



**MODEL 4000
DC POWERED ANALYZER**

**MODEL 10
OPTICAL DISSOLVED OXYGEN
SENSOR**

**MODEL 15/15L
OPTICAL SUSPENDED SOLIDS
SENSOR**

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GENERAL INFORMATION

Product Description

The Model 4000 DC Powered Analyzer is a two channel analyzer designed for the continuous measurement of dissolved oxygen and/or suspended solids in water and wastewater systems. The microprocessor-based electronics of the Model 4000 analyzer provide a high degree of flexibility and ease of use. The instrument is designed to operate with any combination of Insite!G continuous 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 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. It incorporates self-cleaning optics via air or water jet. The Model 4000 utilizes a Modbus interface to report dissolved oxygen content and temperature. In addition to the Modbus interface, the dissolved oxygen content and temperature are reported by 0 to 1 voltage outputs.

The Model 15 sensor has been designed for medium ranges (0 to 30,000 mg/l) as commonly found in aeration basins of wastewater treatment plants. The Model 15L sensor has been designed for low ranges (0 to 1,500 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 4000 utilizes a Modbus interface to report suspended solids content. In addition to the Modbus interface, the suspended solids content is reported by a 0 to 1 voltage output.

INSTALLATION

1. See Outline & Mounting drawing (IIG06N001) for the Model 4000 PC board mounting information.
2. Mount the sensor in the desired location.
3. The sensor input connections are made to the terminal blocks labeled TB1 & TB2 (see drawing IIG06R001). The four wires are color coded and there is a cable shield. Channel 1 connections are made to TB1 and channel 2 connections are made to TB2. 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". +12 Volt power connections are made to the terminal block labeled TB4. The channel 1 and channel 2 voltage outputs are available on the terminal block labeled TB5 and the clean relay outputs are available on the terminal block labeled TB3.
4. Turn power "on" by using switch S3.
5. After being turned on, the unit will initialize and then begin reporting the sensor information.

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

6. The first time the unit is powered up with the sensor in the process, 15 minutes are required for the sensor to stabilize. The reading will drift slightly during this period. After approximately 15 minutes the sensor will respond correctly. In the event the sensor is removed from the process for a short period of time, the sensor should be allowed to stabilize for approximately 10 minutes after it is put back in the process.

Voltage Output

Voltage outputs are available from the terminal block labeled TB5. See drawing IIG06R001 for details. Channel 1 voltage output is labeled "Vout 1". Channel 2 voltage output is labeled "Vout 2". The common or ground for this signals are labeled "Vcom".

Note: The Model 10 temperature may be output on voltage output 2 with a fixed scale of 0 to 50°C if Sensor 2 input is left unconnected and Analog 2 Fail Mode is set for sensor 1 temperature.

Digital Output

The Model 4000 has two Modbus communication outputs. The maintenance port (J2) is a RS-232 compatible port which can be directly connected to a PC. The maintenance port is fixed at 9600 baud, 8-bits, no parity, and 1 stop bit. The auxiliary port (J3) is a TTL-level RS-232 compatible port. The communications protocol for the Digital Output is fully described in Appendix A.

The auxiliary port pinout is as follows:

Pin	Function
1	CTS
3	RxD
4	TxD
5	RTS
6	Reset
10	VCC
11	Gnd

Relay Output

There are two form A type relays used to control the jet wash function. The relays have contacts rated 15 amps load at 12 VDC. The outputs for these are available from TB3. See drawing IIG06R001 for connection details.

OPERATION

After installation, the Model 4000 is ready for operation with the following default mode of operation:

Filter characteristics – 32 seconds, 60 Hz.

Analog output – Analog Min: 0 ppm (Model 10 sensor) / 0 mg/l (Model 15/15L sensor)

 Analog Max: 10.0 ppm (Model 10 sensor) / 1000 mg/l (Model 15/15L sensor)

 Analog Fail: Drop to Zero.

Relay – Clean Cycle: OFF.

The Model 4000 ToolBox Software is included to allow changes to the mode of operation.

MODEL 4000 TOOLBOX SOFTWARE

The Model 4000 ToolBox Software is used to change the mode of operation and verify proper operation of the Model 4000. Although this program appears to be running in a DOS Window, it is actually a fully Windows-friendly application written using PowerBasic Console Compiler. To utilize the Setup and Test Software, connect a standard serial cable between the maintenance port (J2) of the Model 4000 and a PC serial port. Run the M4000.exe program on the floppy disk. After selecting a COM port, the program will poll the Model 4000 about once per second and display the sensor reading. Additional screens may be accessed by pressing the appropriate key.

Sensor Setup and Calibration

This screen allows the Model 4000's filter length (dampening) and notch frequency to be adjusted. Also, sensor information is displayed to aid with factory troubleshooting. For details on sensor calibration see the Sensor Calibration section.

Analog Output Setup or Test

This screen allows the Model 4000's analog output min and max scales values to be adjusted and the analog output behavior during an error condition. The Minimum Output determines what dissolved oxygen/suspended solids level is assigned to 0 volts. The Full Scale Output determines what dissolved oxygen/suspended solids level is assigned to 1 volt. Additionally, the analog output full scale may be tested and adjusted if necessary.

Cleaning Relay Setup

This screen allows the Model 4000's cleaning parameters to be adjusted.

The CLEAN INTERVAL determines how often the jet clean cycle will occur. This parameter can be set to values of 5 minutes to 4 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 5 or 20 minutes.

The CLEAN DURATION determines how long the jet clean cycle will last. It 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. A clean cycle will consist of the sensor being cleaned for the programmed clean jet time immediately followed by the analyzer holding the measurement reading during the clean cycle and the recovery period.

The RECOVERY TIME determines how long the analyzer will hold the sensor reading after the cleaning jet time has expired. The default setting is one 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.

A demand clean cycle may be performed from this screen.

Switch to Channel 2(1)

If channel 1's main screen is displayed, selecting this option will display channel 2's main screen. And if channel 2's main screen is displayed, selecting this option will display channel 1's main screen.

MODEL 10 SENSOR CALIBRATION

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

The Model 10 sensor has been designed to require very infrequent calibration. Unlike polarographic 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.

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. This calibration option 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 ANY 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. The value supplied will be taken as the D.O. value to which the sensor is currently exposed, and an offset value will be calculated and stored to adjust the output to this level.

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.

This calibration option 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 to a Reference" option 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. Note that some of the salt may not dissolve, but will sink to the bottom of the container. This is normal and of no concern. 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 "Calibration to a Reference" procedure described previously to set the D.O. reading to 0.03 PPM. **YOU MUST ACTUALLY PERFORM THE CAL TO REFERENCE PROCEDURE IN ZERO WATER 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 span adjustment may be made. Place the sensor in a solution of known D.O. concentration, and allow about 15 minutes to fully stabilize. The value supplied will be taken as the D.O. value to which the sensor is currently exposed, and a span factor will be calculated and stored to adjust the output to this level.

Factory Default

The procedure will restore the sensor characteristic values of zero and slope to the original factory settings.

MODEL 15/15L SENSOR CALIBRATION

The analyzer and sensor have been zero calibrated at the factory. If the analyzer does not identify the sensor, the display will read "***Zero sensor**" beneath the TSS reading. This will happen anytime the sensor is changed. If the sensor and analyzer are kept together, the factory zero will be recognized and a snapshot/span is all that is needed. In most cases the factory default will be adequate until the lab results of a TSS sample are available.

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 Model 4000 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 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 sensor 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

Each TSS sensor will have a unique zero reference. This calibration mode will calculate and store the zero reference for the current sensor.

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. The sensor must be submerged in clean water for at least 15 minutes before beginning this procedure. A new zero for the sensor will be calculated and stored.

Snapshot

This procedure will take a snapshot of the current conditions and store them for latter recall. At this time a physical sample of the process water should be taken 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 procedure.

Sensor Span

This procedure is performed when an accurate laboratory value has been obtained from the sample previously taken during the Snapshot procedure.

The value supplied will be taken as the suspended solids value to which the sensor was exposed during the snapshot procedure, and a new span calibration value will be calculated and stored. The analyzer will begin using this new span calibration value immediately.

Default Span

This procedure will restore the span calibration value to 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.

MAINTENANCE

The Model 4000 does not require any periodic maintenance. The sensor must be kept free of debris for accurate readings.

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 be used to prevent the slim and scale from attaching itself to the measuring surface.

Fouling conditions at wastewater treatment facilities varies 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.

GUARANTEE AND REPAIR POLICY

The InsiteIG Model 4000 DC Powered Analyzer is guaranteed for one year against manufacturing defects. The Model 15/15L Suspended Solids Sensor is guaranteed for two years against manufacturing defects. 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.

Appendix A – Modbus Protocol

The auxiliary port of the Insite IG Model 4000 analyzer supports communication with other devices via the Modbus protocol using both ASCII and RTU transmission modes. The maintenance port of the Model 4000 supports only the ASCII transmission mode and is fixed at 9600 baud, 8-bits, no parity, and 1 stop bit. 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 Model 4000 analyzers operate as slaves to other Modbus devices.

Message Framing

ASCII mode messages start with a colon (:) character (ASCII 3A hex), and with a carriage return – line feed” (CRLF) pair (ASCII 0D and 0A hex). The allowable characters transmitted for all other fields are hexadecimal 0-9, A-F. Networked devices monitor the network bus continuously for the colon character. Between the start character and stop character are four fields. 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 LRC value.

RTU mode 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.

The fields are as follows:

Address field

The address field contains two characters. Valid slave device addresses are in range 1 to 247 decimal. The slave address for the Model 4000 maintenance port is fixed at 1.

Function code field

The function code field contains two characters. See the section titled Function codes supported by the Model 4000.

Data field

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

LRC field

The LRC (longitudinal redundancy check) field is two characters. The LRC value is calculated by the transmitting device, which appends the LRC to the message. The receiving device recalculates a LRC during receipt of the message, and compares the calculated value to the actual value it received in the LRC field. If the two values are not equal, the message will be discarded.

The LRC is calculated by adding together successive 8-bit bytes in the message, discarding any carries, and then two’s complementing the result.

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 Model 4000

01 Read Coil Status

Reads the ON/OFF status of the relays in the Model 4000 analyzer.

Query

The query message specifies the starting relay and quantity of relays to be read. Relays are addressed starting at zero. Relays 1 & 2 are addressed as 0 & 1.

Below is an example of a request to read relays 1 & 2 from Model 4000 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	02
LRC	--

Response

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	01
LRC	--

The status of relay 1 is ON and the status of relay 2 is OFF.

03 Read Holding Registers

Reads the value(s) of one or more holding registers of the Model 4000 analyzer.

Query

The query message specifies the register to be preset.

The Model 4000 holding registers that can be read are as follows:

Address (Hex)	Register
0003	Clean cycle Duration (1 to 90 seconds)
0004	Clean Interval (0 = OFF, 5 to 240 minutes)
0005	Clean Recovery Time (1 to Clean Interval - 1 minutes)
0006	Analog 1 full scale (ppm X 100 or mg/l)
0007	Analog 1 min scale (ppm X 100 or mg/l)
0008	Analog 1 fail mode (0=0, 1=full scale, 2=no change, 3=sensor 2 temperature)
0009	Analog 2 full scale (ppm X 100 or mg/l)
000A	Analog 2 min scale (ppm X 100 or mg/l)
000B	Analog 2 fail mode (0=0, 1=full scale, 2=no change, 3=sensor 1 temperature)
000C	Dampening for sensor 1 (4,8,12,16,20,24,28,32 seconds)
000D	Dampening for sensor 2 (4,8,12,16,20,24,28,32 seconds)
000F	50/60 Hertz filter (0 = 50Hz, 1 = 60Hz)
0010	Relay Control (0 = Clean relay, 1 = Modbus controlled)
0011	Analog Control (0 = Scaled DO output, 1 = Modbus controlled)
0013	Reserved for factory use
0014	Reserved for factory use
0015	Reserved for factory use
0016	Reserved for factory use
0027	Reserved for factory use
0028	Reserved for factory use
0029	Reserved for factory use
002A	Reserved for factory use
003B ¹	Auxiliary port slave address (1 to 247)
003C ¹	Auxiliary port configuration register (0 to 11) 0 = RTU 8-bit, 9600 baud, even parity, 1 stop 1 = RTU 8-bit, 9600 baud, no parity, 1 stop 2 = RTU 8-bit, 4800 baud, even parity, 1 stop 3 = RTU 8-bit, 4800 baud, no parity, 1 stop 4 = RTU 8-bit, 2400 baud, even parity, 1 stop 5 = RTU 8-bit, 2400 baud, no parity, 1 stop 6 = ASCII 8-bit, 9600 baud, even parity, 1 stop 7 = ASCII 8-bit, 9600 baud, no parity, 1 stop 8 = ASCII 8-bit, 4800 baud, even parity, 1 stop 9 = ASCII 8-bit, 4800 baud, no parity, 1 stop 10 = ASCII 8-bit, 2400 baud, even parity, 1 stop 11 = ASCII 8-bit, 2400 baud, no parity, 1 stop

Notes: 1. Accessible only via the maintenance port.

Below is an example of a request to read the Analog 1 full scale and min scale registers from a Model 4000 with the slave address of 1 and a Model 10 sensor.

Field Name	Example
Slave Address	01
Function	03
Starting Address Hi	00
Starting Address Lo	06
No. of Regs. Hi	00
No. of Regs. Lo	02
LRC	--

Response

Below is an example of a response to the previous query where the Analog 1 full scale is 10.00 ppm and the Analog 1 min scale is 0.00 ppm.

Field Name	Example
Slave Address	01
Function	03
Byte Count	04
Data Hi (Reg 6)	03
Data Lo (Reg 6)	E8
Data Hi (Reg 7)	00
Data Lo (Reg 7)	00
LRC	--

04 Read Input Registers

Reads the binary contents of input registers in the Model 4000 analyzer.

Query

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

The Model 4000 input registers are as follows:

Address (Hex)	Register
0000	Sensor 1 status (see below)
0001	Sensor 1 primary measurement
0002	Sensor 1 secondary measurement
0003	Sensor 2 status
0004	Sensor 2 primary measurement
0005	Sensor 2 secondary measurement

The Model 10 sensor will report the status as follows:

Status	Description
0000	Normal
0001	Sensor not responding
0002	Sensor error

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 °C.

The Model 15 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 (new sensor)
0004	Sensor requires a zero calibration (bad zero)

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

Input Registers 0006 thru 000B, 0013 thru 0020, and 0027 thru 0034 are internal calculation values used by the factory for testing.

Below is an example of a request to read the sensor 1 status, D.O. measurement, and temperature measurement registers from a Model 4000 with the slave address of 1.

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

Response

Below is an example of a response to the previous query where the sensor is 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 0)	00
Data Lo (Reg 0)	00
Data Hi (Reg 1)	03
Data Lo (Reg 1)	3E
Data Hi (Reg 2)	00
Data Lo (Reg 2)	FA
LRC	--

05 Force Single Coil

Forces a single coil to either ON or OFF in the Model 4000. Note: Relay Control register (0010 Hex) must be set for Modbus control (1).

Query

The query message specifies the relay to be forced. Relays are addressed starting at zero. Relays 1 & 2 are addressed as 0 & 1. A value of FF 00 hex requests the coil to be ON. A value of 00 00 requests it to be OFF. All other values are illegal and will not affect the coil.

Below is an example of a request to force relays 1 ON in slave device 1.

Field Name	Example
Slave Address	01
Function	05
Starting Address Hi	00
Starting Address Lo	00
Force Data Hi	FF
Force Data Lo	00
LRC	--

Response

The normal response is an echo of the query, returned after the coil state has been forced.

06 Preset Single Register

Presets a value into a single register of the Model 4000 analyzer.

Query

The query message specifies the register to be preset.

The Model 4000 holding registers are as follows:

Address (Hex)	Register
0000 ¹	Analog 1 output (0 to 1000)
0001 ¹	Analog 2 output (0 to 1000)
0002	Demand Clean cycle
0003	Clean cycle Duration (1 to 90 seconds)
0004	Clean Interval (0 = OFF, 5 to 240 minutes)
0005	Clean Recovery Time (1 to Clean Interval - 1 minutes)
0006	Analog 1 full scale (ppm X 100 or mg/l)
0007	Analog 1 min scale (ppm X 100 or mg/l)
0008	Analog 1 fail mode (0=0, 1=full scale, 2=no change, 3=sensor 2 temperature)
0009	Analog 2 full scale (ppm X 100 or mg/l)
000A	Analog 2 min scale (ppm X 100 or mg/l)
000B	Analog 2 fail mode (0=0, 1=full scale, 2=no change, 3=sensor 1 temperature)
000C	Dampening for sensor 1 (4,8,12,16,20,24,28,32 seconds)
000D	Dampening for sensor 2 (4,8,12,16,20,24,28,32 seconds)
000F	50/60 Hertz filter (0 = 50Hz, 1 = 60Hz)
0010	Relay Control (0 = Clean relay, 1 = Modbus controlled)
0011	Analog Control (0 = Scaled DO output, 1 = Modbus controlled)
0013	Reserved for factory use
0014	Reserved for factory use
0015	Reserved for factory use
0016	Reserved for factory use
0018 ²	Perform Sensor 1 Calibration to a Reference/Zero (see sensor calibration sect.)
0019 ²	Perform Sensor 1 Slope Adjust/Span Calibration (see sensor calibration sect.)
001A ²	Perform Sensor 1 -/Snapshot (see sensor calibration sect.)
001B ²	Perform Sensor 1 Restore Factory Defaults (see sensor calibration sect.)
001C	Analog 1 Calibration Adjust (in mV)
0027	Reserved for factory use
0028	Reserved for factory use
0029	Reserved for factory use
002A	Reserved for factory use
002C ²	Perform Sensor 2 Calibration to a Reference/Zero (see sensor calibration sect.)
002D ²	Perform Sensor 2 Slope Adjust/Span Calibration (see sensor calibration sect.)
002E ²	Perform Sensor 2 -/Snapshot (see sensor calibration sect.)
002F ²	Perform Sensor 2 Restore Factory Defaults (see sensor calibration sect.)
0030	Analog 2 Calibration Adjust (in mV)
003B ³	Auxiliary port slave address (1 to 247)
003C ³	Auxiliary port configuration register (0 to 11, see read holding registers for details)

- Notes:
1. Analog Control register (0011 Hex) must be set for Modbus control (1).
 2. Writing any value will perform action.
 3. Accessible only via maintenance port.

Below is an example of a request to change the sensor 1 dampening on a Model 4000 with the slave address of 1.

Field Name	Example
Slave Address	01
Function	06
Reg. Address Hi	00
Reg. Address Lo	0C
Data Hi	00
Data Lo	20
LRC	--

Response

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
LRC	--

Response

The normal response of the Model 4000 is shown below.

Field Name	Example
Slave Address	01
Function	11
Byte Count	0A
Software Version	XXXX
Sensor Type	ss
Sensor Version	vv
Sensor Serial Number	nnnn
Reserved	XX
Reserved	XX
Reserved	XXXX
LRC	--

where ss is 0A for a Model 10 sensor, 0F for a Model 15 sensor, and 10 for a Model 15L sensor.

Exception Responses

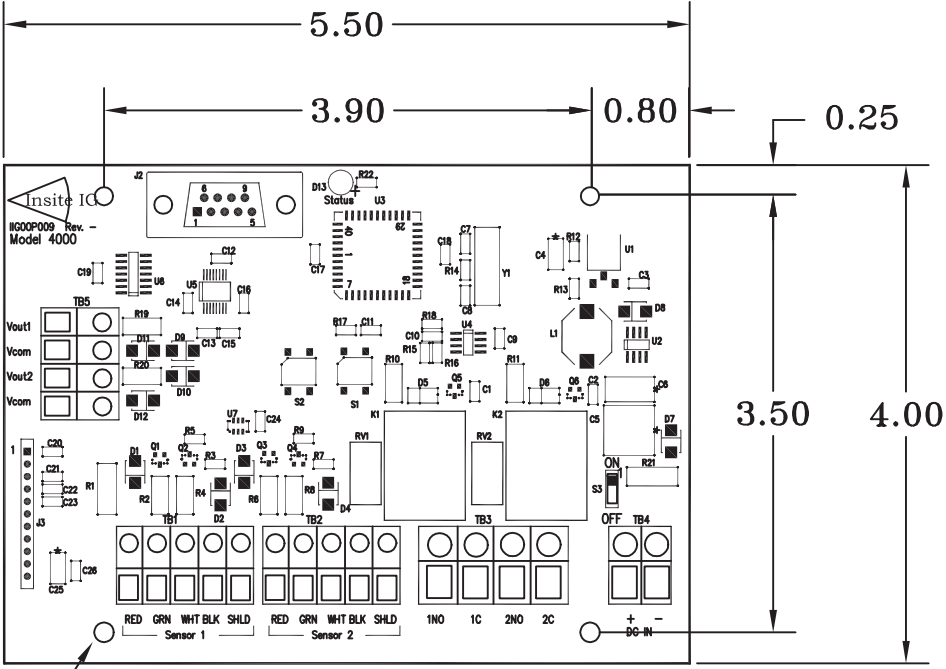
If the Model 4000 analyzer receives a query without a communication error, but cannot handle it, an exception response will be returned.

In a normal response, the Model 4000 echoes the function code of the original query in the function code field of the response. In an exception response, the Model 4000 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 Model 4000 are:

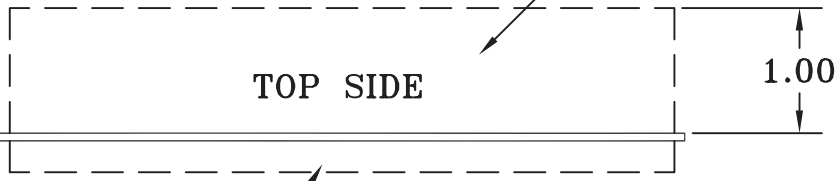
Exception code	Description
01	Illegal function code
02	Illegal data address

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED




∅0.150
4 Places

Component Clearance Area



Component Clearance Area

UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES TOLERANCES DECIMALS ANGULAR .XX ±.010 ° ±1° .XXX ±.005 DO NOT SCALE DRAWING	CONTRACT NO.		 80 Whisperwood Blvd. Suite 107 Slidell, LA 70458
	DRAWN	DATE	
	CHECK		TITLE OUTLINE & MOUNTING INSITE IG MODEL 4000
	DESIGN		
	MATERIAL	APPROVED	SIZE DWG NO. REV C IIG06N001 —
FINISH	CUSTOMER	SCALE NTS SHEET 1 OF 1	

1

2

3

4

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED

D

C

B

A

D

C

REV. A

DWG. No IIG06R001

A

Maintenance Port

Status Light

Scaled D.O. Output
0-1VDC

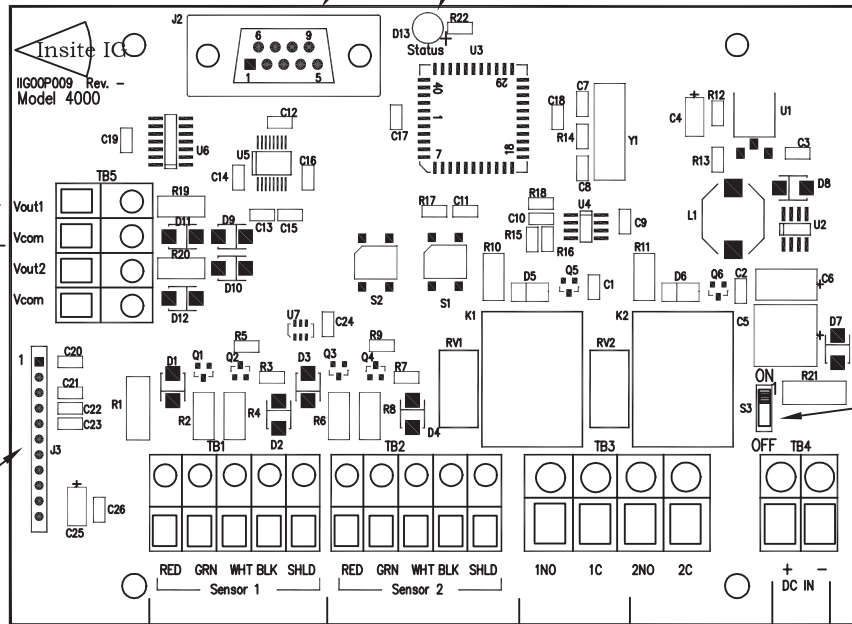
Auxiliary Port

On/Off Switch


DC Voltage Input
9.6 - 16 VDC

Cleaning Relay

Sensor Connections



UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES TOLERANCES DECIMALS ANGULAR .XX ±.010 ° ±1" .XXX ±.005 DO NOT SCALE DRAWING	CONTRACT NO.	
	DRAWN	DATE
	CHECK D. RADLE	7/29/03
	DESIGN	
	APPROVED D. RADLE	7/29/03
	CUSTOMER	

 80 Whisperwood Blvd. Suite 107 Slidell, LA 70458		TITLE		REV
		CUSTOMER CONNECTION INSITE IG MODEL 4000		
SIZE	DWG NO.	REV		
C	IIG06R001	A		
SCALE NTS		SHEET 1 OF 1		

1

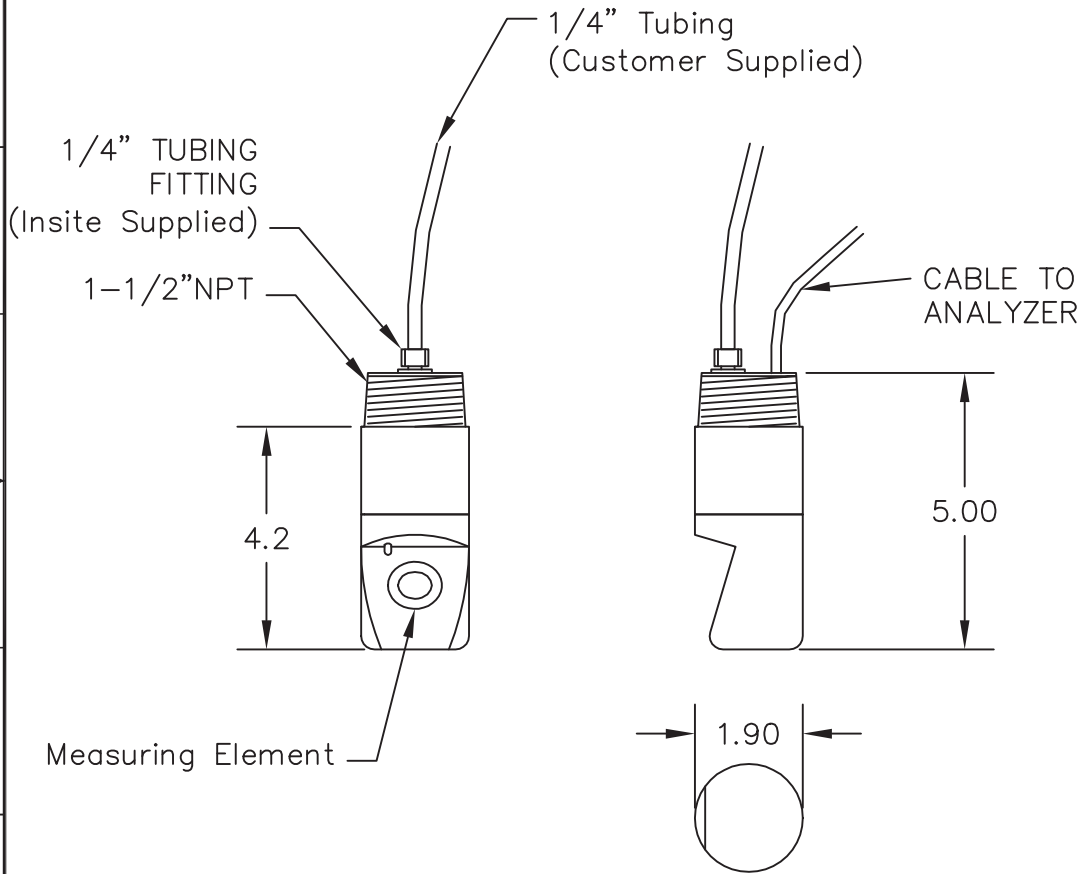
2

3

4


IIG02N004 C

REVISIONS				
ZONE	REV	DESCRIPTION	DATE	APPROVED



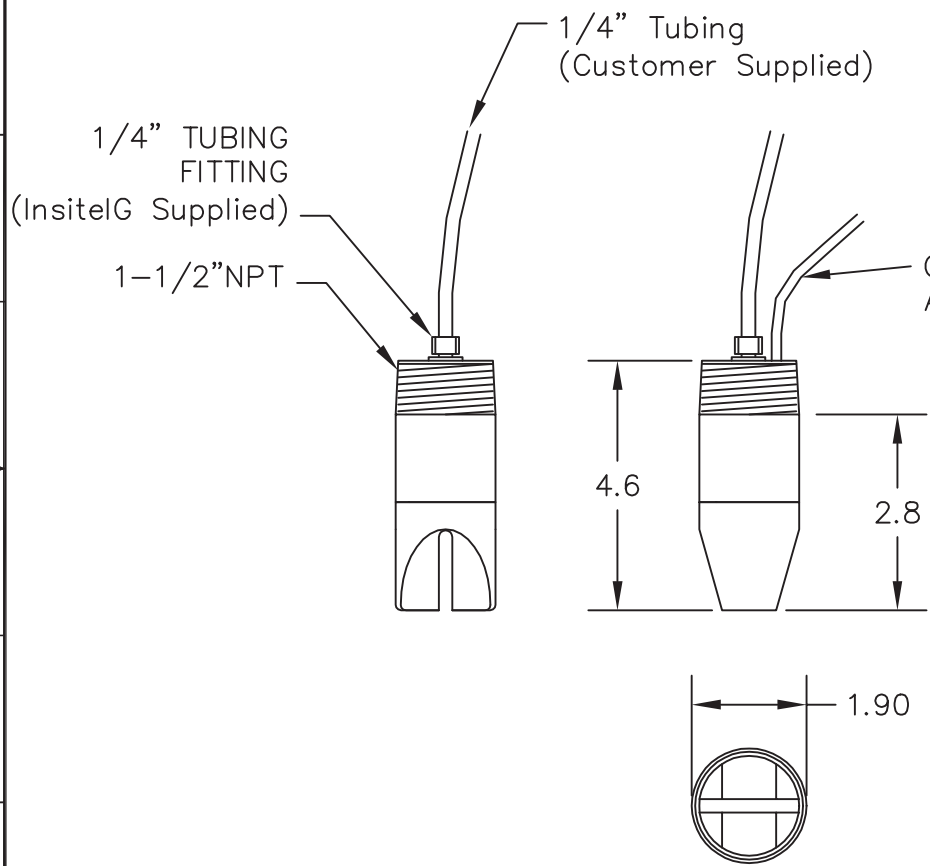
Notes:

- 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	CONTRACT NO.			80 Whisperwood Blvd. Suite 107 Slidell, LA 70458				
	SIGNATURES	DATES		DO SENSOR OUTLINE & MOUNTING				
	DRAFTSMAN		SIZE			FSCM NO.	DRAWING NO.	REV
	CHECKER		B				IIG02N004	C
	DESIGNER		SCALE			NTS	SHEET 1 OF 1	
MATERIAL	-	PROJ. ENGR.						
SPEC		RELEASED						
FINISH	-	APPROVAL						


IIG03N004 A

REVISIONS				
ZONE	REV	DESCRIPTION	DATE	APPROVED



Notes:

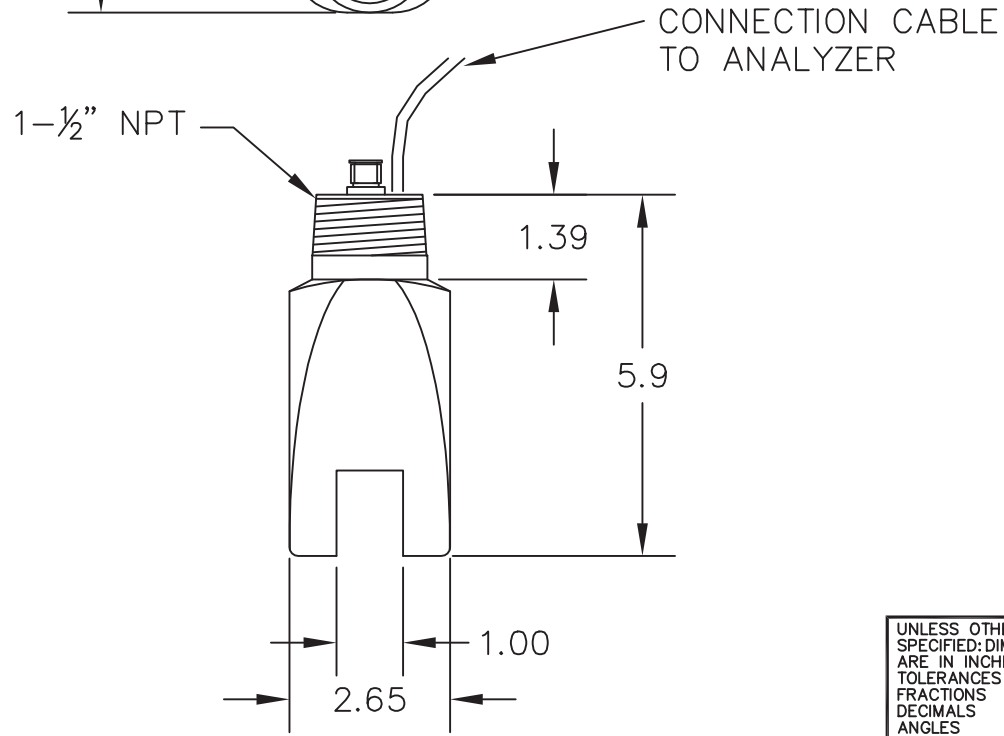
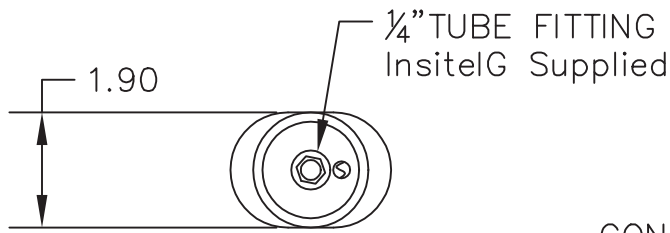
- 1) Material: Epoxy, Polyurethane, & PVC
- 2) For best accuracy, Suspended Solids measurements should be taken 2ft. below the surface and 3ft. from the wall.

UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES TOLERANCES ON: FRACTIONS DECIMALS ANGLES MATERIAL - SPEC FINISH -	CONTRACT NO.			80 Whisperwood Blvd. Suite 107 Slidell, LA 70458	
	SIGNATURES	DATES		TSS SENSOR OUTLINE & MOUNTING	
	DRAFTSMAN				
	CHECKER				
	DESIGNER		SIZE	FSCM NO.	DRAWING NO.
PROJ. ENGR.		B		IIG03N004	A
RELEASED		SCALE	NTS	SHEET 1 OF 1	
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 MATERIAL Listed SPEC FINISH -	CONTRACT NO.		 80 Whisperwood Blvd. Suite 107 Slidell, LA 70458	Outline & Mounting Low Range 15L/25L Sensor		
	SIGNATURES	DATES		SIZE	FSCM NO.	DRAWING NO.
	DRAFTSMAN		B		IIG03N010	-
	CHECKER		SCALE			
	DESIGNER		NTS			SHEET 1 OF 1