MPA-48
MULTI-PARAMETER ANALYZER

June 20, 2014

Insite Instrumentation Group, Inc
80 Whisperwood Blvd.
Suite 107
Slidell, LA 70458
Phone: (985) 639-0006
Fax: (985) 639-0014
E-mail: info@insiteig.com
www.insiteig.com

TABLE OF CONTENTS

GENERAL INFORMATION....3

Product Description....3

Packaging....3

INSTALLATION....4

Analog Outputs....5

Digital Output....5

Relay Outputs....5

OPERATION....6

RUN Mode....6

MAIN MENU....6

SETUP Mode....6

RELAYS....7

Clean Mode....8

ANALOG OUTPUT....8

MODBUS....9

CHANNEL ENABLE....9

SENSOR SETUP....10

DO Sensor....10

SS SENSOR....12

pH SENSOR....14

ORP SENSOR....15

TEST Mode....16

ERROR MESSAGES....17

MAINTENANCE....18

GUARANTEE AND REPAIR POLICY....20

Appendix A - Modbus Protocol....1

Appendix B – Jet Clean System....1

GENERAL INFORMATION

Product Description

The MPA-48 Multi-Parameter Analyzer comes standard with 4 channels for the continuous measurement of dissolved oxygen, suspended solids, pH and/or ORP in an aqueous solution. It can be easily upgraded to handle up to 8 channels with the addition of daughter boards and sensors. The microprocessor-based electronics of the MPA-48 analyzer provide a high degree of flexibility and ease of use. The instrument is designed to operate with any combination of InsiteIG sensors in a variety of applications. The DO sensor to be used with this analyzer is an optical type sensor that measures the fluorescence and quenching reactions of a ruthenium complex that is immobilized in a sol-gel matrix. The SS sensor operates on the principle of single gap light absorption as a means of detecting the presence of suspended solids. The pH and ORP sensors are flat glass electrodes.

The Model 10 Dissolved Oxygen sensor is designed for the continuous monitoring of dissolved oxygen in water and wastewater where parts per million accuracy is required. The unit will display dissolved oxygen content in PPM, mg/l or %SAT. The resolution in PPM and mg/l mode is 0.01 over a range of 0.00 to 3.99 and 0.1 over a range of 4.0 to 25.0. The resolution in %SAT mode is 0.1%SAT over a range of 0.0 to 99.9%SAT and 1%SAT over a range of 100 to 400%SAT. Temperature is displayed in 0.1 degree Celsius increments over a 0.0 to 50.0 degree Celsius range or 1 degree Fahrenheit increments over a 32 to 122 degree Fahrenheit range. It incorporates self-cleaning optics via air or water jet.

The Model 15 TSS sensor has been designed for medium ranges (0 to 30,000 mg/l) as commonly found in aeration basins of wastewater treatment plants and comes in pipe insertion configurations. The Model 15L sensor has been designed for low ranges (0 to 1500 mg/l) as commonly found in effluent streams. Both sensors utilize an infrared emitter to minimize color effects and compensates for emitter variations due to temperature by measuring source brightness. They incorporate self-cleaning optics via air or water jet.

The Model M50 is a microprocessor based preamp interface for the M51 and M52, pH and ORP electrodes (please specify pH or ORP when ordering the M50). The unit will display the pH value in 0.01 pH resolution over a range of zero to 14.00 pH. However, the pH electrode is only rated for a pH range of 2 to 12. The unit will display the ORP value in 1 mV resolution over a range of -2000 to 2000 mV. Water temperature may also be measured for automatic temperature compensation. The temperature may be displayed in degrees Celsius or degrees Fahrenheit. Temperature is displayed in 0.1 degree Celsius increments over a 0.0 to 50.0 degree Celsius range or 1 degree Fahrenheit increments over a 32 to 122 degree Fahrenheit range. They incorporate self-cleaning via air or water jet.

Packaging

The analyzer is housed in a NEMA 4X enclosure (see Drawing IIG07N111 for Outline and Mounting) and is designed for outdoor mounting. For areas where the environmental temperature is expected to drop below 14 degrees Fahrenheit (-10 degrees Celsius) for extended periods of time, the optional automatic heater assembly is recommended.

INSTALLATION

1. The MPA-48 analyzer should be located to allow convenient access for an operator to read and technician to install and maintain. A rear rail mounting kit is available for the standard enclosure (see Drawing IIG07N110). This mounting kit is design for a standard 2" handrail but can be adapted to square or angle handrails as well.

   DO NOT! Locate the analyzer where it is likely to be damaged during unrelated or other periodic maintenance such as pressure washing catwalks.

2. Mount the sensor in the desired location. InsiteIG can supply a sensor handrail mounting kit that easily mounts to most handrails and slide locks the sensor into place with out the use of tools. (See drawings IIG02N004, IIG02N005, IIG03N004 and IIG03N005). Again, this sensor mounting kit is design for a standard 2" handrail but can be adapted to square or angle handrails as well.

   DO NOT install a pH/ORP holder (Model 50) without a pH cartridge (Model 51) or an ORP cartridge (Model 52) installed and properly seated in the pH/ORP holder. Installing a pH/ORP holder without a pH or an ORP cartridge will void the warranty.

   WARNING! – Before opening analyzer cover; switch off the analyzer line power at the circuit breaker to avoid risk of shock. Line power is present on terminals even when analyzer is switched off.

   WARNING! – Circuit breaker meeting IEC-947-3 must be on line supply, in close proximity to equipment and shall be marked as the disconnecting device for the equipment.

3. Open the enclosure of the Process Analyzer. Pass all connection cables through glands or ½" conduit in the bottom of the enclosure (gland and conduit are not supplied). The sensor input connections are made to terminal blocks TB1 through TB4 (labeled SENSOR 1 through 4) on the standard unit (see drawing IIG07R111) and TB2 of the daughter boards for sensor 5 through 8. The four wires are color coded and there is a cable shield. Connect the RED wire to the terminal labeled "RED". Connect the GREEN wire to the terminal labeled "GRN". Connect the WHITE wire to the terminal labeled "WHT". Connect the BLACK wire to the terminal labeled "BLK". Connect the cable SHIELD to the terminal labeled "SHLD". The analog outputs are available on the terminal block labeled TB8 & TB9 and the relay outputs are available on the terminal block labeled TB5.

4. Power Selector Switch: Check switch S2 on the circuit board to be sure that it is set for the type of power being used (115 volts or 230 volts). Power connections should now be made to the terminal block labeled TB6. Turn power "on" by using switch S1. Close and secure the enclosure.

5. Switch the circuit breaker on and the unit will now power up.

6. Once the unit is turned on, the unit will initialize and then jump into the "RUN" mode and begin displaying Channel 1 “CH 1” content on the upper left-hand portion of the display and Channel 2 through 4 content below it and Channel 5 through 8 in the right-hand column.

Note: The Model 10 D.O. sensor undergoes a thorough and accurate test and calibration procedure before shipment from the factory. Calibration of the D.O. reading at startup is not necessary and is not recommended.

Analog Outputs

Four isolated 4-20 or 0-20 milliamp signals capable of driving 600 ohms are available from the terminal block labeled “Current Outputs”. See drawing IIG07R111 for details. The #1 analog output is labeled "I1 & C1” and the #2 analog output is labeled “I2 & C2” and so on. Each analog output may be assigned to any sensor channel. The Analog Outputs for the add-on channels are locate on the respective daughter boards and labeled as such.

Digital Output

A Modbus communications (RS-485) output is available from TB7 and is labeled “Modbus”. This is a three wire signal with a transmit plus (labeled X+), a transmit minus (labeled X-), and a transmit ground or common (labeled X COM). The Modbus interface uses 8 bits, no parity, 1 stop bit. See drawing IIG07R111 for details. The RS-485 interface is electrically isolated from the measurement and microprocessor circuitry of the MPA-48. The communications protocol for the Digital Output is fully described in Appendix A.

Relay Outputs

There are four independent programmable set point control relays that may be assigned to any sensor channel. These relays are Form-C with contacts rated 10/6 amps resistive load at 125/250 VAC. Two Form-A relays with contacts rated 10/6 amps resistive load at 125/250 VAC are used for the jet clean function. The connections for the relay outputs are available from TB5. See drawing IIG07R111 for connection details.

Note! – In "Normal Operation" the hinge cover is to remain tightly screwed closed. Under no circumstance is it necessary for the operator to open the enclosure during normal operation.

RUN Mode

The RUN mode is the normal operating mode of the analyzer and is entered upon power-up. When the Run mode is entered the analyzer will determine what types of sensors are attached to each channel. The display is continuously updated with the current measurement values. Also, the analog output and the relays are updated according to the current conditions and their programmed functions. In the event of an error or alarm condition the display will indicate the problem in plain English text.

The supplied sensors have been calibrated at the factory. Sensor information for the Model 15/15L TSS sensors are stored in non-volatile memory of the analyzer. If a Model 15/15L is connected to the analyzer and the sensor information does not match the information stored in the analyzer, the analyzer will display a configuration message. The configuration message for the Model 15/15L TSS sensor is "**Zero sensor**". These messages will appear whenever the sensor is changed.

While in the RUN Mode, the time to next scheduled clean cycle can be viewed by pressing and holding either arrow key. A clean cycle can be demanded by pressing the ENTER key while in the RUN Mode, see the section on Demand Clean.

MAIN MENU

The MAIN MENU is accessed by pressing the "MENU" key while in the RUN mode of operation. There are three options available from the main menu. Use the arrow keys to switch between RUN, SETUP, and TEST, and then press the "ENTER" key to select.

SETUP Mode

This mode of operation allows the user to customize the unit to the specific operation and needs of the facility. There are a total of five subcategories that may be adjusted.

Operation of the SETUP MODE proceeds as follows:

From the MAIN MENU, select SETUP and the five menu options will be displayed. Use the "ARROW" keys to move the cursor to the desired SETUP option, and then press the "ENTER" key. A menu with five options will be displayed. The options are:

RELAYS
ANALOG OUTPUT
MODBUS
CHANNEL ENABLE
SENSOR

Pressing the “MENU” key will return to the previous page. To return to the RUN mode, press the “MENU” key until the MAIN MENU is displayed and then press the “ENTER” key with the RUN mode selected.

RELAYS

When the RELAYS option is selected from the SETUP menu, the operator is prompted to select which relay is to be configured. There are five menu options for configuring the setpoint relays.

OP MODE - defines operation mode of relay as a high or low setpoint.
ON SETPOINT - defines when the relay will energize.
OFF SETPOINT - defines when the relay will de-energize.
FAIL MODE - defines the relay state during an alarm condition (no change, ON, or OFF).
CH ASSIGN - defines to which sensor the relay is assigned. A sensor may be assigned to more than one relay.

There are four menu options for configuring the clean relays.

SYSTEM TYPE - defines what type of cleaning system is used.
CLEAN SCHEDULE - defines how often a cleaning cycle will occur.
CLEAN JET TIME - defines duration of time the clean relays will be energized.
CLEAN RECOVERY TIME - defines how long the reading holds after the clean cycle has ended.

Note: Do not attempt to adjust relay set points values until a working sensor has been connected to the channel. Otherwise, the analyzer may not display the correct units (TSS or D.O.) for the channel.

Low Setpoint

If a relay “OP MODE” has been set as a LOW setpoint, then the corresponding relay will energize if the reading falls below the value set in the “ON SETPOINT” parameter. Once the relay has been energized by a low reading, it will not be de-energized until the reading rises above the value set in the “OFF SETPOINT” parameter. The relay “OFF SETPOINT” value MUST be greater than or equal to the “ON SETPOINT” value in this mode.

High Setpoint

If a relay “OP MODE” has been set as a HIGH setpoint, then the corresponding relay will energize if the reading rises above the value set in the “ON SETPOINT” parameter. Once the relay has been energized by a high reading, it will not be de-energized until the reading falls below the value set in the “OFF SETPOINT” parameter. The relay “OFF SETPOINT” value MUST be less than or equal to the “ON SETPOINT” value in this mode.

Clean Mode

The jet clean system is intended to be connected to relays “CLN 1” & “CLN 2”. The relays are connected to an InsiteIG compressor, CA-2 and CA-4 or a customer supplied air or water source and a shut-off valve. See drawing IIG07R113, IIG07R112, IIG07R114 and IIG07R116 for details. To program the Clean Type go to Setup Menu – Relays – CLN Relays – System Type and select the appropriate clean system; “CA2 Clean”, “CA4 Clean”, “House”. House clean is used for customer supplied air or water.

The CLEAN SCHEDULE program parameter determines how often the jet clean cycle will occur. This parameter can be set to values of 10 minutes to 24 hrs. Typically, a clean interval of 2 hrs works well for aeration basins. In colder climates, condensation may form then freeze in the jet-clean tubing. To prevent this, set the clean interval to 10 or 20 minutes. If this is set to “0” then cleaning is turned off.

The CLEAN JET TIME program parameter determines how long the jet clean cycle will last. The CLEAN PULSE can be set to values of 5-seconds to 90-seconds with a 1-second resolution. Typically, a clean pulse of 30-seconds works well for aeration basins. The analyzer will hold all the measurement reading during the clean cycle and the recovery period which is equal to the programmed clean jet time.

In CA2 (2 channel clean system) Clean mode, a standard clean cycle will consist of the channel 1 sensor being cleaned for the programmed clean jet time immediately followed by the channel 2 sensor being cleaned for the programmed clean jet time. For channels 3 & 4 a second CA-2 compressor can be connected in series with the first.

In CA4 (4 channel clean system) Clean mode, the compressor is turned on for the whole duration of the clean cycle and the MPA-48 sends a series of pulses to the compressor so each of the four sensors will be cleaned sequentially.

In House Clean mode, both clean relays are turned on for the whole duration of the clean cycle.

The CLEAN RECOVERY parameter determines how long the analyzer will hold the DO reading after the cleaning jet time has expired. The default setting is 1 minute which is adequate in most applications. However, increased recovery time may be required for applications where the sensor is in stagnant water or dead zones.

Demand Clean

When the analyzer is in the RUN mode pressing the "ENTER" button will cause a clean cycle to begin (if the CLEAN SCHEDULE is not set to OFF). Performing demand clean doesn’t affect the normal clean schedule.

ANALOG OUTPUT

When the ANALOG OUTPUT option is selected from the SETUP menu, the operator is prompted to select which analog output is to be configured. There are five menu options for configuring the analog outputs.

TYPE - selects either 4-20mA or 0-20mA operation for the analog output.
FULL SCALE - defines the value that will cause the analog output to go to 20mA.
MIN SCALE - defines the value that will cause the analog output to go to 0/4mA.
FAIL MODE - defines the value of the analog output during an alarm or error condition (no change, full scale, or min scale).
CH ASSIGN - defines to which sensor the analog output is assigned. A sensor may be assigned to more than one analog output.

MODBUS

There are two menu options for configuring the serial digital output.

Comm Address – defines the address of the analyzer
Comm Baud Rate – defines the baud rate of the digital output

Appendix A describes the Modbus protocol implementation in the MPA-48.

CHANNEL ENABLE

When the CHANNEL ENABLE option is selected from the SETUP menu, the operator is prompted to select which sensor channel is to be configured. The selected channel may be ENABLED or DISABLED by pressing the “ARROW” keys and then pressing the “ENTER” key.

SENSOR SETUP

Each channel has its own sensor setup menu. The analyzer will select the appropriate menu for the type of sensor that is currently connected to each channel.

DO Sensor

General

The Model 10 sensor has been designed to require very infrequent calibration. Unlike polaragraphic systems, light fouling of the sensing element should not affect the accuracy of the reading, but should only slow the response time of the system. (However, heavy biological fouling that prevents reasonable sensor contact with the water will cause erroneous readings.) With the sensor kept reasonably clean, the calibration should hold for 3 months to a year, depending upon conditions.

> **Note: The Model 10 D.O. sensor undergoes a thorough and accurate test and calibration procedure before shipment from the factory. Calibration of the D.O. reading at startup is not necessary and is not recommended.**

The MPA-48 analyzer allows the user to select from two different calibration procedures. The procedure can be selected by choosing SETUP from the main menu. Once the SETUP menu appears, use the arrow keys to choose the "SENSOR" option, and then select the desired sensor.

Sensor Calibration to a Reference

Calibration to a known reference is the easiest, simplest, and also the preferred method of calibration when calibration is required. Calibration option number 1 "SENSOR REF CAL" allows the operator to make adjustments to the D.O. reading to agree with any other source of D.O. information. THIS CALIBRATION PROCEDURE MUST ONLY BE USED ON A CLEAN SENSOR. IF THE SENSOR IS READING ERRONEOUSLY DUE TO HEAVY BIOLOGICAL FOULING, USE OF THIS CALIBRATION METHOD WILL RESULT IN UNRELIABLE RESULTS. The sensor must be stable in the water to be used as a reference before beginning this procedure. From the SENSOR SETUP menu, choose the "Sensor Ref Cal" option, and press ENTER. The analyzer will now read the sensor for the period of time indicated by the "dampening" parameter, and display the result as D.O. in PPM. If this result matches the reference, simply press ENTER to exit. Otherwise, use the arrow keys to adjust the reading to match the reference value, and then press ENTER to store this new value. This procedure is primarily an adjustment to the offset value of the sensor, but an adjustment in slope will also be made when this procedure is performed.

Sensor Slope Adjustment (NOT RECOMMENDED)

If performed correctly, the previously described "Sensor Calibration to a Reference" should be all that is required by the user. "Sensor slope adjustment" should only be attempted upon recommendation from the factory.

Sensor calibration option 2 "SENSOR SLOPE ADJ" allows the user to adjust the span of the sensor, but this procedure must only be used immediately AFTER the sensor has been "zeroed" using calibration option 1 with the sensor submerged in a zero oxygen solution. This zero solution may be prepared by adding one tablespoon of sodium sulfite salt per liter of tap water in an open container (bucket). The sodium sulfite salt will remove all oxygen from the water as it dissolves. Stir the water for about one minute to dissolve the salt. Submerge the Model 10 sensor in this water and allow it to rest for at least 30 minutes. Make sure that no air bubbles are trapped on the face of the sensing element during the soak. Once the sensor is stable, use the "Sensor Calibration to a Reference" procedure described

previously to set the D.O. reading to 0.03 PPM. THE CAL TO REFERENCE PROCEDURE IN ZERO WATER MUST BE PERFORMED EVEN IF THE SENSOR READS ZERO FROM THE RUN MODE. [NOTE: If the user's application requires a zero that is absolutely accurate (frequent readings below 0.5 PPM), then the zero solution needed for this procedure should be mixed 12 to 24 hours before use, and distilled water should be used in place of tap water. Freshly mixed solution actually has a value of about 0.04 PPM, but a calm solution at rest for 12 hours will drop down very close to absolute zero.]

Once a sensor has been properly zeroed, a slope adjustment may be made. Place the sensor in a solution of known D.O. concentration, and allow about 15 minutes to fully stabilize. Choose the sensor slope adjustment calibration procedure as option 2 "Sensor Slope Adj" from the SENSOR SETUP menu, and press ENTER. Press ENTER again to bypass the "!Warning! Proper Zero Required" message. The analyzer will now read the sensor for the period of time indicated by the "dampening" parameter, and display the result as D.O. in PPM. If this result matches the reference, simply press ENTER to exit. Otherwise, use the arrow keys to adjust the reading to match the reference value, and then press ENTER to store this new value.

FACTORY DEFAULT

The Factory Default parameter allows the user to restore the sensor characteristic values of zero and slope to the original factory settings.

TEMP. UNITS

The temperature units parameter allows the user to specify Celsius or Fahrenheit for the displayed temperature units.

DAMPENING

The dampening parameter will allow the adjustment of the amount of averaging taking place. This is entered in the amount of time it will take to achieve a stabilized reading, in seconds. This may be useful when using the system in a new application or trouble shooting.

SALINITY

This option allows for the correction of salts in the water. The salinity correction range is 0 to 45 ppt with a resolution of 1 ppt. Average sea water is about 34 ppt.

DISPLAY MODE

This option allows the dissolved oxygen to be displayed in either PPM or %SAT.

PASSCODE

The passcode parameter will allow the operator to limit access to the sensor setup parameters. The passcode may be set to any three-digit number.

SS SENSOR

To do a complete calibration, three steps are required. The analyzer must first be zeroed, and then a sample/snapshot is taken. After the sample has been analyzed, the span of the analyzer can be adjusted to the sample. As long as the lenses are kept clean, frequent recalibration should not be necessary. Every six months should be more than adequate for a complete calibration.

Any optically based device for measuring suspended solids should only be span calibrated against a typical sample of the actual process water being measured. Synthetic laboratory standards will add unnecessary inaccuracies to the system and are not recommended. The MPA-48 utilizes its microprocessor memory in a unique way to make span calibration as easy and accurate as possible. This calibration is performed as a two step process. First, the SNAPSHOT SAMPLE function of the analyzer is used to store actual process conditions to the instrument's memory. Later, when standard laboratory analysis results are available for those previous conditions, the analyzer's SPAN function will recall the stored value and allow the user to adjust the span value accordingly.

The range of operation of the Model 15 sensors is 0-30,000 mg/l total suspended solids. Within this range, accuracy and repeatability are only specified over a range of +/- 50% of the user's point of calibration. Accuracy will be +/- 5% of the current reading or +/- 100 mg/l, whichever is greater. Repeatability will be +/- 1% of the current reading or +/- 20 mg/l, whichever is greater.

The range of operation of the Model 15L sensor is 0-1500 mg/l total suspended solids. Within this range, accuracy and repeatability are only specified over a range of +/- 50% of the user's point of calibration. Accuracy will be +/- 5% of the current reading or +/- 2 mg/l, whichever is greater. Repeatability will be +/- 1% of the current reading or +/- 2 mg/l, whichever is greater.

SENSOR ZERO

Submerge the sensor in clean water. It is important that the water used to zero the sensor be clean. At the very least use potable water for this, and distilled water is even better. Do not use plant process water of any type.

Select the "SENSOR ZERO" option from the SENSOR SETUP menu using the up and down arrow buttons. Press the "ENTER" button. With the sensor submerged in clean water, wait about 15 minutes and then press "ENTER". The analyzer will take about sixty seconds to zero. The display will return to the SENSOR SETUP menu automatically when it is finished. Press the "MENU" button to exit or use the up and down arrow buttons to select another sensor setup option.

SNAPSHOT

With the sensor submerged in the process to be measured and stable, select the "SNAPSHOT" option from the SENSOR SETUP menu using the up and down arrow buttons. Press the "ENTER" button. Pressing the "ENTER" button again will cause the analyzer to take a snapshot of the conditions. The analyzer will take about sixty seconds to obtain a sample value. The display will return to the SENSOR SETUP menu automatically when it is finished. At this point, the calibration of the analyzer has NOT been altered at all; the conditions of the process water have only been stored in memory for future use. Press the "MENU" button to exit or use the up and down arrow buttons to select another sensor setup option.

At this time, take a physical sample of the process water from the same location so that it can be analyzed using standard laboratory techniques to determine suspended solids concentration. This value will be used during the span calibration.

SENSOR SPAN

This step is performed when an accurate laboratory value has been obtained from the sample previously taken during the SNAPSHOT procedure. Select the "SENSOR SPAN" option from the SENSOR SETUP menu using the up and down arrow buttons and press the "ENTER" button. The value that was previously saved snapshot will be displayed. Use the up and down arrow buttons to adjust the analyzer reading to the value of the laboratory analysis. Press the "ENTER" button when done. The system is now calibrated and ready for normal operation. Press the "MENU" button to exit or use the up and down arrow buttons to select another sensor setup option.

DEFAULT SPAN

This calibration mode will replace the current span calibration value with the factory default value. This may be useful when using the system in a new application. If the analyzer has been properly zeroed in clean water, the analyzer will read values that are typical for an average waste treatment plant. No absolute accuracy is guaranteed after this procedure, but the numbers will, in the least, be useful for observing trends in the suspended solids concentration over time.

RESPONSE TIME

The response time parameter will allow the adjustment of the amount of averaging taking place. This is entered in the amount of time it will take to achieve a stabilized reading, in seconds. This may be useful when using the system in a new application or trouble shooting.

SENSOR CURVE

The sensor curve mode will allow the selection of a standard TSS sensor curve which should be used for most applications or a special TSS sensor curve which can be used for applications when the standard curve does not apply. Contact the factory for details on using the special curve setting.

PASSCODE

The passcode parameter will allow the operator to limit access to the sensor setup parameters. The passcode may be set to any three-digit number.

pH SENSOR

Calibration of pH electrodes have been greatly simplified, with ONE POINT or TWO POINT calibration modes available.

pH buffers are special solutions which are used in the standardization or calibration of pH measuring electrode systems. They are special because they have the ability to resist changing pH due to contamination or dilution. The most common buffer dilutions are 4, 7 and 10 pH values. Other special values can be purchased, and buffers for special biological and chemical applications are common.

pH buffers are supplied in either a powdered form to be mixed with distilled water or a premixed liquid form. For pH buffers greater than 7, it is recommended that liquid buffer solutions be used because they tend to be more accurate. However, liquid buffer solutions have a short shelf life (typically 3 months) which must be considered when ordering.

One Point Calibration Method

Select ONE POINT CAL from the setup menu. Submerge the sensor in the buffer solution. Press the ENTER key. After the analyzer has acquired data, the pH value will be displayed. Use the UP and DOWN arrow keys to change to the correct pH value and then press the ENTER key. The calibration is stored in the non-volatile memory of the analyzer.

NOTE: This method of calibration only adjusts for asymmetry in the electrode and thus should only be used in applications where the process has a small range of pH values.

Two Point Calibration Method

Select TWO POINT CAL from the setup menu. Submerge the sensor in the first buffer solution. Press the ENTER key. After the analyzer has acquired data, the pH value will be displayed. Use the UP and DOWN arrow keys to change to the correct pH value and then press the ENTER key. Submerge the sensor in the second buffer solution. Press the ENTER key. After the analyzer has acquired data, the pH value will be displayed. Use the UP and DOWN arrow keys to change to the correct pH value and then press the ENTER key. The calibration is stored in the non-volatile memory of the analyzer.

FACTORY DEFAULT

The Factory Default parameter allows the user to restore the sensor characteristic values of zero and slope to the original factory settings.

TEMP. UNITS

The temperature units parameter allows the user to specify Celsius or Fahrenheit for the displayed temperature units.

PASSCODE

The passcode parameter will allow the operator to limit access to the sensor setup parameters. The passcode may be set to any three-digit number.

ORP SENSOR

SENSOR TYPE

Displays are normally in the American convention which produces a negative voltage during a reduction of the platinum and a positive reading during the oxidation of the platinum. The European convention reverses the polarities.

ORP OFFSET

Select ORP OFFSET from the setup menu. Submerge the sensor in the buffer solution. Press the ENTER key. After the analyzer has acquired data, the ORP value will be displayed. Use the UP and DOWN arrow keys to change to the correct ORP value and then press the ENTER key. The calibration is stored in the non-volatile memory of the analyzer.

PASSCODE

The passcode parameter will allow the operator to limit access to the sensor setup parameters. The passcode may be set to any three-digit number.

TEST Mode

This mode of operation allows the user to perform basic test functions to aid in troubleshooting.

Operation of the TEST MODE proceeds as follows. From the Main Menu use the arrow keys to move the cursor to the TEST option, then press the “ENTER” key. Use the arrow keys to select one of the seven options, and then press the “ENTER” key.

VIEW SENSOR DATA

This option is intended primarily to aid the InsiteIG technical support engineers in troubleshooting. The following sensor data is displayed: sensor type, sensor serial number, sensor reporting mode, and sensor raw data. Press the “MENU” key to exit.

VIEW SENSOR CLK

This option will display the power line frequency which is used to filter the sensor data. Press the “MENU” key to exit.

CAL ANALOG OUTPUT

This option will cause the analyzer to generate full scale output of 20mA on the selected analog output. Use the “UP” and “DOWN” arrows keys to adjust the output, then press the “ENTER” key to save.

TEST RELAYS

This option will test the setpoint and cleaning relays.
Setpoint relays:

This option will display the current status of the selected relay. To toggle the state of the relay, press the "ENTER" key. The new status of the relay will be displayed. To exit, press the "MENU" key.

Clean relays:

This option will display the current status of the clean relays. To toggle the state of the CLN1 relay, press the “UP” key. To toggle the state of the CLN2 relay, press the “DOWN” key. The new status of the clean relays will be displayed. To exit, press the “MENU” key.

TEST MODBUS

This option will test the RS-485 communication port.

SOFTWARE VERSION

This option will display the current version of software in the analyzer. To exit, press the "MENU" key.

VIEW SENSOR CHAR

This option is intended primarily to aid the InsiteIG technical support engineers in troubleshooting. The characteristics for the selected sensor are displayed.

ERROR MESSAGES

During operation, the MPA-48 analyzer may determine that an error condition exists. If this happens, the display will contain an error message. The 4 possible error messages are as follows:

****SENSOR NOT RESPONDING****

This error message indicates that the analyzer is not receiving any data from the sensor. This could be caused by either the sensor is not properly connected to the analyzer or a faulty sensor or analyzer electronics.

***SENSOR ERROR* (Model 10 only)**

This error message will be displayed if the sensor's electronics become faulty. Call the factory for assistance.

****Zero Sensor** (Model 15/15L only)**

The analyzer is indicating that a zero cal operation is required for proper operation. This can occur if a new or different sensor has been connected to the analyzer. This would be indicated if the current counts are greater than 5% of the pervious stored zero value.

***Ambient Error* (Model 15/15L only)**

This error message will be displayed if the sensor is exposed to too much ambient light (exposed to direct sunlight) or the sensor LED is faulty. Call the factory for assistance.

MAINTENANCE

The analyzer does not require any periodic maintenance. However, it may be necessary to periodically clean the exterior of the analyzer. This may be done with a soft brush, broom or low pressure water rinse.

DO NOT! use hi-pressure water or a pressure washer to clean the analyzer. It is likely to be damaged during pressure washing.

The sensor must be kept clean for accurate readings. Normally, the jet clean system will adequately perform this function.

Model 10 D.O. Sensor: In normal wastewater aeration basins the Model 10 Sensor will not require a jet clean system; however it is important that the aqueous sample to be measured be allowed to come in contact with the measuring surface. The sensor should be visually inspected on a monthly basis to insure that rags and hair have not completely covered the measuring surface. During this time we recommend rinsing the sensor with a water hose.

In systems with high bio-slim and scaling, the integrated jet clean system is recommended to prevent the slim and scale from attaching itself to the measuring surface. If wiping the sensing element is required, use a wet cloth, do not use a brush.

Fouling conditions at wastewater treatment facilities vary considerably from plant to plant. Experience gained during the first few months of sensor operation will allow the plant operators to determine their own reasonable schedule of sensor inspection. In no case should this inspection interval exceed one year.

Model 15/15L TSS Sensor: The sensor must be kept clean for accurate readings. Normally, the jet clean system will adequately perform this function. However, the sensor should be retrieved and cleaned manually on a periodic basis to remove the heaviest fouling that may impair the performance of the sensor. The frequency of this cleaning will vary depending on the application.

Model 51/52 pH/ORP Sensor: The electrodes are shipped with a protective boot over the pH glass. This boot should be used to keep the electrode glass wet while the electrode out of service. If the electrode system has been unused for a long period of time, immerse the flat glass end of the electrode(s) in tap water for at least 30 minutes. This hydrates the pH flat glass and prepares the liquid junction of the reference electrode for contact with the test solution. To maintain response, the electrode system should always remain wet. The preferred storage solution is pH 4.0 buffer with saturated KCl added. Tap water will suffice for short term storage.

NOTE: <u>Do not</u> soak in distilled water. Utilize the pliable storage boot provided with the electrode(s) for storage.

Electrodes which are not broken or cracked can be restored, or rejuvenated, to full response by the following procedures:

- **Inorganic Scale Deposits -** Dissolve the deposit by immersing the electrode first in 0.1M HCl, then in 0.1M NaOH, and again in 0.1M HCl. Each immersion should be for a 5 minute period.
- **Organic Oil or Grease Films -** Wash electrode tip in a liquid detergent and water. If film is known to be soluble in a particular organic solvent, wash with this solvent. Rinse electrode tip in tap water.

If these procedures fail to rejuvenate the electrode, the problem is probably a clogged reference junction in the reference electrode portion of the electrode system. Cleaning the reference junction involves heating a diluted KCl solution to 60 - 80 degrees Celsius. Place the electrode tip in the heated KCl solution for approximately ten minutes. Allow the electrode to cool naturally before re-testing. If these steps fail to improve the electrode response, replace the electrode.

Successful long term storage of an InsiteIG electrode depends entirely upon the care taken to assure that the glass and reference junction remain immersed in the recommended storage solution. Electrodes in storage with the protective rubber boot should be checked at least every 2 months to be sure that there is an adequate amount of storage liquid. Electrodes stored in this manner will normally last for 2 years. If a stored electrode is allowed to dry the reference junction may become clogged with dried electrolyte. Should this occur, attempt to rejuvenate the reference junction using the "Cleaning Electrodes" procedure for reference junctions discussed earlier.

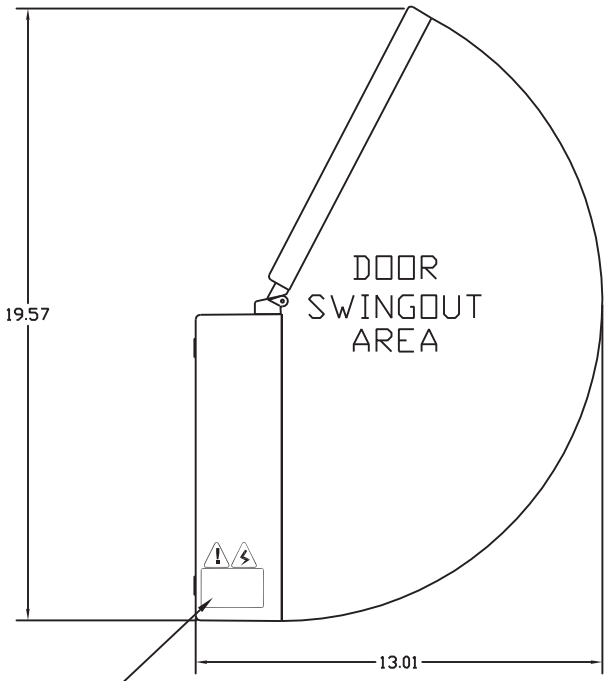
GUARANTEE AND REPAIR POLICY

MPA-48 Process Analyzer, Model 15/15L sensors, Model M50 electrode holder and related items are guaranteed for two years against defective materials and workmanship. The Model 10 Dissolved Oxygen Sensor is guaranteed for five years against manufacturing defects. They will be replaced or repaired free of charge during the guarantee period. Call the factory at 985-639-0006 for a return authorization number for traceability. Mark the package to the attention of the R/A number and address it to the factory at 80 Whisperwood Blvd., Suite 107, Slidell, LA 70458. Freight to the factory is to be paid by the customer and items should be insured in case of damage or loss of shipment.

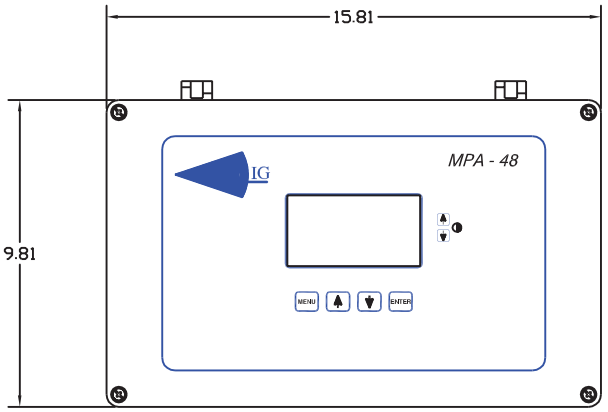
All shipments are insured. If you receive a damaged unit, please notify InsiteIG Instrument immediately at 985-639-0006.

Repairs to the equipment not covered by the guarantee will be billed per standard service charges.

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED



SIDE VIEW



PLAN VIEW

Notes:
1. Construction: Fiberglass, NEMA 4X, IP66, IP67, IP68 Enclosure is UL Listed BD-183835
2. Approximate Weight: 12 LB..

In "Normal Operation" the hinged cover is to remain tightly screwed closed. Under no circumstance is it necessary for the operator to open the enclosure.

Warning! – Before opening; switch off the analyzer power at the circuit breaker to avoid risk of shock.

UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES TOLERANCES DECIMALS .XX ±.010 .XXX ±.005 ANGULAR X° ±1° DO NOT SCALE DRAWING	CONTRACT NO.	
	DRAWN	DATE
	CHECK	
MATERIAL –	DESIGN	
FINISH –	APPROVED	
SPEC.	CUSTOMER	

Insite IG
80 Whisperwood Blvd.
Suite 107
Slidell, LA 70458

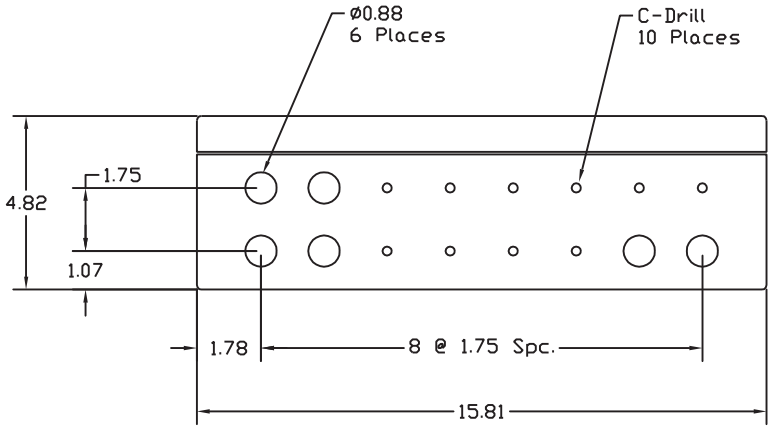
TITLE
OUTLINE & MOUNTING
InsiteIG MPA-48

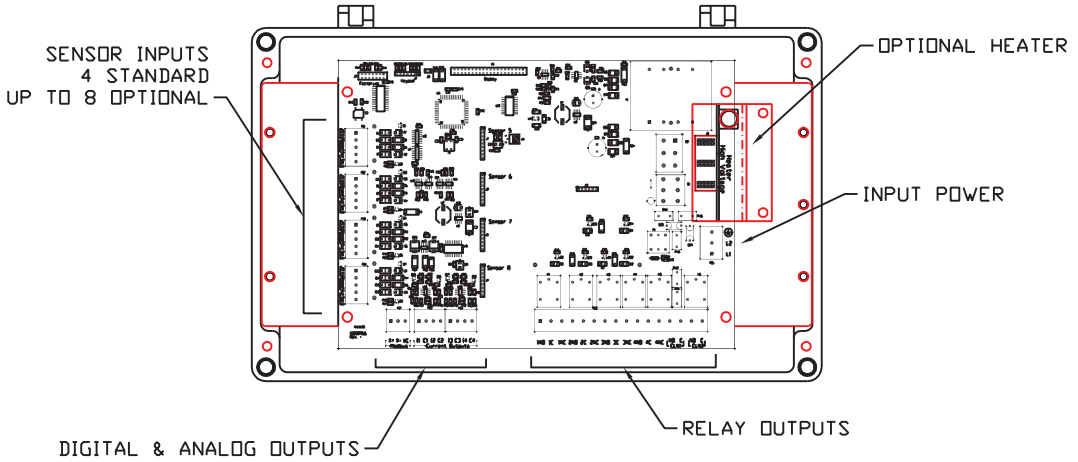
SIZE	DWG NO.	REV
C	IIG07N111	–

SCALE NTS | SHEET 1 OF 2

DWG. NO IIG07N111 REV. –

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED

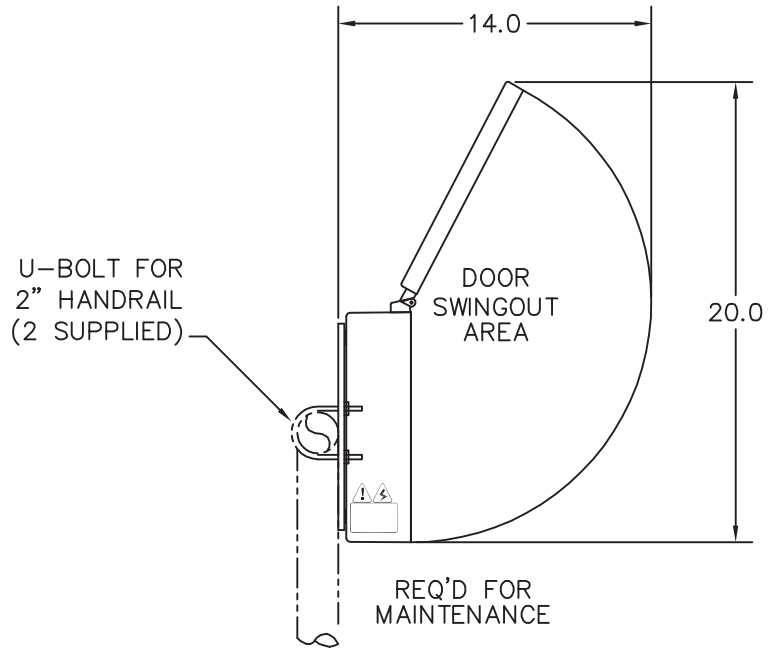




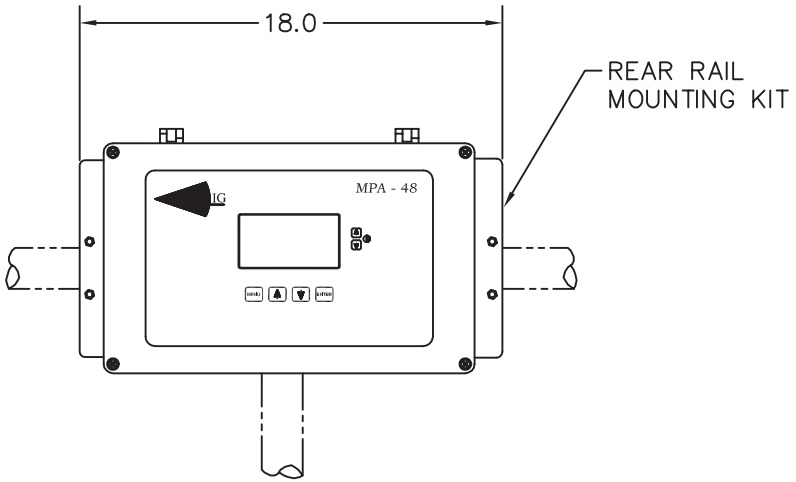
SIZE	DWG NO.	REV
C	IIG07N111	—
SCALE NTS		SHEET 2 OF 2

DWG. NO IIH07Y111 REV. 1

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED



SIDE VIEW



PLAN VIEW

NOTES:

1. CONSTRUCTION: FIBERGLASS, NEMA 4X TYPE ENCLOSURE MOUNTED ON .125" PASSIVATED STAINLESS STEEL BRACKETS.

2. APPROXIMATE WEIGHT: 14 LBS.

UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES TOLERANCES DECIMALS .XX ±.010 .XXX ±.005 ANGULAR X° ±1° DO NOT SCALE DRAWING	CONTRACT NO.	Insite IG 80 Whisperwood Blvd. Suite 107 Slidell, LA 70458
MATERIAL –	DRAWN D. RADLE	DATE 4/25/07
FINISH –	CHECK	
SPEC.	DESIGN D. RADLE	4/25/07
	APPROVED	
	CUSTOMER	

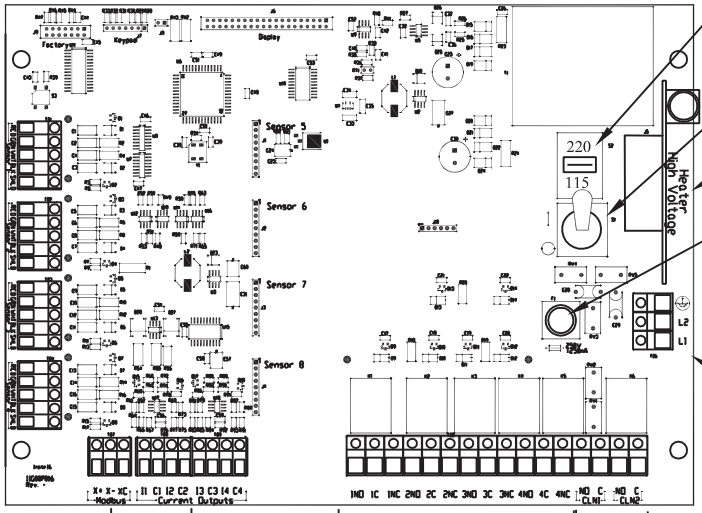
TITLE: REAR RAIL MOUNTING InsiteIG MPA–48

SIZE	DWG NO.	REV
C	IIG07N110	–

SCALE NTS | SHEET 1 OF 1

DWG. No IIG07N110 REV. –

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED



115/230 VAC
SELECTOR SWITCH

ON/OFF SWITCH

OPTIONAL HEATER

5x20mm, 1/4 AMP, 250V
TIME DELAY FUSE
(GCD-250mA)

Sensor Input 1-4

115 OR 230 VAC @ 50 OR 60 HZ
MAIN POWER CONNECTION
AND WILL NORMALLY CONSUME LESS
THAN 25 WATTS.

MODBUS INTERFACE (RS-485)

ANALOG OUTPUT (0-20 or 4-20mA)
600 OHMS MAX. LOAD

CLEAN RELAY CONTACTS

PROGRAMABLE RELAY CONTACTS
RATED 6 AMPS AT 250 VAC
RESISTIVE LOAD.

⚠ Circuit Breaker meeting IEC-947-3 must be on line supply, in close proximity to equipment and shall be marked as the disconnecting devise for the equipment.

UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES TOLERANCES DECIMALS ANGULAR .XX ±.010 X° ±1° .XXX ±.005 DO NOT SCALE DRAWING	CONTRACT NO.	
	DRAWN	DATE
	CHECK	
	DESIGN	
	APPROVED	
	CUSTOMER	
MATERIAL –		
FINISH –		
SPEC.		

Insite IG
80 Whisperwood Blvd.
Suite 107
Slidell, LA 70458

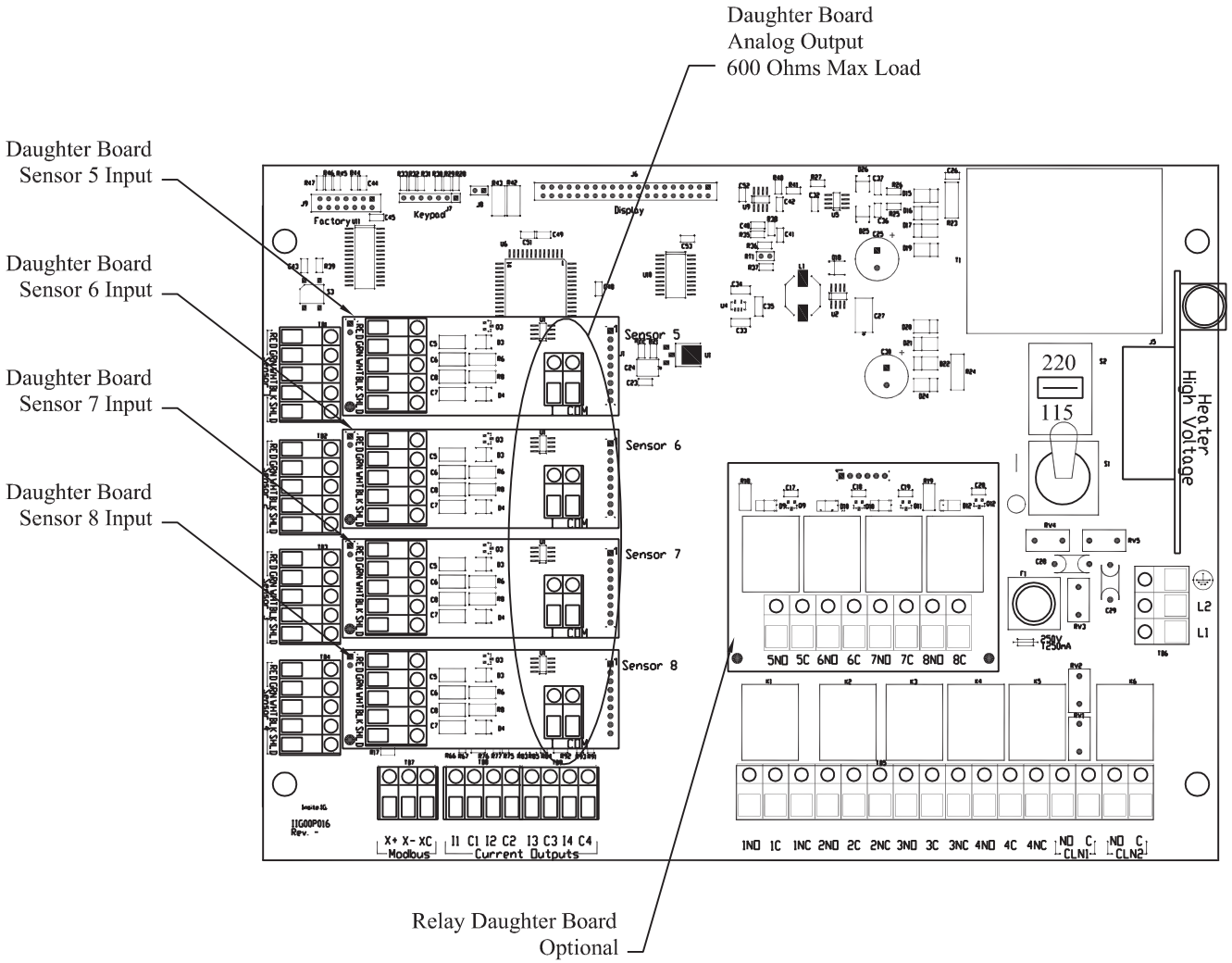
TITLE
CUSTOMER CONNECTION
MPA-48

SIZE	DWG NO.	REV
C	IIG07R111	–

SCALE NTS | SHEET 1 OF 1

DWG. NO IIG07R111 REV. –

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED

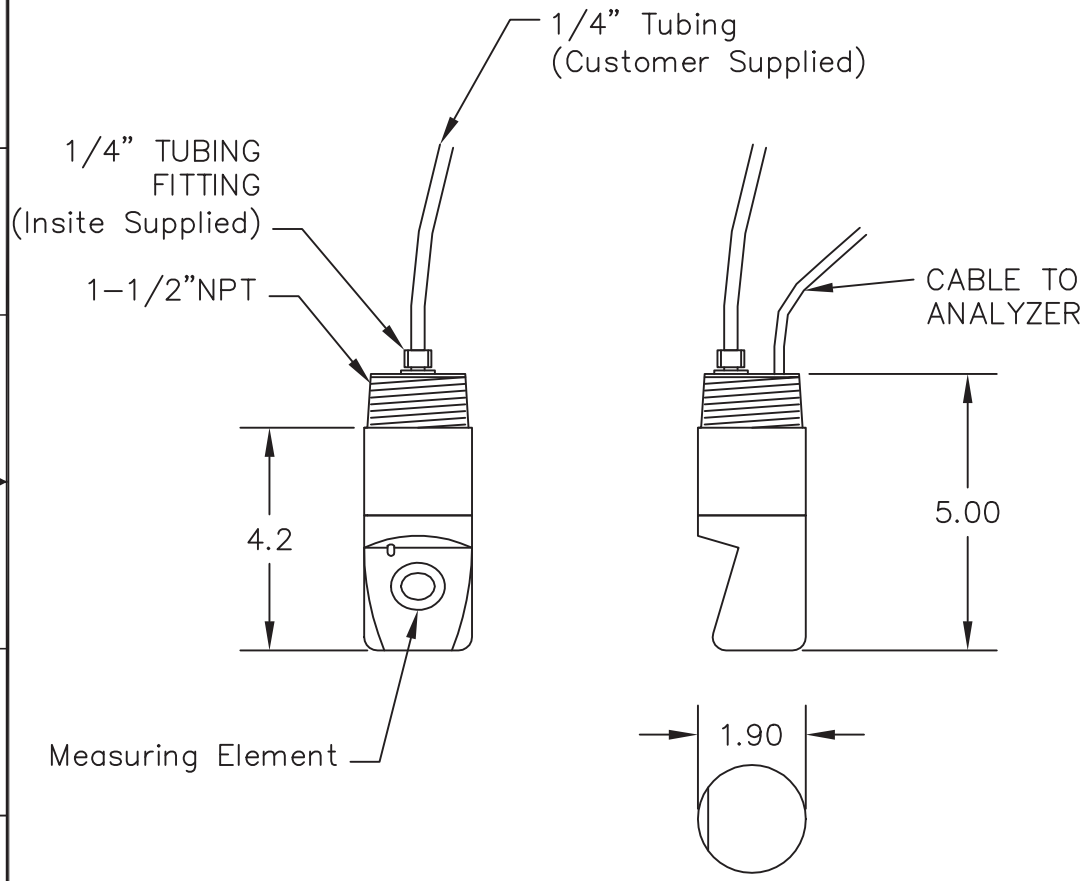


SIZE	DWG NO.	REV
C	IIG07R111	—
SCALE NTS		SHEET 2 OF 2

DWG. No IIG07R111 REV. —

IIG02N004 | C

REVISIONS				
ZONE	REV	DESCRIPTION	DATE	APPROVED



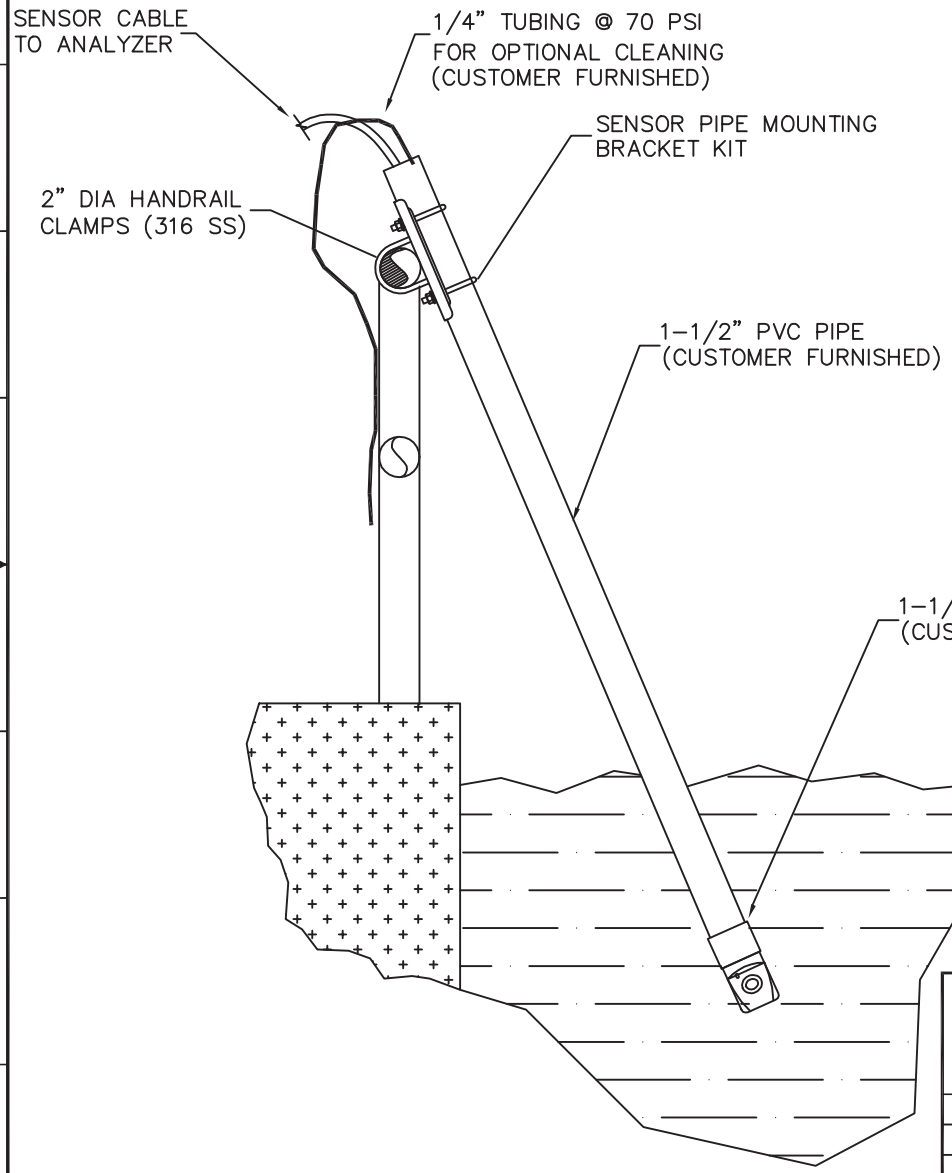
Notes:

1) Sensor Material: Epoxy, Polyurethane, PVC, 316 SS
2) Oxygen measurements should be take 2ft. below the surface and 3ft. from the wall.
3) Measurement element surface should not be facing downward in order to avoid collecting air bubbles.

UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES TOLERANCES ON: FRACTIONS DECIMALS ANGLES MATERIAL – SPEC FINISH –	CONTRACT NO.	InsiteIG 80 Whisperwood Blvd. Suite 107 Slidell, LA 70458
	SIGNATURES / DATES DRAFTSMAN CHECKER DESIGNER PROJ. ENGR. RELEASED APPROVAL	DO SENSOR OUTLINE & MOUNTING
		SIZE B | FSCM NO. | DRAWING NO. IIG02N004 | REV C
		SCALE NTS | SHEET 1 OF 1

IIG02N005 | A

REVISIONS				
ZONE	REV	DESCRIPTION	DATE	APPROVED



Notes:

1) For best accuracy, Oxygen measurements should be taken 2ft. below the surface and 3ft. from the wall.
2) Measurement element surface should not be facing directly upward or downward. Sensor should be clocked to the 3 or 9 o'clock position as shown.

UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES
TOLERANCES ON:
FRACTIONS
DECIMALS
ANGLES
MATERIAL _
SPEC
FINISH _

CONTRACT NO.

SIGNATURES	DATES
DRAFTSMAN	
CHECKER	
DESIGNER	
PROJ. ENGR.	
RELEASED	
APPROVAL	

InsiteIG
80 Whisperwood Blvd.
Suite 107
Slidell, LA 70458

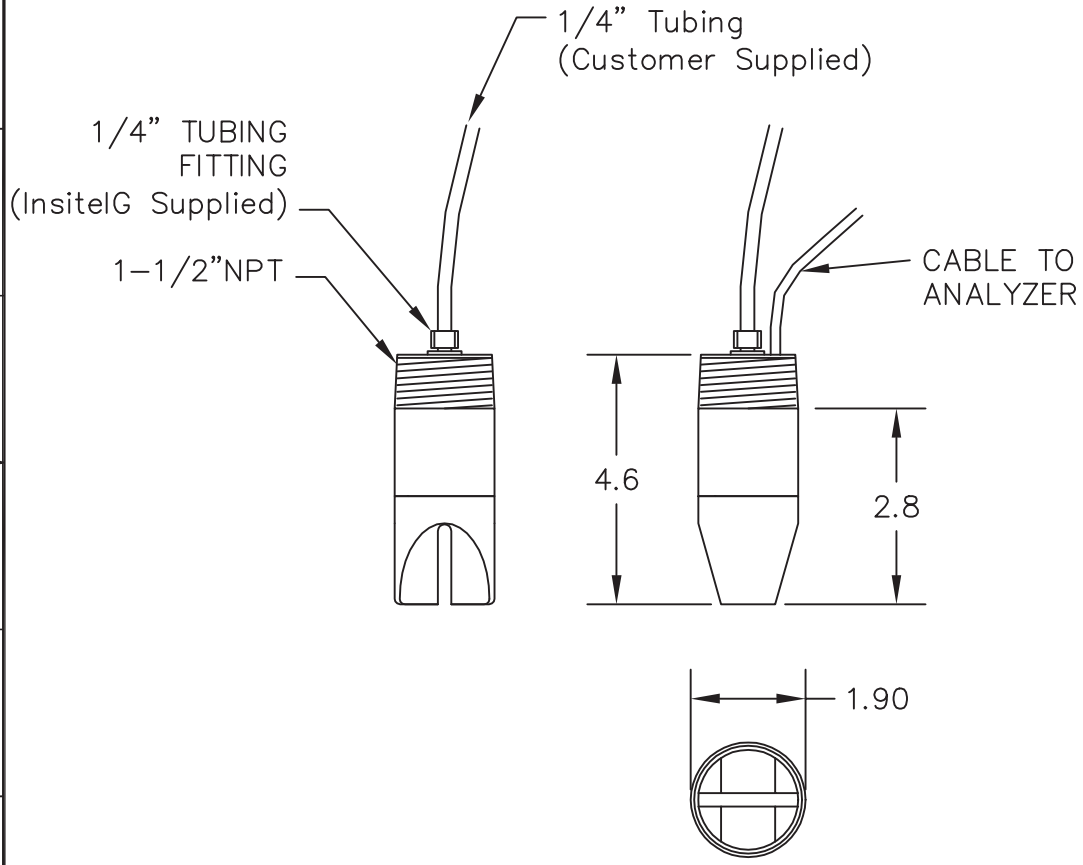
DO SENSOR MOUNTING

SIZE	FSCM NO.	DRAWING NO.	REV
B		IIG02N005	A

SCALE NTS | SHEET 1 OF 1

IIG03N004 | A

REVISIONS				
ZONE	REV	DESCRIPTION	DATE	APPROVED



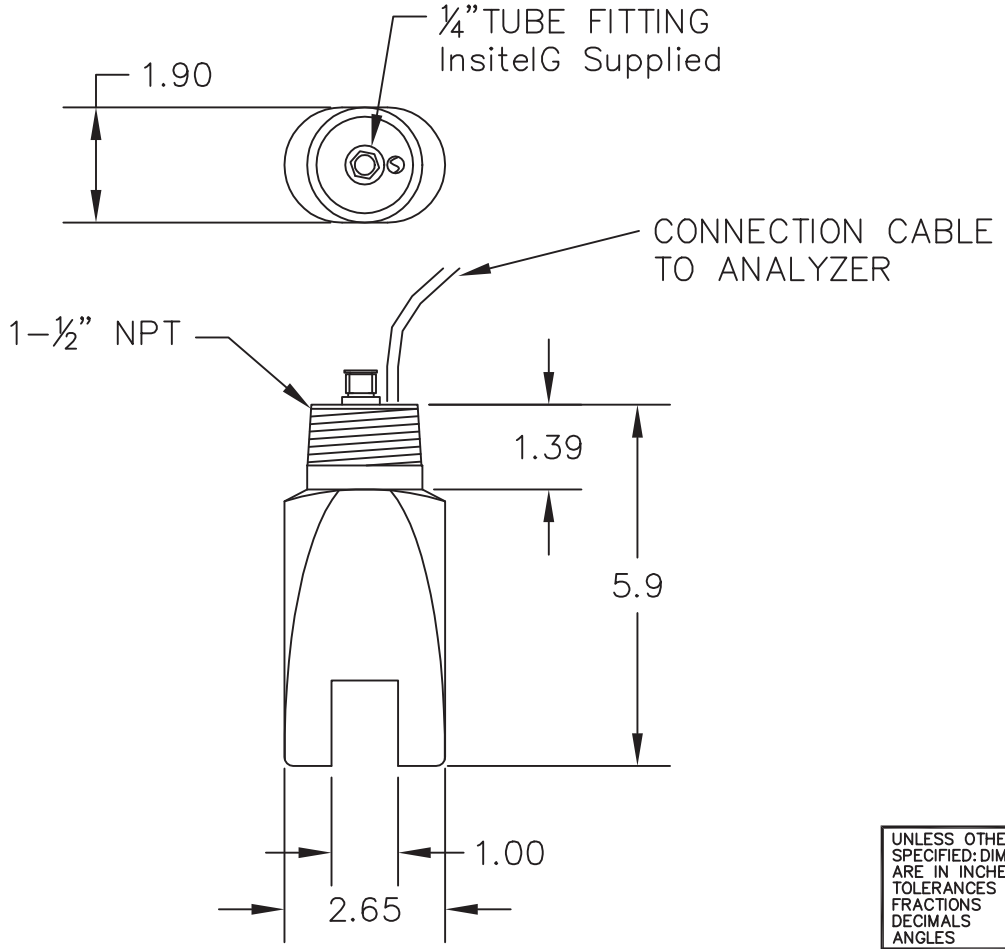
Notes:

1) Material: Epoxy, Polyurethane, & PVC
2) For best accuracy, Suspended Solids measurements should be taken 2ft. below the surface and 3ft. from the wall.

UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES TOLERANCES ON: FRACTIONS DECIMALS ANGLES	CONTRACT NO.	InsiteIG	80 Whisperwood Blvd. Suite 107 Slidell, LA 70458
MATERIAL _	SIGNATURES / DATES	TSS SENSOR OUTLINE & MOUNTING	
SPEC	DRAFTSMAN	SIZE: B	FSCM NO.
FINISH _	CHECKER	DRAWING NO.: IIG03N004	REV: A
	DESIGNER	SCALE: NTS	SHEET 1 OF 1
	PROJ. ENGR.		
	RELEASED		
	APPROVAL		

IIG03N010 | –

REVISIONS				
ZONE	REV	DESCRIPTION	DATE	APPROVED



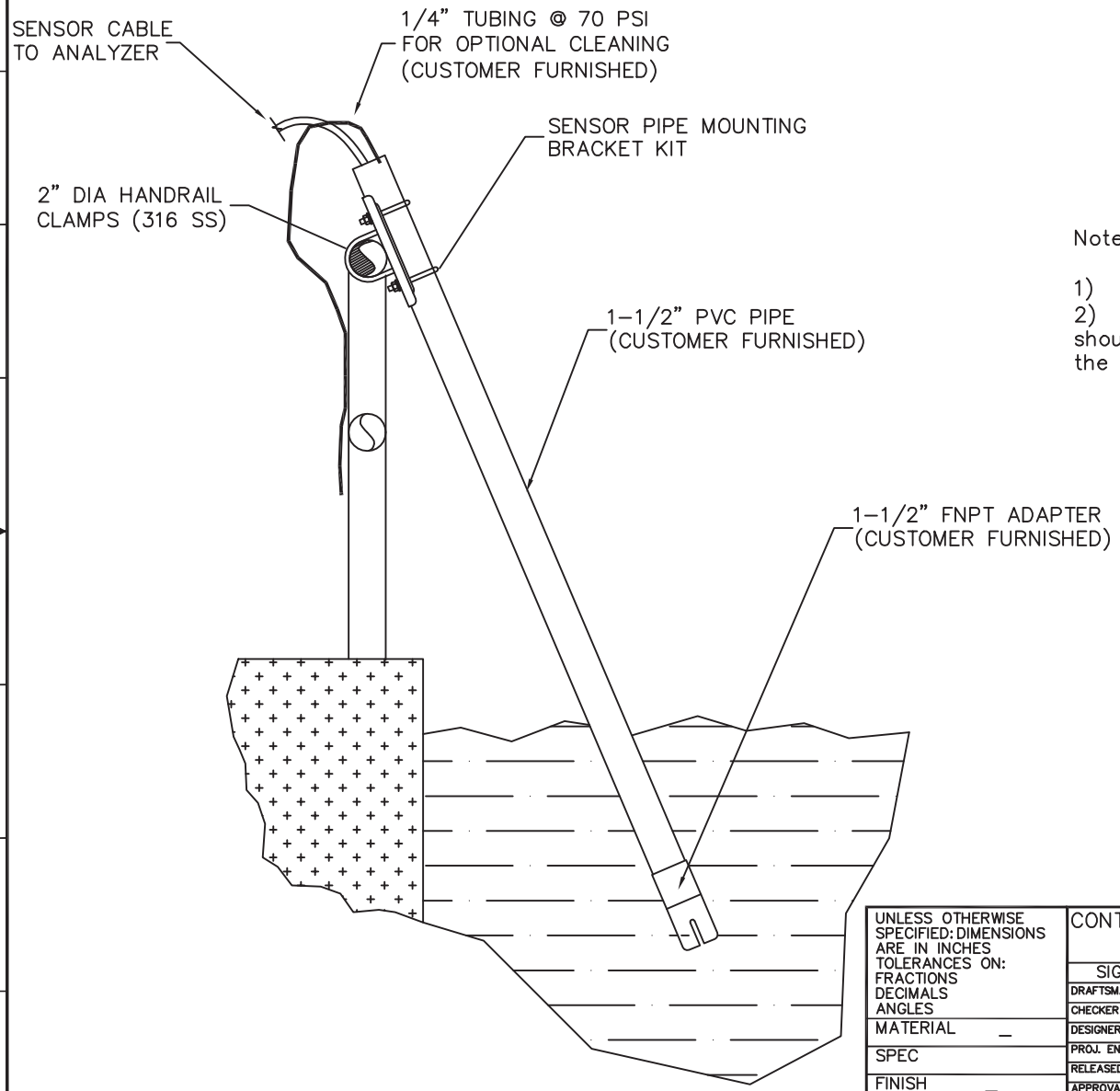
Notes:

1) Material: Epoxy, Polyurethane, & PVC
2) For best accuracy, Suspended Solids measurements should be taken 2ft. below the surface and 3ft. from the wall.

UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES TOLERANCES ON: FRACTIONS DECIMALS ANGLES	CONTRACT NO.	InsitelG 80 Whisperwood Blvd. Suite 107 Slidell, LA 70458
MATERIAL Listed	SIGNATURES / DATES	Outline & Mounting Low Range 15L/25L Sensor
SPEC	DRAFTSMAN	SIZE B | FSCM NO. | DRAWING NO. IIG03N010 | REV –
FINISH –	CHECKER	SCALE NTS | SHEET 1 OF 1
	DESIGNER	
	PROJ. ENGR.	
	RELEASED	
	APPROVAL	

IIG03N005 | A

REVISIONS				
ZONE	REV	DESCRIPTION	DATE	APPROVED



Notes:

1) Material: Epoxy, Polyurethane, & PVC
2) For best accuracy, Suspended Solids measurements should be taken 2ft. below the surface and 3ft. from the wall.

UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES
TOLERANCES ON:
FRACTIONS
DECIMALS
ANGLES
MATERIAL _
SPEC
FINISH _

CONTRACT NO.

SIGNATURES	DATES
DRAFTSMAN	
CHECKER	
DESIGNER	
PROJ. ENGR.	
RELEASED	
APPROVAL	

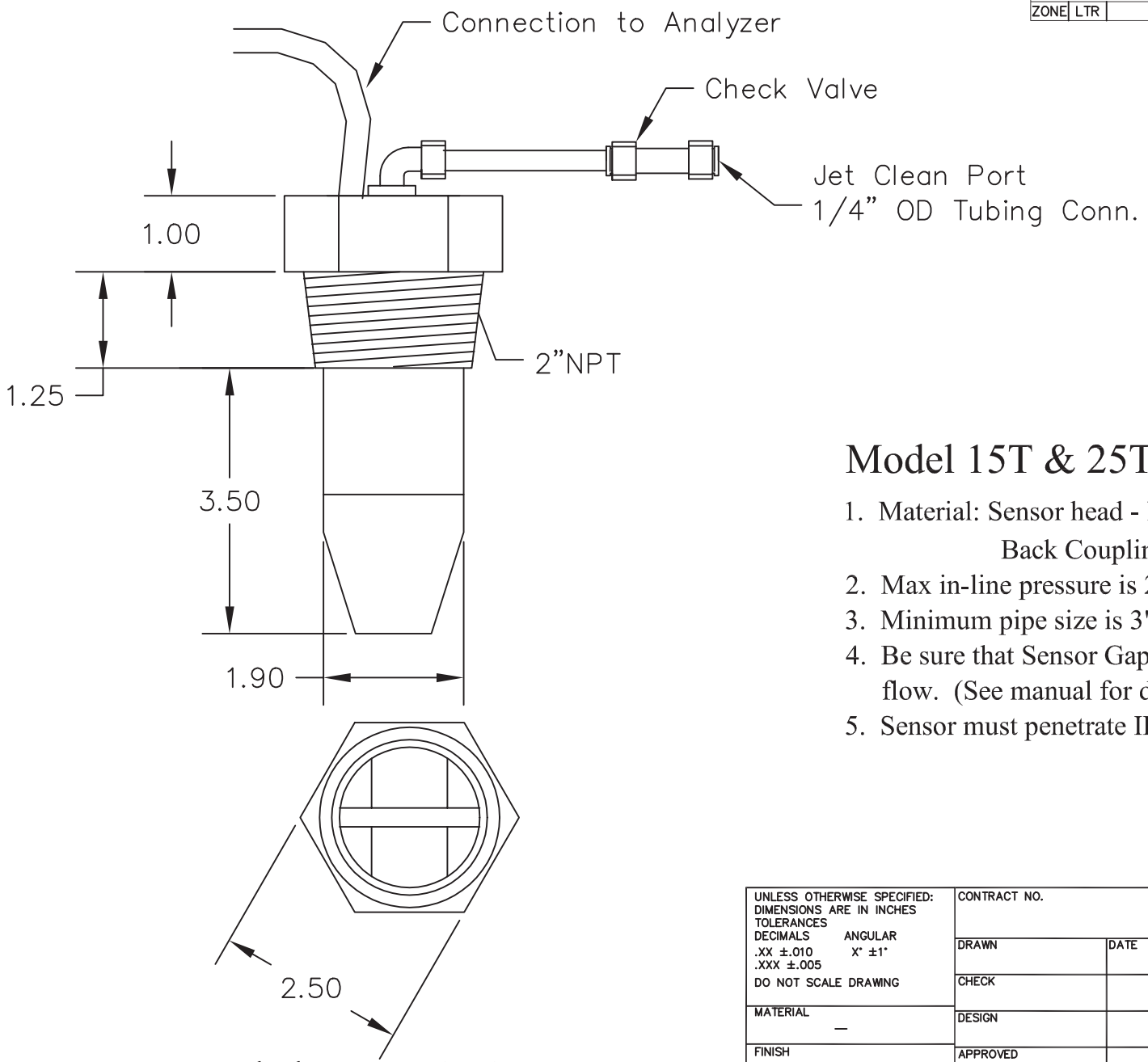
InsiteIG
80 Whisperwood Blvd.
Suite 107
Slidell, LA 70458

TSS SENSOR MOUNTING

SIZE	FSCM NO.	DRAWING NO.	REV
B		IIG03N005	A

SCALE NTS | SHEET 1 OF 1

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED



Model 15T & 25T

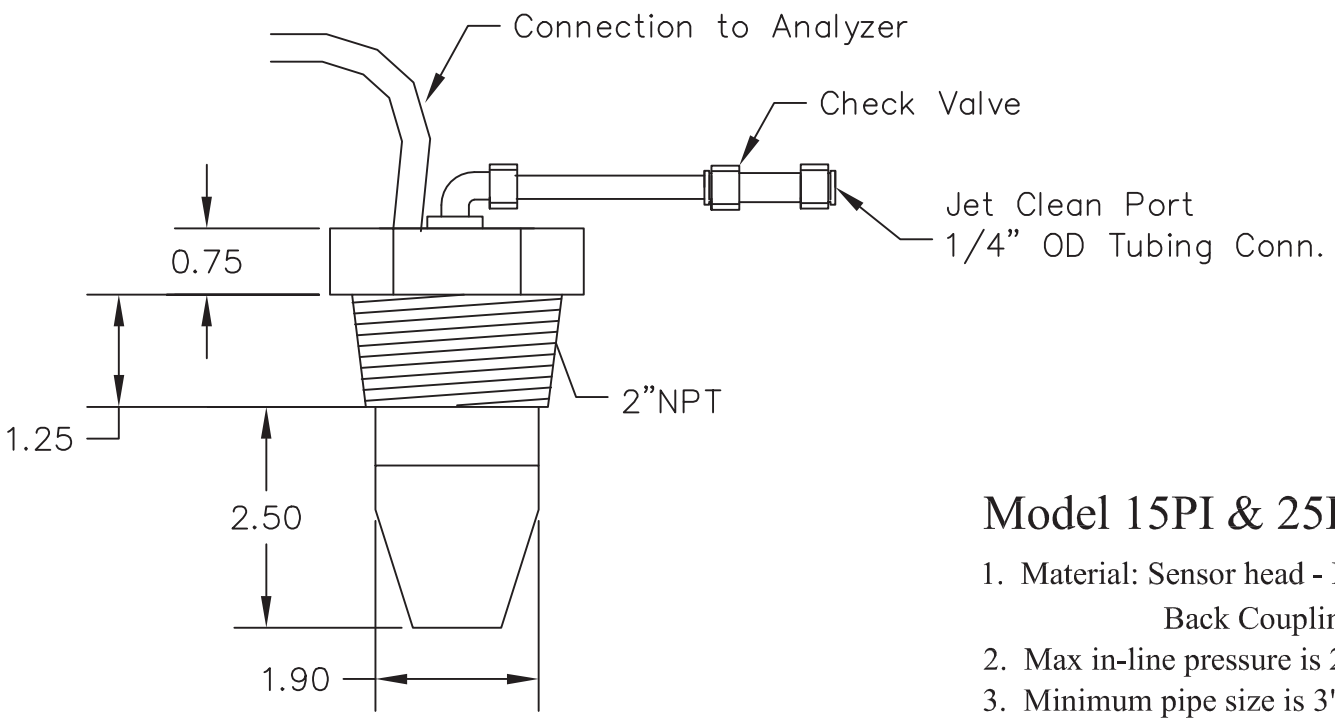
Model 15T & 25T Notes:

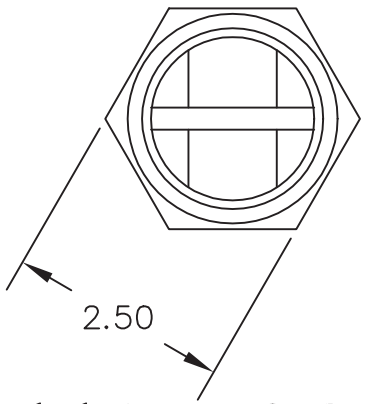
1. Material: Sensor head - Epoxy and Polyurethane
   Back Coupling - Gray PVC
2. Max in-line pressure is 20psi
3. Minimum pipe size is 3" nominal dia.
4. Be sure that Sensor Gap is in-line with sample flow. (See manual for details.)
5. Sensor must penetrate ID of the pipe by 1.5".

UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES TOLERANCES DECIMALS .XX ±.010 .XXX ±.005 ANGULAR X° ±1° DO NOT SCALE DRAWING	CONTRACT NO.	InsiteIG 80 Whisperwood Blvd. Suite 107 Slidell, LA 70458
MATERIAL –	DRAWN / DATE	TITLE: OUTLINE & MOUNTING MODEL 15T/PI & 25T/PI
FINISH –	CHECK	SIZE C / DWG NO. IIG03N006 / REV B
SPEC.	DESIGN	SCALE NTS / SHEET 1 OF 3
	APPROVED	
	CUSTOMER	

DWG. No IIG03N006 REV. B

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED





Model 15PI & 25PI

Model 15PI & 25PI Notes:

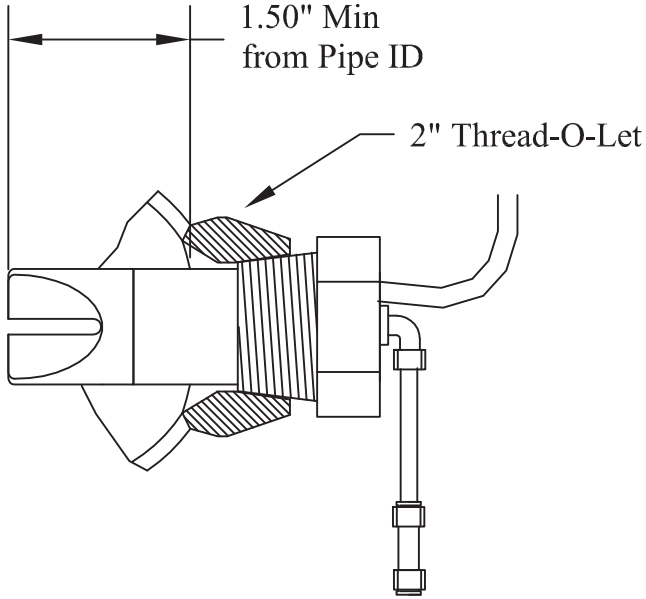
1. Material: Sensor head - Epoxy and Polyurethane
   Back Coupling - 316 Stainless Steel, Passivated
2. Max in-line pressure is 20psi
3. Minimum pipe size is 3" nominal dia.
4. Be sure that Sensor Gap is in-line with sample flow. (See manual for details.)
5. Sensor must penetrate ID of the pipe by 1.5".

REV. D

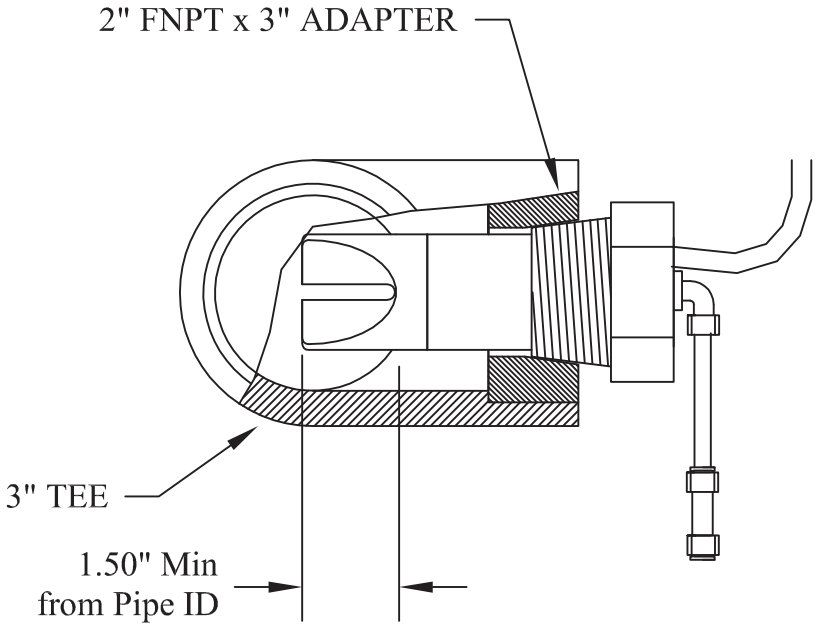
DWG. No IIG03N006

SIZE	DWG NO.	REV
C	IIG03N006	B
SCALE NTS		SHEET 2 OF 3

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED



Thread–O–Let
Installation

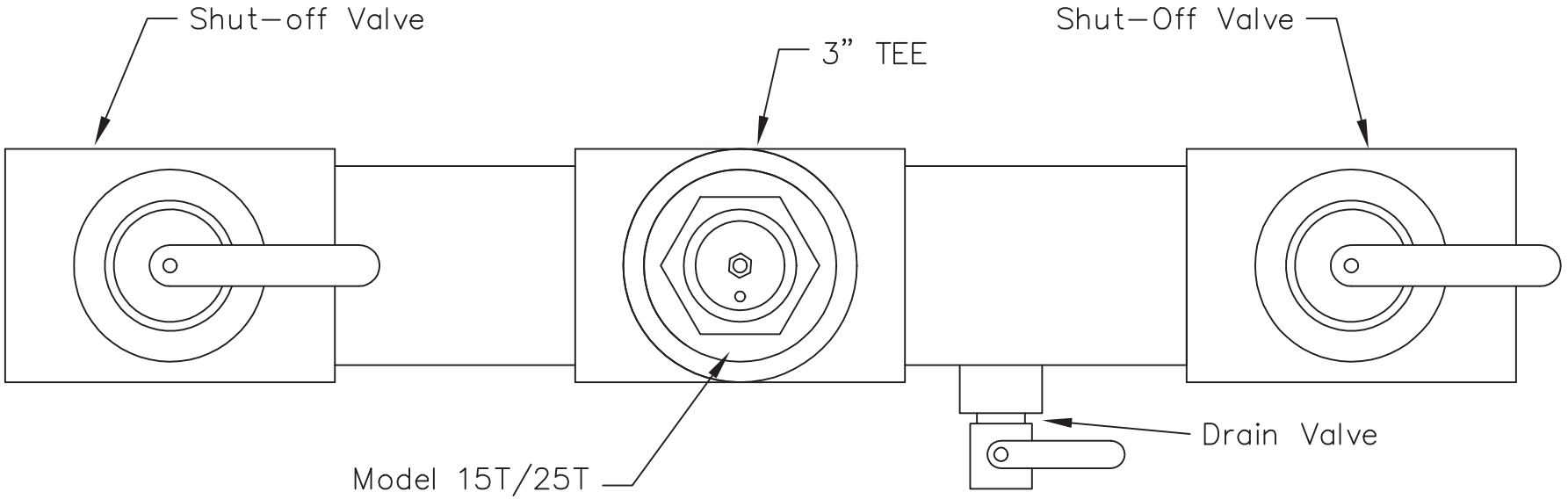


PVC TEE Installation

SIZE	DWG NO.	REV
C	IIG03N006	B
SCALE NTS		SHEET 3 OF 3

REV. B
DWG. No IIG03N006

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED

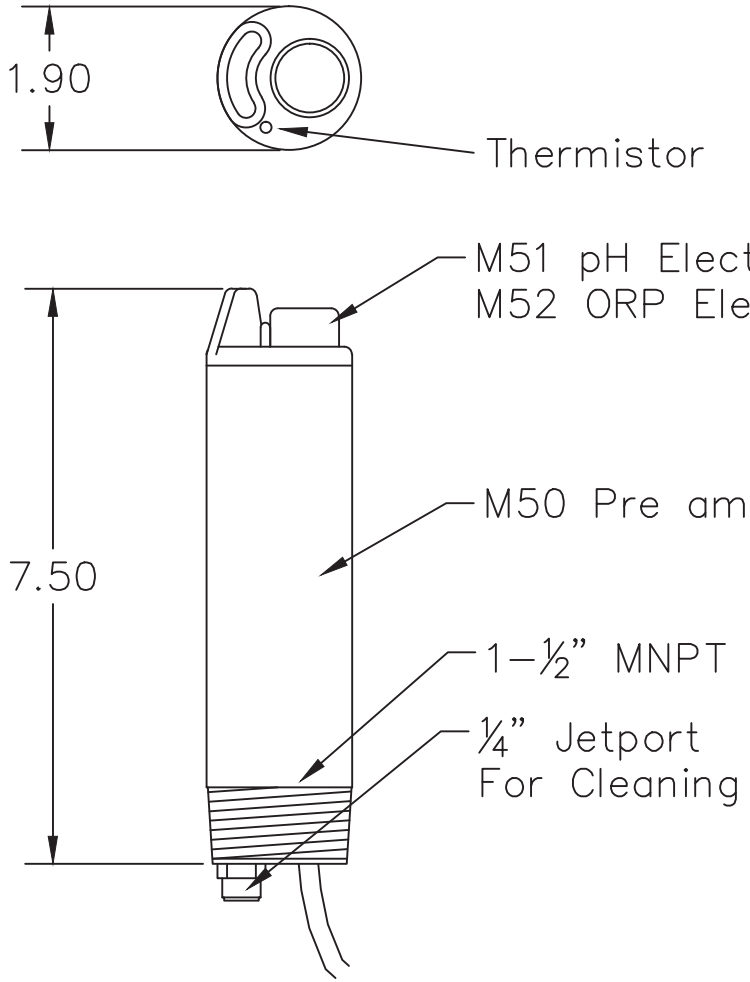


Sample By–Pass Line

DWG. No IIG03N007 REV. –

UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES TOLERANCES DECIMALS ANGULAR .XX ±.010 X° ±1° .XXX ±.005 DO NOT SCALE DRAWING	CONTRACT NO.	InsiteIG 80 Whisperwood Blvd. Suite 107 Slidell, LA 70458
MATERIAL –	DRAWN / DATE	TITLE INSTALLATION DIAGRAM MODEL 15T/25T
FINISH –	CHECK / DESIGN / APPROVED	SIZE C · DWG NO. IIG03N007 · REV –
SPEC.	CUSTOMER	SCALE NTS · SHEET 1 OF 1

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED



Notes:
1) Material:
   M50 – PVC, Polyurethane and Viton O–rings
   M51 – Flat Glass Double Junction w/Viton O–rings
   M52 – Flat Glass Double Junction w/Viton O–rings
2) Temperature Range – 10 to 100°C
3) Cable length 33'
4) Operating Range:
   M51 – 2 to 12pH
   M52 – ±2000mV

REV. A
DWG. No IIG07N201

UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES TOLERANCES DECIMALS .XX ±.010 .XXX ±.005 ANGULAR X° ±1° DO NOT SCALE DRAWING	CONTRACT NO.	InsiteIG 80 Whisperwood Blvd. Suite 107 Slidell, LA 70458
MATERIAL –	DRAWN / DATE	TITLE OUTLINE & MOUNTING 28 & 50 SERIES pH/ORP
FINISH –	CHECK	SIZE C / DWG NO. IIG07N201 / REV A
SPEC.	DESIGN	SCALE NTS / SHEET 1 OF 1
	APPROVED	
	CUSTOMER	

Appendix A - Modbus Protocol

Insite IG analyzers support communication with other devices via the Modbus protocol using RTU transmission mode. The Modbus protocol defines a message structure that controllers will recognize and use, regardless of the type of networks over which they communicate. It establishes a common format for the layout and contents of message fields. Transactions use a master-slave technique, in which only one device (the master) can initiate transactions (called queries). The other devices (the slaves) respond by supplying the requested data to the master and by taking the action requested in the query. Insite IG analyzers operate as slaves to other modbus devices.

Message framing

Messages start with a silent interval of at least 3.5 character times followed by 4 fields and then followed by another silent interval of at least 3.5 character times. The first field contains the device address. The second field contains the function code. The third field contains the data. The fourth field contains the CRC value. Each byte has 1 start bit, 8 data bits, no parity, and 1 stop bit.

Address field

The address field contains one byte. Valid slave device addresses are in range 1 to 247 decimal.

Function code field

The function code field contains one byte. See the section titled Function codes supported by the MPA-48.

Data field

The data field contains one or more byte. This information is used by the analyzers to take the action defined by the function code.

CRC field

The CRC (cyclical redundancy check) field is two bytes, containing a 16-bit binary value. The CRC value is calculated by the transmitting device, which appends the CRC to the message. The receiving device recalculates a CRC during receipt of the message, and compares the calculated value to the actual value it received in the CRC field. If the two values are not equal, the message will be discarded.

The CRC is started by first preloading a 16-bit register to all 1's. Then a process begins of applying successive 8-bit bytes of the message to the current contents of the register. During the generation of the CRC, each 8-bit character is exclusive ORed with the register contents. Then the result is shifted in the direction of the least significant bit (LSB), with a zero filled into the most significant bit (MSB) position. The LSB is extracted and examined. If the LSB was a 1, the register is then exclusive ORed with a preset fixed value. If the LSB was a 0, no exclusive OR takes place.

The process is repeated until eight shifts have been performed. After the last (eight) shift, the next 8-bit byte is exclusive ORed with the register's current value, and the process repeats for eight more shifts as described above. The final contents of the register, after all the bytes of the message have been applied, is the CRC value.

When the CRC is appended to the message, the low-order byte is appended first, followed by the high-order byte.

Function codes supported by the MPA-48

01 Read Coil Status

Description
Reads the ON/OFF status of the relays in the MPA-48 analyzer.

Query
The query message specifies the starting relay and quantity of relays to be read. Relays are addressed starting at zero. Relays 1 – 8 are addressed as 0 – 7.

Below is an example of a request to read relays 1 – 8 from MPA-48 with slave address 1.

Field Name	Example
Slave Address	01
Function	01
Starting Address Hi	00
Starting Address Lo	00
No. of Relays Hi	00
No. of Relays Lo	08
CRC	--

The coil status in the response message is packed as one relay per bit of the data field. Status is indicated as: 1 = ON; 0 = OFF. The LSB of the first data byte contains the relay addressed in the query. The other relays follow toward the high order end of this byte.

Below is an example of a response to the previous query.

Field Name	Example
Slave Address	01
Function	01
Byte Count	01
Data	05
CRC	--

The status of relays 1 and 3 is ON and the status of relays 2, 4, 5, 6, 7 and 8 is OFF.

04 Read Input Registers

Reads the binary contents of input registers in the MPA-48 analyzer.

Query
The query message specifies the starting register address and the quantity of registers to be read.

The MPA-48 input registers are as follows:

Address	Register
0000	Channel 1 status
0001	Channel 1 primary measurement
0002	Channel 1 secondary measurement
0003	Channel 2 status
0004	Channel 2 primary measurement
0005	Channel 2 secondary measurement
0006	Channel 3 status
0007	Channel 3 primary measurement
0008	Channel 3 secondary measurement
0009	Channel 4 status
000A	Channel 4 primary measurement
000B	Channel 4 secondary measurement
000C	Channel 5 status
000D	Channel 5 primary measurement
000E	Channel 5 secondary measurement
000F	Channel 6 status
0010	Channel 6 primary measurement
0011	Channel 6 secondary measurement
0012	Channel 7 status
0013	Channel 7 primary measurement
0014	Channel 7 secondary measurement
0015	Channel 8 status
0016	Channel 8 primary measurement
0017	Channel 8 secondary measurement
0022	Last 4 digits of the channel 1 sensor serial number
0027	Last 4 digits of the channel 2 sensor serial number
002C	Last 4 digits of the channel 3 sensor serial number
0031	Last 4 digits of the channel 4 sensor serial number
0036	Last 4 digits of the channel 5 sensor serial number
003B	Last 4 digits of the channel 6 sensor serial number
0040	Last 4 digits of the channel 7 sensor serial number
0045	Last 4 digits of the channel 8 sensor serial number

The Model 10 sensor will report the channel status as follows:

Status	Description
0000	Normal
0001	Sensor not responding
0002	Sensor error
0003	New sensor codes needed

The Model 10 sensor will report D.O. as the primary measurement and temperature as the secondary measurement. The units for D.O. are hundredths of ppm and the units for temperature are tenths of ℃.

The Model 15/15L sensor will report the channel status as follows:

Status	Description
0000	Normal
0001	Sensor not responding
0002	Sensor error
0003	Sensor requires a zero calibration

The Model 15/15L sensor will report TSS as the primary measurement and the secondary measurement is undefined. The units for TSS are mg/l.

The Model 51/52 sensor will report the channel status as follows:

Status	Description
0000	Normal
0001	Sensor not responding
0002	Sensor error
0003	Sensor error

The Model 51 sensor will report pH as the primary measurement and temperature as the secondary measurement. The units for pH are hundredths of pH and the units for temperature are tenths of °C.

The Model 52 sensor will report ORP as the primary measurement and the secondary measurement is undefined. The units for ORP are mV with a 2000 mV bias to make all readings positive.

Below is an example of a request to read the channel 2 status and channel 2 primary and secondary measurement registers from an analyzer with the slave address of 1.

Field Name	Example
Slave Address	01
Function	04
Starting Address Hi	00
Starting Address Lo	03
No. of Regs. Hi	00
No. of Regs. Lo	03
CRC	--

Below is an example of a response to the previous query where channel 2 is connected to a Model 10 D.O. sensor measuring 8.3 ppm at 25.0°C.

Field Name	Example
Slave Address	01
Function	04
Byte Count	06
Data Hi (Reg 3)	00
Data Lo (Reg 3)	00
Data Hi (Reg 4)	03
Data Lo (Reg 4)	3E
Data Hi (Reg 5)	00
Data Lo (Reg 5)	FA
CRC	--

06 Preset Single Register

Presets a value into a single register of the MPA-48 analyzer.

Query

The query message specifies the register to be preset. The demand clean cycle register is the only register in the MPA-48 which can be written to. When any value is written to this register, a clean cycle is initiated. The address of the demand clean cycle register is 238C (hex).

Below is an example of a request for a demand clean cycle on an analyzer with the slave address of 1.

Field Name	Example
Slave Address	01
Function	06
Reg. Address Hi	23
Reg. Address Lo	8C
Data Hi	00
Data Lo	00
CRC	--

The normal response is an echo of the query.

17 Report Slave ID

Returns a description of the type of device at the slave address.

Query
Below is an example of a request to report the ID and status of slave address 1.

Field Name	Example
Slave Address	01
Function	11
CRC	--

The normal response of the MPA-48 is shown below.

Field Name	Example
Slave Address	01
Function	11
Byte Count	0A
Slave ID	30
Run status	00=Off, FF = On
Ch 1 sensor type	00=Model 10, 10=Model 15, 20=Model 15L, 30=Model 51, 31=Model 52
Ch 2 sensor type	00=Model 10, 10=Model 15, 20=Model 15L, 30=Model 51, 31=Model 52
Ch 3 sensor type	00=Model 10, 10=Model 15, 20=Model 15L, 30=Model 51, 31=Model 52
Ch 4 sensor type	00=Model 10, 10=Model 15, 20=Model 15L, 30=Model 51, 31=Model 52
Ch 5 sensor type	00=Model 10, 10=Model 15, 20=Model 15L, 30=Model 51, 31=Model 52
Ch 6 sensor type	00=Model 10, 10=Model 15, 20=Model 15L, 30=Model 51, 31=Model 52
Ch 7 sensor type	00=Model 10, 10=Model 15, 20=Model 15L, 30=Model 51, 31=Model 52
Ch 8 sensor type	00=Model 10, 10=Model 15, 20=Model 15L, 30=Model 51, 31=Model 52
CRC	--

Exception Responses

If the MPA-48 analyzer receives a query without a communication error, but cannot handle it, an exception response will be returned.

In a normal response, the MPA-48 echoes the function code of the original query in the function code field of the response. In an exception response, the MPA-48 sets the MSB of the function code to 1. This makes the function code value in an exception response exactly 80 hexadecimal higher than the value would be for a normal response.

The data field in an exception response contains an exception code. The exception codes supported by the MPA-48 are:

Exception code	Description
01	Illegal function code
02	Illegal data address

Appendix B – Jet Clean System

The InsiteIG cleaning system uses a pressurized stream of air or water to remove bio growth or other debris from the optical surfaces of our sensors. The InsiteIG analyzers control the frequency and duration of the clean cycle through clean relays (see drawing IIG07R112, IIG07R113, IIG07R114 and IIG07R116). These relays are programmable through the setup menu, see Relays section of this manual for more detail.

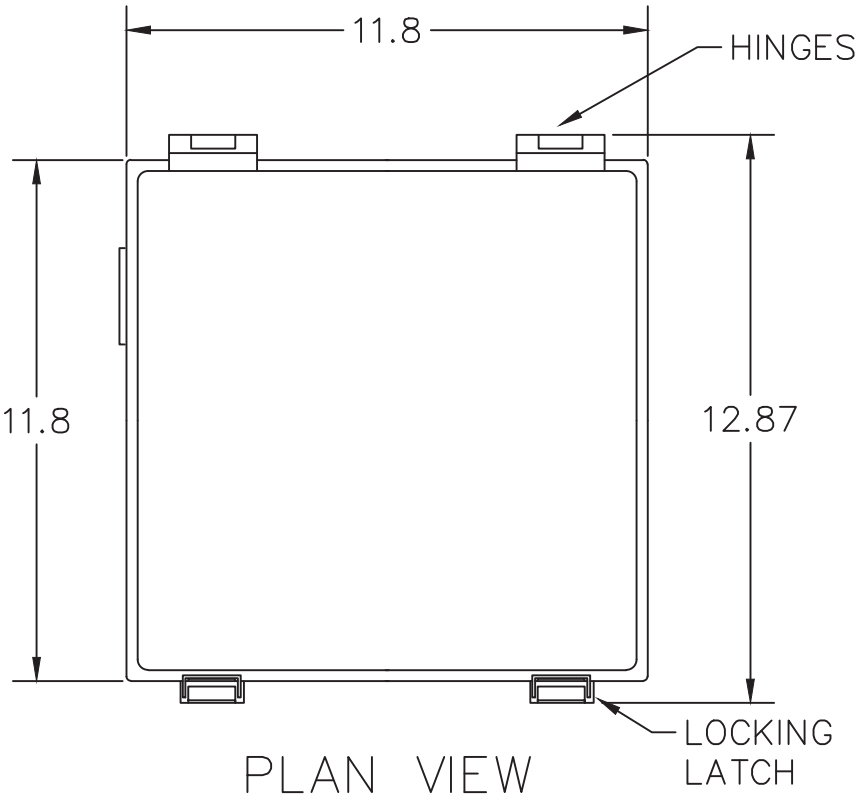
The InsiteIG Model CA Compressors consists of a compressor pump which delivers a sufficient blast of air to clean debris from the optics in most wastewater treatment plant basins and a directional solenoid valves to blast the sensors on two or four channels independently. A CA-2 compressor is need for each pair of sensors and the CA-4 compressor is need for each set of four sensors. It is housed in a UL, NEMA 4X enclosure (see drawing IIG01N030 for CA-2 and IIGN031 for CA-4) with quick disconnect ¼" tubing fittings provided on the bottom of the enclosure. The power requirements are 110/120 VAC @ 50/60 Hz and 1.8A. The unit is fused at 3 amps with a 1¼ x ¼" time delay fuse. The ambient operating conditions are a temperature of 0 degree Celsius to 55 degree Celsius and 0 to 100% humidity. A ¼" OD flexible tube with a 70 psi rating (customer supplied) connects the sensors to the compressor assembly. Quick disconnect fitting are supplied on both the sensor heads and compressor. The tubing length should be as short and possible. (If over 100' please consult the factory)

The compressor system should be mounted as close to the sensor as possible. The tubing connection, input power and relay connection to the analyzer are on the bottom of the enclosure. Handrail brackets are available for the compressor enclosure. See drawing IIG01N030 and IIG07R112, IIG07R114, IIG07R116.

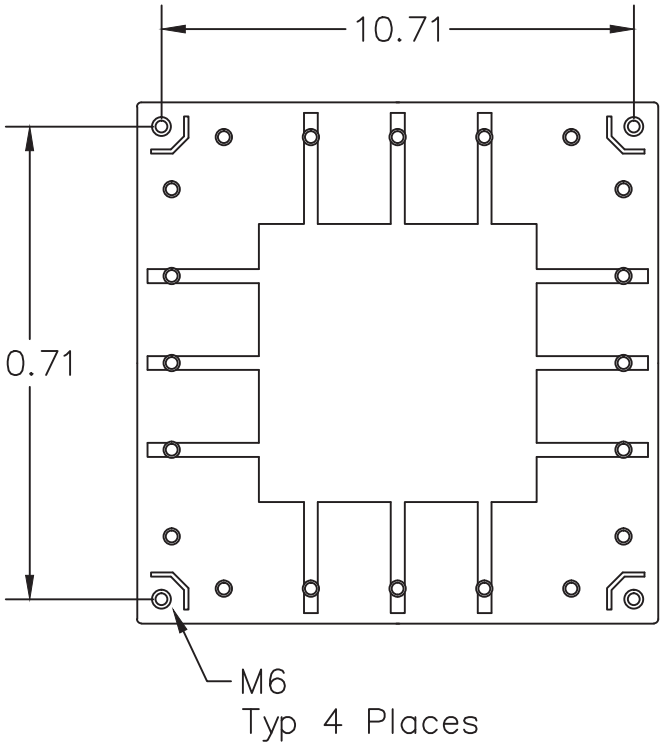
If plant water is being used, or shop air, the customer must supply clean water at 35 to 50 psig or air at 40 to 60 psig. A 2-way solenoid valve (customer supplied) may be used to turn on and off the water to two or more sensor heads. A ¼" quick disconnect fitting is supplied with the sensor. See drawing IIG07R113 for wire details. There are no changes required in the sensor head for use with water or shop air. Additional solenoids valves can be added in series for additional channels. One solenoid valve per channel may be used so that the cleaning blast is not divided.

All of the InsiteIG sensors have the jet clean design built-into the sensor housing. The sensors are constructed of impact resistant epoxies and polyurethanes, suitable for most waste treatment. The nozzle aims the water, or air, stream across the optics of the sensor, removing any debris that may cause fouling.

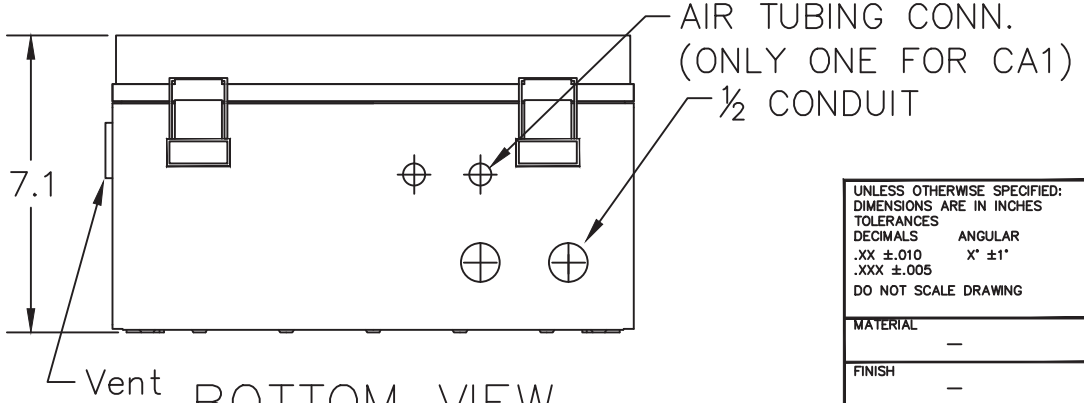
REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED



PLAN VIEW



BACK VIEW

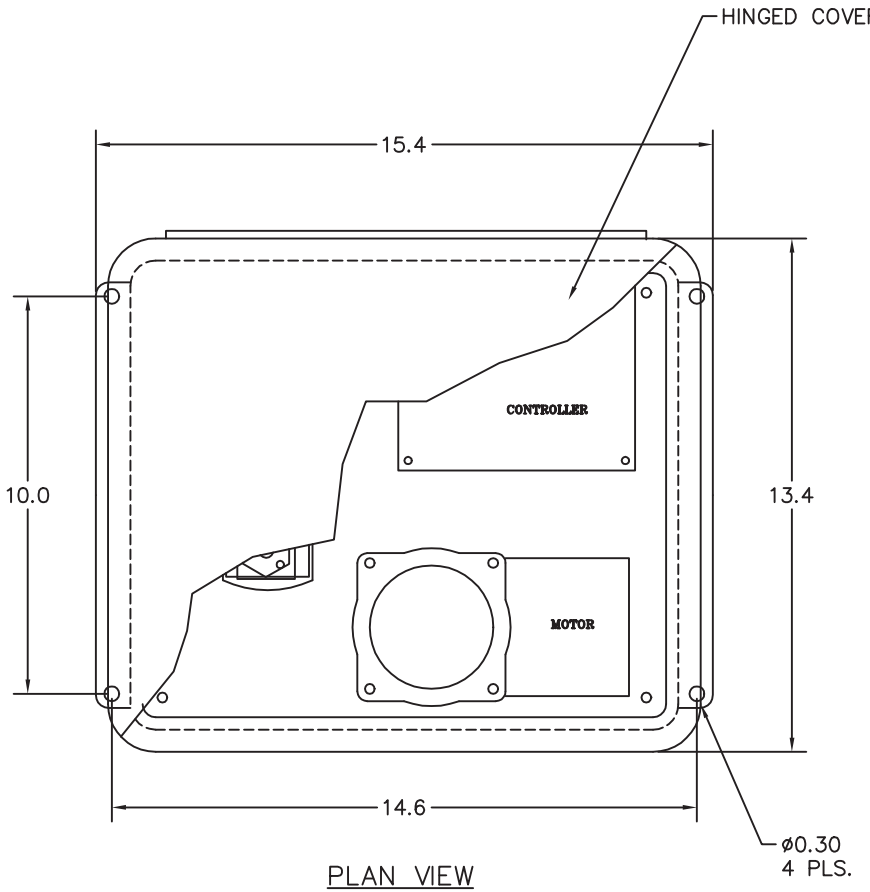


BOTTOM VIEW

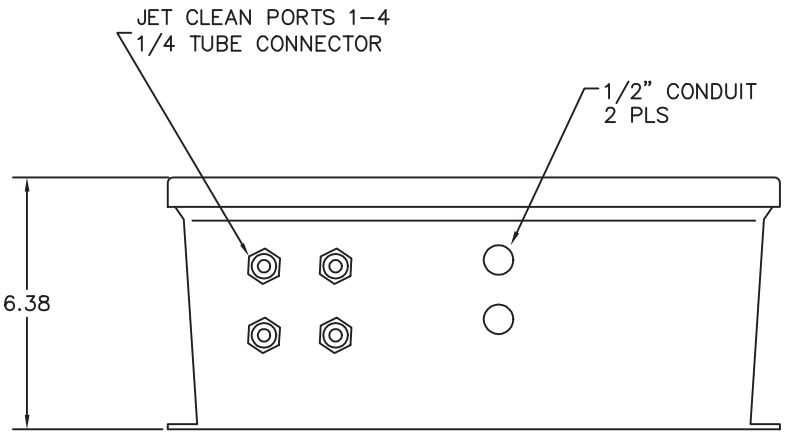
UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES TOLERANCES DECIMALS .XX ±.010 .XXX ±.005 ANGULAR X° ±1° DO NOT SCALE DRAWING	CONTRACT NO.		Insite IG 1550 W. Lindburg Dr. Slidell, LA 70458
	DRAWN D. RADLE	DATE 1/29/02	TITLE OUTLINE & MOUNTING MODEL CA1 & CA2 COMPRESSOR
	CHECK		
MATERIAL –	DESIGN D. RADLE	1/29/02	
FINISH –	APPROVED		SIZE C DWG NO. IIG01N030 REV A
SPEC.	CUSTOMER		SCALE NTS SHEET 1 OF 1

DWG. No IIG01N030 REV. A

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED



PLAN VIEW



PLAN VIEW

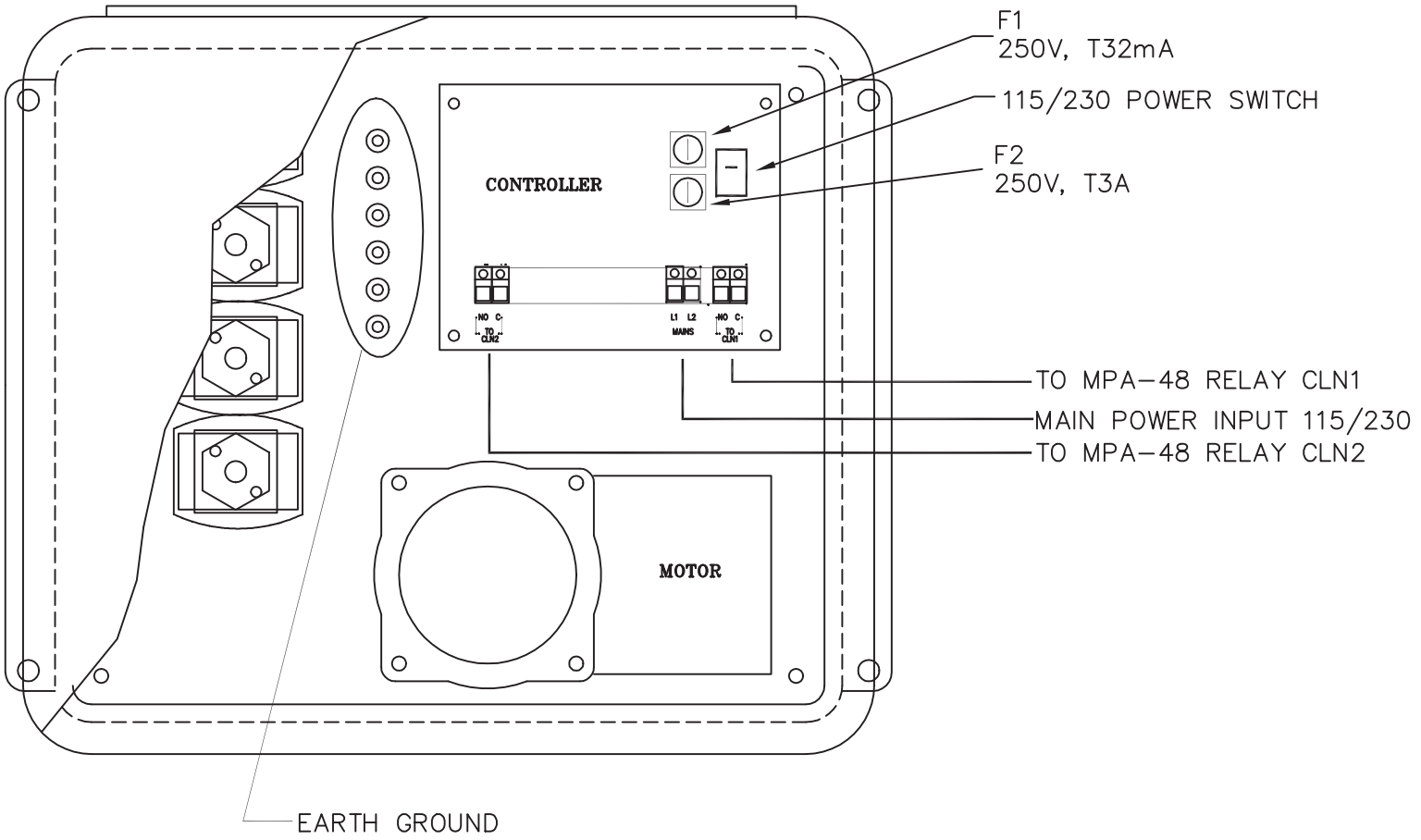
NOTES:
1) Material: Stahlin Fiberglass Enclosure #J1412HW

REV. X1

DWG. No IIG07N031

UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES TOLERANCES DECIMALS .XX ±.010 .XXX ±.005 ANGULAR X° ±1° DO NOT SCALE DRAWING D. RADLE 1/29/02	CONTRACT NO.	Insite IG 1550 W. Lindburg Dr. Slidell, LA 70458
MATERIAL —	DRAWN / DATE	TITLE OUTLINE & MTG DETAIL CA4 COMPRESSOR
FINISH D. RADLE 1/29/02 —	CHECK / DESIGN / APPROVED	SIZE C · DWG NO. IIG07N031 · REV X1
SPEC.	CUSTOMER	SCALE NTS · SHEET 1 OF 1

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED



PLAN VIEW

UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES TOLERANCES DECIMALS ANGULAR .XX ±.010 X° ±1° .XXX ±.005 DO NOT SCALE DRAWING	CONTRACT NO.	
MATERIAL –	DRAWN	DATE
FINISH –	CHECK	
SPEC.	DESIGN	
	APPROVED	
	CUSTOMER	

Insite IG 1550 W. Lindburg Dr.
Slidell, LA 70458

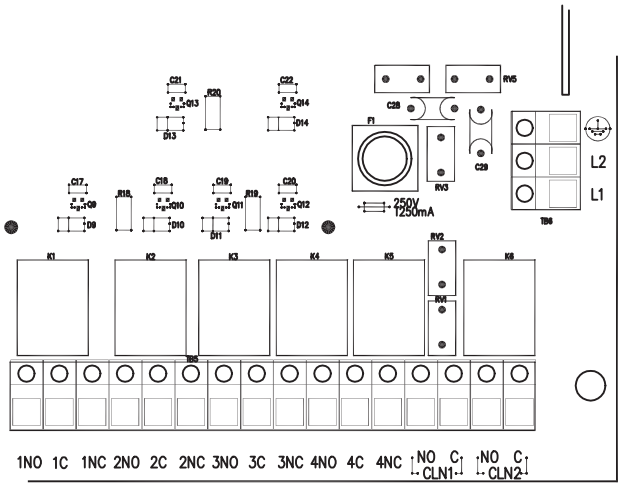
TITLE CUSTOMER CONNECTION
CA4 COMPRESSOR

SIZE	DWG NO.	REV
C	IIG07R031	–

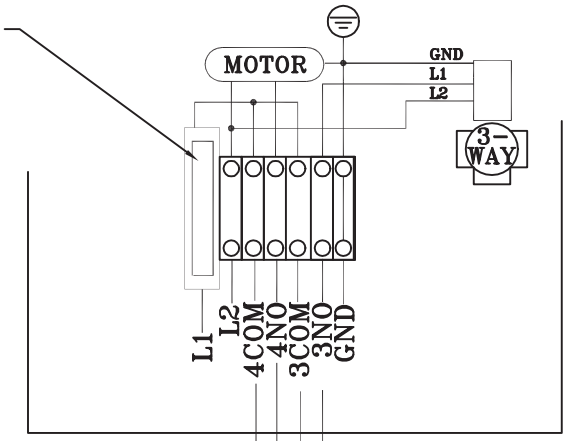
SCALE NTS SHEET 1 OF 1

DWG. No IIG07R031 REV. –

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED



1-1/4" x 1/4"
3 AMP FUSE
MAX WITH
TIME DELAY
(GDC TYPE)



CUSTOMER SUPPLIED
4 CONDUCTOR CONNECTION
18 AWG OR LARGER (2AMP)
RATED FOR 115/230 VAC

ANALYZER CONNECTIONS

COMPRESSOR CONNECTIONS
INSITE IG – MODEL CA2

MPA-48	CA-2 COMPRESSOR
CLN1 - NO	4-NO
CLN1 - C	4-COM
CLN2 - NO	3-NO
CLN2 - C	3-COM

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES
TOLERANCES
DECIMALS ANGULAR
.XX ±.010 X° ±1°
.XXX ±.005
DO NOT SCALE DRAWING

MATERIAL –

FINISH –

SPEC.

CONTRACT NO.

DRAWN DATE

CHECK D. RADLE

DESIGN

APPROVED D. RADLE

CUSTOMER

Insite IG
80 Whisperwood Blvd.
Suite 107
Slidell, LA 70458

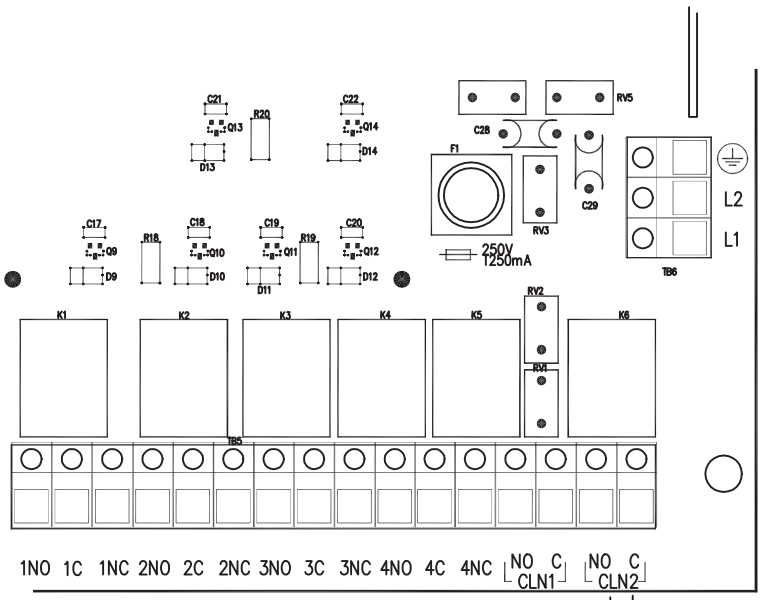
TITLE
MODEL CA2 CONNECTION
INSITE IG MPA-48

SIZE	DWG NO.	REV
C	IIG07R112	–

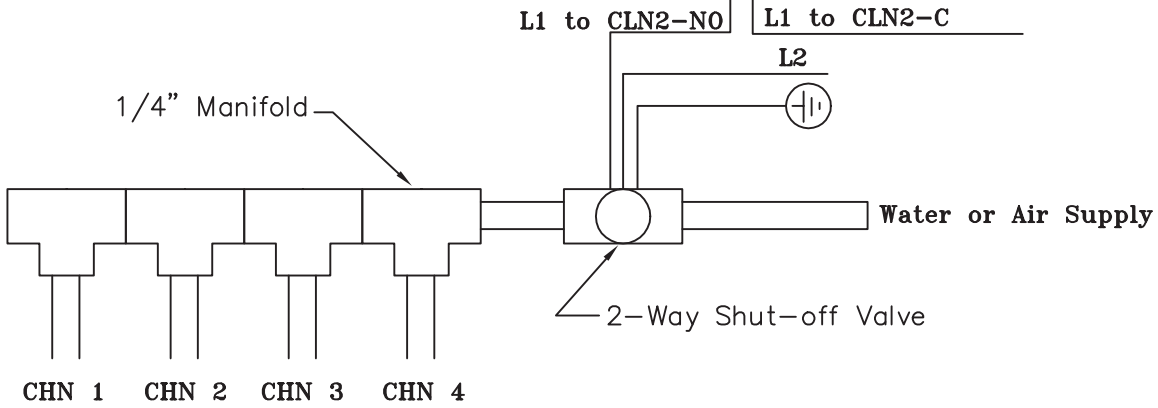
SCALE NTS SHEET 1 OF 1

DWG. No IIG07R112 REV. –

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED



ANALYZER CONNECTIONS



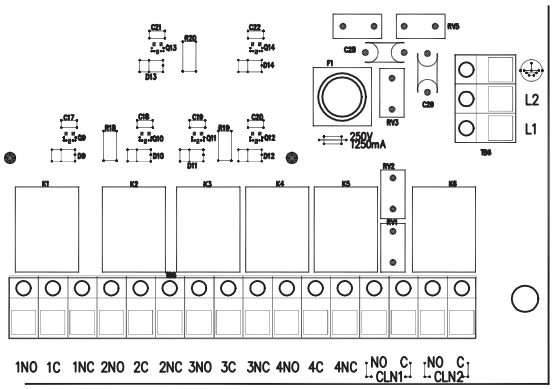
NOTES:

1. All solenoid wiring should be per National Electric Code.
2. Solenoids are general duty suitable for air and water to maximize flow at maximum pressure of 60 psi.

UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES TOLERANCES DECIMALS .XX ±.010 .XXX ±.005 ANGULAR X° ±1° DO NOT SCALE DRAWING	CONTRACT NO.	Insite IG 80 Whisperwood Blvd. Suite 107 Slidell, LA 70458
MATERIAL –	DRAWN D. RADLE / DATE	TITLE SOLENOID JET CONNECTION InsiteIG MPA-48
FINISH –	CHECK	
SPEC.	DESIGN D. RADLE	SIZE C / DWG NO. IIG07R113 / REV –
	APPROVED	SCALE NTS / SHEET 1 OF 1
	CUSTOMER	

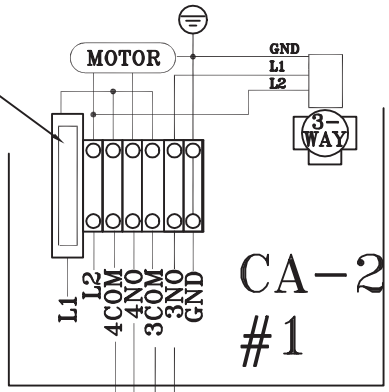
DWG. No IIG07R113 REV. 1

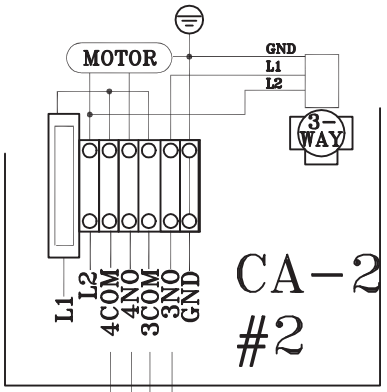
REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED



1-1/4" x 1/4"
3 AMP FUSE
MAX WITH
TIME DELAY
(GDC TYPE)

CUSTOMER SUPPLIED
4 CONDUCTOR CONNECTION
18 AWG OR LARGER (2AMP)
RATED FOR 115/230 VAC





ANALYZER CONNECTIONS

COMPRESSOR CONNECTIONS
INSITE IG - MODEL CA2

MPA-48	CA-2 #1	CA-2 #2
CLN1 - NO	4-NO	4-NO
CLN1 - C	4-COM	4-COM
CLN2 - NO	3-NO	3-NO
CLN2 - C	3-COM	3-COM

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES
TOLERANCES
DECIMALS ANGULAR
.XX ±.010 X° ±1°
.XXX ±.005
DO NOT SCALE DRAWING

MATERIAL — D. RADLE

FINISH — D. RADLE

SPEC.

CONTRACT NO.

DRAWN DATE

CHECK

DESIGN

APPROVED

CUSTOMER

Insite IG
80 Whisperwood Blvd.
Suite 107
Slidell, LA 70458

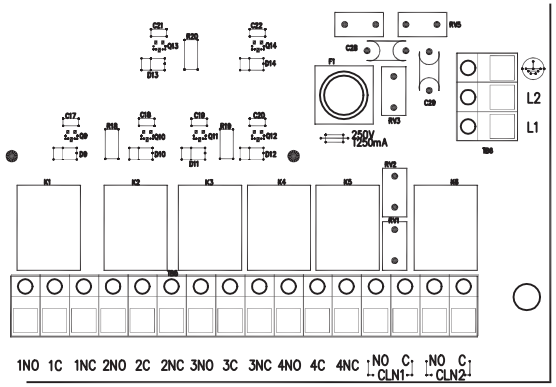
TITLE
MPA-48 CONNECTION
to TWO CA-2 Compressors

SIZE C | DWG NO. IIG07R114 | REV —

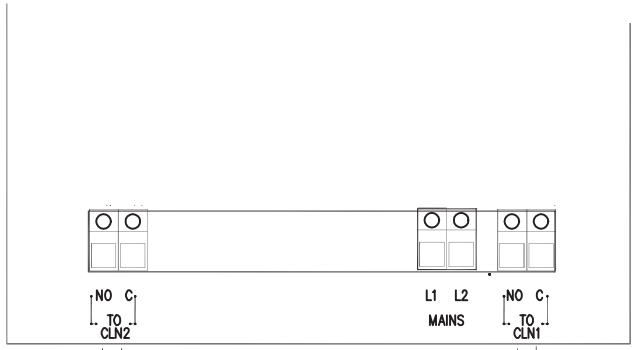
SCALE NTS | SHEET 1 OF 1

DWG. No IIG07R114 REV. I

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED



CUSTOMER SUPPLIED
4 CONDUCTOR CONNECTION
18 AWG OR LARGER (2AMP)
RATED FOR 115/230 VAC



ANALYZER CONNECTIONS

COMPRESSOR CONNECTIONS
INSITE IG – MODEL CA4

MPA-48	CA-4
CLN1 - NO	NO - TO CLN1
CLN1 - C	C - TO CLN1
CLN2 - NO	NO - TO CLN2
CLN2 - C	C - TO CLN2

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES
TOLERANCES
DECIMALS ANGULAR
.XX ±.010 X° ±1°
.XXX ±.005
DO NOT SCALE DRAWING

MATERIAL — D. RADLE

FINISH — D. RADLE

SPEC.

CONTRACT NO.

	DATE
DRAWN	
CHECK	
DESIGN	
APPROVED	
CUSTOMER	

Insite IG
80 Whisperwood Blvd.
Suite 107
Slidell, LA 70458

TITLE
MPA–48 CONNECTION to CA–4

SIZE	DWG NO.	REV
C	IIG07R116	—

SCALE NTS | SHEET 1 OF 1

REV. —

DWG. No IIG07R116