SCADAPack 4202 DR

Installation, Operation and Maintenance Setup Manual

5/19/2011



The information provided in this documentation contains general descriptions and/or technical characteristics of the performance of the products contained herein. This documentation is not intended as a substitute for and is not to be used for determining suitability or reliability of these products for specific user applications. It is the duty of any such user or integrator to perform the appropriate and complete risk analysis, evaluation and testing of the products with respect to the relevant specific application or use thereof. Neither Schneider Electric nor any of its affiliates or subsidiaries shall be responsible or liable for misuse of the information contained herein. If you have any suggestions for improvements or amendments or have found errors in this publication, please notify us.

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All pertinent state, regional, and local safety regulations must be observed when installing and using this product. For reasons of safety and to help ensure compliance with documented system data, only the manufacturer should perform repairs to components.

When devices are used for applications with technical safety requirements, the relevant instructions must be followed. Failure to use Schneider Electric software or approved software with our hardware products may result in injury, harm, or improper operating results.

Failure to observe this information can result in injury or equipment damage.

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Safety Information

Read these instructions carefully, and look at the equipment to become familiar with the device before trying to install, operate, or maintain it. The following special messages may appear throughout this documentation or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.



The addition of this symbol to a Danger or Warning safety label indicates that an electrical hazard exists, which will result in personal injury if the instructions are not followed.



This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

A DANGER

DANGER indicates an imminently hazardous situation which, if not avoided, **will result in** death or serious injury.

AWARNING

WARNING indicates a potentially hazardous situation which, if not avoided, **can result** in death or serious injury.

ACAUTION

CAUTION indicates a potentially hazardous situation which, if not avoided, **can result** in minor or moderate.

CAUTION

CAUTION used without the safety alert symbol, indicates a potentially



hazardous situation which, if not avoided, **can result** in equipment damage..

PLEASE NOTE

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

A qualified person is one who has skills and knowledge related to the construction and operation of electrical equipment and the installation, and has received safety training to recognize and avoid the hazards involved.

BEFORE YOU BEGIN

Do not use this product on machinery lacking effective point-of-operation guarding. Lack of effective point-of-operation guarding on a machine can result in serious injury to the operator of that machine.

A CAUTION

EQUIPMENT OPERATION HAZARD

Verify that all installation and set up procedures have been completed.

Before operational tests are performed, remove all blocks or other temporary holding means used for shipment from all component devices.

Remove tools, meters, and debris from equipment.

Failure to follow these instructions can result in injury or equipment damage.

Follow all start-up tests recommended in the equipment documentation. Store all equipment documentation for future references.

Software testing must be done in both simulated and real environments.

Verify that the completed system is free from all short circuits and grounds, except those grounds installed according to local regulations (according to the National Electrical Code in the U.S.A, for instance). If high-potential voltage testing is necessary, follow recommendations in equipment documentation to prevent accidental equipment damage.

Before energizing equipment:

- Remove tools, meters, and debris from equipment.
- Close the equipment enclosure door.
- · Remove ground from incoming power lines.
- Perform all start-up tests recommended by the manufacturer.

OPERATION AND ADJUSTMENTS

The following precautions are from the NEMA Standards Publication ICS 7.1-1995 (English version prevails):

- Regardless of the care exercised in the design and manufacture of equipment or in the selection and ratings of components, there are hazards that can be encountered if such equipment is improperly operated.
- It is sometimes possible to misadjust the equipment and thus produce unsatisfactory or unsafe operation. Always use the manufacturer's instructions as a guide for functional adjustments. Personnel who have access to these adjustments should be familiar with the equipment manufacturer's instructions and the machinery used with the electrical equipment.
- Only those operational adjustments actually required by the operator should be accessible to the operator. Access to other controls should be restricted to prevent unauthorized changes in operating characteristics.

About The Book

At a Glance

Document Scope

This manual describes the operation and maintenance of the SCADAPack 4202 DR controller.

Validity Notes

This document is valid for all versions of the SCADAPack 4202 DR.

Product Related Information

AWARNING

UNINTENDED EQUIPMENT OPERATION

The application of this product requires expertise in the design and programming of control systems. Only persons with such expertise should be allowed to program, install, alter and apply this product.

Follow all local and national safety codes and standards.

Failure to follow these instructions can result in death, serious injury or equipment damage.

User Comments

We welcome your comments about this document. You can reach us by e-mail at technicalsupport@controlmicrosystems.com.

Overview

The SCADAPack 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 61131-1.

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, 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 transmitter functions that is compatible with the Rosemount 3095FB MVT is also provided. This SCADAPack 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 SCADAPack 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 **SCADAPack 4000 Configurator** UI, which is shipped on an accompanying Configuration CD. The SCADAPack 4000 Configurator supports the configuration, monitoring, and calibration of SCADAPack 4000 transmitters.

Installation

Mounting

A SCADAPack 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*.

If the transmitter is not installed in the vertical position as shown in *Figure 1* or *Figure 2*, readjust zero output to remove 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 4000 transmitter sensor, do not use any impact devices, such as an impact wrench or stamping device on the transmitter.

Use a suitable thread sealant on all connections.

Process-Mounted Transmitter

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

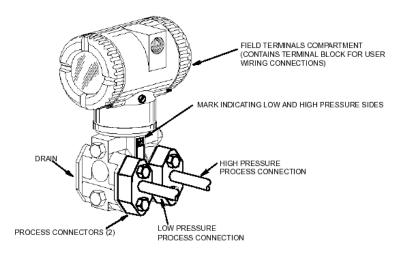


Figure 1: Process-Mounted Transmitter

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 90° 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.

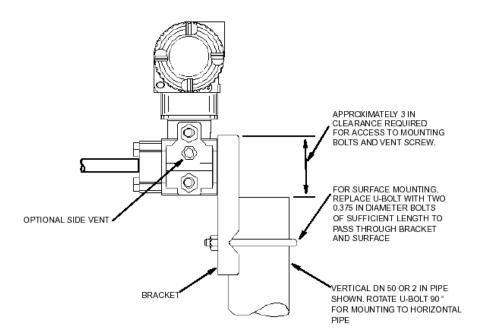


Figure 2: Mounting the Transmitter to a Pipe or Surface

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.

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.

The small setscrew on the housing keeps the housing from being rotated too far. This is NOT a locking screw. Damage to the housing can occur if this setscrew is tampered with.

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.

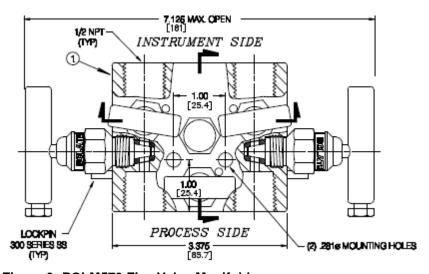


Figure 3: PGI-M573 Five Valve Manifold

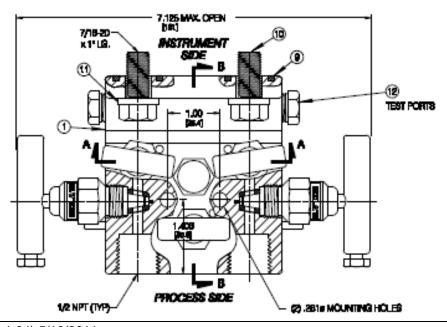


Figure 4: PGI-M673 Five Valve Manifold

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

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 is opened. When performing a Differential Pressure calibration the bypass valve is closed.

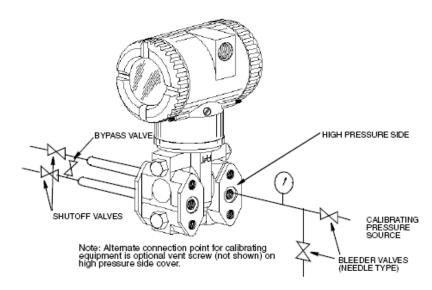


Figure 5: Differential Pressure Calibration Connections

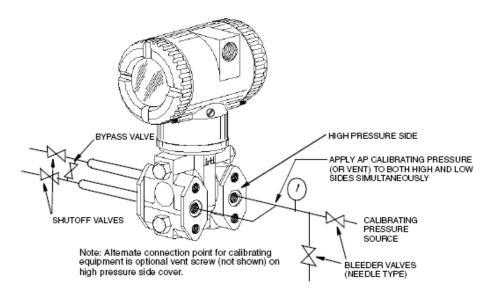


Figure 6: Absolute Pressure Calibration Connections

Optional Display Module

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

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

The SCADAPack 4000 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.

Configuring a SCADAPack transmitter using the local display is possible with older transmitters only. See the application note "Configuring an older SCADAPack transmitter using the Local Dsplay.pdf", located in the

same directory as this document, for a detailed procedure. Newer SCADAPack 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.

Adding the Optional Display

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

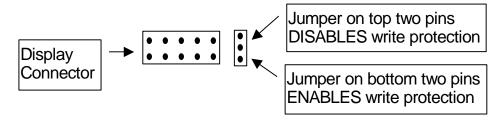
- Turn off the transmitter power source.
- Remove the electronics compartment cover by rotating it counterclockwise.
 Screw in the cover lock if applicable.
- Plug the display into the receptacle at the top of the electronics assembly.
- Seat the O-ring in its groove in the display housing. Then insert 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.
- Turn on the transmitter power source.

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.



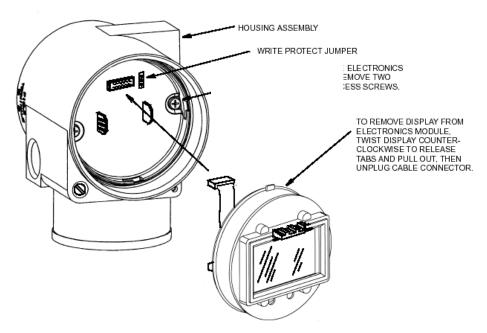


Figure 7: Optional Display and Write Protect Jumper

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. Check 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.

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*. The embossed letters **FIELD TERMINALS** identify the proper compartment.

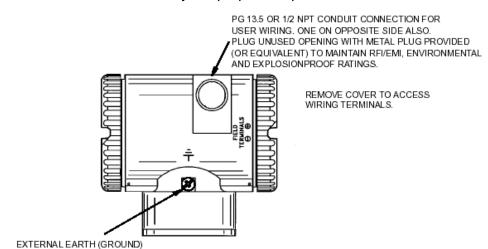


Figure 8: Accessing Field Terminals

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.

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

ACAUTION

Remove power before servicing unit.

The transmitter threaded end cap with the terminal board wiring diagram is installed on the housing end that has the terminal board. This is a Class 1, 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.

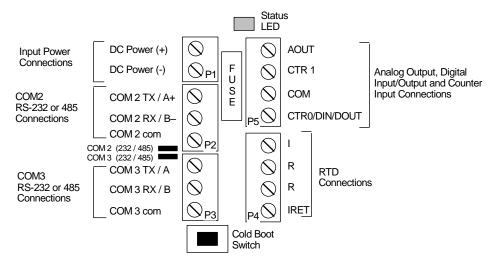


Figure 9: Terminal Board Layout

Power Supply

A SCADAPack 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 *0- 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.

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. Remove these connectors 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 TBUM297308.

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

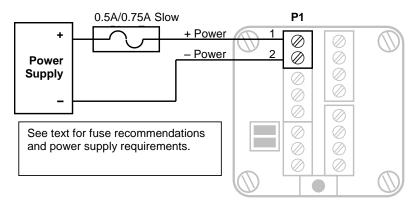


Figure 10: Input Power Wiring with External Fuse

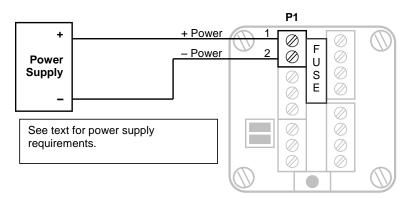


Figure 11: Input Power Wiring with Internal Fuse

System Grounding

Transmitter circuitry is electrically isolated from the housing for voltages up to 550Vac. 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 share the same electrical common.

Internal Analog Input

A SCADAPack 4202 DR has one internal analog input. The internal analog input is 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 Telepace 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.

RTD Input

A SCADAPack 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.

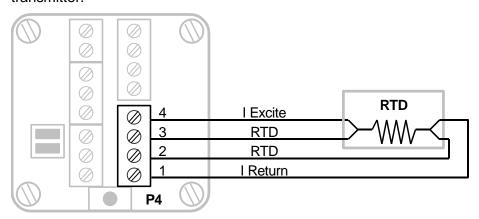


Figure 12: 4-Wire RTD Wiring

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.

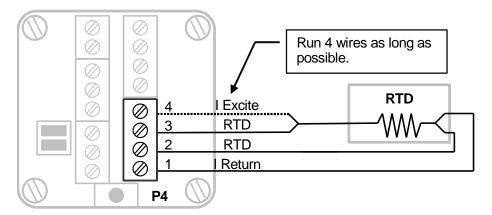


Figure 13: 3-Wire RTD Wiring

The RTD inputs on a SCADAPack 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.

Analog Output

A SCADAPack 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 Telepace 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 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.

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

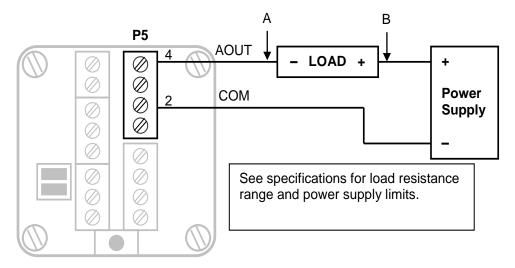


Figure 14: Analog Output Wiring

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.

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

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

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.

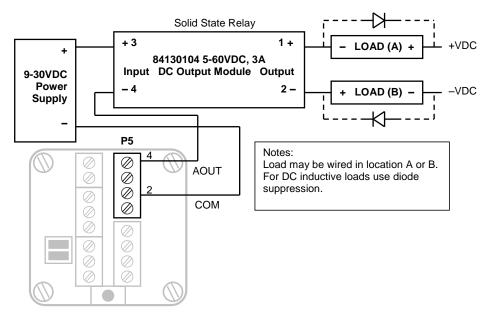


Figure 15: DC Digital Output Wiring Example

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.

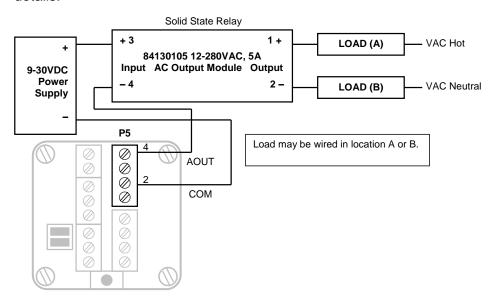


Figure 16: AC Digital Output Wiring Example

Digital I/O and Counters

A SCADAPack 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 Telepace applications, refer to the Register Assignment and I/O Complex Equipment respectively for the transmitter.

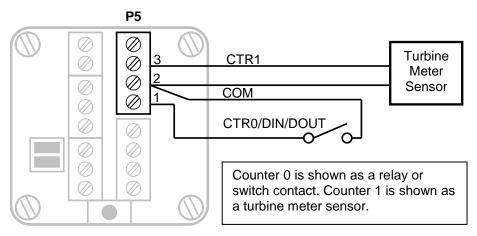


Figure 17: Digital and Counter Input Wiring

Turbine Meter Counter Input - CTR1

A SCADAPack 4202 DR allows for the direct connection to one turbine meter sensor. These sensors produce millivolt outputs and an external pre-amplifier is not required 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 is used and the shield should be connected at one end only. There is an enclosure ground connection that can be used for this purpose.

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. Check that the applied input is free of contact bounce.

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.

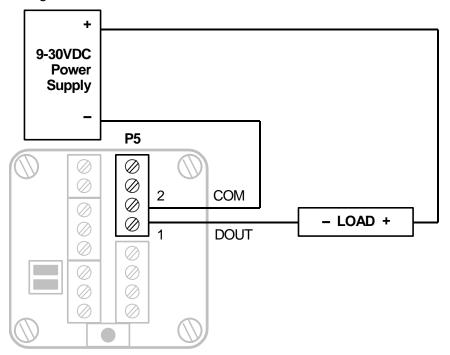


Figure 18: Digital Output Wiring Example

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.

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 RS-232 receivers. Cables should be limited to a maximum of 10 ft (3m).
- Shielded cable should be used to isolate the signals from noise and to comply with FCC and CE regulatory requirements. The shield is connected to Ground at one end only.

RS-232 Wiring Examples

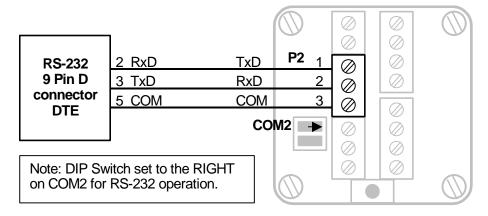


Figure 19: COM2 RS-232 Wiring

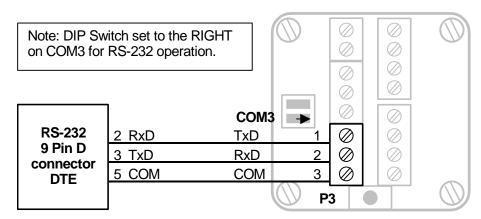


Figure 20: COM3 RS-232 Wiring

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

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, Telepace 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, 4 38400	4800, 9600, 19200 and
	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 DNP. Default: Modbus RTU	Modbus ASCII, DF1 and
Addressing Mode	Standard or Extended	Default: Standard

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, Telepace 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, 960	0, 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 DNP. Default: Modbus RTU	Modbus ASCII, DF1 and
Addressing Mode	Standard or Extended	Default: Standard

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 devices communicating on the signal pair be referenced to the same point. On a SCADAPack 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 *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 are wired to be within several volts of each other.

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

RS-485 Wiring Examples

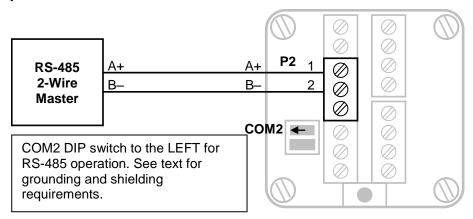


Figure 21: COM2 RS-485 Wiring

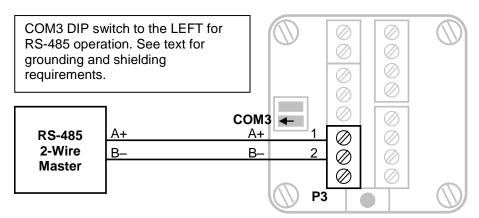


Figure 22: COM3 RS-485 Wiring

RS-485 Bias Resistors

The RS-485 receiver inputs on the transmitter are biased to such 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.

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. 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 is to 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.

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, Telepace 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, 4 38400	4800, 9600, 19200 and
	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 DNP. Default: Modbus RTU	Modbus ASCII, DF1 and
Addressing Mode	Standard or Extended	Default: Standard

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, Telepace 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

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

Operation

Operating Modes

A SCADAPack controller may start up in Run, Service, Sensor or Cold Boot mode. Start up in the RUN mode automatically executes Telepace or Telepace 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 application programs.

Run Mode

RUN mode is the normal operating mode of the transmitter. Check that 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 COM ports are used.
- If a Telepace Ladder Logic or Telepace application program is loaded in RAM, it is executed.
- If a Telepace or Telepace 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.

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 **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 Telepace program is stopped.
- The C program is stopped.
- Application programs are retained in non-volatile memory.
- The controller lock settings and password are used.

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

- Remove power from the controller.
- Push and hold the Cold Boot button down.
- Apply power to the controller.
- Continue holding the Cold Boot push button down STAT LED turns on solid.
 This will take about 3 seconds.
- Release the Cold Boot push button.
- The Service Boot remains in effect until the controller is reset.

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

Sensor Mode

The Sensor Mode allows direct communication with the sensor electronics. This mode is provided to allow use of applications and tools that 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 Telepace program is stopped.
- The C program is stopped.
- No other controller features are available.

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

- Remove power from the controller.
- Push and hold the Cold Boot push button down.
- Apply power to the controller.
- 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.
- The STAT LED will blink short, short, long while the controller is in the Sensor mode.

The Sensor Boot remains in effect until the controller is reset.

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

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 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 Telepace 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.

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

- Remove power from the controller.
- Push and hold the Cold Boot push button down.
- Apply power to the controller.
- 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.

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

LED Status Indicator

The STAT LED indicates a controller condition. The STAT LED blinks when a condition exists. The STAT LED turns off when the conditions are cleared.

The STAT LED blinks a binary sequence indicating 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, leading zeros are ignored. The application program defines the values of the codes.

The table below shows the meaning of the sequences.

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

LED Power Control

The STAT LED on a SCADAPack 4202 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, Telepace 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.

Firmware Loading

Periodically the firmware for a controller is updated to add new features or provide bug fixes. As they become available new firmware versions may be downloaded from www.controlmicrosystems.com.

Allowed connection for firmware loading for a **SCADAPack 4202** controller is **com2**.

Using Realflo

Check that the Realflo Application is installed on the PC you are using. If it is not installed then insert the Realflo CD into your CD-ROM drive and run install from the autorun menu.

Open the Realflo Gas Flow application by clicking the *Windows Start* button then selecting *Programs* then select the *Realflo* group and click *Realflo*.

The SCADAPack 4202DR has been configured at the factory with a sample configuration. The following sections will describe how to read, monitor and modify this configuration using Realflo.

Connect to the SCADAPack Serial Port

The SCADAPack 4202DR have two serial communication ports COM2 and COM3. These serial ports are on connectors, P2 (COM2) and P3 (COM3).

Each serial port may be selected for RS-232 or RS-485 operation using switches COM2 and COM3. These switches are located to the left of connector P3. With the switch in the right hand position the serial port is RS-232 and with the j switch in the left hand position the serial port is RS-485. These jumpers are installed at the factory making both serial ports RS-232.

Connect one of the serial ports to the PC that is running Realflo.

Open a New Configuration File

From the Realflo window click the *File* menu button and then click *New*. When this is done the *Create New File* dialog is opened.

Select Read configuration from the Flow Computer and click the Next button. In the Connect to Flow Computer dialog select Choose/View Communication Settings. In the PC Communication Settings select Modbus RTU and then configure the Port setting for the serial port used on the PC running Realflo. The default serial port settings on the SCADAPack 4202DR are 9600, 8, none, 1.

Click the Next button to read the flow run configuration from the SCADAPack 4202DR.

Once the configuration is read from the SCADAPack 4202DR the Save File dialog will open to prompt for a location to save the file. Once a location is selected click the *Next* button and then click the *Finish* button.

Monitor the Current Flow Readings

From the *Maintenance* menu select *Update Readings* to monitor the flow run parameters. This completes the Getting Started procedure.

Viewing and Modifying Flow Run Configuration

The Flow Run Configuration will need to be modified to suit your application requirements. To view the flow run configuration that was installed at the factory do the following.

From the *Maintenance* menu select *Update Readings* to stop the update.

From the *Configuration* menu select *Flow Run*. In the *Select Run to Configure* dialog check that 1 is selected and click the *OK* button. The *Configuration – Run 1* dialog is opened. The *Configured* windows contain data and the *Actual* windows are blank.

Click the *Read Run* button at the bottom of the dialog. The *Configured* and *Actual* windows will contain the same information.

You can select configuration tabs across the top of the dialog to see the configuration parameters for each tab.

Refer to the Realflo User manual for complete details on the configuration parameters used in each tab.

Re-Zero Differential Pressure

To compensate for the mounting position effects it is necessary to perform a re-zero of the Differential Pressure.

Follow the steps in the Open Configuration File procedure above to check that you have Realflo opened and are communicating with the SCADAPack 4202DR.

From the *Maintenance* menu select *Calibration*. If the *Calibration* selection is greyed out you will need to click on the *Update Readings* selection to stop updating readings.

In the Sensor Calibration dialog select the *Sensor* radio button and click the *Next* button at the bottom of the dialog.

In the Sensor Calibration dialog select the *Calibrate Differential Pressure Sensor* by clicking in the white box at the left of the selection. Then click the *Next* button at the bottom of the dialog.

During the re-zeroing of the Differential Pressure the SCADAPack 4202DR transmitter inputs are forced to either a fixed value or the current value so the flow calculations are not interrupted during the re-zeroing. Select *Current Value* or *Fixed Value* for each input. Then click the *Next* button at the bottom of the dialog.

When the Record As Found Values dialog is displayed the SCADAPack 4202DR transmitter is ready to be re-zeroed. It is recommended that the Differential pressure be zeroed at line pressure. Adjust the manifold or external piping such that the H and L sides of the SCADAPack 4202DR are equalized at line pressure.

In the Record As Found Values dialog enter 0 (zero) for the *Applied Value* and click the *Record* button. Then click the *Next* button at the bottom of the dialog.

If the Applied Value and the Measured Value are not within the transmitter accuracy then re-zeroing will be required. Select the Yes radio button. If the Applied and Measured values are within the transmitter accuracy select No. Then click the Next button at the bottom of the dialog.

In the Calibrate Sensor dialog click the *Re-Zero* radio button and enter a value of 0.0 in the *Re-Zero* window. Click the *Re-Zero* button and wait several seconds for the Measured Value to be updated. Once you are satisfied the Measured Value is within specification click the *Next* button at the bottom of the dialog.

In the Record As Left Values dialog enter 0 (zero) for the Applied Value and click the *Record* button. Then click the *Next* button at the bottom of the dialog.

Reconnect the transmitter to the process and then click the *Finish* button.

Verify Atmospheric Pressure

The Static Pressure sensor on the SCADAPack 4202DR is an absolute pressure sensor. The sensor does not require re-zeroing at the installed location. If you wish to verify the Static Pressure zero you will need a barometer that is at least as accurate as the SCADAPack 4202DR transmitter.

Follow the steps in the Open Configuration File procedure above to check you have Realflo opened and are communicating with the transmitter.

From the *Flow Computer* menu select *Calibration*. If the *Calibration* selection is greyed out you will need to click on the *Update Readings* selection to stop updating readings.

In the Sensor Calibration dialog select the *Sensor* radio button and click the *Next* button at the bottom of the dialog.

In the Sensor Calibration dialog select the *Calibrate Static Pressure Sensor* by clicking in the white box at the left of the selection. Then click the *Next* button at the bottom of the dialog.

During the verification of the Static Pressure, the SCADAPack 4202DR transmitter inputs are forced to either a fixed value or the current value, so the flow calculations are not interrupted during the re-zeroing. Select *Current Value* or *Fixed Value* for each input. Then click the *Next* button at the bottom of the dialog.

When the Record As Found Values dialog is displayed you can remove the transmitter from the process. Once the transmitter is isolated from the process, vent both the high and low sides of the sensor to atmosphere.

In the Record As Found Values dialog enter the reading from your barometer for the *Applied Value* and click the *Record* button. Then click the *Next* button at the bottom of the dialog.

If the Applied Value and the Measured Value are not within the SCADAPack 4202DR transmitter accuracy, then re-zeroing will be required. Select the Yes radio button. If the Applied and Measured values are within the transmitter accuracy, select No. Then click the Next button at the bottom of the dialog.

In the Calibrate Sensor dialog click the *Re-Zero* radio button and enter a value from the barometer in the *Applied Value* window. Click the *Re-Zero* button and wait several seconds for the Measured Value to be updated. Once you are satisfied the Measured Value is within specification click the *Next* button at the bottom of the dialog.

In the Record As Left Values dialog enter the reading from your barometer for the Applied Value and click the *Record* button. Then click the *Next* button at the bottom of the dialog.

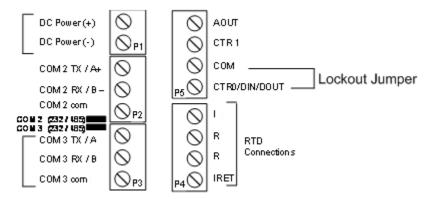
Reconnect the transmitter to the process and then click the *Finish* button.

Industry Canada Lockout

This section applies when:

- The SCADAPack 4202DR controller has been purchased as an Industry Canada approved gas flow computer. Refer to the Realflo User and Reference manual for the commands that are disabled in Realflo when the lock out is enabled.
- Firmware version 2.30 is installed, the flow computer option is enabled, the gas flow computer application version 6.10 is installed and a jumper has been inadvertently installed between COM and CTR0/DIN/DOUT on the 4202DR gas flow computer.

If the Industry Canada lockout is enabled by mistake the firmware will not allow new firmware to be installed. To deactivate the lockout simply remove the jumper between COM and CTR0/DIN/DOUT.



Modbus Register Mapping

The tables in this section of the manual describe the parameters within a SCADAPack 4202 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.

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.

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 Telepace 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.

Data Formats

Data formats defined in the table below are used in a SCADAPack 4202 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. Read or write both registers in the same Modbus command.
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.

Modbus Registers

Table 2: Modbus Registers

Register	Туре	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 = SCADAPack 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

Register	Туре	Read/Write	Parameter
			40004.
40005 - 40006			Reserved
40007 - 40008	Integer	Read	Transmitter Serial Number Register 40007 holds the manufacture date as bits in the format YYYYYYMMMMDDDDD, 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 sets the value in 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

Register	Туре	Read/Write	Parameter
			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.
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

Register	Туре	Read/Write	Parameter
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	
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	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 1 st user defined data set Bit 05 = Display 2 nd user defined data
			set Bit 06 = Display 3 rd user defined data

Register	Туре	Read/Write	Parameter
			set Bit 07 = Display 4 th user defined data set Bit 08 = Display 5 th user defined data set Bit 09 = Display 6 th user defined data set Bit 10 = Display 7 th user defined data set Bit 11 = Display 8 th user defined data set Bit 12 = Display 9 th user defined data set Bit 12 = Display 9 th user defined data set Bit 13 = Display 10 th user defined data set Bit 14 = Display 11 th user defined data set Bit 15 = Display 12 th 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. 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

Register	Туре	Read/Write	Parameter
			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
			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

Register	Туре	Read/Write	Parameter
			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 is cleared

Register	Туре	Read/Write	Parameter
			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 return 0 when read.
40205	Integer	Read/Write	Reset to Default Parameters
			Writing to this register resets the transmitter to default parameters.
			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 is written to the register to cause a reset. 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.
			Process values are updated only in the online 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

Register	Туре	Read/Write	Parameter
Register	Type	Read/Write	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). 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. This register is cleared when the power is lost to the transmitter. The transmitter 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	1 st 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 1 st 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

Register	Туре	Read/Write	Parameter
			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 <i>Table 4-Display Module ASCII Characters</i> table below lists the displayable characters.
40216 – 40217	Float	Read/Write	These registers hold the floating-point value that will be included in the display cycle if the bit to display the 2 nd 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	2 nd user defined display text These registers hold the text that will be included in the display cycle if the bit to display the 2 nd 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 <i>Table 4-Display Module ASCII Characters</i> table below lists the displayable characters.
40225 – 40226	Float	Read/Write	3 rd 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 3 rd 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	3 rd user defined display text These registers hold the text that will be included in the display cycle if the bit to display the 3 rd user defined data

Register	Туре	Read/Write	Parameter
			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 <i>Table 4-Display Module ASCII Characters</i> table below lists the displayable characters.
40234 – 40235	Float	Read/Write	4 th 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 4 th 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	4 th user defined display text These registers hold the text that will be included in the display cycle if the bit to display the 4 th 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 <i>Table 4-Display Module ASCII Characters</i> table below lists the displayable characters.
40243 – 40244	Float	Read/Write	5 th 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 5 th 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	5 th user defined display text These registers hold the text that will be included in the display cycle if the bit to display the 5 th user defined data

Register	Туре	Read/Write	Parameter
			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 <i>Table 4-Display Module ASCII Characters</i> table below lists the displayable characters.
40252 – 40253	Float	Read/Write	6 th 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 6 th 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	6 th user defined display text These registers hold the text that will be included in the display cycle if the bit to display the 6 th 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 <i>Table 4-Display Module ASCII Characters</i> table below lists the displayable characters.
40261 – 40262	Float	Read/Write	7 th 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 7 th 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	7 th user defined display text These registers hold the text that will be included in the display cycle if the bit to display the 7 th user defined data

Register	Туре	Read/Write	Parameter
			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 <i>Table 4-Display Module ASCII Characters</i> table below lists the displayable characters.
40270 – 40271	Float	Read/Write	8 th 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 8 th 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	8 th user defined display text These registers hold the text that will be included in the display cycle if the bit to display the 8 th 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 <i>Table 4-Display Module ASCII Characters</i> table below lists the displayable characters.
40279 – 40280	Float	Read/Write	9 th 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 9 th 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	9 th user defined display text These registers hold the text that will be included in the display cycle if the bit to display the 9 th user defined data

Register	Туре	Read/Write	Parameter
			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 <i>Table 4-Display Module ASCII Characters</i> table below lists the displayable characters.
40288 – 40289	Float	Read/Write	These registers hold the floating-point value that will be included in the display cycle if the bit to display the 10 th 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	10 th user defined display text These registers hold the text that will be included in the display cycle if the bit to display the 10 th 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 <i>Table 4-Display Module ASCII Characters</i> table below lists the displayable characters.
40297 – 40298	Float	Read/Write	11 th 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 11 th 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	11 th user defined display text These registers hold the text that will be included in the display cycle if the bit to display the 11 th user defined data

Register	Туре	Read/Write	Parameter
			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 <i>Display Module ASCII Characters</i> table below lists the displayable characters.
40306 – 40307	Float	Read/Write	12 th 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 12 th 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	12 th user defined display text These registers hold the text that will be included in the display cycle if the bit to display the 12 th 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 <i>Table 4-Display Module ASCII Characters</i> 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 is in the same units as the static pressure. The transmitter is in the offline mode to change this register. No change will be made if the transmitter mode is not

Register	Туре	Read/Write	Parameter	
			correct.	
40401 - 40402	Float	Read	Differential Pressure (DP)	
			These registers hold the doressure as a floating-poin The specified floating-point	nt number in
40403 - 40404	Float	Read	Static Pressure (SP)	
			These registers hold the sopressure as a floating-point the specified floating-point. The diagnostic bits indicated this register.	nt number in format.
40405 - 40406	Float	Read	Process Temperature (PT))
			These registers hold the p emperature as a floating-p n the specified floating-po	point number
40407	Integer	Read	Diagnostic Bits	
			This register holds a bit-ma The individual bits corresp conditions	
			15 Calibration flag (se 40206)	e register
			14 The process value be valid	s may not
			 If this bit is the or then contact Techr Support. 	
			13 Primary Variables outside	are
			specification	
			12 DP signal above U Range Limit (URL) +10%	pper
			11 DP signal above U Range Limit	pper
			(URL)	
			10 DP signal above U Operating Limit	pper
			(URV) 9 DP signal below Lo Operating Limit (LRV)	ower
			8 DP signal below Lo	ower

Register	Туре	Read/Write	Parame	eter
			7	Range Limit (LRL) 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	This reg The ind condition Bit 15 = Bit 14 = Range Bit 13 = Range Bit 12 = Operati Bit 11 = Operati Bit 10 = Range Bit 09 =	= N/A = RTD signal above Upper Limit (URL) +10% = RTD signal above Upper Limit (URL) = RTD signal above Upper Ing Limit (URV) = RTD signal below Lower Ing Limit (LRV) = RTD signal below Lower Limit (LRL)

Register	Туре	Read/Write	Parameter
			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 = RTD Offset is outside normal range. The RTD should be checked for physical damage if this bit is enabled. Comparing RTD results with a known good RTD and checking the resistance between the RTD and case is recommended.
			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 contains 0.
40411	Integer	Read	Diagnostic Bits
			This register is reserved for future

Register	Туре	Read/Write	Parameter
			diagnostic bits. This register contains 0.
40412	Integer	Read	Diagnostic Bits
			This register is reserved for future diagnostic bits. This register contains 0.
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.
			Set the transmitter to 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	
			These registers hold the DP lower operating limit as a floating-point number in the specified floating-point format.
			Set the transmitter to the offline mode to change this register No change will

Register	Туре	Read/Write	Parameter
			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 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

Register	Туре	Read/Write	Parameter
			These registers hold the SP lower operating limit as a floating-point number in the specified floating-point format.
			Set the transmitter to 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 LOL is no larger than the difference between the tertiary variable URL and tertiary variable LRL. The difference between

Register	Туре	Read/Write	Parameter
			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. Set the transmitter to 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	Write	DP Span
			These registers hold the DP span as a floating-point number in the specified floating-point format. The value written is the new span in
			configured units.

Register	Туре	Read/Write	Parameter
			Set the transmitter to the offline mode to change this register. No change will be made if the transmitter mode is not correct. The DP span entered divided by the transmitter span limit must result in a value 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 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	Write	SP Span These registers hold the SP slope as a floating-point number in the specified floating-point format. The value written is the new span in configured units. 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 span entered divided by the transmitter span limit must result in a value of between 0.5 and 2.0. In order to change the span at least 5% of the

Register	Туре	Read/Write	Parameter	
			rated pressure must be applied, otherwise the calibration will be rejected.	
40447 - 40448	Float	Read/Write	· ·	
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)	

Default Parameters

A SCADAPack 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: SCADAPack 4202 Transmitter -Default Parameters

Register	Туре	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	

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	Н	0x62	b
0x25	%	0x49	1	0x63	С

Hex Value	Character	Hex Value	Character	Hex Value	Character
0x2A	*	0x4A	J	0x64	d
0x2B	+	0x4B	K	0x65	е
0x2D	-	0x4C	L	0x66	f
0x2F	/	0x4D	M	0x67	g
0x30	0	0x4E	N	0x68	h
0x31	1	0x4F	0	0x69	i
0x32	2	0x50	Р	0x6A	j
0x33	3	0x51	Q	0x6B	k
0x34	4	0x52	R	0x6C	1
0x35	5	0x53	S	0x6D	m
0x36	6	0x54	Т	0x6F	n
0x37	7	0x55	U	0x70	0
0x38	8	0x56	V	0x71	р
0x39	9	0x57	W	0x72	q
0x3C	<	0x58	Х	0x73	r
0x3D	=	0x59	Υ	0x74	S
0x3E	>	0x5A	Z	0x75	t
0x41	Α	0x5B	[0x76	u
0x42	В	0x5C	\	0x77	V
0x43	С	0x5D]	0x78	W
0x44	D	0x5E	٨	0x79	Х
0x45	Е	0x5F	_	0x7A	у
0x46	F	0x60	í	0x70	Z
0x47	G	0x61	Α		

Maintenance

A SCADAPack 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.

AWARNING

Remove power or confirm the area is known to be non-hazardous before changing field wiring, including the wiring to the RS-232 ports.

Failure to follow these instructions can result in death, serious injury or equipment damage.

Lithium Battery

A small lithium battery powers the CMOS memory and real-time clock when input power is removed. The 3.6V lithium battery will measure a typical value of 3500 to 3700. A reading less than 3000 (3.0V) indicates that the lithium battery requires replacement.

Lithium Battery Replacement

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.

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

A SCADAPack transmitter must be cold booted after a battery replacement to initialize RAM. Unpredictable operation may result if a cold boot is not performed.

Read through the following steps and gain an understanding of the replacement process before beginning.

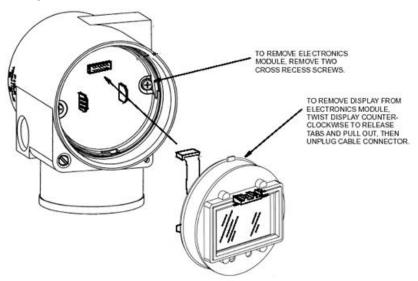
Step 1 Have a replacement battery ready for installation once the old battery is removed. A replacement battery is available from Control Microsystems. The part number is TBUM297268.

Step 2 Save the Realflo configuration and logs/history files and any Telepace of Telepace programs. Retrieve these files before disconnecting power.

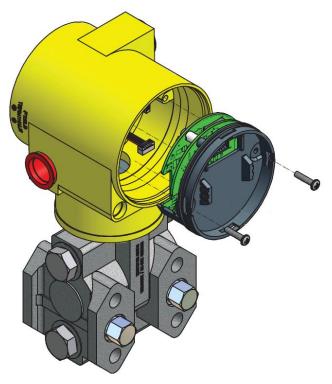
Step 3 Remove power to the transmitter.

Step 4 Remove the front cover of the transmitter. This is the cover with the LCD display or if no display is present this is the cover opposite the Field Wiring cover. The field wiring cover is identified on the transmitter chassis.

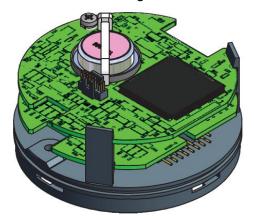
Step 5 Remove the LCD display, if present, using the following diagram as a guide.



Step 6 Remove the Controller board/Sensor interface housing as shown in the following diagram. Confirm that none of the 3 connecting cables to the Controller board/Sensor interface become disconnected. If they are disconnected during the replacement procedure reconnect them at the completion of the procedure. Connectors are keyed and easy to mate with the socket.



Step 7 Once the Controller board/Sensor interface housing is removed gently tilt the assembly to expose the lithium battery. Use wire cutters to remove the tywrap. The tywrap is used to keep the battery ion place during shipment and does not need to be replaced with the new battery. Refer to the following for the location of the battery.



Step 8 Unplug the battery from the circuit board and replace with the new battery. The circuit board has a keyed socket for plugging the new battery in.

Step 9 Gently reassemble the transmitter checking all cables are connected and are not pinched during reassembly.

Step 10 Once transmitter is reassembled reconnect power an reload the Realflo configuration and Telepace or Telepace programs.

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*.

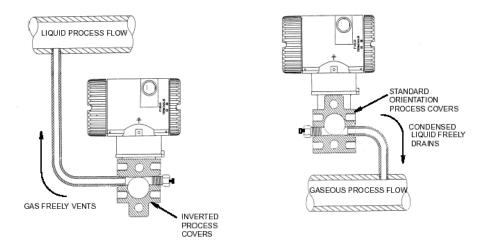


Figure 23: Sensor Cavity Venting and Draining

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

- Remove the process covers from the sensor by removing two hex head bolts.
- Replace the gaskets in the process covers.
- Rotate the process covers so that the longer tab is at the bottom.
- 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.
- Pressure test the sensor and process cover assembly by applying a hydrostatic pressure of 150% of the maximum static and over range pressure 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.

Sensor Calibration

The Calibration requirements are determined by the local regulatory agency and/or corporate policies.

Field Calibration is **Not Recommended** unless the Calibration Equipment is at least **2X** more accurate than the sensor itself ($\pm 0.05\%$ of span and ± 0.15 °C for temp.).

If Calibration is required and equipment with the necessary accuracy is not available, please return the unit to Control Microsystems or send to a Calibration Lab.

Realflo provides a Calibration Wizard to guide you through the steps to calibrate the sensor. See the Realflo wizards>>Calibrate Input Wizards>>MVT Calibration section of the Realflo User and Reference manual. Realflo provides a record of the calibration in the Event Log as well as a Calibration Report that can be printed for your records.

See the *Connections For Sensor Calibration* section for details on how to connect to the sensor for the calibration process.

Troubleshooting

Analog Output

Condition	Action
Outputs are 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.

Digital Input

Condition	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.

Digital Output

Condition	Action
Using Telepace firmware cannot turn output on or off.	Check that the 4202 DR Extended/4301 I/O register assignment is being used.
Using Telepace firmware cannot turn output on or off.	Check 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.

Counter Inputs

Condition	Action
Incorrect counts on	CTR0/DIN0counter digital input is a high-speed

Condition	Action
CTR/DIN0	input. Check that the applied input is free of contact bounce.

Specifications

Disclaimer: Control Microsystems reserves the right to change product specifications. For more information visit <u>www.controlmicrosystems.com</u>.

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

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

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.
	5100 Ω 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

Visual Indicators

Status	Internal
	Status LED (shows functional status)

Power Supply

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

Analog Input

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

Analog Output

Output Signal	0-20mA		
Range			

Load Resistance	550 to 1400Ω with 30Vdc supply
Range	250 to 1100Ω with 24Vdc supply
	0 to 850 Ω with 19Vdc supply
	0 to 500Ω with 12Vdc supply
	0 to 350 Ω with 9Vdc supply
	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

Turbine Meter Counter Input

Туре	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.

Digital Counter Input

Туре	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 turn on input voltage.
	1.5V typical turn off input voltage.
	Greater than 2.0V turn off input voltage.
Contact Resistance	ON input requires less than 100Ω contact resistance.
	OFF input requires greater than $1k\Omega$ 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.

Digital Output

Туре	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.

Transmitter Functional Specifications

Span and Range Limits for Differential Pressure & Absolute Pressure

Span	Differential Pressure		Absolute Pressure		
Code	inches of H ₂ 0	kPa	psia	MPa	
Α	0.5 to 30 inH2O	(0.12 to 7.5 kPa)	1 to 100 psi	(0.007 to 0.7 MPa)	
В	2 to 200 inH2 O	(0.50 to 50 kPa)	3 to 300 psi	(0.021 to 2.1 MPa)	
С	10 to 840 inH2O	(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)	
Е	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 Pr	ofile 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)
Υ	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)
Р	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)		Maxin Static		Maxin Worki (MWP	ng	Maxim Overra	
	DP	AP	Мра	psi	Мра	Psi	Мра	psi
Α	30 inH2O (7.5 kPa)	100 psia	0.7	100	0.7	100	1.0	150
В	200 inH2O (50 kPa)	300 psia	2.1	300	2.1	300	3.1	450
С	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)

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 $24 +/- 2 \circ C (75 +/- \circ F)$

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.

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

Calibrated Span is equal to URL on all 4203 or 4102 transmitters, unless a special order has been placed for special calibration over a smaller 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:

 $\pm 0.05\%$ 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

±0.15°C (±0.27°F) for the SCADAPack 4202 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 0.7 MPa, (100 psi), change in static pressure is:

ZERO SHIFT

Span Code	Zero shift for a 0.7 Mpa (100 psi) change:
A and U	±0.050
B and V	±0.007
C and W	±0.002
D and X	±0.010
F and Z	±0.007
E and Y	±0.004
J and M	±0.010
K and P	±0.007
L and R	±0.004

SPAN SHIFT

±0.01% of Reading

Position Effect

Transmitter may be mounted in any position. Any zero effect caused by mounting position can be removed 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% Span).

For Span Codes A and L:

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

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

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

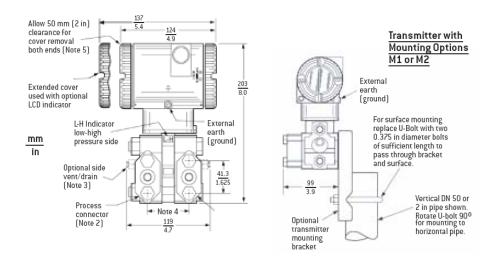
Approvals and Certifications

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.			
	CSA certified to the following standards:			
	CSA Std. C22.2 No. 213-M1987 - Class I, Division 2 Hazardous Locations			
	CSA Std. C22.2 No. 142-M1987 - Process Control Equipment			
	UL Std. No. 1604 - Class I and II, Division 2; Class III Hazardous (Classified) Locations			
	UL Std No. 916 - Energy Management Equipment			
	LCIE 07 ATEX6058 Ex d IIC T6			
	ATEX and IECEx			
	Ex d IIC T6; -50°C ≤ Ta ≤ 70°C			
	per IEC 60079-1, protection type d (Flameproof)			
Digital	FCC Part 15, Subpart B, Class A Verification			
Emissions	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			

ATEX/IECEx label



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
- 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
- Process cover end plugs are substituted for vent screws when optional side vents are specified