SCADASense 4202 DR

Installation and User Manual

CONTROL MICROSYSTEMS

SCADA products... for the distance

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1 Overview

The SCADASense 4202 DR is a two meter run gas flow controller with an integrated multivariable sensor. This controller, also referred to as transmitter throughout this document, is supplied with a pre-configured gas flow application, and can also be programmed in TelePACE Relay Ladder Logic, C, and IEC 61131-3 ISaGRAF.

The transmitter provides a discrete input/output that can be used as status input, or as a high frequency counter input or a sinking digital output. A second high frequency counter input accepts low-level inputs from devices such as turbine meters. Standard analog output provides flexible control for variable speed motor drives, control valves, emergency shutdowns, or whatever your site requires. The applied power source voltage is internally monitored and available for communication to the SCADA host.

Modbus mapping of all transmitter functions that is compatible with the Rosemount 3095FB MVT is also provided. This SCADASense transmitter can be used with or without the flow computer program.

Two fully functional RS-232/485 selectable serial ports are provided on the transmitter. Either or both ports can be used with remote I/O, radios, local displays, or other serial devices such as other SCADAPack controllers.

The SCADASense 4202 DR provides Modbus master/slave and EFM Modbus as its native protocols. DNP 3.0 protocol is optionally available. Custom protocols can be implemented using C programming.

These transmitters can also be configured using the **SCADASense 4000 Series Configurator** UI, which is shipped on an accompanying Configuration CD. The SCADASense 4000 Series Configurator supports the configuration, monitoring, and calibration of all SCADASense 4000 Series transmitters.

2 Important Safety Information

Power, input and output (I/O) wiring must be in accordance with Class I, Division 2 wiring methods Article 501-4 (b) of the National Electrical Code, NFPA 70 for installations in the U.S., or as specified in Section 18-1J2 of the Canadian Electrical Code for installations within Canada and in accordance with the authority having jurisdiction.

WARNING !
EXPLOSION HAZARD - SUBSTITUTION OF COMPONENTS MAY IMPAIR SUITABILITY FOR CLASS 1, DIVISION 2.

WARNING !
EXPLOSION HAZARD – WHEN IN HAZARDOUS LOCATIONS, TURN OFF POWER BEFORE REPLACING OR WIRING MODULES.

WARNING !
EXPLOSION HAZARD - DO NOT DISCONNECT EQUIPMENT UNLESS POWER HAS BEEN SWITCHED OFF OR THE AREA IS KNOWN TO BE NONHAZARDOUS.

3 Installation

3.1 Mounting

A SCADASense 4202 DR can be supported by the process piping as shown in ***Figure 1*** or mounted to a vertical or horizontal pipe or surface using the optional mounting bracket shown in ***Figure 2***.

Note: If the transmitter is not installed in the vertical position as shown in ***Figure 1*** or ***Figure 2***, readjust zero output to eliminate the position zero effect. The transmitter should be mounted so that any moisture condensing or draining into the field-wiring compartment can exit through one of the two threaded conduit connections.

CAUTION !
To avoid damage to the GFC sensor, do not use any impact devices, such as an impact wrench or stamping device, on the transmitter.

Note: Use a suitable thread sealant on all connections.

3.1.1 Process-Mounted Transmitter

Figure 1 shows a 4202 DR transmitter mounted to and supported by the process piping.

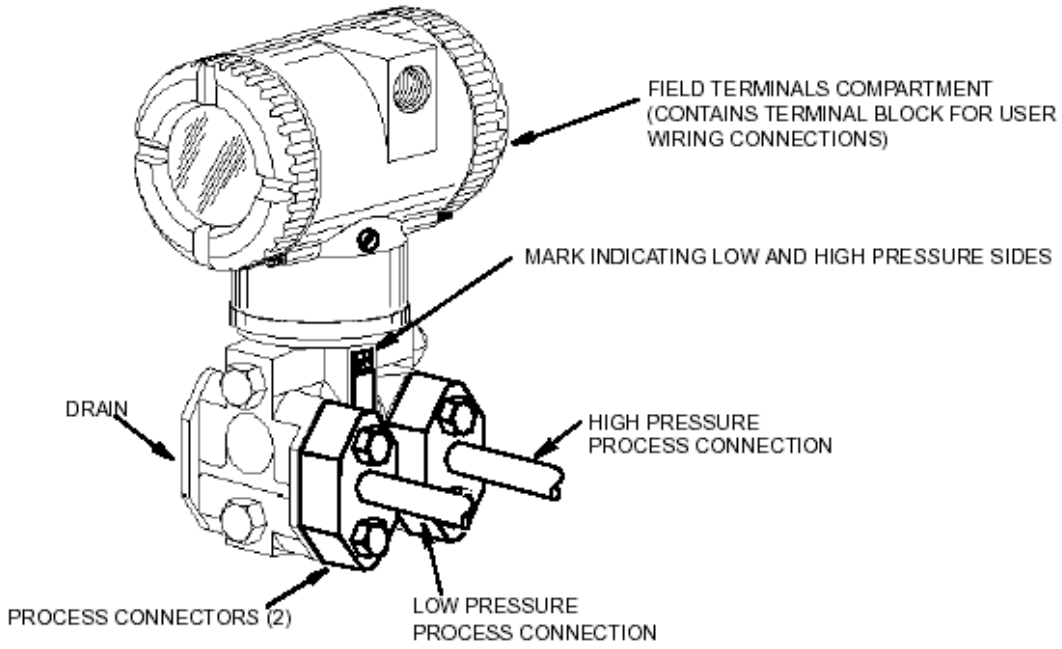

Figure 1: Process-Mounted Transmitter

3.1.2 Pipe or Surface-Mounted Transmitter

To mount the transmitter to a pipe or surface, use the Optional Mounting Bracket Set (Model Code Option -M). Referring to ***Figure 2***, secure the mounting bracket to the transmitter using the two lock washers and screws provided. Mount the TRANSMITTER with mounting bracket to a vertical or horizontal, DN 50 or 2-in pipe. To mount to a horizontal pipe, turn the U-bolt 90º from the position shown in ***Figure 2***. The mounting bracket can also be used for wall mounting by securing the bracket to a wall using the U-bolt mounting holes.

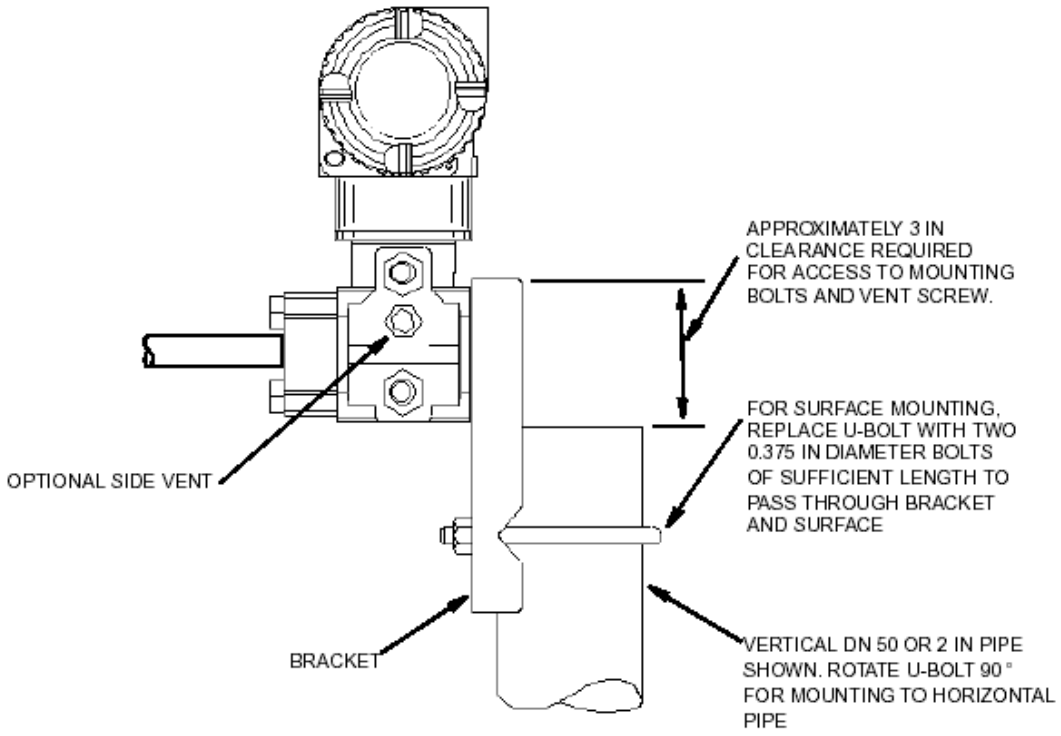

Figure 2: Mounting the Transmitter to a Pipe or Surface

3.1.3 Positioning the Transmitter Housing

The transmitter housing (top works) can be rotated up to one full turn in the counterclockwise direction when viewed from above for optimum access to adjustments, display, or conduit connections.

Note:	Do not rotate the housing more than one turn from the "as received" position. If there is doubt about the housing rotational position, turn fully clockwise and then back off no more than one full turn.
WARNING:	The small setscrew on the housing keeps the housing from being rotated too far. This is NOT a locking screw. Do not tamper with this screw. Damage to the housing can occur if this setscrew is tampered with.

3.1.4 Manifold Types and Installation

Several manifold models are available to interface a transmitter with the process piping. The PGI-M573 has ½" FNPT inlets and ½" FNPT outlets, while the PGI-M673 has ½" FNPT inlets and

Instrument Flange outlets. Two options are available. The CDT option is of carbon steel construction while the SDJ option uses 316SS NACE construction (140F max) and has a fluorosilicone stem seal.

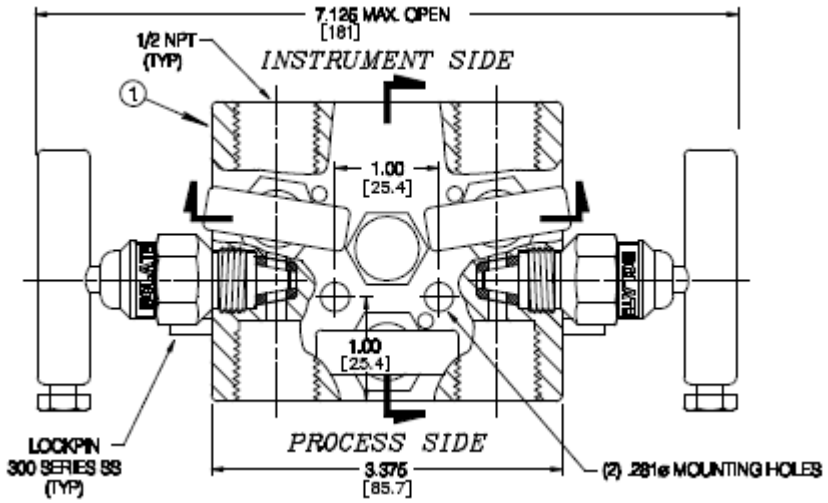

Figure 3: PGI-M573 Five Valve Manifold

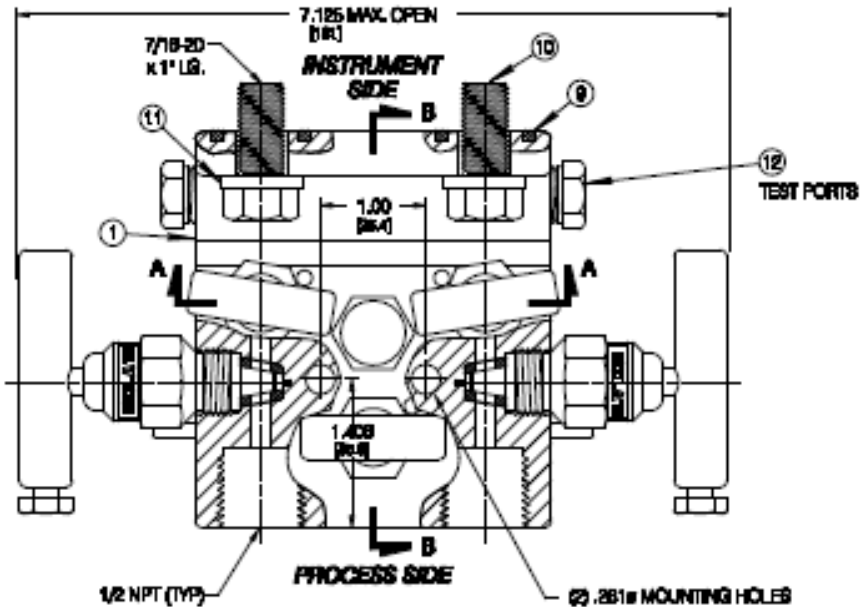

Figure 4: PGI-M673 Five Valve Manifold

The bolts to mount the PGI-M673 model to the sensor are 7/16-20 x 1”

3.1.5 Connections For Sensor Calibration

It should be noted that when an Absolute (Static) Pressure calibration is performed the bypass or cross feed valve on the manifold must be open. When performing a Differential Pressure calibration the bypass valve must be closed.

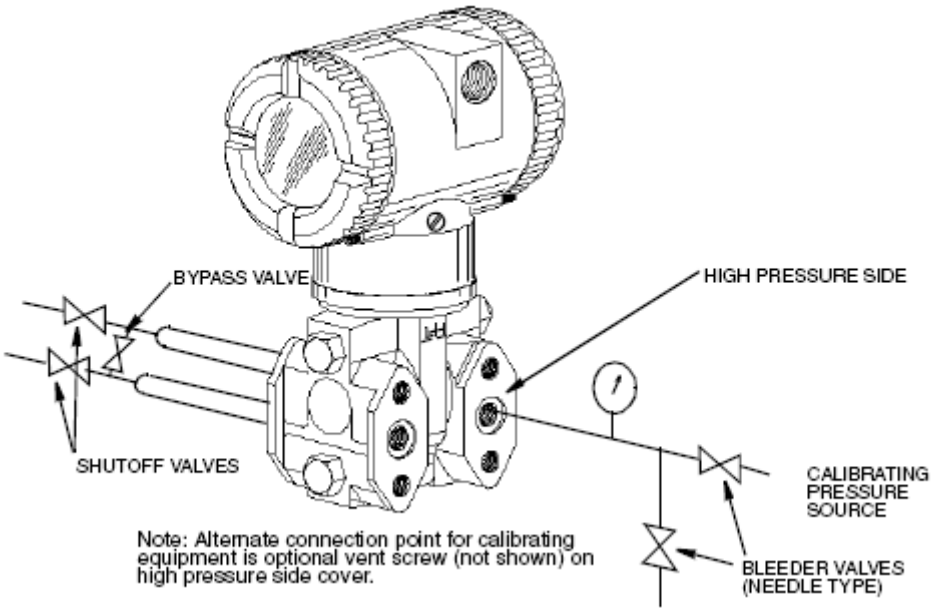

Figure 5: Differential Pressure Calibration Connections

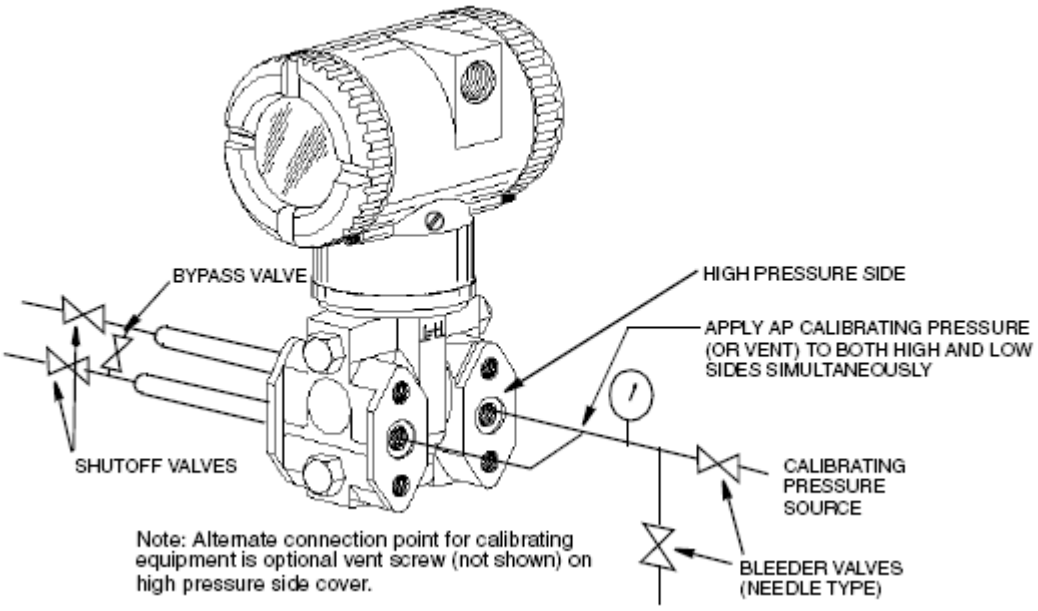

Figure 6: Absolute Pressure Calibration Connections

3.2 Optional Display Module

The optional display module is used to provide local display of meter run data. The display may be configured using the SCADASense 4000 Series Configurator, RealFLO, Flow Computer commands, or Modbus Register Mapping. The data to display and the interval between the displayed items is user defined.

The SCADASense 4000 Series Configurator is installed from the Hardware Documentation CD. When installed on your PC, it is found in the Windows || Programs || Control Microsystems || 4000 Series program group. Refer to the online help document of this program for additional assistance in configuring your transmitter display.

The SCADASense series of transmitter can also be configured using the RealFLO application. Refer to the MVT Configuration commands section of the RealFLO User and Reference manual for complete information on using RealFLO to configure the Display Module.

The Display Control Configuration section of the TeleBUS Protocol Section of the RealFLO User and Reference manual provides the information for using the Display Module with Flow Computer commands.

The Modbus Register Mapping section of this manual contains information on configuring the Display Module using Modbus registers.

Note: Configuring a SCADASense transmitter using the local display is possible with older transmitters only. See the application note "Configuring an older SCADASense transmitter using the Local Dsplay.pdf", located in the same directory as this document, for a detailed procedure. Newer SCADASense transmitters no longer have this configuration menu available off the local display, and have to be configured using other means as noted above. If you cannot access the menu, it is not available on your transmitter version.

3.2.1 Adding the Optional Display

To add the optional display, refer to ***Figure 7*** and proceed as follows:

Turn off the transmitter power source.

Remove the electronics compartment cover by rotating it counterclockwise. Screw in the cover lock if applicable.

Plug the display into the receptacle at the top of the electronics assembly.

Ensure that the O-ring is seated in its groove in the display housing. Then insert the display into the electronics compartment by grasping the two tabs on the display and rotating it approximately 10° in a clockwise direction.

Install the new cover (with a window) onto the housing by rotating it clockwise until the O-ring contacts the housing; then continue to hand tighten it as much as possible (at least 1/4 turn). If cover locks are present, align the serration in the cover with the lock and unscrew the lock until it extends into the cover serration to prevent unwanted cover rotation.

Turn on the transmitter power source.

3.2.1.1 Write Protect Jumper

The write protect jumper is located to the right of the display connector as shown in figure 3. The jumper is used to connect two of the three pins on the write protect header.

- Connecting the top two pins with the jumper disables the write protection.
- Connecting the bottom two pins with the jumper enables the write protection.

See the ***Write Protect Jumper*** section for information on the effects of the Write Protect jumper.

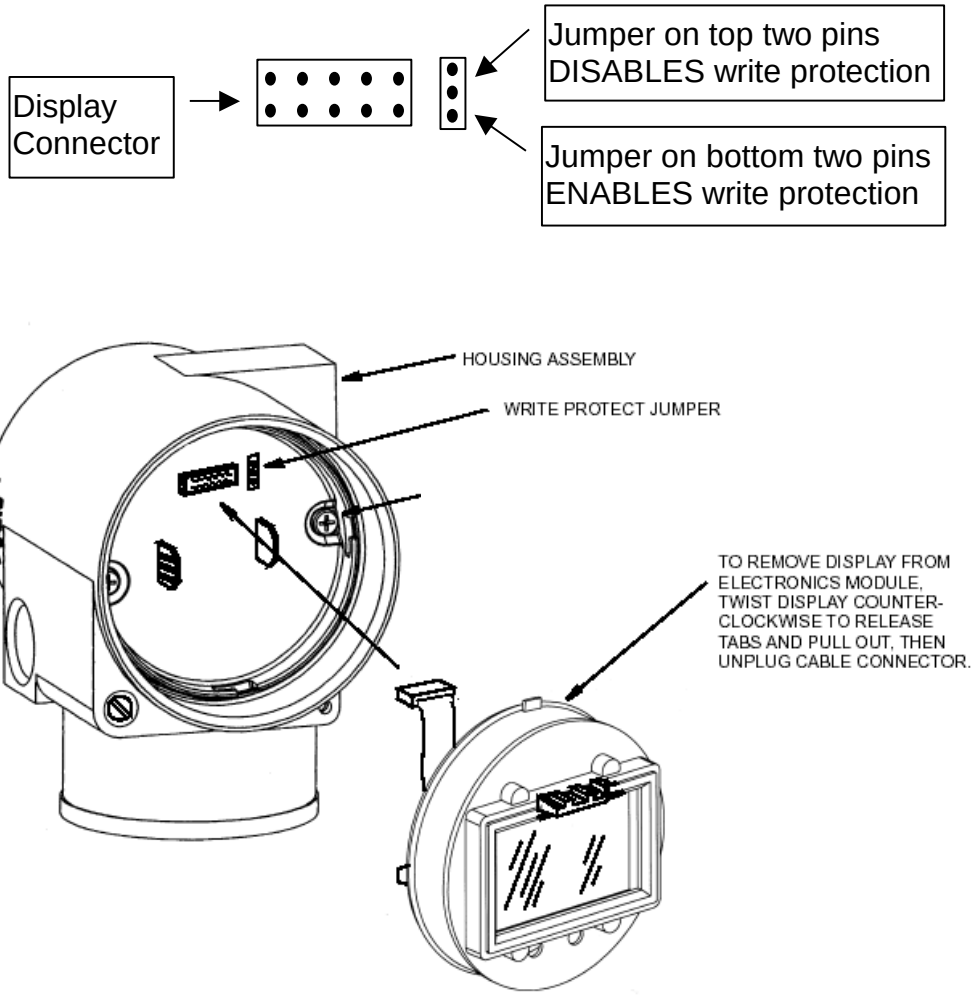

Figure 7: Optional Display and Write Protect Jumper

The optional display can be rotated within the housing to any of four positions at 90° increments.

To do this, grasp the two tabs on the display and rotate it about 10° in a counterclockwise direction. Pull out the display. Ensure that the O-ring is fully seated in its groove in the display housing. Turn the display to the desired position, reinsert it in the electronics module, aligning the tabs on the sides of the assembly, and twist it in the clockwise direction.

3.3 Transmitter Wiring

The installation and wiring of the transmitter must conform to local code requirements.

Note for North America: Seal not required when installed with rigid conduit per requirements of the applicable electrical code. When using instrument cable approved for the hazardous location, a seal must be made with an approved cable gland or conduit seal per the requirements of the applicable electrical code.

Note for ATEX IECEx: Seal required when installed with rigid conduit per requirements of the applicable electrical code. When using instrument cable approved for the hazardous

location, a seal must be made with an approved cable gland or conduit seal per the requirements of the applicable electrical code.

For access to the field terminals, thread the cover lock (if present) into the housing to clear the threaded cover and remove the cover from the field terminals compartment as shown in ***Figure 8***. Note that the embossed letters **FIELD TERMINALS** identify the proper compartment.

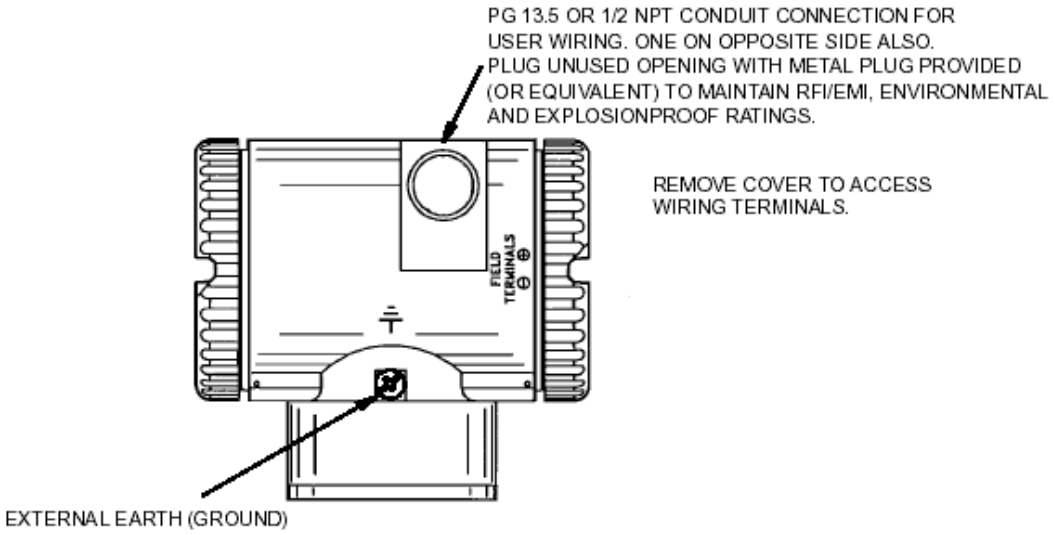

Figure 8: Accessing Field Terminals

The transmitter uses screw termination style connectors for termination of field wiring. These connectors accommodate solid or stranded wires from 16 to 28 AWG. The connectors are removable for field service and replacement purposes. Leave enough slack in the field wiring for the connector to be removed.

Note: The use of transient/surge protection is recommended in installations prone to high levels of electrical transients and surges.

CAUTION !
Remove power before servicing unit.

CAUTION !
The transmitter threaded end cap with the terminal board wiring diagram must be installed on the housing end that has the terminal board. This is a Class Div. 2 Hazardous Locations requirement.

There are five connectors for field wiring. Refer to ***Figure 9: Terminal Board Layout*** for connector locations. Connector pinouts and wiring examples are described in each of the respective sections of this manual.

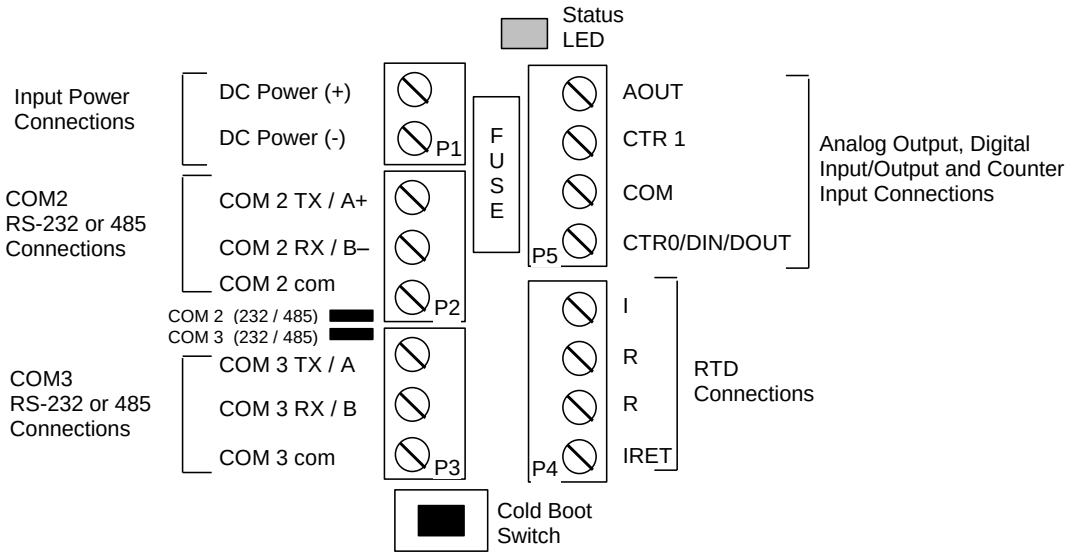

Figure 9: Terminal Board Layout

3.4 Power Supply

A SCADASense 4202 DR is powered from a 9 to 30VDC input power source.

- Input power is applied to the +PWR and –PWR terminals on connector P1.

Refer to section ***9- Specifications*** of this manual for the minimum and maximum operating voltages and input power requirements.

- When the input voltage is below the minimum recommended voltage the transmitter will turn off.
- Exceeding the maximum input voltage or applying a reverse voltage may damage the transmitter. External Fusing is recommended on early production of these models.

3.4.1 Fusing

The transmitter requires fusing on the power supply inputs. This fusing is included on the terminal board. The fuse is located between connectors P1 and P5. These connectors must be removed to have access to the fuse. The replacement fuse is a Littelfuse R452.750 (0.75A Slow Blow). See ***Figure 11: Input Power Wiring with Internal Fuse***.

Littelfuse R452.750 is available from Control Microsystems in a kit comprising 10 fuses; Part number of the fuse kit is 297308.

Note: External Fusing is recommended on early production transmitters. Use a 0.5A Fuse for a SCADASense 4202 DR as shown in ***Figure 10: Input Power Wiring with External Fuse***.

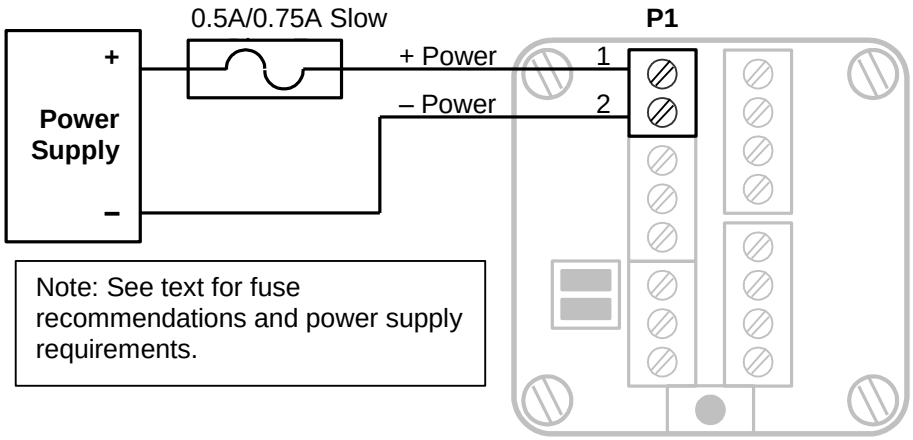

Figure 10: Input Power Wiring with External Fuse

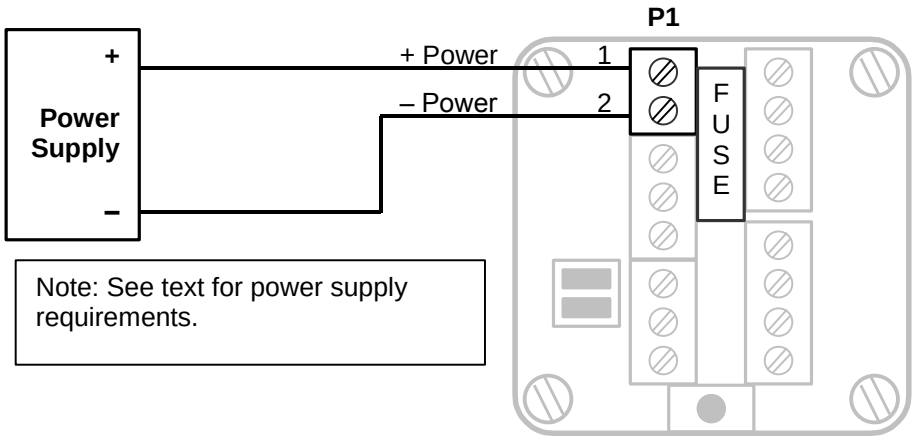

Figure 11: Input Power Wiring with Internal Fuse

3.4.2 System Grounding

Transmitter circuitry is electrically isolated from the housing for voltages up to 550Vac. All terminal board connections labeled COM on connectors P2, P3 and P5 are tied together and connected to –PWR on the input power terminal block P1. The Serial Communication Ports, Counter/Digital Inputs, Analog Outputs and Input Power all share the same electrical common.

3.5 Internal Analog Input

A SCADASense 4202 DR has one internal analog input. These internal analog inputs are accessed from the user application program. The analog input monitors the supply voltage.

The analog input returns 16-bit integer values. Valid values are 0 to 32700. The input value is scaled to represents the voltage in mV with 100mV resolution.

For TelePACE applications use:

- The ***4202 DR I/O*** or ***4202 DR Extended/4301 DR IO*** module register assignment to read the supply voltage in mV on the transmitter. The I/O module selected depends on your transmitter. Use the ***4202 DR I/O*** module if you have an older 4202 DR controller without a digital output.

For ISaGRAF applications use:

- The ***ss4202*** complex equipment to read the supply voltage in mV on an older 4202 DR transmitter without a digital output.
- The ***ss4202dr*** complex equipment to read the supply voltage in mV on a newer 4202 DR with a digital output.

3.6 RTD Input

A SCADASense 4202 DR provides an RTD input. A 4-wire connection to the RTD is recommended for the highest accuracy. Refer to ***Figure 12: 4-Wire RTD*** Wiring for wiring information for 4-Wire RTDs to the transmitter.

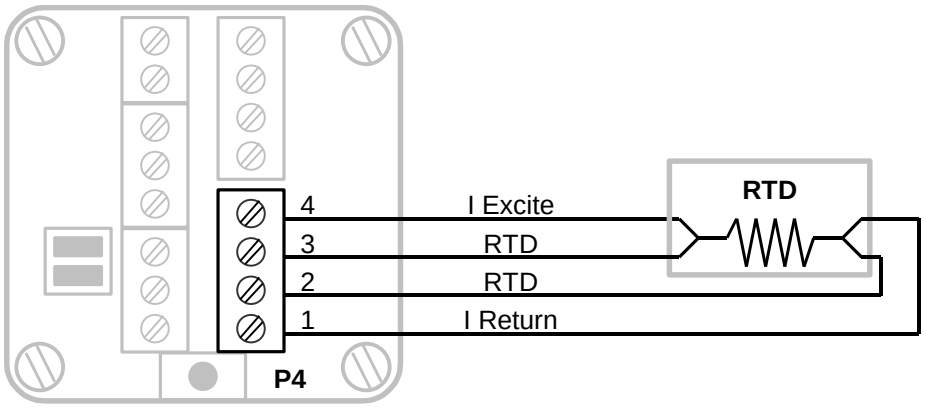

Figure 12: 4-Wire RTD Wiring

A 3 wire RTD can be used with a minimal reduction in accuracy. When using 3 wire RTDs run 4 wires as long as possible from the terminal board to the RTD. See ***Figure 13*** for a 3-Wire RTD schematic.

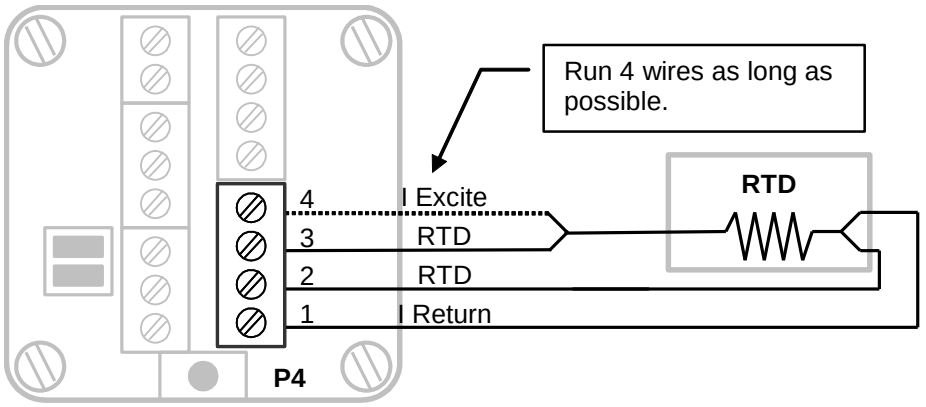

Figure 13: 3-Wire RTD Wiring

The RTD inputs on a SCADASense 4202 DR have been declared as non-incendive for use in Class 1 Div. 2 Hazardous locations. Ordinary wiring methods can be used in accordance with the NEC and CEC.

3.7 Analog Output

A SCADASense 4202 DR controller provides one 0-20mA current sinking analog output. The analog output is a sinking type in the sense that it limits the current flowing through its terminals to 0-20mA. When a value of 0 is written to the D/A converter, the analog output allows 0mA of current flow through its terminals. When a value of 32760 is written to the D/A converter, the analog limits the current flow through its terminals to 20mA. Given that the analog output is referenced to a power source, these currents have to be provided through an external load.

Refer to the appropriate software manual for information on using the analog output in an application programs. For TelePACE and ISaGRAF applications refer to the Register Assignment or I/O Complex Equipment respectively, for the controller.

When a sinking analog output is wired to an external device care must be taken to ensure the operating characteristics of the analog output are considered. As can be seen in ***Figure 14: Analog Output Wiring*** the LOAD does not connect to ground at any point. The LOAD must be able to float above ground in order for the analog output to function. The analog output must be connected to a differential input device

For example, in the wiring example shown in Figure 10, the points A and B will each be at a positive voltage based on the sinking current output, the LOAD resistance and the Power Supply voltage.

- For a sinking current of 0 mA, a LOAD resistance of 250 Ohms and a power supply voltage of 24VDC the voltage at both A and B points is 24VDC.
- For a sinking current of 20 mA, a LOAD resistance of 250 Ohms and a power supply voltage of 24VDC the voltage at point B is 24VDC and the voltage at point A is 24VDC minus 5VDC (20 mA x 250 Ohms) or 19VDC.

NOTE: The LOAD cannot be connected to ground in any wiring configuration for the analog output.

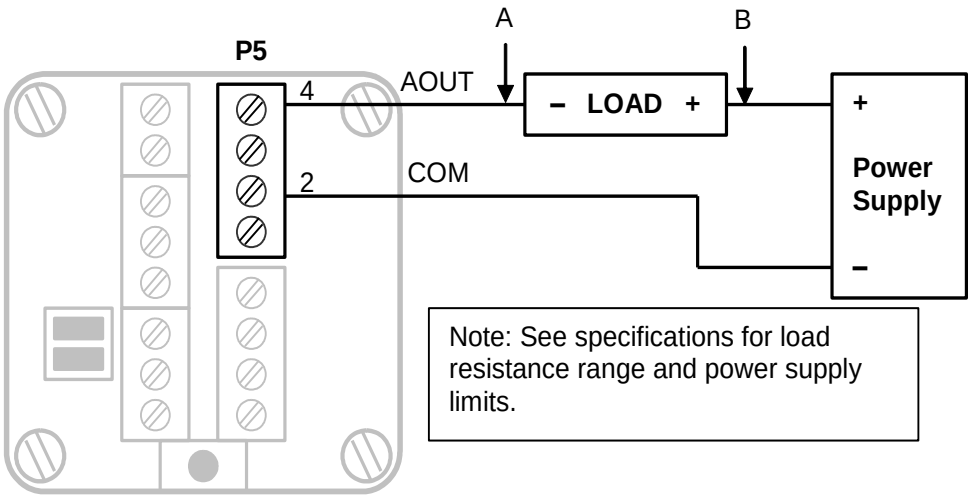

Figure 14: Analog Output Wiring

3.7.1 Current Outputs

The analog output is a sinking output that is not ground referenced. The load connects between connector P5, pin 4 and a positive power supply as shown in ***Figure 14: Analog Output Wiring***. Refer the ***Specifications*** section for power supply limits and load resistance ranges.

3.7.2 Voltage Outputs

To obtain voltage outputs, connect a load resistor in the current output. Connect the voltage device across the load resistor. The table below list resistance values and output range settings for two common voltage ranges. The resistance value listed is the parallel resistance of the device and the load resistor.

Voltage Range	Resistance	Output Range
0 to 5V	250Ω	0-20mA
0 to 10V	500Ω	0-20mA

3.7.3 Analog Outputs Data Format

The analog output has a 12-bit, unipolar, digital to analog converter. There are 4096 counts in the output signal range. The 0-20mA output range resolution is 4.88µA/count. The table below shows the output current for several D/A values. Given that the analog output is referenced to a power source, these currents have to be provided through a load.

D/A Value	Current
0	0mA
8	4.88µA
6552	4mA
16384	10mA
24576	15mA
32760	19.995mA

3.7.4 Digital Output Control with External Relay

The analog output can be used to control an external relay. Electromechanical or solid state relays that meet the output requirements of the analog output can be used. An example of AC and DC digital outputs is shown using solid state relay modules. These examples use DIN rail mounted output modules from Crouzet/Gordos. These modules have a 4-32VDC input range.

Turn OFF an output module by writing 0 to the Analog Output. Turn ON an output module by writing 32767 (20mA) to the Analog Output. Lower currents can be used to save power. Refer to the relay specifications for the input requirements for the selected relay.

Model 84130104 is a 5-60VDC, 3A DC output module with integrated fuse. Refer to ***Figure 15: DC Digital Output Wiring Example*** for wiring details.

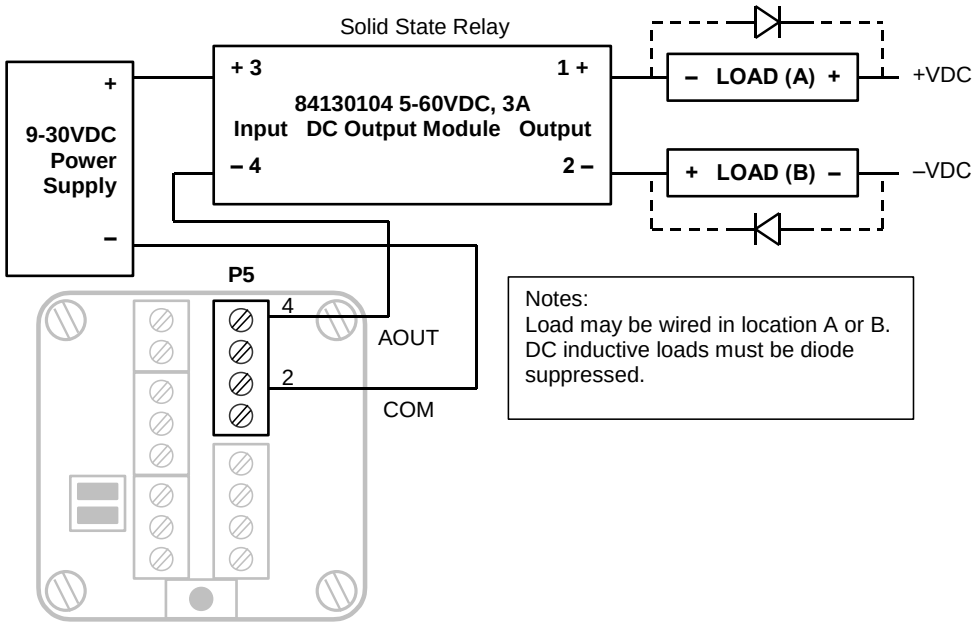

Figure 15: DC Digital Output Wiring Example

Model 84130105 is a 12-280VAC, 5A AC output module with integrated fuse. Refer to ***Figure 16: AC Digital Output Wiring Example*** for wiring details.

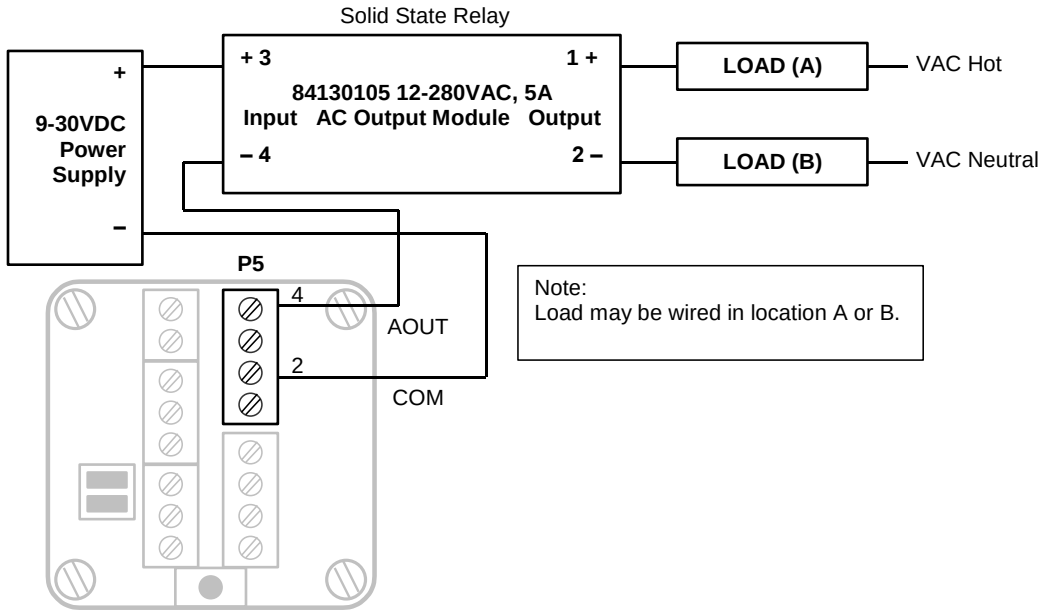

Figure 16: AC Digital Output Wiring Example

3.8 Digital I/O and Counters

A SCADASense 4202 DR has a turbine meter counter input identified as CTR1. Counter input CTR1 includes a built in pre-amplifier and is designed to work with turbine meter inputs. This counter input operates as a counter only.

In addition to the turbine meter input the transmitter has a multi-purpose counter input and digital input/output connection identified as CTR0/DIN/DOUT.

The CTR0/DIN/DOUT counter / input is used with open collector or drain output devices, relay contacts or switches. The CTR0/DIN/DOUT digital output is an open drain (sinking) digital output.

Refer to the appropriate software manual for information on using counter Inputs in application programs. For TelePACE applications and ISaGRAF applications, refer to the Register Assignment and I/O Complex Equipment respectively for the transmitter.

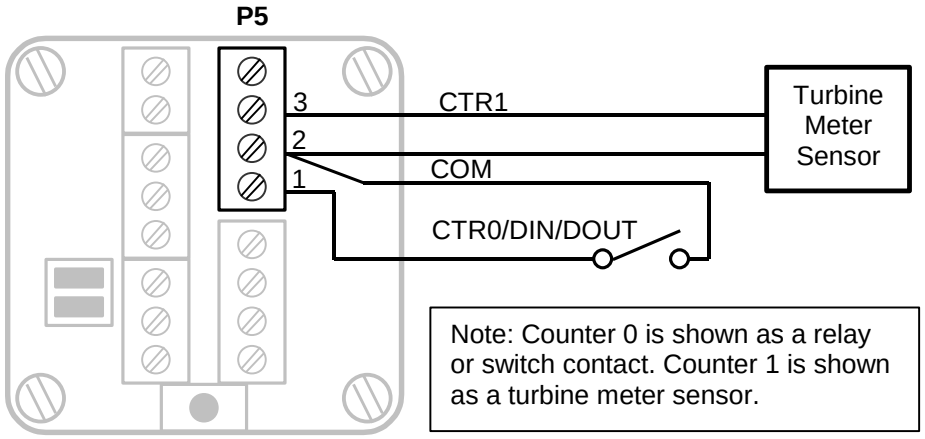

Figure 17: Digital and Counter Input Wiring

3.8.1 Turbine Meter Counter Input - CTR1

A SCADASense 4202 DR allows for the direct connection to one turbine meter sensor. These sensors produce millivolt outputs and do not require an external pre-amplifier when used with the transmitter. The turbine meter input can be used in low noise environments with shielded cabling. Counter 1 is shown with a direct connection to a turbine meter sensor. Shielded wiring must be used and the shield should be connected at one end only. There is an enclosure ground connection that can be used for this purpose.

3.8.2 Counter / Digital Input - CTR0/DIN/DOUT

The counter/digital input is used to count or monitor contact closures and open collector/drain devices. The input circuitry provides 5mA of wetting current for the contact.

Refer to ***Figure 17: Digital and Counter Input Wiring*** for examples of wiring to this input. This input shares a Common with CTR1.

The CTR0/DIN/DOUT counter digital input is a high-speed input. Ensure that the applied input is free of contact bounce.

3.8.3 Digital Output - CTR0/DIN/DOUT

The CTR0/DIN/DOUT is an open drain (sinking) digital output. The output is typically used to control 12VDC to 24VDC loads with currents up to 500mA. The positive side of the load connects to a +ve (30VDC maximum) power supply. The negative side of the load connects to connector P5, 1. Refer to ***Figure 18: Digital Output Wiring Example*** for wiring details.

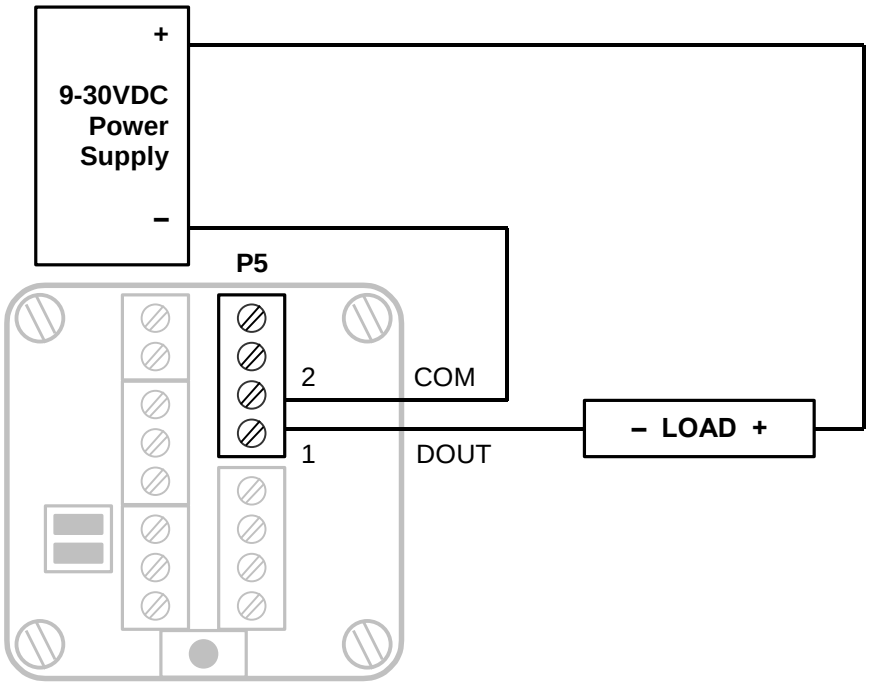

Figure 18: Digital Output Wiring Example

4 Serial Communication

The transmitter is equipped with two serial communication ports for user interface to the controller. Both serial communication ports support RS-232 serial communication and RS-485 serial communication.

In addition to these two serial ports these transmitters have an internal serial port defined as COM1. This serial port is not assessable by users and is used for communication between the controller and the sensor.

Serial ports on the transmitter are designated as COM2 and COM3. Connections to COM2 and COM3 are made using removable 3 position terminal blocks.

4.1 RS-232 Serial Communications Ports

Both COM2 and COM3 are capable of RS-232 operation. RS-232 operation is selected by installing the appropriate jumper link on the terminal board labeled COM2 and COM3. RS-232 operation uses RxD, TxD and COM signals. Refer to ***Figure 19: COM2 RS-232 Wiring*** and ***Figure 20: COM3 RS-232 Wiring*** for connector wiring descriptions.

NOTES:

- The low power transmitters used in COM2 and COM3 generate 0 to 5V levels. This is less than the RS-232 specification but still compatible with all RS-232 receivers. Cables should be limited to a maximum of 10 ft (3m).
- Shielded cable should be used to protect the signals from noise and to comply with FCC and CE regulatory requirements. The shield is connected to Ground at one end only.

4.1.1 RS-232 Wiring Examples

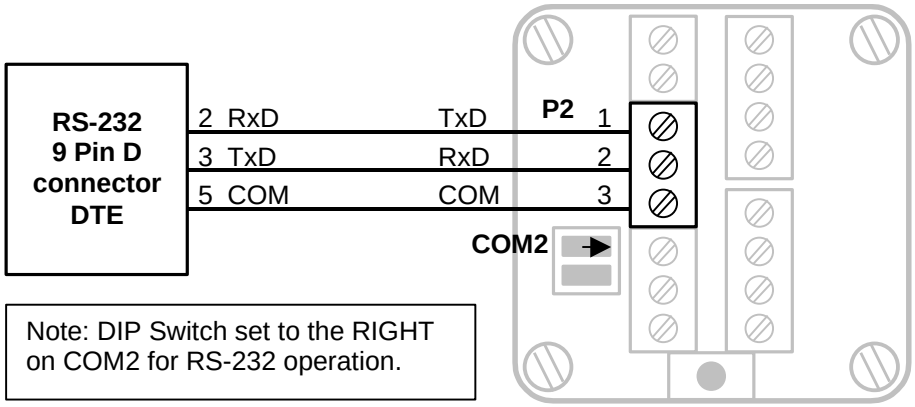

Figure 19: COM2 RS-232 Wiring

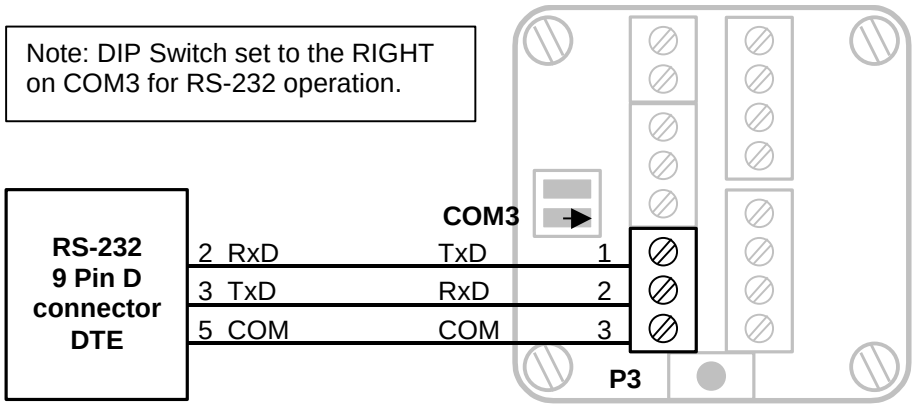

Figure 20: COM3 RS-232 Wiring

4.1.2 COM1 RS-232 Serial Port Settings

The following table shows the serial and protocol communication parameters supported by COM1. These parameters are fixed and cannot be changed by users.

Parameter	Supported Values
Baud Rate	4800
Duplex	Full
Parity	None
Data Bits	8 Bits
Stop Bits	1 Bit
Receive Flow Control	None
Transmit Flow Control	None
Protocol	Sensor

4.1.3 COM2 RS-232 Serial Port Settings

The following table shows the serial and protocol communication parameters supported by COM2. These parameters are set from TelePACE, ISaGRAF Workbench or from an application program running in the controller. Default values are set when a Cold Boot or Service Boot is performed on the controller.

Parameter	Supported Values	
Baud Rate	300, 600, 1200, 2400, 4800, 9600, 19200 and 38400 Default: 9600	
Duplex	Half only	
Parity	Odd, None or Even	Default: None
Data Bits	7 or 8 Bits	Default: 8 Bits
Stop Bits	1 or 2 Bits	Default: 1 Bit
Receive Flow Control	None	
Transmit Flow Control	None	
Station	1 to 65534	Default: 1

Parameter	Supported Values
Protocol	None, Modbus RTU or Modbus ASCII, DF1 and DNP. Default: Modbus RTU
Addressing Mode	Standard or Extended Default: Standard

4.1.4 COM3 RS-232 Serial Port Settings

The following table shows the serial and protocol communication parameters supported by COM3. These parameters are set from TelePACE, ISaGRAF Workbench or from an application program running in the controller. Default values are set when a Cold Boot or Service Boot is performed on the controller.

Parameter	Supported Values
Baud Rate	1200, 2400, 4800, 9600, 19200 and 38400 Default: 9600
Duplex	Half only
Parity	Odd, None or Even Default: None
Data Bits	7 or 8 Bits Default: 8 Bits
Stop Bits	1 or 2 Bits Default: 1 Bit
Receive Flow Control	ModbusRTU Default: ModbusRTU
Transmit Flow Control	Ignore CTS or None Default: None
Station	1 to 65534 Default: 1
Protocol	None, Modbus RTU or Modbus ASCII, DF1 and DNP. Default: Modbus RTU
Addressing Mode	Standard or Extended Default: Standard

4.2 RS-485 Serial Communications Ports

Both COM2 and COM3 are capable of 2 wire RS-485 operation. RS-485 operation is selected by removing the appropriate jumper link on the terminal board labeled COM2 and COM3. RS-485 operation uses A+ and B– signals. Refer to ***Figure 21: COM2 RS-485 Wiring*** and ***Figure 22: COM3 RS-485 Wiring*** for connector wiring descriptions.

RS-485 uses balanced differential signals. Proper RS-485 operation requires that all devices communicating on the signal pair be referenced to the same point. On a SCADASense 4202 DR transmitter, this reference point is established by the devices connected to the Power Input and I/O. The incoming power (–PWR on P1,1) will generally establish the reference point.

The RS-485 serial communication ports transmit and receive differential voltages to other RS-485 devices on a network. The RS-485 specification allows a maximum of 32 devices connected on a single RS-485 network. The specification for RS-485 recommends that the cable length should not exceed a maximum of 4000 feet or 1200 meters. Termination resistors are required when using long cable lengths and high baud rates. Refer to section ***4.2.3-RS-485 Termination Resistors*** for information on termination resistors.

The signal grounds of the RS-485 devices in the network are not connected together but instead are referenced to their respective incoming electrical grounds. The grounds of the RS-485 devices on the network must be within several volts of each other.

Note: Shielded cable should be used to protect the signals from noise and to comply with FCC and CE regulatory requirement. The shield is connected to Ground at one end only.

4.2.1 RS-485 Wiring Examples

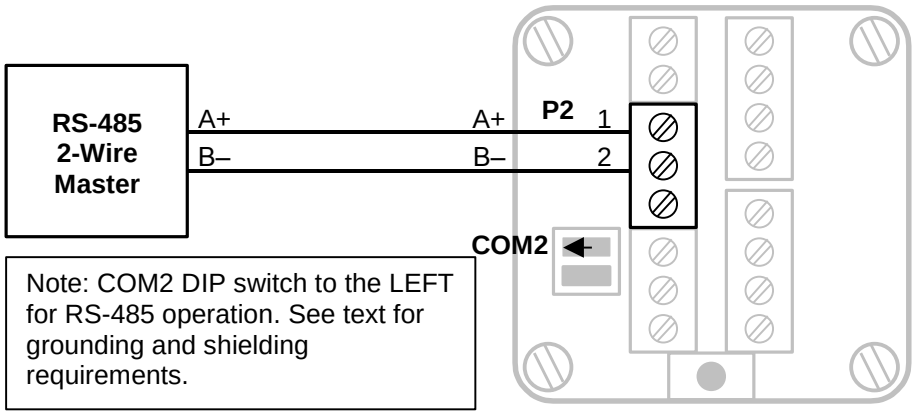

Figure 21: COM2 RS-485 Wiring

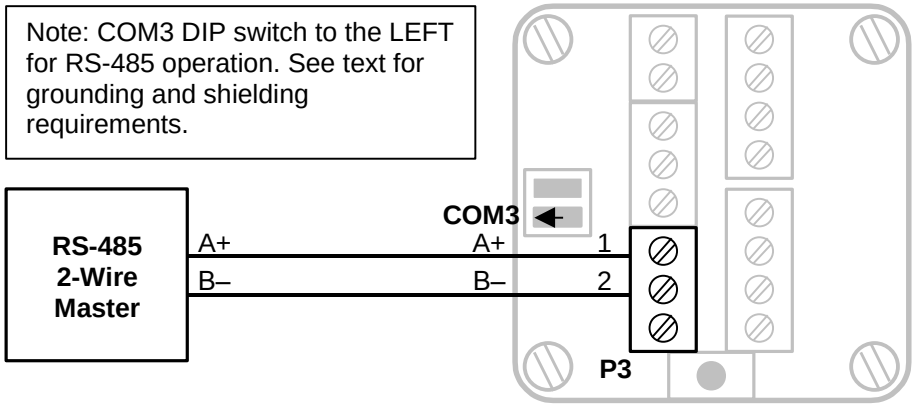

Figure 22: COM3 RS-485 Wiring

4.2.2 RS-485 Bias Resistors

The RS-485 receiver inputs on the transmitter are biased to ensure that that received data is driven to a valid state (space) when there are no active drivers on the network. The value of these bias resistors is 5100 ohms from Ground to the B– input and 5100 ohms from +5V to the A+ input.

4.2.3 RS-485 Termination Resistors

Termination resistors are required in long networks operating at the highest baud rates. Shorter networks in high noise environments may also benefit from terminations. Networks as long 1000 ft. operating at 9600 baud will function without termination resistors. Terminations should be considered if the baud rate is higher and the network is longer.

When termination resistors are required, they are installed on the first and last station on the RS-485 wire pair. All other stations should not have termination resistors.

RS-485 networks are generally terminated with 120-ohm resistors on each end. The required 120-ohm resistor must be supplied and installed by the user. When using termination resistors it is necessary to increase the line biasing by adding lower value bias resistors in order to generate at least 0.2V across RS-485 line. The suggested value of the bias resistors is 470 ohms. One bias

resistor is installed from the RS-485 line B– to COM. The second bias resistor is installed from the RS-485 line A+ to +5V. +5V is not available on a 4202 DR but may be available on another device on the RS-485 network.

4.2.4 COM2 RS-485 Serial Port Settings

The following table shows the serial and protocol communication parameters supported by COM2. These parameters are set from TelePACE, ISaGRAF Workbench or from an application program running in the controller. Default values are set when a Cold Boot or Service Boot is performed on the controller.

Parameter	Supported Values	
Baud Rate	300, 600, 1200, 2400, 4800, 9600, 19200 and 38400 Default: 9600	
Duplex	Half only	
Parity	Odd, None or Even	Default: None
Data Bits	7 or 8 Bits	Default: 8 Bits
Stop Bits	1 or 2 Bits	Default: 1 Bit
Receive Flow Control	None	
Transmit Flow Control	None	
Station	1 to 65534	Default: 1
Protocol	None, Modbus RTU or Modbus ASCII, DF1 and DNP. Default: Modbus RTU	
Addressing Mode	Standard or Extended	Default: Standard

4.2.5 COM3 RS-485 Serial Port Settings

The following table shows the serial and protocol communication parameters supported by COM3. These parameters are set from TelePACE, ISaGRAF Workbench or from an application program running in the controller. Default values are set when a Cold Boot or Service Boot is performed on the controller.

Parameter	Supported Values	
Baud Rate	1200, 2400, 4800, 9600, 19200 and 38400 Default: 9600	
Duplex	Half only	
Parity	Odd, None or Even	Default: None
Data Bits	7 or 8 Bits	Default: 8 Bits
Stop Bits	1 or 2 Bits	Default: 1 Bit
Receive Flow Control	ModbusRTU	Default: ModbusRTU
Transmit Flow Control	Ignore CTS or None	Default: None
Station	1 to 65534	Default: 1
Protocol	None, Modbus RTU or Modbus ASCII, DF1 and DNP. Default: Modbus RTU	
Addressing Mode	Standard or Extended	Default: Standard

5 Operation

5.1 Operating Modes

A SCADASense controller may start up in Run, Service, Sensor or Cold Boot mode. Start up in the RUN mode automatically executes TelePACE or ISaGRAF applications and the C applications the controller memory. Start up in the Service mode stops the programs to allow reprogramming and controller initialization. Start up in the COLD BOOT mode initializes the controller and erases all programs.

5.1.1 Run Mode

RUN mode is the normal operating mode of the transmitter. Ensure the Cold Boot push button is not pushed when power is applied to start Run mode operation. When power is applied to the controller board:

- The user defined serial communication parameters, for all COM ports are used.
- If a TelePACE Ladder Logic or ISaGRAF application program is loaded in RAM, it is executed.
- If a TelePACE or ISaGRAF C application program is loaded in RAM and the program checksum is correct, it is executed.
- If there is no application program in RAM and there is an application program in flash ROM then the flash ROM program will be executed.
- The controller lock settings and password are used.

5.1.2 Service Mode

Service mode is used during application programming and maintenance work. When a 4202 controller starts in Service mode:

- The default serial communication parameters are used (see section ***4-Serial Communication*** for a description of the default parameters).
- The Sensor driver is installed on Com 1. Com 1 is set to Sensor protocol, 4800 Baud, no parity, 8 data bits and one stop bit.
- The TelePACE Ladder Logic or ISaGRAF program is stopped.
- The C program is stopped.
- All programs are retained in non-volatile memory.
- The controller lock settings and password are used.

5.1.2.1 Service Boot

Service mode is selected by performing a **Service Boot** using the following procedure:

1. Remove power from the controller.
2. Push and hold the Cold Boot button down.
3. Apply power to the controller.
4. Continue holding the Cold Boot push button down STAT LED turns on solid. This will take about 3 seconds.
5. Release the Cold Boot push button.

6. The Service Boot remains in effect until the controller is reset.

Note: If the Cold Boot push button is released before the STAT LED turns on, the controller will start in RUN mode.

5.1.3 Sensor Mode

The Sensor Mode allows direct communication with the sensor electronics. This mode is provided to allow use of applications and tools that must communicate directly with the sensor electronics. When the controller starts in Sensor mode:

- The com1 and com2 serial ports operate at 4800 baud, no parity, 8 data bits, and one stop bit.
- The com3 serial port does not function.
- Sensor messages received on com2 are transmitted on com1 with the initial FF removed. Sensor messages received on com1 are transmitted on com2. Sensor timing restrictions are observed when transmitting. In effect, the 4202 controller is acting as a repeater.
- The TelePACE Ladder Logic or ISaGRAF program is stopped.
- The C program is stopped.
- No other controller features are available.

5.1.3.1 Sensor Boot

Sensor mode is selected by performing a **Sensor Boot** using the following procedure:

1. Remove power from the controller.
2. Push and hold the Cold Boot push button down.
3. Apply power to the controller.
4. A Sensor boot occurs when the Cold Boot push button is pushed and held for between 15 and 30 seconds. The STAT LED blinks rapidly after 15 seconds to indicate the Sensor boot mode is selected.
5. The STAT LED will blink short, short, long while the controller is in the Sensor mode.
6. The Sensor Boot remains in effect until the controller is reset.

Note: If the Cold Boot push button is released before the STAT LED starts to blink rapidly the controller will start in Service mode.

5.1.4 Cold Boot Mode

Cold Boot mode is used after installing new controller firmware or when it is desirable to initialize the controller to its default state. When the controller starts in Cold Boot mode:

- The default serial communication parameters are used (see section ***4- Serial Communication*** for a description of the default parameters).
- The Sensor driver is installed on com1. Com1 serial port parameters are set to 4800-baud, no parity, 8 data bits, and one stop bit.
- The TelePACE Ladder Logic or ISaGRAF programs are erased.
- The C program is erased.
- The registers in the I/O database or I/O Connection are initialized to their default values.

- The Register Assignment is erased.
- The controller is unlocked.

5.1.4.1 Cold Boot

Cold Boot mode is selected by performing a **Cold Boot** using the following procedure:

1. Remove power from the controller.
2. Push and hold the Cold Boot push button down.
3. Apply power to the controller.
4. A Cold Boot occurs when the Cold Boot push button is pushed and held for more than 30 seconds. The STAT LED blinks slowly after 30 seconds to indicate the Cold Boot mode is selected.

Note: If the Cold Boot push button is released before the STAT LED starts to blink slowly the controller will start in Sensor mode.

5.2 LED Status Indicator

The STAT LED indicates an alarm condition. The STAT LED blinks when an alarm occurs. The STAT LED turns off when all alarms clear.

The STAT LED blinks a binary sequence indicating alarm codes. The sequences consist of long and short flashes, followed by an off delay of 1 second. The sequence then repeats. The sequence may be read as the Controller Status Code. A short flash indicates a binary zero. A long flash indicates a binary one. The least significant bit is output first. As few bits as possible are displayed, all leading zeros are ignored. The application program defines the values of the alarm codes.

The table below shows the meaning of the sequences.

Sequence	CONTROLLER STATUS CODE
Off	0 = Normal
1 Short, 1 Long	Register Assignment Checksum Error

5.2.1 LED Power Control

The STAT LED on a SCADASense 4202 Series transmitter can be disabled to conserve power. This is particularly useful in solar powered or unattended installations.

The application program sets the default state of the LED power. The state of the STAT LED, on or off, and the time to return to the default state may be set in the TelePACE, ISaGRAF or C application. The default state is set for OFF and time to return to the default state is set for 5 minutes at the factory.

6 Modbus Register Mapping

The tables in this section of the manual describe the parameters within a SCADASense 4202 Series controller, which are assigned to Modbus registers. The registers defined may be read only or read and write registers. The Read/Write column in the tables indicates the register type.

- **Read** indicates the register is read only.
- **Read/Write** indicates the register may be read or written to.

6.1 Write Protect Jumper

The transmitter can be write protected by installing the write-protect jumper. See **Figure 7: Optional Display and Write Protect Jumper** for the location of the write protection jumper.

- When the write-protect jumper is installed, registers 40001 to 40499 are read only.
- When the write-protect jumper is not installed, the read/write ability corresponds to the table.

Note: When the write protect jumper is changed while the transmitter is powered it may take up to one minute for the change to be recognized.

6.2 Software Write Protect

The Flow Computer must log all changes to measurement parameters. When the flow computer is running the software write-protect is enabled. This prevents Modbus protocol commands and logic applications from writing the transmitter registers.

- When the software write-protect is enabled, registers 40001 to 40499 are read only via Modbus commands, Ladder Logic register access, and ISaGRAF register access. C programs can write to the registers in the normal fashion.
- When the software write-protect is disabled, the read/write ability corresponds to the table.

The software write-protect is disabled by default at reset.

6.3 Data Formats

Data formats defined in the table below are used in a SCADASense 4202 Series controller.

Table 1: Data Format

Data Type	Registers Required	Description
Integer	1	Unsigned integer in the range 0 to 65535.
Float	2	IEEE single precision floating-point number. The byte order is determined by the contents of the Floating Point Byte Order register, 40132. Floating-point values are stored in two consecutive registers. Both registers must be read or written in the same Modbus command. Failure to do so may result in indeterminate values.

Data Type	Registers Required	Description
ASCII	1	Two characters are stored in each register. Valid values are any ASCII character. The first character is in the low order byte, the second in the high order byte. The string is terminated with a NULL (= 0) character if it is less than 8 characters. Set the first register to 0 to indicate a NULL (empty) string.

6.4 Modbus Registers

Table 2: Modbus Registers

Register	Type	Read/Write	Parameter
40001	Integer	Read	Manufacturer's Code This register holds a constant value of 4000. This indicates the transmitter is manufactured by Control Microsystems.
40002	Integer	Read	Type Code This indicates the model of the transmitter. Type Code 4202 = SCADASense 4202 DR
40003	Integer	Read	Software Revision Level This register holds the revision number of the controller firmware.
40004	Integer	Read	Sensor Software Version Level This register holds the version number of the sensor firmware. This is read from the sensor. It uses the format: MAJOR_VERSION * 100 + MINOR_VERSION. For example: 1.19 would be viewed as 119 in register 40004.
40005 - 40006			Reserved
40007 - 40008	Integer	Read	Transmitter Serial Number Register 40007 holds the manufacture date as bits in the format YYYYYYYMMMMDDDDD, where these bits correspond to Year+1986/Month/Day. Register 40008 holds the core number.
40009	Integer	Read	Sensor Hardware Version This register holds the version number of the sensor hardware. This is read from the sensor.
40010	Integer	Read	Modbus Revision This register holds the Modbus mapping and protocol revision. It is fixed at 1.
40011	Integer	Read/Write	Sensor Type This register selects if the Static Pressure measures gage or absolute pressure. A value of 1 means gage pressure. The gage pressure is calculated by measuring the absolute pressure and adding the contents of register 40399. The user must set the value in

Register	Type	Read/Write	Parameter
			register 40399 for the gage pressure to be accurate. A value of 0 means absolute pressure.
40012 - 40014			Reserved
40015	Integer	Read/Write	Baud rate (com2) This register is used to set the baud rate on Com2 of this transmitter. When the value of this register changes, the baud rate on Com2 is changed accordingly. Valid values are: 0 = 75 1 = 110 2 = 150 3 = 300 4 = 600 5 = 1200 6 = 2400 7 = 4800 8 = 9600 (default) 9 = 19200 10 = 38400
40016	Integer	Read/Write	Transmitter Address This register holds the transmitter address. This information comes from the COM2 station number. Changing this value also changes the COM2 serial port settings to the new Modbus station number and makes the settings permanent.
40018 - 40031			Reserved
40032 - 40035	ASCII	Read/Write	Tag name (8 characters) These registers hold the transmitter tag name. The tag name can be up to 8 characters. Two characters are stored in each register. Valid values are any ASCII character.
40036 - 40043	ASCII	Read/Write	Description (16 characters) These registers hold the transmitter description. The description can be up to 16 characters. Two characters are stored in each register. Valid values are any ASCII character.
40044 - 40059	ASCII	Read/Write	Message (32 characters) These registers hold the transmitter message. The message can be up to 32 characters. Two characters are stored in each register. Valid values are any ASCII character.

Register	Type	Read/Write	Parameter
40060	Integer	Read/Write	Differential Pressure Units This register holds a value representing the engineering units for the differential pressure. Valid values are shown below. 2 = Pascals (Pa) 3 = kiloPascal (kPa) 6 = inches of water at 68 F
40061	Integer	Read/Write	Static Pressure Units This register holds a value representing the engineering units for the static pressure. Valid values are shown below. 3 = kiloPascal (kPa) 4 = megaPascal (MPa) 5 = pounds per square inch (psi)
40062	Integer	Read/Write	Process Temperature Units This register holds a value representing the engineering units for the process temperature. Valid values are shown below. 20 = degrees Celsius (C) 21 = degrees Fahrenheit (F)
40063 – 40125			Reserved
40126	Integer	Read/Write	Display Scan Interval This register controls the display scan interval. It will hold the value in seconds that each reading selected in the Display Control will remain on the display. Valid values will be integers between 2000 and 60000 ms.
40127			Reserved
40128	Bit field	Read/Write	Display Control This register controls which items are displayed on the display. This register is a bit-mapped field. The following shows the effects of individual bits. When a bit is turned on the floating point value and associated text will be cycled through on the display. Bit 00 = Display DP in transmitter units Bit 01 = Display SP in transmitter units Bit 02 = Display PT in transmitter units Bit 03 = Display Communication settings (baud rate and station number) Bit 04 = Display 1st user defined data set Bit 05 = Display 2nd user defined data set Bit 06 = Display 3rd user defined data set Bit 07 = Display 4th user defined data set Bit 08 = Display 5th user defined data set Bit 09 = Display 6th user defined data set Bit 10 = Display 7th user defined data set Bit 11 = Display 8th user defined data set Bit 12 = Display 9th user defined data set Bit 13 = Display 10th user defined data set

Register	Type	Read/Write	Parameter
			Bit 14 = Display 11th user defined data set Bit 15 = Display 12th user defined data set
40129 – 40130			Reserved
40131	Integer	Read/Write	Response Delay time This register is included for 3095FB compatibility only. The response delay time cannot be set. The value in this register has no effect.
40132	Integer	Read/Write	Floating Point Format This register is included for 3095FB compatibility only. The floating-point format is fixed. This register specifies the byte order of floating-point registers. All floating-point numbers are in the IEEE 754 format. Numbers are made up of one sign bit (S), eight exponent bits (E), and twenty-three mantissa bits (M). A number consists of 4 bytes as shown below. Byte A Byte B Byte C Byte D SEEE EEEE EMMM MMMM MMMM MMMM MMMM MMMM The only valid value is 0. The register will always return 0 when read. 0 = A B C D (default, RealFLO format) 1 = C D A B (not available) 2 = D C B A (not available) 3 = B A D C (not available)
40133 - 40144			Reserved
40145	Integer	Read	com2 framing errors This register holds the number of framing errors on com2. This register is cleared when the controller is reset.
40146	Integer	Read	com2 parity errors This register holds the number of parity errors on com2. This register is cleared when the controller is reset.
40147	Integer	Read	com2 overrun errors This register holds the number of character-overrun errors on com2. This register is cleared when the controller is reset.
40148	Integer	Read	com2 Modbus checksum errors This register holds the number of Modbus checksum errors on com2. This register is cleared when the controller is reset.
40149	Integer	Read	com2 Modbus commands received This register holds the number of Modbus commands received on com2. This register is cleared when the controller is reset.
40150	Integer	Read	com2 Modbus responses sent

Register	Type	Read/Write	Parameter
			This register holds the number of Modbus responses sent on com2. This register is cleared when the controller is reset.
40151	Integer	Read	com3 framing errors This register holds the number of framing errors on com3. This register is cleared when the controller is reset.
40152	Integer	Read	com3 parity errors This register holds the number of parity errors on com3. This register is cleared when the controller is reset.
40153	Integer	Read	com3 overrun errors This register holds the number of character-overrun errors on com3. This register is cleared when the controller is reset.
40154	Integer	Read	com3 Modbus checksum errors This register holds the number of Modbus checksum errors on com3. This register is cleared when the controller is reset.
40155	Integer	Read	com3 Modbus commands received This register holds the number of Modbus commands received on com3. This register is cleared when the controller is reset.
40156	Integer	Read	com3 Modbus responses sent This register holds the number of Modbus responses sent on com3. This register is cleared when the controller is reset.
40157	Integer	Read	Sensor framing errors This register holds the number of framing errors on Sensor communication with the sensor electronics. This register is cleared when the controller is reset.
40158	Integer	Read	Sensor parity errors This register holds the number of parity errors on Sensor communication with the sensor electronics. This register is cleared when the controller is reset.
40159	Integer	Read	Sensor overrun errors This register holds the number of character-overrun errors on Sensor communication with the sensor electronics. This register is cleared when the controller is reset.
40160	Integer	Read	Sensor checksum errors This register holds the number of checksum errors on Sensor communication with the sensor electronics. This register is cleared when the controller is reset.
40161	Integer	Read	Sensor commands sent This register holds the number of Sensor commands sent to the sensor electronics. This

Register	Type	Read/Write	Parameter
			register is cleared when the controller is reset.
40162	Integer	Read	Sensor responses received This register holds the number of Sensor responses received from the sensor electronics. This register is cleared when the controller is reset.
40164 – 40203			Reserved
40204	Integer	Read	Scaled Integer Method This register is included only for 3095 compatibility. Scaled integers are not supported. The only valid value is 0. The register will always return 0 when read.
40205	Integer	Read/Write	Reset to Default Parameters Writing to this register resets the transmitter to default parameters. Note: The transmitter calibration is reset to full scale with an offset of zero. The transmitter should be re-zeroed after this action. A sequence of three numbers must be written to the register to cause a reset. This protects accidental modification of the register from resetting the parameters. Use the following procedure to reset the parameters. Write the value 493 to the register. Write the value 27254 to the register. Write the value 6003 to the register. To abort the sequence once it is started write any value other than the next value in the sequence. See Table 3-Default Parameters table for default values.
40206	Integer	Read/Write	Sensor operating mode This register controls the operating mode of the transmitter: online mode, offline mode, or calibrate mode. Note: Process values are updated only in the online mode. Ensure the system is in a safe state before switching to offline or calibrate mode. This register must be set to offline mode before changing engineering units or re-ranging the transmitter. This register must be in either offline mode or calibrate mode before changing the damping values. This register must be set to calibration mode before changing the span or the zero. Changes are not applied until the unit is placed online. Valid values shown below. The default value is 0 (online).

Register	Type	Read/Write	Parameter
			0 = online mode, normal operation 63 = offline mode, change engineering units, re-range transmitter or change damping values. 255 = calibrate mode, change zero, span or damping values. The display will indicate OFFLINE when the transmitter is in the offline or calibrate modes. The display will operate normally in the online mode. When the transmitter is in offline mode the only valid mode change is to online mode. Note: This register is cleared when the power is lost to the transmitter. The transmitter always starts in online mode. If power is lost while in either calibration or offline mode the transmitter may report incorrect measurement values. Should this occur put the transmitter in offline mode and write a valid DP Damping value. The transmitter will now need to be returned to online mode to complete the recovery.
40207 – 40208	Float	Read/Write	1st user defined display value These registers hold the floating-point value that will be included in the display cycle if the bit to display the 1st user defined data set is turned on in the Display Control register. Only values between –9999 and 99999 can be displayed. Any value outside of that range will be replaced by ----- (5 dashes) on the display.
40209 – 40215	ASCII	Read/Write	1st user defined display text These registers hold the text that will be included in the display cycle if the bit to display the 1st user defined data set is turned on in the Display Control register. Each register holds 2 ASCII characters. The first 7 ASCII characters will be displayed on line 2 of the display, followed by the second 7 ASCII characters. The ***Table 4-Display Module ASCII Characters*** table below lists the displayable characters.
40216 – 40217	Float	Read/Write	2nd user defined display value These registers hold the floating-point value that will be included in the display cycle if the bit to display the 2nd user defined data set is turned on in the Display Control register. Only values between –9999 and 99999 can be displayed. Any value outside of that range will be replaced by ----- (5 dashes) on the display.
40218 – 40224	ASCII	Read/Write	2nd user defined display text These registers hold the text that will be included in the display cycle if the bit to display the 2nd user defined data set is turned on in the Display Control register. Each register holds 2 ASCII characters. The first 7 ASCII characters will be displayed on line 2 of the display,

Register	Type	Read/Write	Parameter
			followed by the second 7 ASCII characters. The ***Table 4-Display Module ASCII Characters*** table below lists the displayable characters.
40225 – 40226	Float	Read/Write	3rd user defined display value These registers hold the floating-point value that will be included in the display cycle if the bit to display the 3rd user defined data set is turned on in the Display Control register. Only values between –9999 and 99999 can be displayed. Any value outside of that range will be replaced by ----- (5 dashes) on the display.
40227 – 40233	ASCII	Read/Write	3rd user defined display text These registers hold the text that will be included in the display cycle if the bit to display the 3rd user defined data set is turned on in the Display Control register. Each register holds 2 ASCII characters. The first 7 ASCII characters will be displayed on line 2 of the display, followed by the second 7 ASCII characters. The ***Table 4-Display Module ASCII Characters*** table below lists the displayable characters.
40234 – 40235	Float	Read/Write	4th user defined display value These registers hold the floating-point value that will be included in the display cycle if the bit to display the 4th user defined data set is turned on in the Display Control register. Only values between –9999 and 99999 can be displayed. Any value outside of that range will be replaced by ----- (5 dashes) on the display.
40236 – 40242	ASCII	Read/Write	4th user defined display text These registers hold the text that will be included in the display cycle if the bit to display the 4th user defined data set is turned on in the Display Control register. Each register holds 2 ASCII characters. The first 7 ASCII characters will be displayed on line 2 of the display, followed by the second 7 ASCII characters. The ***Table 4-Display Module ASCII Characters*** table below lists the displayable characters.
40243 – 40244	Float	Read/Write	5th user defined display value These registers hold the floating-point value that will be included in the display cycle if the bit to display the 5th user defined data set is turned on in the Display Control register. Only values between –9999 and 99999 can be displayed. Any value outside of that range will be replaced by ----- (5 dashes) on the display.
40245 – 40251	ASCII	Read/Write	5th user defined display text These registers hold the text that will be included in the display cycle if the bit to display the 5th user defined data set is turned on in the Display Control register. Each register holds 2

Register	Type	Read/Write	Parameter
			ASCII characters. The first 7 ASCII characters will be displayed on line 2 of the display, followed by the second 7 ASCII characters. The ***Table 4-Display Module ASCII Characters*** table below lists the displayable characters.
40252 – 40253	Float	Read/Write	6th user defined display value These registers hold the floating-point value that will be included in the display cycle if the bit to display the 6th user defined data set is turned on in the Display Control register. Only values between –9999 and 99999 can be displayed. Any value outside of that range will be replaced by ----- (5 dashes) on the display.
40254 – 40260	ASCII	Read/Write	6th user defined display text These registers hold the text that will be included in the display cycle if the bit to display the 6th user defined data set is turned on in the Display Control register. Each register holds 2 ASCII characters. The first 7 ASCII characters will be displayed on line 2 of the display, followed by the second 7 ASCII characters. The ***Table 4-Display Module ASCII Characters*** table below lists the displayable characters.
40261 – 40262	Float	Read/Write	7th user defined display value These registers hold the floating-point value that will be included in the display cycle if the bit to display the 7th user defined data set is turned on in the Display Control register. Only values between –9999 and 99999 can be displayed. Any value outside of that range will be replaced by ----- (5 dashes) on the display.
40263 – 40269	ASCII	Read/Write	7th user defined display text These registers hold the text that will be included in the display cycle if the bit to display the 7th user defined data set is turned on in the Display Control register. Each register holds 2 ASCII characters. The first 7 ASCII characters will be displayed on line 2 of the display, followed by the second 7 ASCII characters. The ***Table 4-Display Module ASCII Characters*** table below lists the displayable characters.
40270 – 40271	Float	Read/Write	8th user defined display value These registers hold the floating-point value that will be included in the display cycle if the bit to display the 8th user defined data set is turned on in the Display Control register. Only values between –9999 and 99999 can be displayed. Any value outside of that range will be replaced by ----- (5 dashes) on the display.
40272 – 40278	ASCII	Read/Write	8th user defined display text These registers hold the text that will be included in the display cycle if the bit to display

Register	Type	Read/Write	Parameter
			the 8th user defined data set is turned on in the Display Control register. Each register holds 2 ASCII characters. The first 7 ASCII characters will be displayed on line 2 of the display, followed by the second 7 ASCII characters. The ***Table 4-Display Module ASCII Characters*** table below lists the displayable characters.
40279 – 40280	Float	Read/Write	9th user defined display value These registers hold the floating-point value that will be included in the display cycle if the bit to display the 9th user defined data set is turned on in the Display Control register. Only values between –9999 and 99999 can be displayed. Any value outside of that range will be replaced by ----- (5 dashes) on the display.
40281 – 40287	ASCII	Read/Write	9th user defined display text These registers hold the text that will be included in the display cycle if the bit to display the 9th user defined data set is turned on in the Display Control register. Each register holds 2 ASCII characters. The first 7 ASCII characters will be displayed on line 2 of the display, followed by the second 7 ASCII characters. The ***Table 4-Display Module ASCII Characters*** table below lists the displayable characters.
40288 – 40289	Float	Read/Write	10th user defined display value These registers hold the floating-point value that will be included in the display cycle if the bit to display the 10th user defined data set is turned on in the Display Control register. Only values between –9999 and 99999 can be displayed. Any value outside of that range will be replaced by ----- (5 dashes) on the display.
40290 – 40296	ASCII	Read/Write	10th user defined display text These registers hold the text that will be included in the display cycle if the bit to display the 10th user defined data set is turned on in the Display Control register. Each register holds 2 ASCII characters. The first 7 ASCII characters will be displayed on line 2 of the display, followed by the second 7 ASCII characters. The ***Table 4-Display Module ASCII Characters*** table below lists the displayable characters.
40297 – 40298	Float	Read/Write	11th user defined display value These registers hold the floating-point value that will be included in the display cycle if the bit to display the 11th user defined data set is turned on in the Display Control register. Only values between –9999 and 99999 can be displayed. Any value outside of that range will be replaced by ----- (5 dashes) on the display.
40299 – 40305	ASCII	Read/Write	11th user defined display text

Register	Type	Read/Write	Parameter
			These registers hold the text that will be included in the display cycle if the bit to display the 11th user defined data set is turned on in the Display Control register. Each register holds 2 ASCII characters. The first 7 ASCII characters will be displayed on line 2 of the display, followed by the second 7 ASCII characters. The ***Display Module ASCII Characters*** table below lists the displayable characters.
40306 – 40307	Float	Read/Write	12th user defined display value These registers hold the floating-point value that will be included in the display cycle if the bit to display the 12th user defined data set is turned on in the Display Control register. Only values between –9999 and 99999 can be displayed. Any value outside of that range will be replaced by ----- (5 dashes) on the display.
40308 – 40314	ASCII	Read/Write	12th user defined display text These registers hold the text that will be included in the display cycle if the bit to display the 12th user defined data set is turned on in the Display Control register. Each register holds 2 ASCII characters. The first 7 ASCII characters will be displayed on line 2 of the display, followed by the second 7 ASCII characters. The ***Table 4-Display Module ASCII Characters*** table below lists the displayable characters.
40315 – 40398			Reserved
40399 - 40400	Float	Read/Write	Atmospheric Pressure These registers hold the user-specified atmospheric pressure as a floating-point number in the specified floating-point format. This value is used when the sensor type is set to gage using register 40011. This value is ignored if the sensor type is set to absolute. The value in this register must be in the same units as the static pressure. The transmitter must be in the offline mode to change this register. No change will be made if the transmitter mode is not correct.
40401 - 40402	Float	Read	Differential Pressure (DP) These registers hold the differential pressure as a floating-point number in the specified floating-point format.
40403 - 40404	Float	Read	Static Pressure (SP) These registers hold the static pressure as a floating-point number in the specified floating-point format. The diagnostic bits indicate the validity of this register.
40405 - 40406	Float	Read	Process Temperature (PT) These registers hold the process temperature

Register	Type	Read/Write	Parameter
			as a floating-point number in the specified floating-point format.
40407	Integer	Read	Diagnostic Bits This register holds a bit-mapped value. The individual bits correspond to these conditions 15 Calibration flag (see register 40206) 14 The process values may not be valid – If this bit is the only bit set then contact Technical Support. 13 Primary Variables are outside specification 12 DP signal above Upper Range Limit (URL) +10% 11 DP signal above Upper Range Limit (URL) 10 DP signal above Upper Operating Limit (URV) 9 DP signal below Lower Operating Limit (LRV) 8 DP signal below Lower Range Limit (LRL) 7 DP signal below Lower Range Limit (LRL) – 10% 6 SP signal above Upper Range Limit (URL) +10% 5 SP signal above Upper Range Limit (URL) 4 SP signal above Upper Operating Limit (URV) 3 SP signal below Lower Operating Limit (LRV) 2 SP signal below Lower Range Limit (LRL) 1 SP signal below Lower Range Limit (LRL) – 10% 0 N/A
40408	Integer	Read	Diagnostic Bits This register holds a bit-mapped value. The individual bits correspond to these conditions. Bit 15 = N/A Bit 14 = RTD signal above Upper Range Limit (URL) +10% Bit 13 = RTD signal above Upper Range Limit

Register	Type	Read/Write	Parameter
			(URL) Bit 12 = RTD signal above Upper Operating Limit (URV) Bit 11 = RTD signal below Lower Operating Limit (LRV) Bit 10 = RTD signal below Lower Range Limit (LRL) Bit 09 = RTD signal below Lower Range Limit (LRL) – 10% Bit 08 = N/A Bit 07 = Primary Variable is bad. Bit 06 = Secondary Variable is bad. Bit 05 = Tertiary Variable is bad. Bit 04 = Reserved Bit 03 = Reserved Bit 02 = Reserved Bit 01 = Reserved Bit 00 = Off-line Flag (see register 40206)
40409	Integer	Read	Diagnostic Bits This register holds a bit-mapped value. The individual bits correspond to these conditions. Bit 15 = Sensor module is not updating Bit 14 = reserved Bit 13 = Sensor microprocessor is not responding Bit 12 = reserved Bit 11 = reserved Bit 10 = reserved Bit 09 = reserved Bit 08 = reserved Bit 07 = reserved Bit 06 = reserved Bit 05 = reserved Bit 04 = reserved Bit 03 = reserved Bit 02 = reserved Bit 01 = Hardware write protect status Bit 00 = Software write protect status
40410	Integer	Read	Diagnostic Bits This register is reserved for future diagnostic bits. This register always contains 0.
40411	Integer	Read	Diagnostic Bits This register is reserved for future diagnostic bits. This register always contains 0.
40412	Integer	Read	Diagnostic Bits This register is reserved for future diagnostic bits. This register always contains 0.

Register	Type	Read/Write	Parameter
40413 - 40414	Float	Read	DP Upper Range Limit These registers hold the DP upper range value as a floating-point number in the specified floating-point format.
40415 - 40416	Float	Read	DP Lower Range Limit These registers hold the DP lower range value as a floating-point number in the specified floating-point format.
40417 - 40418	Float	Read/Write	DP Upper Operating Limit These registers hold the DP upper operating limit as a floating-point number in the specified floating-point format. The transmitter must be in the offline mode to change this register. No change will be made if the transmitter mode is not correct. The DP upper operating limit may be set higher than the primary variable upper range limit. The primary variable upper operating limit my be set as high as 1.5 times the primary variable upper range limit, provided that the difference between the primary variable UOL and primary variable LOL is no larger than the difference between the primary variable URL and primary variable LRL. The difference between the primary variable UOL and primary variable LOL must also be larger than 1% of the primary variable URL.
40419 - 40420	Float	Read/Write	DP Lower Operating Limit These registers hold the DP lower operating limit as a floating-point number in the specified floating-point format. The transmitter must be in the offline mode to change this register. No change will be made if the transmitter mode is not correct. The DP lower operating limit may be set lower than the primary variable lower range limit. The primary variable lower operating limit my be set as low as 1.5 times the primary variable lower range limit, provided that the difference between the primary variable UOL and primary variable LOL is no larger than the difference between the primary variable URL and primary variable LRL. The difference between the primary variable UOL and primary variable LOL must also be larger than 1% of the primary variable URL.
40421 - 40422	Float	Read	SP Upper Range Limit These registers hold the SP upper range value as a floating-point number in the specified floating-point format.
40423 - 40424	Float	Read	SP Lower Range Limit These registers hold the SP lower range value as a floating-point number in the specified

Register	Type	Read/Write	Parameter
			floating-point format.
40425 - 40426	Float	Read/Write	SP Upper Operating Limit These registers hold the SP upper operating limit as a floating-point number in the specified floating-point format. The transmitter must be in the offline mode to change this register. No change will be made if the transmitter mode is not correct. The SP upper operating limit may be set higher than the secondary variable upper range limit. The secondary variable upper operating limit may be set as high as 1.25 times the secondary variable upper range limit. The difference between the secondary variable UOL and secondary variable LOL must also be larger than 1% of the secondary variable URL.
40427 - 40428	Float	Read/Write	SP Lower Operating Limit These registers hold the SP lower operating limit as a floating-point number in the specified floating-point format. The transmitter must be in the offline mode to change this register. No change will be made if the transmitter mode is not correct. The SP lower operating limit must be greater than or equal to 0 if absolute pressure is selected, or –1* atmospheric reference if gage pressure is selected. The difference between the secondary variable UOL and secondary variable LOL must also be larger than 0.5% of the secondary variable URL.
40429 - 40430	Float	Read	PT Upper Range Limit These registers hold the PT upper range value as a floating-point number in the specified floating-point format.
40431 - 40432	Float	Read	PT Lower Range Limit These registers hold the PT upper range value as a floating-point number in the specified floating-point format.
40433 - 40434	Float	Read/Write	PT Upper Operating Limit These registers hold the PT upper operating limit as a floating-point number in the specified floating-point format. The transmitter must be in the offline mode to change this register. No change will be made if the transmitter mode is not correct. The PT upper operating limit may be set higher than the tertiary variable upper range limit. The tertiary variable upper operating limit my be set as high as 1.25 times the tertiary variable upper range limit, provided that the difference between the tertiary variable UOL and tertiary variable

Register	Type	Read/Write	Parameter
			LOL is no larger than the difference between the tertiary variable URL and tertiary variable LRL. The difference between the tertiary variable UOL and tertiary variable LOL must also be larger than 0.5% of the tertiary variable URL.
40435 - 40436	Float	Read/Write	PT Lower Operating Limit These registers hold the PT lower operating limit as a floating-point number in the specified floating-point format. The transmitter must be in the offline mode to change this register. No change will be made if the transmitter mode is not correct. The PT lower operating limit may be set lower than the tertiary variable lower range limit. The tertiary variable lower operating limit my be set as low as absolute zero (-273.15 °C, -459.67°F, 0 K, or 0 °R), provided that the difference between the tertiary variable UOL and tertiary variable LOL is no larger than the difference between the tertiary variable URL and tertiary variable LRL. The difference between the tertiary variable UOL and tertiary variable LOL must also be larger than 0.5% of the tertiary variable URL.
40437 - 40438	Float	Write	DP offset These registers are used to change the DP offset as a floating-point number in the specified floating-point format. This register is write only. The transmitter must be in the calibrate mode to change this register. No change will be made if the transmitter mode is not correct. The DP offset must be within 0.5 * primary variable URL of the default reading.
40439 - 40440	Float	Read/Write	DP Slope These registers hold the DP slope as a floating-point number in the specified floating-point format. The transmitter must be in the calibrate mode to change this register. No change will be made if the transmitter mode is not correct. The DP span entered must result in a slope of between 0.5 and 2.0.
40441 - 40442	Float	Read/Write	DP Damping These registers hold the DP damping as a floating-point number in the specified floating-point format. Valid values are 0.0 (damping off), 0.25, 0.5, 1.0, 2.0, 4.0, 8.0, 16.0, and 32.0 seconds. The default value is 0 (damping off). The transmitter must be in the offline or calibrate mode to change this register. No

Register	Type	Read/Write	Parameter
			change will be made if the transmitter mode is not correct.
40443 - 40444	Float	Write	SP offset These registers are used to change the SP offset as a floating-point number in the specified floating-point format. This register is write only. The transmitter must be in the calibrate mode to change this register. No change will be made if the transmitter mode is not correct. The SP offset must be within 0.5* secondary variable URL of the default reading.
40445 - 40446	Float	Read/Write	SP slope These registers hold the SP slope as a floating-point number in the specified floating-point format. The transmitter must be in the calibrate mode to change this register. No change will be made if the transmitter mode is not correct. The SP span entered must result in a slope of between 0.5 and 2.0. In order to change the span at least 5% of the rated pressure must be applied, otherwise the calibration will be rejected.
40447 - 40448	Float	Read/Write	SP Damping These registers hold the SP damping as a floating-point number in the specified floating-point format. Valid values are 0.0 (damping off), 0.25, 0.5, 1.0, 2.0, 4.0, 8.0, 16.0, and 32.0 seconds. The default value is 0 (damping off). The transmitter must be in the offline or calibrate mode to change this register. No change will be made if the transmitter mode is not correct.
40449 - 40450	Float	Read/Write	PT Offset These registers hold the PT offset as a floating-point number in the specified floating-point format. The transmitter must be in the calibrate mode to change this register. No change will be made if the transmitter mode is not correct. The PT offset may be adjusted from the default value by up to 1% of the tertiary URL.
40451 - 40499			Reserved
40500	Integer	Read/Write	Reserved for analog output (see default register assignment)

6.4.1 Default Parameters

A SCADASense 4202 transmitter is reset to default values when the correct sequence is written to register 40205. The following table shows the registers that are reset and their default values.

Table 3: SCADASense 4202 Transmitter -Default Parameters

Register	Type	Value	Parameter
40060	Integer	inches of water at 68 F	Differential Pressure Units
40061	Integer	Psia	Static Pressure Units
40062	Integer	degrees C	Process Temperature Units
40407	Integer	current conditions	Diagnostic Bits
40408	Integer	current conditions	Diagnostic Bits
40409	Integer	current conditions	Diagnostic Bits
40410	Integer	0	Diagnostic Bits
40411	Integer	0	Diagnostic Bits
40412	Integer	0	Diagnostic Bits
40417 - 40418	Float	factory maximum sensor limit	DP Upper Operating Limit
40419 - 40420	Float	0.0	DP Lower Operating Limit
40425 - 40426	Float	factory maximum sensor limit	SP Upper Operating Limit
40427 - 40428	Float	0.0	SP Lower Operating Limit
40433 - 40434	Float	factory maximum sensor limit	PT Upper Operating Limit
40435 - 40436	Float	factory minimum sensor limit	PT Lower Operating Limit
40437 - 40438	Float	0.0	DP offset
40439 - 40440	Float	1.0	DP Slope (factory calibration)
40441 - 40442	Float	0.0	DP Damping
40443 - 40444	Float	0.0	SP offset
40445 - 40446	Float	1.0	SP slope (factory calibration)
40447 - 40448	Float	0.0	SP Damping
40449 - 40450	Float	0.0	PT Offset

6.4.2 Display Module ASCII Characters

The table below lists the useable ASCII characters for the Display Module. The User Defined Display Text registers use these characters.

Table 4: Display Module ASCII Characters

Hex Value	Character	Hex Value	Character	Hex Value	Character
0x20	Space	0x48	H	0x62	b
0x25	%	0x49	I	0x63	c
0x2A	*	0x4A	J	0x64	d
0x2B	+	0x4B	K	0x65	e
0x2D	-	0x4C	L	0x66	f
0x2F	/	0x4D	M	0x67	g
0x30	0	0x4E	N	0x68	h
0x31	1	0x4F	O	0x69	i
0x32	2	0x50	P	0x6A	j
0x33	3	0x51	Q	0x6B	k
0x34	4	0x52	R	0x6C	l

Hex Value	Character	Hex Value	Character	Hex Value	Character
0x35	5	0x53	S	0x6D	m
0x36	6	0x54	T	0x6F	n
0x37	7	0x55	U	0x70	o
0x38	8	0x56	V	0x71	p
0x39	9	0x57	W	0x72	q
0x3C	<	0x58	X	0x73	r
0x3D	=	0x59	Y	0x74	s
0x3E	>	0x5A	Z	0x75	t
0x41	A	0x5B	[	0x76	u
0x42	B	0x5C	\	0x77	v
0x43	C	0x5D	]	0x78	w
0x44	D	0x5E	^	0x79	x
0x45	E	0x5F	_	0x7A	y
0x46	F	0x60	‘	0x70	z
0x47	G	0x61	A		

7 Maintenance

A SCADASense 4202 controller requires little maintenance. If the program is lost during power outages, the lithium battery may require replacement.

The analog input and output circuitry is calibrated at the factory and does not require periodic calibration. Calibration may be necessary if the module has been repaired as a result of damage.

If the controller is not functioning correctly, contact Control Microsystems Technical Support for information on returning the SCADAPack Controller for repair.

CAUTION !
Do not connect or disconnect any field wiring, including the wiring to the RS-232 ports, unless the power is off or the area is know to be non-hazardous.

7.1 Lithium Battery

A small lithium battery powers the CMOS memory and real-time clock when input power is removed.

The battery should not require replacement under normal conditions. The shelf life of the battery is 10 years. The battery is rated to maintain the real-time clock and RAM data for two years with the power off. Accidental shorting or extreme temperatures may damage the battery.

The battery is plugged into the circuit board and secured with a tie-wrap. If necessary it can be replaced with an identical battery available from Control Microsystems.

Battery replacement requires complete disassembly of the electronics assembly inside the controller. Extreme care should be used when disassembling and reassembling the device. Any cables that are removed in the disassembly process must by carefully reconnected. Be sure not to pinch or damage these cables during reassembly. It is necessary to replace the tie-wrap to secure to mechanically secure the battery.

Note: A SCADASense 4202 Series controller must be cold booted after a battery replacement to initialize RAM. Unpredictable operation may result if a cold boot is not performed.

7.2 Rotating Process Covers for Venting

As received, the IDP10 Transmitter provides sensor cavity draining without the need for side drain connections, regardless of whether the transmitter is mounted vertically or horizontally. Sensor cavity venting is provided by mounting horizontally or with the optional vent screw (-V). However, if you did not specify this option, you can still achieve venting (instead of draining) with vertical mounting by rotating the process covers. See ***Figure 23***.

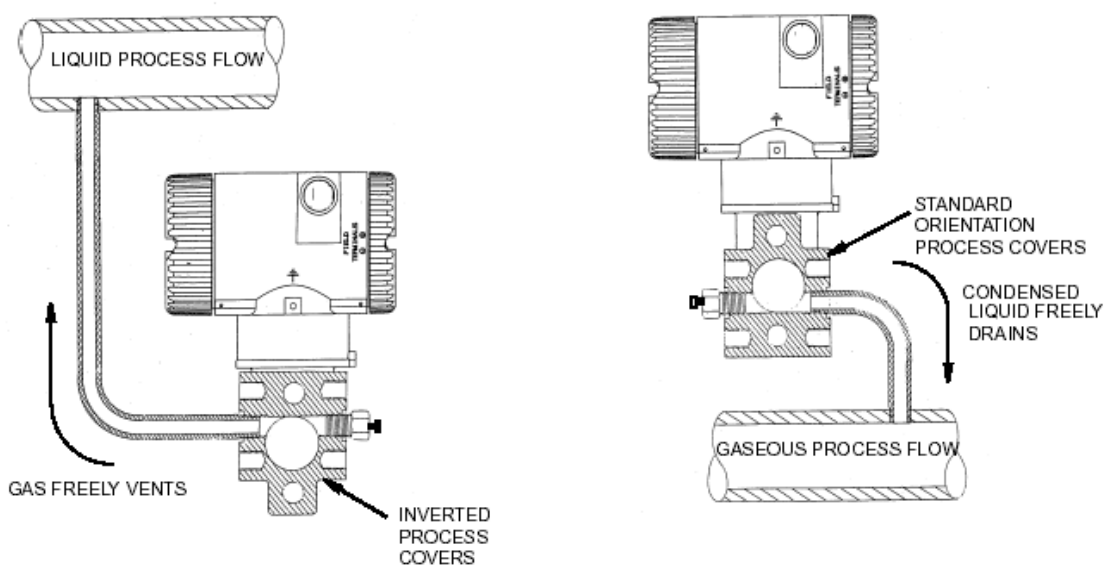

Figure 23: Sensor Cavity Venting and Draining

To rotate the process covers, refer to ***Figure 23: Sensor Cavity Venting and Draining*** and proceed as follows:

1. Remove the process covers from the sensor by removing two hex head bolts.
2. Replace the gaskets in the process covers.
3. Rotate the process covers so that the longer tab is at the bottom.
4. Reinstall the process covers and bolts. Torque the cover bolts to 100 Nm (75 lbft) in several even increments. Torque values are 66 Nm (50 lbft) when optional 316 ss bolts are specified.
5. Pressure test the sensor and process cover assembly by applying a hydrostatic pressure of 150% of the maximum static and over range pressure (see page 3) to both sides of the process cover/sensor assembly simultaneously through the process connections. Hold pressure for one minute. There should be no leakage of the test fluid through the gaskets. If leakage occurs, retighten the cover bolts per Step 4 or replace the gaskets and retest.

CAUTION !
Perform hydrostatic test with a liquid and follow proper hydrostatic test procedures.

8 Troubleshooting

8.1 Analog Output

Problem	Action
Outputs are always 0mA	Check the power supply. Check the wiring. The transmitter analog output is a sinking type and is not ground referenced.
The full-scale output is less than 20mA.	Check that the load resistance and power supply is within specification.
Output is constant and should be changing.	Check that the analog output is not forced.

8.2 Digital Input

Problem	Action
Input is off when a voltage is supplied.	Remove the voltage. The digital input monitors contacts or transistor collector/drain only.
Input is on when no signal is applied.	Check that the digital input is not forced on.
Input is off when a signal is applied.	Check that the digital input is not forced off.

8.3 Digital Output

Problem	Action
Using TelePACE firmware cannot turn output on or off.	Ensure that the 4202 DR Extended/4301 I/O register assignment is being used.
Using ISaGRAF firmware cannot turn output on or off.	Ensure that the ss4202dr I/O equipment is added to I/O connection.
Output is on when no signal is applied.	Check that the digital input is not forced on.
Output is off when a signal is applied.	Check that the digital input is not forced off.

8.4 Counter Inputs

Problem	Action
Incorrect counts on CTR/DIN0	CTR0/DIN0counter digital input is a high-speed input. Ensure that the applied input is free of contact bounce.

9 Specifications

***Disclaimer**: Control Microsystems reserves the right to change product specifications without notice. For more information visit www.controlmicrosystems.com .*

9.1 General

I/O Terminations	2, 3 and 4 pole, removable terminal blocks. 16 to 28 AWG 8A contacts
Environment	5% RH to 95% RH, non-condensing –40°C to 70°C –40°F to 158°F

9.2 Controller

Processors	16-bit CMOS microcontroller, 14.74MHz clock integrated watchdog timer microcontroller co-processor, 14.74MHz clock
Memory	1MBytes CMOS RAM 512kBytes Flash ROM 1kBytes EEPROM
Non-volatile RAM	CMOS RAM with lithium battery retains contents for 2 years with no power
Clock calendar	±1 minute/month at 25°C +1/-3 minutes/month 0 to 50°C

9.3 Communications

Communication Port COM2 andCOM3	3 position removable terminal block Jumper selectable RS-232 or RS485
RS-232	TxD and RxD implemented. RS-232 compatible serial port (CMOS) Functions when COM2/3 jumper installed.
RS-485	2-wire half duplex. 5100Ω bias resistors Functions when COM2/3 jumper removed.
COM2 Baud Rates	300, 600, 1200, 2400, 4800, 9600, 19200 and 38400
COM3 Baud Rates	1200, 2400, 4800, 9600, 19200, 38400, 57600 and 115200
Parity	none, even, or odd
Word Length	7 or 8 bits
Stop Bits	1 or 2 bits
Transient Protection	COM2, COM3: 2.5kV surge withstand capability as per ANSI/IEEE C37.90.1-1989
Isolation	Common ground return connected to negative side of Vin power input.
Cable Length	RS-232 –maximum 10 ft (3 m)

	RS-485 –maximum 4000 ft (1200 m)
Protocol	TeleBUS (compatible with Modbus RTU and Modbus ASCII)
Protocol Modes	Slave, master, master/slave, store and forward

9.4 Visual Indicators

Status	Internal Status LED (shows functional status)

9.5 Power Supply

DC power Input	9V minimum 30V maximum Typically 330mW (at 12V) during normal operation. Maximum 400mW (at 30V) at full temperature range, DIN0 ON and Communication on both serial ports.

9.6 Analog Input

Power Input Voltage Monitor	8 bits resolution Accuracy ±1.0V. 9-32.768V measurement range 0-32.768V scaling
Isolation	Common ground return connected to negative side of Vin power input.

9.7 Analog Output

Output Signal Range	0-20mA
Load Resistance Range	550 to 1400Ω with 30Vdc supply 250 to 1100Ω with 24Vdc supply 0 to 850Ω with 19Vdc supply 0 to 500Ω with 12Vdc supply 0 to 350Ω with 9Vdc supply Note: Analog output sinks current. Maximum power dissipation is 380mW. Example: 20mA at 19V.
Output Type	Single ended regulation on negative side with positive side of load connected to a positive voltage.
Isolation	Common ground return connected to negative side of Vin power input.
Resolution	12 bits
Accuracy	Specified from 0.5-20mA ±0.15% of full scale at 25°C (77°F) ±0.25% of full scale over temperature range
Noise and Ripple	0.04% maximum
Transient Protection	Transient: 2.5kV surge withstand capability as per ANSI/IEEE C37.90.1-1989
Response Time	Less than 10µs for 10% to 90% signal change

9.8 Turbine Meter Counter Input

Type	Counter 1

	Single turbine meter input. Designed for use with low voltage, turbine meter outputs.
Turbine Meter Sensitivity	Minimum input 30mVp-p at 5-50Hz. Minimum input 150mVp-p at 150Hz. Minimum input 650mVp-p at 5kHz. Minimum input 750mVp-p at 10kHz. Maximum input 4Vp-p using internal amplifier.
Transient Protection	2.5kV surge withstand capability as per ANSI/IEEE C37.90.1-1989
Isolation	Common ground return connected to Chassis Ground.

9.9 Digital Counter Input

Type	Counter 0. Dry contact input. Wetting current typically 5mA. Contact closure to ground is ON. Open input is OFF.
Frequency	0-10kHz.
Input Thresholds	0.8V typical turn on input voltage. Less than 0.4V guaranteed turn on input voltage. 1.5V typical turn off input voltage. Greater than 2.0V guaranteed turn off input voltage.
Contact Resistance	ON input requires less than 100Ω contact resistance. OFF input requires greater than 1kΩ contact resistance.
Transient Protection	2.5kV surge withstand capability as per ANSI/IEEE C37.90.1-1989
Isolation	Common ground return connected to Chassis Ground.

9.10 Digital Output

Type	Open drain sinking
Load Range	500mA maximum 30VDC maximum
Transient Protection	2.5kV surge withstand capability as per ANSI/IEEE C37.90.1-1989
Isolation	Common ground return connected to Chassis Ground.
Note	Digital Output available on version 5 and later controller hardware.

9.11 Transmitter Functional Specifications

Span and Range Limits for Differential Pressure & Absolute Pressure

Span Code	**Differential Pressure**		**Absolute Pressure**	
	inches of H_20	kPa	psia	MPa
A	0.5 to 30 inH_2O	(0.12 to 7.5 kPa)	1 to 100 psi	(0.007 to 0.7 MPa)
B	2 to 200 inH_2O	(0.50 to 50 kPa)	3 to 300 psi	(0.021 to 2.1 MPa)
C	10 to 840 inH_2O	(2.50 to 210 kPa)	3 to 300 psi	(0.021 to 2.1 MPa)

D	2 to 200 inH2O	(0.50 to 50 kPa)	30 to 1500 psi	(0.21 to 10 MPa)
F	3 to 300 inH2O	(0.75 to 75 kPa)	30 to 1500 psi	(0.21 to 10 MPa)
E	10 to 840 inH2O	(2.50 to 210 kPa)	30 to 1500 psi	(0.21 to 10 MPa)
J	2 to 200 inH2O	(0.50 to 50 kPa)	30 to 3000 psi	(0.21 to 21 MPa)
K	3 to 300 inH2O	(0.75 to 75 kPa)	30 to 3000 psi	(0.21 to 21 MPa)
L	10 to 840 inH2O	(2.5 to 210 kPa)	30 to 3000 psi	(0.21 to 21 MPa)
Low Profile Sensor				
U	0.5 to 30 inH2O	(0.12 to 7.5 kPa)	1 to 100 psi	(0.007 to 0.7 MPa)
V	2 to 200 inH2O	0.50 to 50 kPa)	3 to 300 psi	(0.021 to 2.1 MPa)
W	10 to 840 inH2O	(2.5 to 210 kPa)	3 to 300 psi	(0.021 to 2.1 MPa)
X	2 to 200 inH2O	(0.50 to 50 kPa)	30 to 1500 psi	(0.21 to 10 MPa)
Z	3 to 300 inH2O	(0.75 to 75 kPa)	30 to 1500 psi	(0.21 to 10 MPa)
Y	10 to 840 inH2O	(2.5 to 210 kPa)	30 to 1500 psi	(0.21 to 10 MPa)
M	2 to 200 inH2O	(0.50 to 50 kPa)	30 to 3000 psi	(0.21 to 21 MPa)
P	3 to 300 inH2O	(0.75 to 75 kPa)	30 to 3000 psi	(0.21 to 21 MPa)
R	10 to 840 inH2O	(2.5 to 210 kPa)	30 to 3000 psi	(0.21 to 21 MPa)

Maximum Static Pressure, Working Pressure (MWP), and Overrange Pressure

Span Code	**Sensor URL (DP and AP)**		**Maximum Static**		**Maximum Working (MWP)**		**Maximum Overrange**	
	DP	AP	Mpa	psi	Mpa	Psi	Mpa	psi
A	30 inH2O (7.5 kPa)	100 psia	0.7	100	0.7	100	1.0	150
B	200 inH2O (50 kPa)	300 psia	2.1	300	2.1	300	3.1	450
C	840 inH2O (210 kPa)	300 psia	2.1	300	2.1	300	3.1	450
D	200 inH2O (50 kPa)	1500 psia	10	1500	10	1500	15	2250
F	300 inH2O (75 kPa)	1500 psia	10	1500	10	1500	15	2250
E	840 inH2O (210 kPa)	1500 psia	10	1500	10	1500	15	2250

Measured and Transmitted Outputs

- Absolute Pressure (Configurable for Gauge Pressure; PGP = PAP - Patm)
- Differential Pressure
- Process Temperature (from External RTD)

Process Temperature Measurement and Limits

Measurement

DIN/IEC, 2-, 3-, or 4-wire, 100 ohm, Platinum

Resistance-Temperature-Detector (RTD)

Span Limits

10 and 538°C (50 and 1000°F)

Range Limits

-40 and +649°C (-40 and +1200°F)

Adjustable Damping

The transmitter response time is normally 1.0 s, or the electronically adjustable setting of 0.00 (none), 0.50, 1, 2, 4, 8, 16, or 32 seconds, whichever is greater, for a 90% recovery from an 80% input step as defined in ANSI/ISA S51.1.

Suppressed Zero and Elevated Zero

Suppressed or elevated zero ranges acceptable as long as Span and Range Limits are not exceeded.

Minimum Allowable Pressure

With Silicone Fill Fluid

Full vacuum: up to 121 °C (250 °F)

9.12 Transmitter Temperature Specifications

Sensor Body

Reference conditions	24 +/- 2 o C (75 +/- o F)
Normal operating conditions	-29 to 82 o C (-20 to 180 o F)
Operative limits	-46 to 121 o C (-50 to 250 o F)
Storage and transportation limits	N/A

Sensor Electronics

Reference conditions	24 +/- 2 o C (75 +/- o F)
Normal operating conditions	-29 to 82 o C (-20 to 180 o F)
Operative limits	-40 to 85 o C (-40 to 185 o F)
Storage and transportation limits	-54 to 85 o C (-65 to 185 o F)

LCD Display

Reference conditions	24 +/- 2 o C (75 +/- o F)
Normal operating conditions	-29 to 82 o C (-20 to 180 o F)
Operative limits	-29 to 85 o C (-20 to 185 o F)
Storage and transportation limits	-54 to 85 o C (-65 to 185 o F)

Although the LCD will not be damaged at any temperature within the Storage and Transportation Limits updates will be slowed and readability will be decreased at temperatures outside the Normal Operating Conditions.

9.13 Transmitter Performance Specifications

Zero-Based Calibrations; Stainless Steel Sensor with Silicone Fluid; Under Reference Operating Conditions unless otherwise specified; URL=Upper Range Limit and Span=Calibrated Span

Accuracy

Accuracy stated includes the effects of Linearity, Hysteresis, and Repeatability.

Differential and Absolute Pressure

For gauge pressure accuracy, add anticipated variation from user-entered barometric pressure.

Digital output accuracy:

±0.05% of Span for spans > or = 10% of URL

Digital Output Accuracy for spans of <10% URL:

±(0.005)X(URL / Span) % of Span

Process Temperature

±0.28°C (±0.5°F) for the SCADASense 4202 Series of transmitters. This does not include RTD uncertainties, which are additive.

Stability

Long-Term Drift less than ±0.05% of URL per year over a 5-year period.

Power-up Time

Less than 10 seconds for output to reach first valid measurement.

Vibration Effect

±0.2% of URL per "g" for vibrations in the range of 5 to 500 Hz; with double amplitudes of 6.3 mm (0.25 in) in the range of 5 to 15 Hz, or accelerations of 3 "g" in the range of 15 to 500 Hz, whichever is smaller, for transmitter with aluminum housing; and with double amplitudes of 6.3 mm (0.25 in) in the range of 5 to 9 Hz, or accelerations of 1 "g" in the range of 9 to 500 Hz, whichever is smaller, for transmitter with 316 ss housing.

RFI Effect

The output error is less than 0.1% of span for radio frequencies in the range of 27 to 1000 MHz and field intensity of 30 V/m when the transmitter is properly installed with shielded conduit and grounding, and housing covers are in place. (Per IEC Std. 801-3.)

Supply Voltage Effect

Output changes less than 0.005% of span for each 1 V change within the specified supply voltage requirements.

Static Pressure Effect on Differential Pressure

The zero and span shift for a 7 MPa, (1000 psi), change in static pressure is:

ZERO SHIFT ±0.05% of URL

SPAN SHIFT ±0.1% of Reading

Position Effect

Transmitter may be mounted in any position. Any zero effect caused by mounting position can be eliminated by re-zeroing. There is no span effect.

Ambient Temperature Effect

Total effect for a 28°C (55°F) change within Normal Operating Condition limits for both absolute and differential pressure measurements is:

DIGITAL OUTPUT: ±(0.03% URL + 0.06% Reading).

For Span Codes A and L:

DIGITAL OUTPUT: ±(0.18% URL + 0.025% Reading).

Switching and Indirect Lightning Transients

The transmitter can withstand a transient surge up 2000 V common mode or 1000 V normal mode without permanent damage. Output shift is <1.0%. (Per ANSI/IEEE C62.41-1980 and IEC Std. 801-5.)

Electromagnetic Compatibility

Complies with NAMUR Part 1 Interference Immunity Requirement (EMC). Complies with Electromagnetic Compatibility Requirements of European EMC Directive 89/336/EEC by Conforming to following CENELEC and IEC Standards: EN 50081-2, EN 50082-2, IEC 801-2 through 801-6

9.14 Transmitter Physical Specifications

Process Cover and Connector Material (Process Wetted)

316 ss or Hastelloy C, as specified.

Process Cover and Process Connection Gaskets

Glass filled ptfe (Chemloy)

Process Cover Bolts and Nuts

ASTM A193, Grade B7 high strength alloy steel for bolts, and ASTM A194 Grade 2H high strength alloy steel for nuts are standard. Options include NACE Class B7M bolting, 17-4 ss bolting, and 316 ss bolting.

Sensor Material (Process Wetted)

316 L ss or Hastelloy C, as specified

Sensor Fill Fluids

Silicone Oil

Environmental Protection

Transmitter is dust tight and weather proof per IEC IP66 and provides the environmental and corrosion resistant protection of NEMA Type 4X.

Electronics Housing and Housing Covers

Housing has two compartments to separate the electronics from the field connections. The housing and covers are made from low copper, die-cast aluminum alloy with an epoxy finish, or from 316 ss. Buna-N O-ring seals are used to seal the threaded housing covers, housing neck, and terminal block.

Electrical Connections

Field wiring enters through 1/2" NPT threaded entrances on either side of the electronics housing. Wires terminate in removable terminal blocks for ease of installation and calibration.

Mounting Position

The transmitter may be mounted in any orientation.

Approximate Mass

3.5 kg (7.8 lb) – without Process Connectors

4.2 kg (9.2 lb) – with Process Connectors

Add 1.1 kg (2.4 lb) – with 316 ss Housing

Add 0.2 kg (0.4 lb) – with LCD Indicator Option

9.15 Approvals and Certifications

Safety	c(CSA)us Explosion proof. Class I, Div. 1 Groups B, C and D Hazardous Locations.
	c(CSA)us Class I, Div. 2 Groups A, B, C and D Hazardous Locations.
	Temperature code T5 at maximum ambient, 70°C.
	Provides non-incendive field circuits for RTD.
	LCIE 07 ATEX6058 Ex d IIC T6 IECEx CSA 05.0011 Exd IIC T6
Digital Emissions	FCC Part 15, Subpart B, Class A Verification EN 61000-6-4: 2001 Electromagnetic Compatibility Generic Emission Standard for Industrial Environments
Immunity	EN 61000-6-2; 2001 Electromagnetic Compatibility Generic Standards Immunity For Industrial Environments

9.15.1 ATEX/IECEx label

CONTROL MICROSYSTEMS
TELEMETERING EQUIPMENT FOR USE IN HAZARDOUS LOCATIONS

ENCLOSURE TYPE 4X

48 Steacie Drive
Kanata, ON K2K 2A9
CANADA

WARNING: EXPLOSION HAZARD.
DO NOT OPEN WHEN ENERGIZED.
KEEP COVER TIGHT WHILE CIRCUITS ARE ALIVE.
DO NOT DISCONNECT EQUIPMENT UNLESS POWER HAS BEEN SWITCHED OFF OR THE AREA IS KNOWN TO BE NONHAZARDOUS.

0344 II 2 G
LCIE 07 ATEX6058 Ex d IIC T6
IECEx CSA 05.0011 Exd IIC T6
-20degC <= Ta <= 70degC IP66
Max. ambient temp. 70degC
CONDUIT ENTRIES ARE 1/2 IN. NPT

SCADASense

MODEL	4202-DR22F101XA1-L		
SERIAL	T001234	Span Code	F
Supply	9-30VDC 384mW	Differential	300"WC/75kPa
		Absolute	1500psi/10MPa
MFG DATE	2007	MWP	1500psi/10MPa
For all other specifications please refer to product manual			

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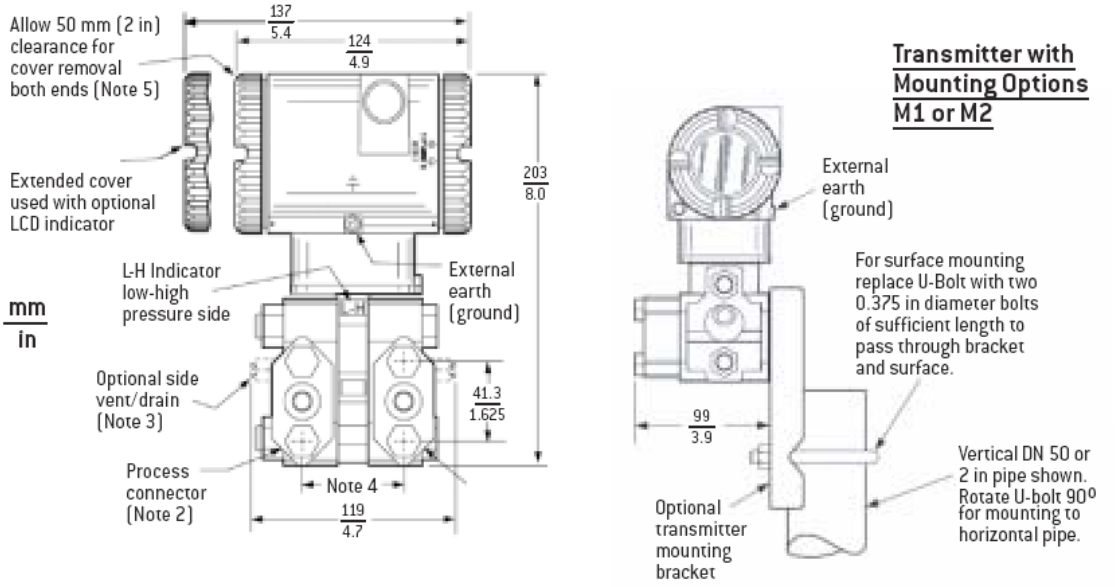
0344 II 2 G
LCIE 07 ATEX6058 Ex d IIC T6
IECEx CSA 05.0011 Exd IIC T6
-20degC <= Ta <= 70degC IP66
Max. ambient temp. 70degC
CONDUIT ENTRIES ARE 1/2 IN. NPT

SCADASense

MODEL	4202-DS22F101XA1-L		
SERIAL	T001234	Span Code	F
Supply	9-30VDC 384mW	Differential	300"WC/75kPa
		Absolute	1500psI/10MPa
MFG DATE	2007	MWP	1500psi/10MPa
For all other specifications please refer to product manual			

WARNING !
EXPLOSION HAZARD - SUBSTITUTION OF COMPONENTS MAY IMPAIR SUITABILITY FOR CLASS 1, DIVISION 2.

9.16 Dimensions



NOTES:

1. Conduit connection 1/2 NPT or PG 13.5, both sides: plug unused connection with metal plug (supplied)
2. Process connectors may be removed and connections made directly to process cover using 1/4 NPT internal thread in process cover
3. Process cover can be inverted making optional side vents or side drains
4. Process connectors can be inverted to give either 51, 54, or 57 mm (2.0, 2.125, or 2.25 in) center-to-center distance between high and low pressure connections
5. Topworks can be rotated to any position within one turn counterclockwise of the fully tightened position
6. Process cover end plugs are substituted for vent screws when optional side vents (Note 3) are specified