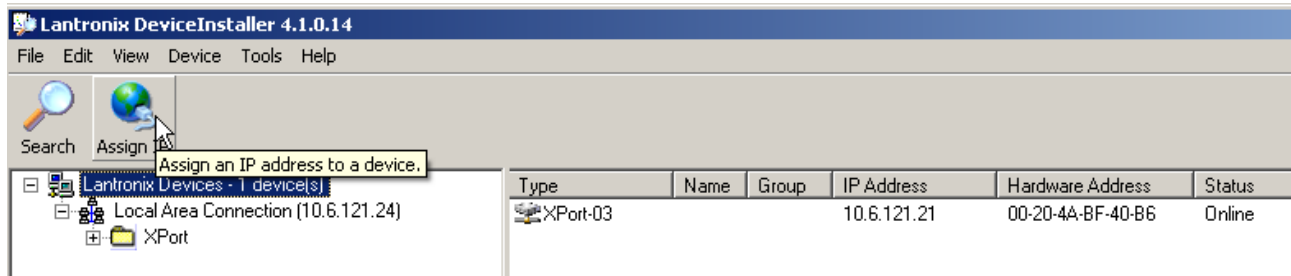
483C41 is equipped with an Ethernet Interface so the unit's IP address must be set up before any remote communication can commence.

The steps to set the IP address are as follow:

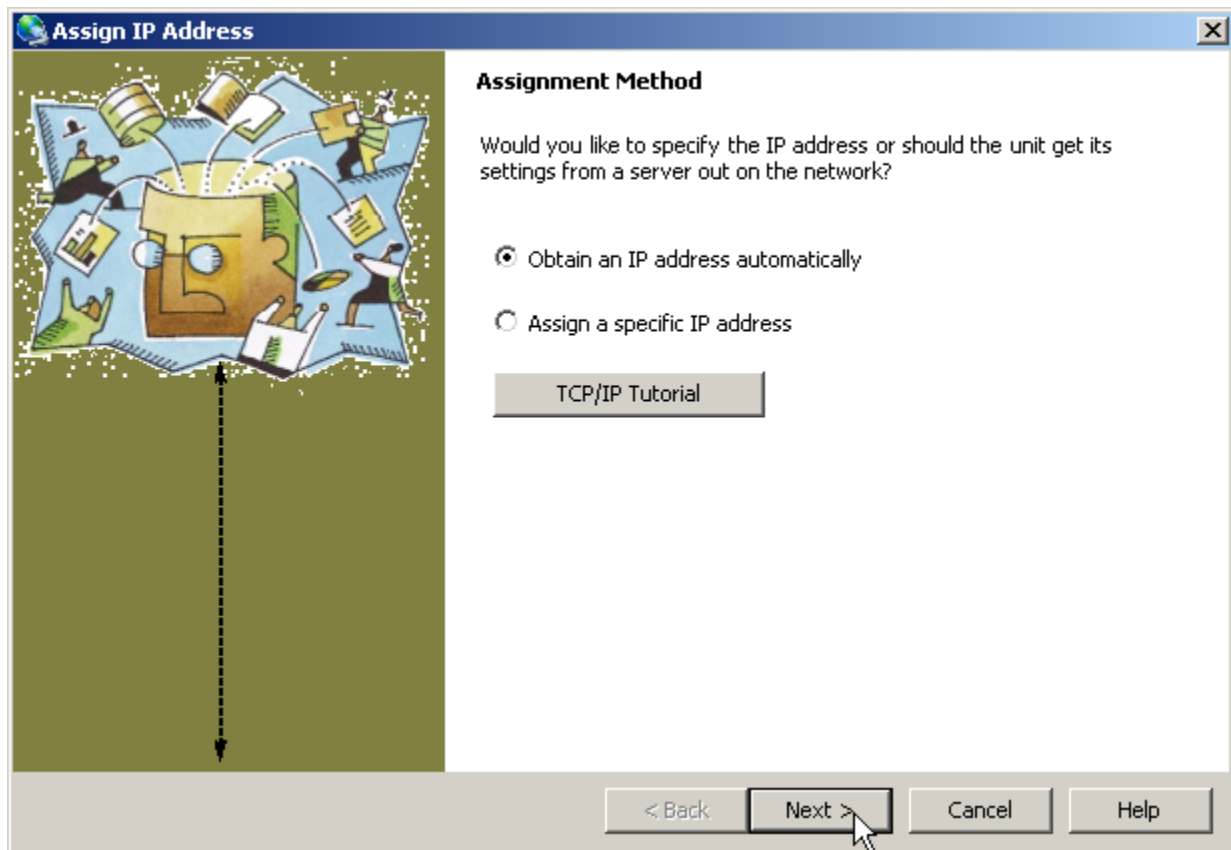
- Connect, either directly with a crossover CAT5 cable or through a hub, to a single unit. This unit is presumed to have a Unit ID of 1,
- Set the IP address using an independent utility from Lantronix called DeviceInstaller™. This utility is provided on the PCB MCSC application software installer CD 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.



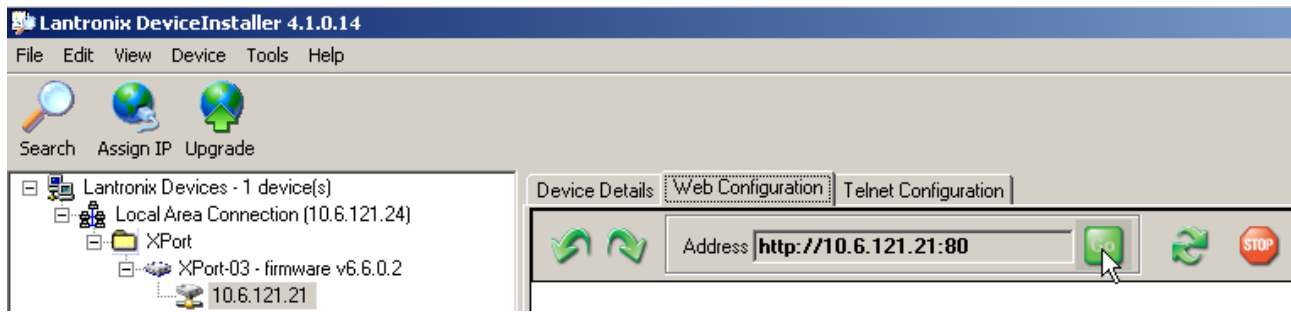
- Select **Assign IP** and the following screen will appear. Select whether you want to assign a static IP address that is appropriate for your network or have it assigned from a network server. Subsequent steps are self-explanatory.



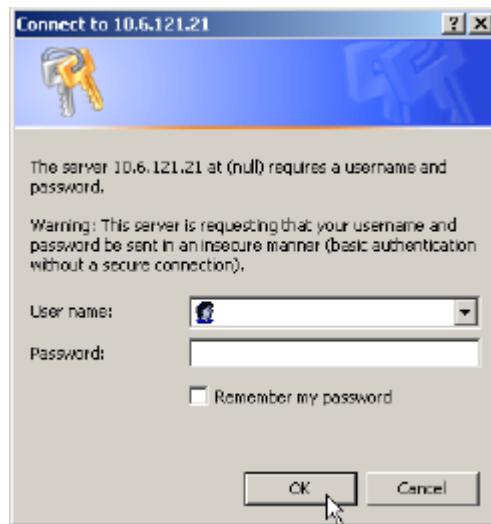
- Now you can use the assigned IP address to address the unit.

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:

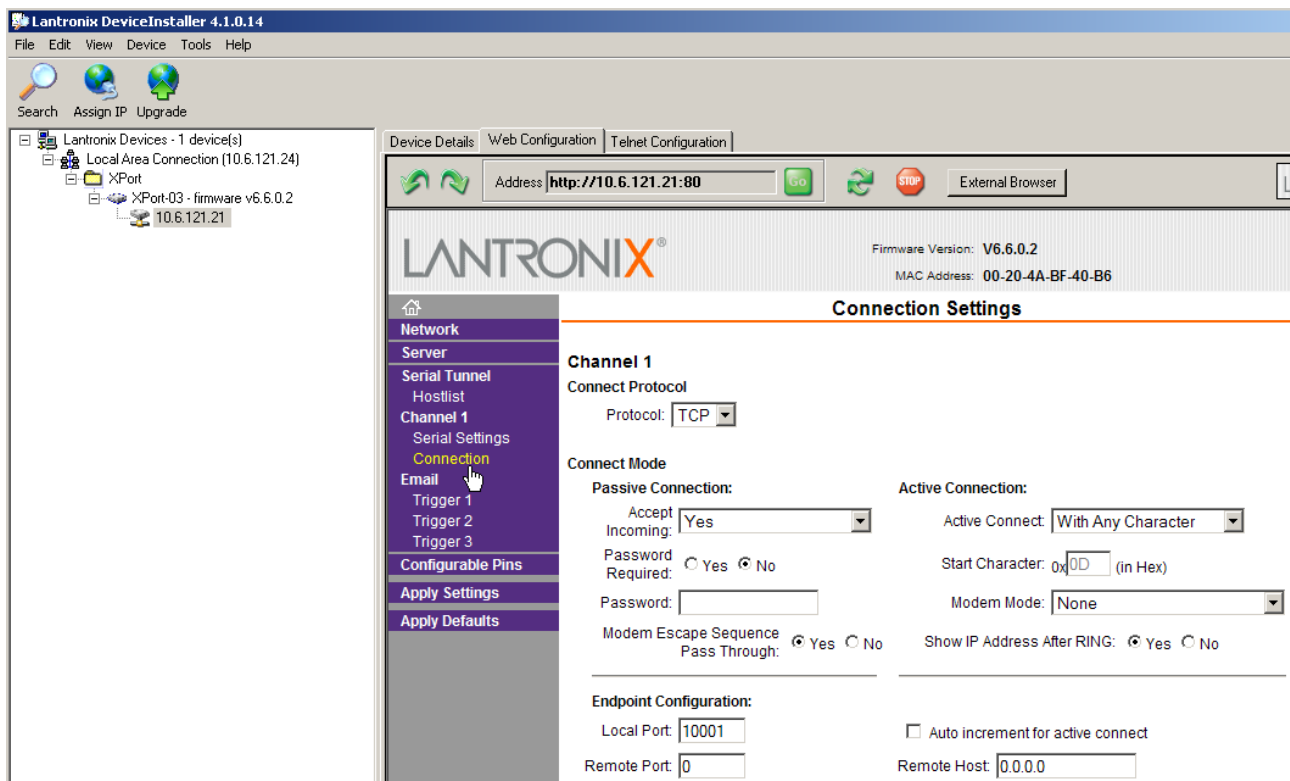
Active Connect: With Any Character

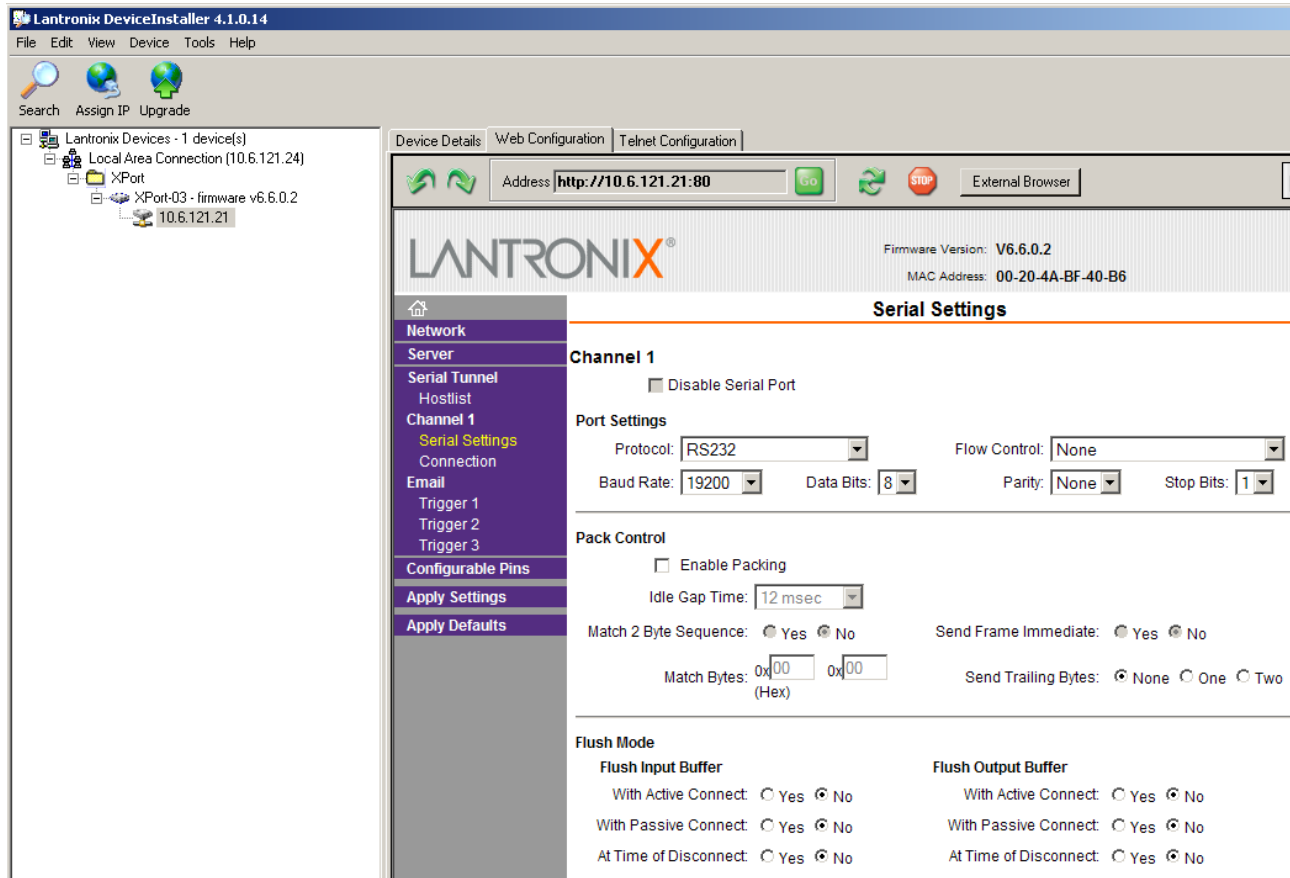
Endpoint Configuration:

Local Port: 10001

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.





4-3. 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.

4-4. 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.

4-5. 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.

4-6. 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 1st channel of the board that processed the command.

4-7. Multiple Board Models

The 483C41 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 2nd board's address would be 129)

4-8. 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:

Gain = FSO*1000/(FSI*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® 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

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 1st 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:**168010a009750000**12648016a88ae8e112801f2000f60ec4046dd18737f3206a380555e765390800

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 1st option of input Filter corners: output filter corners<cr><lf>

Query: 1:1:UNIT?

Response :1:UNIT:483C41\s\s\s\s\s\s\s\s\s\s:FW\sVer\s4.00\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:

Gain Options

OPT_GAIN_INC	0x10	Incremental Gain
Input Options		
OPT_INP_CIM	0x02	ICP VOLT CHG
OPT_INP_INTCAL	0x08	Internal Cal
Filter		
OPT_FILTER_OUT	0x02	Output filter (optional)
OPT_FILTER_PGM_BTR	0x10	Programmable Butterworth LP filter
Miscellaneous Options		
OPT_MISC_TEDS	0x04	TEDS
OPT_MISC_IEXC	0x08	current excitation
More Miscellaneous Options		
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
- Gain Type = Gain
- 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.

Model Number 483C41	EIGHT-CHANNEL ICP®/VOLTAGE/CHARGE SENSOR SIGNAL CONDITIONER		Revision: E ECN #: 49172
Performance	ENGLISH	SI	OPTIONAL VERSIONS
Channels	8	8	Optional versions have identical specifications and accessories as listed for the standard model except where noted below. More than one option may be used.
Sensor Input Type(s)	ICP®, Voltage, Charge	ICP®, Voltage, Charge	
Gain(ICP®/ Voltage Input)	0.1 to 200	0.1 to 200	[4]
Gain(mV/pC)(Charge Input)	0.01 to 2000	0.01 to 2000	
Gain Increment(minimum)(ICP®/ Voltage Input)	0.1	0.1	[5]
Gain Increment(minimum)(Charge Input)	0.01	0.01	
Accuracy(ICP®/ Voltage Input)(Gain, 0.1 to 0.4)	± 5 %	± 5 %	[6]
Accuracy(ICP®/ Voltage Input)(Gain, 0.5 to 200)	± 1 %	± 1 %	
Accuracy(Charge Input)(Gain, 0.01 to 0.04)	± 6 %	± 6 %	[7]
Accuracy(Charge Input)(Gain, 0.05 to 2000)	± 1 %	± 1 %	
Input Range(maximum)(Charge Input)	100,000 pC pk	100,000 pC pk	[8]
Input Range(maximum)(ICP® Input)	10 Vpk	10 Vpk	
Input Range(maximum)(Voltage Input)	5 Vpk	5 Vpk	[9]
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	[10]
Electrical Filter Roll-off	160 dB/decade	160 dB/decade	
Filter Type(8-pole Butterworth)	Low Pass	Low Pass	[11]
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	[12]
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 Pass Band Amplitude Accuracy	1 %	1 %	[13]
Phase Response(at 1 kHz)	± 2 °	± 2 °	
Non-Linearity	1 %	1 %	[14]
Cross Talk	<-72 dB	<-72 dB	
TEDS Sensor Support	Yes	Yes	[15]
Fault/Bias Monitor LEDs	Open/Short/Overload	Open/Short/Overload	
Control Interface			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.
Digital Control Interface	Ethernet	Ethernet	
Human Interface	Keypad	Keypad	[16]
Display	2 rows, 16 columns	2 rows, 16 columns	
Environmental			[17]
Temperature Range(Operating)	+32 to +120 °F	0 to +50 °C	
Electrical			[18]
Power Required(direct input to unit)	AC Power	AC Power	
AC Power(47 to 63 Hz)	100 to 240 VAC	100 to 240 VAC	[19]
AC Power	≤ 0.7 Amps	≤ 0.7 Amps	
Excitation Voltage(To Sensor)	>24 VDC	>24 VDC	[20]
DC Offset	<50 mV	<50 mV	
Constant Current Excitation(To Sensor)	2 to 20 mA	2 to 20 mA	[21]
Output Voltage(minimum)	10 V	10 V	
Output Current(minimum)	10 mA	10 mA	[22]
Output Impedance	<50 Ohm	<50 Ohm	
Broadband Electrical Noise(1 to 10,000 Hz)(Gain x1)	50 µV/rms	50 µV/rms	[23]
Spectral Noise(1 Hz)	8 µV/√Hz	8 µV/√Hz	
Spectral Noise(10 Hz)	2 µV/√Hz	2 µV/√Hz	[24]
Spectral Noise(100 Hz)	0.7 µV/√Hz	0.7 µV/√Hz	
Spectral Noise(1 kHz)	0.7 µV/√Hz	0.7 µV/√Hz	[25]
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	[26]
Spectral Noise(1 Hz)	18 µV/√Hz	18 µV/√Hz	
Spectral Noise(10 Hz)	1.5 µV/√Hz	1.5 µV/√Hz	[27]
Spectral Noise(100 Hz)	1.0 µV/√Hz	1.0 µV/√Hz	
Spectral Noise(1 kHz)	1.0 µV/√Hz	1.0 µV/√Hz	[28]
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	[29]
Spectral Noise(1 Hz)	100 µV/√Hz	100 µV/√Hz	
Spectral Noise(10 Hz)	10 µV/√Hz	10 µV/√Hz	[30]
Spectral Noise(100 Hz)	6 µV/√Hz	6 µV/√Hz	
Spectral Noise(1 kHz)	5 µV/√Hz	5 µV/√Hz	[31]
Broadband Electrical Noise(1 to 10,000 Hz)(0.1 mV/pC)	52.0 µV/rms	52.0 µV/rms	
Spectral Noise(10 kHz)	5 µV/√Hz	5 µV/√Hz	[32]
Spectral Noise(1 Hz)	10.0 µV/√Hz	10.0 µV/√Hz	
Spectral Noise(10 Hz)	1.5 µV/√Hz	1.5 µV/√Hz	[33]
Spectral Noise(100 Hz)	0.6 µV/√Hz	0.6 µV/√Hz	
Spectral Noise(1 kHz)	0.6 µV/√Hz	0.6 µV/√Hz	[34]
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	[35]
Spectral Noise(1 Hz)	14.0 µV/√Hz	14.0 µV/√Hz	
Spectral Noise(10 Hz)	2.0 µV/√Hz	2.0 µV/√Hz	[36]
Spectral Noise(100 Hz)	0.7 µV/√Hz	0.7 µV/√Hz	
Spectral Noise(1 kHz)	0.7 µV/√Hz	0.7 µV/√Hz	[37]
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	[38]
Spectral Noise(1 Hz)	15.0 µV/√Hz	15.0 µV/√Hz	
Spectral Noise(10 Hz)	2.0 µV/√Hz	2.0 µV/√Hz	[39]
Spectral Noise(100 Hz)	0.6 µV/√Hz	0.6 µV/√Hz	
Spectral Noise(1 kHz)	0.6 µV/√Hz	0.6 µV/√Hz	[40]
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	[41]
Oscillator(+/- 2%)(Internal Generator - Charge Mode)	100 pC pk	100 pC pk	
Oscillator(+/- 2%)(Internal Generator - ICP®/ Voltage Mode)	100/1000 Hz	100/1000 Hz	[42]
Overload Threshold(± 0.5 Vpk)	± 10 Vpk	± 10 Vpk	
Physical			[43]
Electrical Connector(Input, sensor)	BNC Jack	BNC Jack	
Electrical Connector(Output)	BNC Jack	BNC Jack	[44]
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	[45]
Weight	8 lb	3.6 kg	
			[46]
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.			
		SUPPLIED ACCESSORIES: Model 017AXX Power Cord (1) Model EE75 PCB MCSC Control Software. (1)	[47]
Entered: LK	Engineer: CPH	Sales: KK	
Date: 2/26/2019	Date: 2/26/2019	Date: 2/26/2019	[48]
Approved: DY	Spec Number:		
			[49]
		Phone: 716-684-0001 Fax: 716-684-0987 E-Mail: info@pcb.com	[50]
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