CAMERON
A Schlumberger Company

Valves & Measurement

Scanner 2100 EFM Hardware Manual

Manual No. 2350954-01, Rev. 03

Important Safety Information

Symbols and Terms Used in this Manual

WARNING: This symbol identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss.

CAUTION	**Indicates actions or procedures which if not performed correctly may lead to personal injury or incorrect function of the instrument or connected equipment.**

Important	**Indicates actions or procedures which may affect instrument operation or may lead to an instrument response which is not planned.**

Symbols Marked on Equipment

Attention! Refer to manual

Protective (earth) ground

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Other company, product, and service names are the properties of their respective owners.

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Section 1—Introduction

The Scanner* 2100 provides gas, steam and liquid measurement capabilities in a low-power flow computer with optional wireless communications for installation and operational cost savings. The device is available in an explosion-proof model for Class I, Division 1 installations, an ATEX-compliant explosion-proof model for Zone 1 installations, and a weatherproof model for Class I, Division 2 installations.

The Scanner 2100 shares the same flow computation capabilities as the Scanner 2000, but features a larger enclosure and four conduit openings (not including a bottom opening for a sensor connection) for added convenience in connecting external equipment.

A wireless version of the Scanner 2100 can be networked with wired or wireless Scanner 2000 Series devices in a wireless mesh network administered by a Scanner 3100 network manager. As a network manager, the Scanner 3100 monitors and manages network performance and relays data to the host application, and Scanner 2100 "nodes" relay data to and from each other and the Scanner 3100 via antennas and ultra-low power wireless modules.

A wired Scanner 2100 can be used as a stand-alone flow computer or as a Scanner slave device in a wired RS-485 network mastered by the Scanner 3100. When the device is networked with a Scanner 3100, users have the added convenience of collecting all of their data in a single access point (the Scanner 3100) and accessing it via a web-browser interface.

Wired and wireless Scanner devices can be seamlessly integrated into a comprehensive SCADA solution. See the Scanner SCADA Solutions brochure for details.

Dual lithium battery packs can power the instrument autonomously for up to one year, assuming the Scanner 2100 is not powering other external devices or used in extreme temperatures. When the Scanner 2100 is externally powered, the battery packs provide a valuable backup supply to help prevent interruption of operations during a power outage.

The Scanner 2100 measures and computes standard volumes of gas, steam, petroleum liquids and generic liquids with a high degree of accuracy. These measurements are typically based on the differential pressure outputs of an orifice plate or a cone meter, or the linear pulse output of a turbine, positive displacement (PD) or vortex flowmeter. This combination is ideal for the gas and water measurement associated with coal bed methane operations.

Combining the differential pressure and static pressure inputs of an integral multi-variable transmitter (MVT) with a process temperature input, the Scanner 2100 offers everything needed for an AGA 3 or cone meter run in a compact explosion-proof device. Similarly, compensated liquid measurements can be obtained with an orifice meter, cone meter, or averaging pitot tube meter (such as Annubar) installation, using flow calculations based on AGA 3, ISO 5167, cone, or averaging pitot tube calculation methods.

The Scanner 2100 can be paired with a pulse output gas meter to obtain gas measurements in compliance with AGA 7 standards. Live temperature and pressure inputs and the AGA 7 algorithm allow computations based on gas turbine, rotary or vortex meters.

When liquid measurement is the goal and pressure inputs are not required, the Scanner 2100 can be purchased without an integral MVT and remote-mounted to a liquid turbine meter, with an RTD in the flow line for temperature compensation. The Scanner 2100 applies temperature and pressure corrections according to API MPMS Chapter 11.1 to give accurate measurement of hydrocarbon liquids.

The Scanner 2100 is a complete alternative to the chart recorder that has a comparable installation cost due to its integral power source. High-speed communication via industry standard Modbus and Enron Modbus protocols makes it easy to integrate the Scanner into other measurement systems. For a complete list of specifications, see page 15.

Firmware

Firmware for the wired Scanner 2100 will be identified as 2100, and firmware for the wireless version will be identified as 2100W ("W" for "wireless"). The firmware version installed will appear on the display as the device boots up and will appear in the web-based interface (Slave Device General/System screen) when a Scanner 2100 is connected to a Scanner 3100 network manager. See the Scanner 3100 Web Interface Manual for more information on verifying firmware versions and updating firmware. See the Scanner 3100 Modbus Protocol Manual for more information on registers supported.

Software and User Help Documents

To experience the full range of the Scanner 2100 functionality, explore the complimentary software products and user documentation on the Cameron website.

Supporting software includes:

- ***ModWorX* Pro.*** PC application used to configure, calibrate, and download the Scanner 2100.
- ***Scanner Data Manager.*** PC application that allows a user to view, export, and convert the data downloaded from the Scanner 2100 and Scanner 3100. It provides many of the reporting functions in ModWorX Pro and adds tools for creating professional custom reports.
- ***ScanFlash*.*** Software utility for installing Scanner 3100 firmware or uploading a configuration file to a Scanner 2100 EFM.

Software and hardware manuals are also available for download from the website.

Important **To download software or user documentation, visit Cameron's Measurement website, products.slb.com/flowcomputers, select Scanner 2000 Series Wired and Wireless, and click on the link for the desired software install/manual.**

When the Scanner 2100 is networked with a Scanner 3100 as a wired or wireless slave device, the Scanner 3100 web interface can be used to view Scanner 2100 configuration settings, perform limited maintenance tasks, and download and view Scanner 2100 archives. See the Scanner 3100 Web Interface User Manual for details.

Standard Features

The standard Scanner 2100 (Figure 1.1) features an explosion-proof double-ended enclosure with a large LCD, a three-button keypad, integral MVT with vent plugs, and dual lithium double-D cell battery packs. Removal of the front windowed lid provides access to the keypad and field wiring terminals for a turbine input, two communications ports (one active port for wireless devices), an RTD input, and a digital output. Removal of the rear solid lid provides access to the lithium battery compartment.

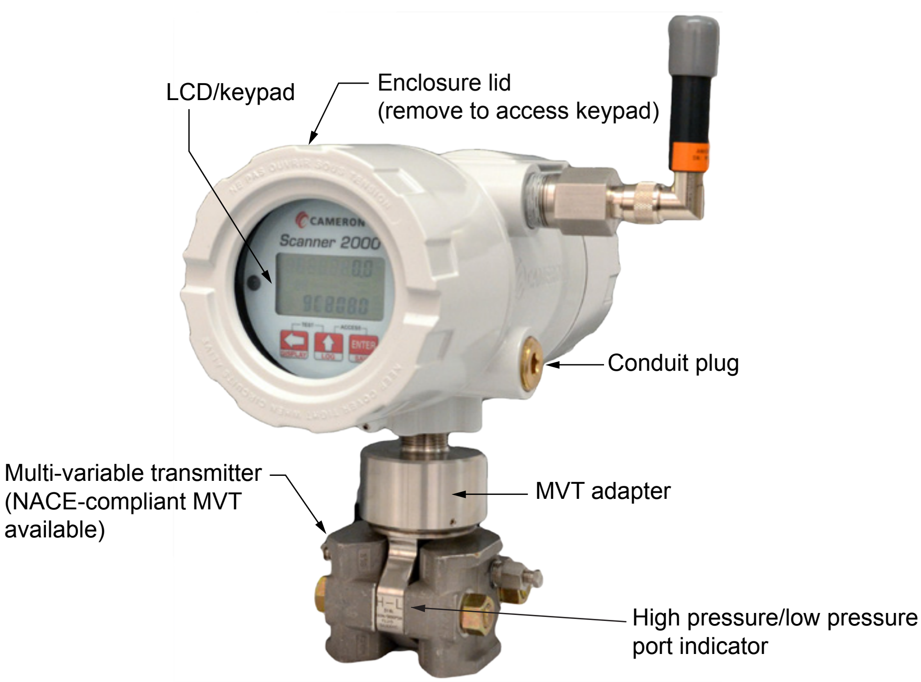


Figure 1.1—Scanner 2100 EFM with optional integral MVT

Product Identification

Each device is labeled with a serial tag that identifies the product by model number and serial number and identifies the maximum operating pressure, working pressure, and differential pressure of the integral MVT (Figure 1.2). The tag content depicted in Figure 1.2 shows the electrical protection afforded by ATEX/IECEx certification. CSA-approved products are marked accordingly with the respective ratings and symbols.

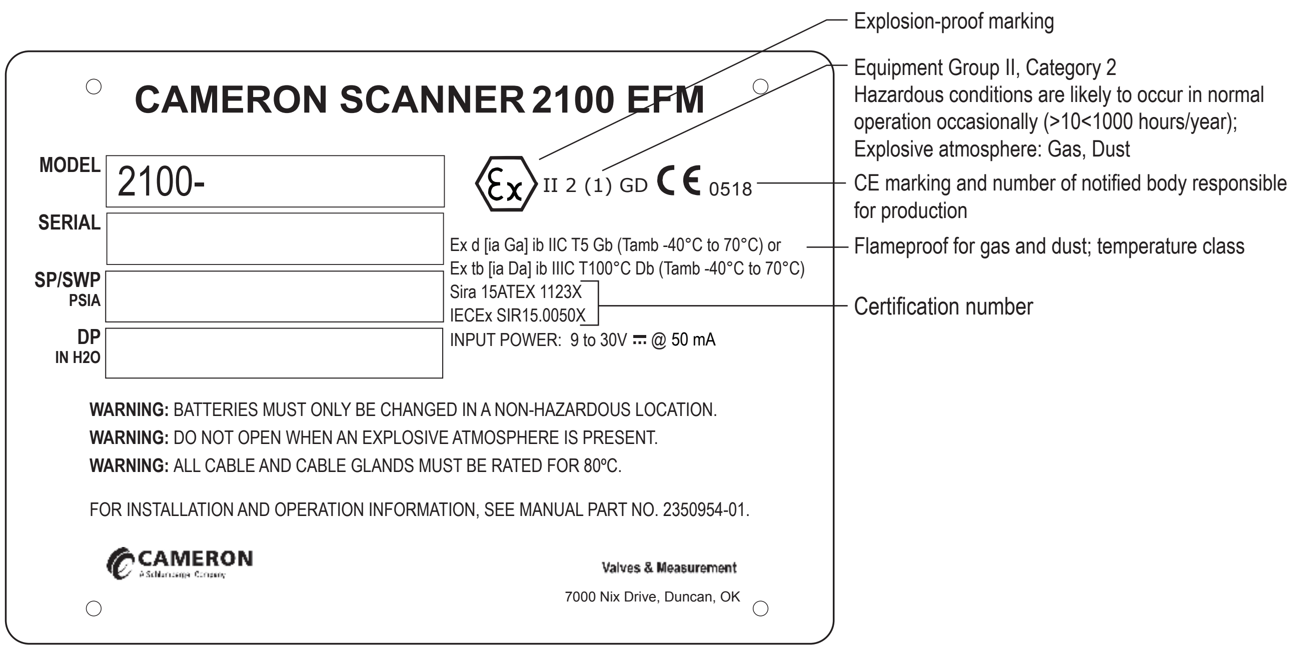


Figure 1.2—Device serial tag

Optional Hardware

A variety of hardware options are available for customizing the Scanner 2100 to a user's specific needs.

Integral Pressure Sensor (MVT)

The Scanner 2100 is available with no sensor or with an integral MVT. MVTs are available in NACE and non-NACE models, and with bottom ports (gas measurement) and side ports (liquid and steam measurement), as shown in Figure 1.3.

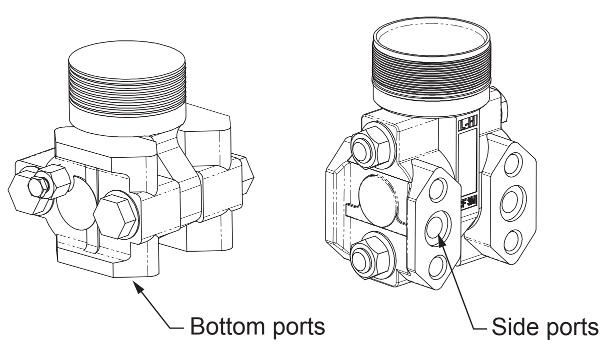


Figure 1.3—MVT bottom ports and side ports

Four-Port MVT Adapter

The standard Scanner 2100 enclosure provides four conduit entries for input/output connections in addition to a bottom sensor port. If more entries are required, the CSA-approved Scanner 2100 can be ordered with an optional stainless steel MVT adapter (Figure 1.4) in place of the standard MVT adapter, adding four additional conduit entries. The four-port MVT adapter is not approved for use with ATEX-certified devices.

CAUTION **The four-port MVT adapter and all devices connected to the adapter are factory-installed and cannot be changed in the field. Equipment damage resulting from attempts to disconnect the four-port adapter or devices connected to it is not warranted by Cameron. In accordance with the CSA certification, all connections to the 4-port MVT adapter must be sealed at the adapter (no additional conduit may be used).**

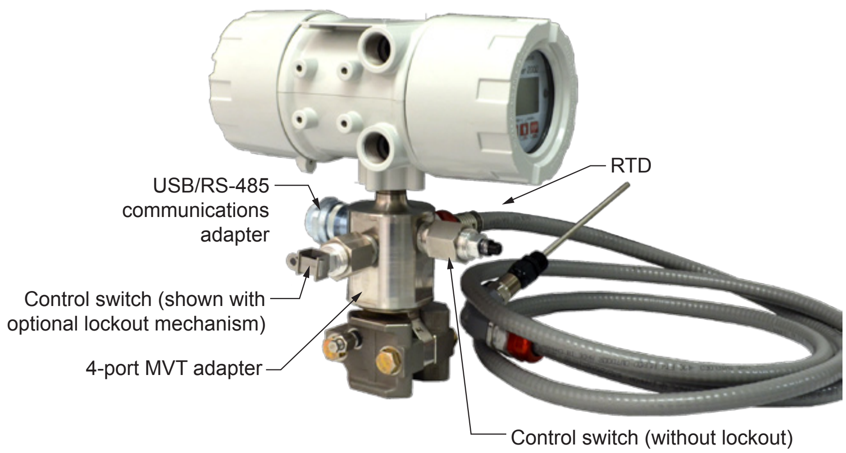


Figure 1.4—Four-port MVT adapter shown with four factory-installed connections

Battery Packs

Cameron's lithium battery packs provide backup power for the Scanner 2100 and can support the Scanner 2100 autonomously for up to 1 year. Battery life can vary significantly, depending on the input/output configuration in use.

The Scanner 2100 supports two battery packs simultaneously (Figure 1.5), allowing the user to change depleted batteries one at a time without interrupting operations, even when the device is operating on battery power alone. For battery handling instructions, see Lithium Battery Pack Replacement, page 75 and Lithium Battery Disposal, page B-1.

Wiring diagrams are provided in Section 3—Wiring the Scanner 2100 EFM, page 53.

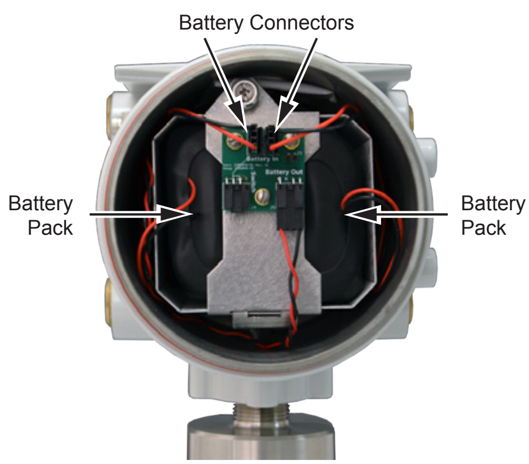


Figure 1.5—Lithium battery pack compartment just beneath the rear (solid) lid

Explosion-Proof Switch

An external explosion-proof switch (Figure 1.6) is available in either of two models:

- ***Toggle Switch.*** Opens or closes a circuit with each push and release of the button. This switch allows the user to disable power to the Scanner 2100 to eliminate radio transmissions as required during operations such as perforating. The switch can also be used to conserve battery power during well testing and other temporary operations when the Scanner 2100 is moved from one site to another. In this configuration, the switch is wired to a small battery board in the rear battery hatch compartment. See Toggle Switch (CSA, Class I, Div. 1 and Div. 2; ATEX, Zone 1), page A-8.
- ***Momentary Switch.*** Opens or closes a circuit when the button is pushed and held in position. This switch allows the user to manually pace the display parameters and to view daily logs within the display. In this configuration, the switch is wired to the main circuit board. See Momentary Switch (CSA, Class I, Div. 1 and 2; ATEX, Zone 1), page A-6.

Lockout Mechanism

The toggle switch and the momentary switch are available with a factory-installed mechanical lockout device that can be used with a lock or a seal to prevent unauthorized changes to the switch position, as may be required for safety compliance.

To lockout a toggle switch to remove power from the Scanner 2100

1. Place the switch in the "Power On" position.
2. Using one continuous motion, depress the push button until it clicks (changing the switch to the "Power Off" position) and with the other hand, slide the metal lockout tab over the button to secure it in place, as shown in Figure 1.6.
3. Install a padlock or a wire seal through the hole in the lockout mechanism to prevent access to the push button.

Figure 1.6—Explosion-proof control switch (left); control switch with factory-installed lockout device (right)

Important **When a mechanical lockout device is required, the switch must be factory-installed in the Scanner 3100. A switch with lockout cannot be ordered separately for field installation.**

A control switch can be installed in any of the four threaded conduit openings in the top of the Scanner 2100 enclosure. If more conduit entries are required, consider an optional four-port MVT adapter, which is approved for use with CSA-approved devices. The four-port MVT adapter is not approved for use with ATEX-approved devices. See Four-Port MVT Adapter, page 10 for details.

CAUTION **If an explosion-proof control switch (with or without a mechanical lockout device) is ordered with an optional four-port MVT, the control switch will be factory-installed. Do not attempt to remove this switch from the MVT port. Doing so can damage other components. Contact the factory for assistance with repairs or replacement.**

RTD Assembly

The temperature input for Scanner 2100 flow calculations is typically supplied by an RTD. Cameron offers three types of 4-wire RTDs to cover explosion-proof, flameproof, and weatherproof applications.

The Barton Model 21 explosion-proof RTD can be connected to the Scanner 2100 without conduit in a Class I, Div. 1 installation and is CSA-certified for use in Class I, Groups B, C, and D; Class II, Groups E, F and G; and Class III hazardous area environments.

Cameron's flameproof RTD is ATEX-certified for use in Zone 1 installations.

Cameron’s weatherproof RTD is CSA-certified for use in Class I, Div. 2 hazardous area installations.

For installation details, see Explosion-Proof RTD Assembly (CSA, Class I, Div. 1), page A-9, Flameproof RTD Assembly, page A-9, and Weatherproof RTD Assembly (CSA, Class I, Div. 2), page A-9. For wiring instructions, see RTD Input, page 57.

Communications Adapters

Cameron offers two adapters for making walk-up laptop connections to the Scanner 2100 without removing the enclosure. A USB connector uses an off-the-shelf USB connector cable, and an RS-485 connector uses a Cameron-supplied cable.

USB Communications Adapter (CSA Class I, Div. 1 and Div. 2; ATEX, Zone 1)

The CSA-approved USB communications adapter (Figure 1.7) is designed to connect a Scanner 2100 directly to a USB port of a laptop or PC. A user-supplied type A/B USB cable is required. The adapter is factory-installed when purchased with a Scanner 2100. It is available in two forms:

- Communications adapter (replacement part, no installation CD)
- Communications adapter kit (USB adapter socket, blanking plug, union nut and an installation CD for upgrading communications in a field unit)

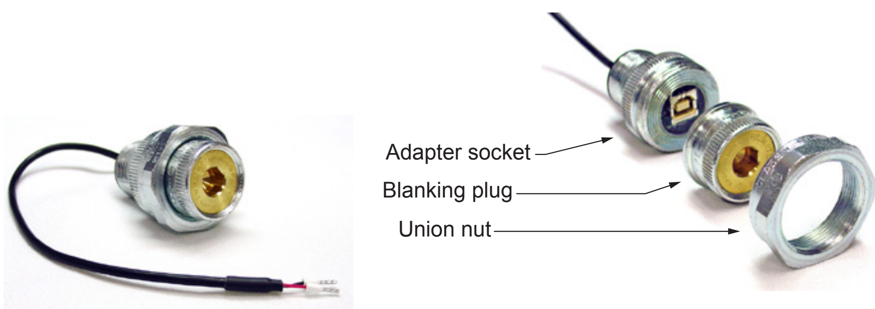


Figure 1.7—USB communications adapter

If the USB adapter is purchased as a kit, see USB Adapter Kit Installation, page A-12, for field installation instructions.

Important **Do not connect the USB adapter to a computer until a USB driver is installed using the CD provided. ModWorX Pro cannot connect to a Scanner 2100 without these files. See Using the Adapter, page A-12.**

When the USB port is not in use, the blanking plug should be nested inside the union nut and the union nut screwed onto the adapter to cover the USB socket.

RS-485 Adapter (CSA Class I, Div. 1 and Div. 2; ATEX, Zone 1)

The CSA-approved RS-485 explosion-proof communications adapter (Figure 1.8, page 13) is shipped pre-assembled in the Scanner 2100 when it is ordered with the flow computer. The installed adapter is comprised of an RS-485 adapter socket, a blanking plug, and a union nut. A plug connector that mates with the RS-485 adapter socket when the adapter is in use is shipped with the device (uninstalled). This plug connector should be wired to an RS-485 converter cable (available from Cameron) and stored with the cable when the adapter is not in use. See RS-485 Adapter Field Installation, page A-11 for field installation instructions. See Figure 3.9 and Figure 3.10, page 59 for instructions on connecting the plug connector to an RS-485 converter cable.

See Table 6.1—Scanner 2100 EFM (Wired) Parts List, page 83 for part numbers.

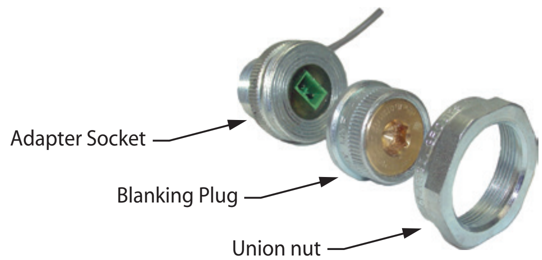


Figure 1.8—RS-485 communications adapter

Pole-Mounting Kit

Cameron's pole mounting kit (Figure 1.9) is recommended for mounting a Scanner 2100 to a 2-in. pipe with a 2 3/8-in. outside diameter. The kit consists of a stainless steel "L" mounting bracket with four mounting holes, two U-bolts, and four 10-mm M6 screws.

The bracket bolts directly to the mounting bosses along the left side of the enclosure, and the U-bolt secures the assembly to a pole. For installation instructions, see Pole-Mounting the Scanner 2100, page 30. For part numbers, see Table 6.1—Scanner 2100 EFM (Wired) Parts List, page 83.

Figure 1.9—Pole mounting kit

Wireless Communications

The Scanner 2100 wireless communications option includes a factory-installed wireless radio module and an explosion-proof coupler (Figure 1.10, page 14) that enables an external antenna to be safely used in a hazardous area. Equivalent antennas with a 1-watt maximum power rating and a frequency range of 2400 to 2483.5 MHz may also be used with the coupler.

Explosion-proof Coupler (CSA Class I, Div. 1 and Div. 2; ATEX, Zone 1)

An explosion-proof coupler is factory-installed in the top right conduit opening of the Scanner 2100 enclosure. The coupler's 12-inch coaxial cable connects to the radio module seated on the Scanner 2100 circuit board inside the Scanner enclosure as shown in Figure 1.10, page 14. The coupler is approved for use with CSA (North America) and ATEX certified devices. For part numbers, see Section 6—Spare Parts, page 83.

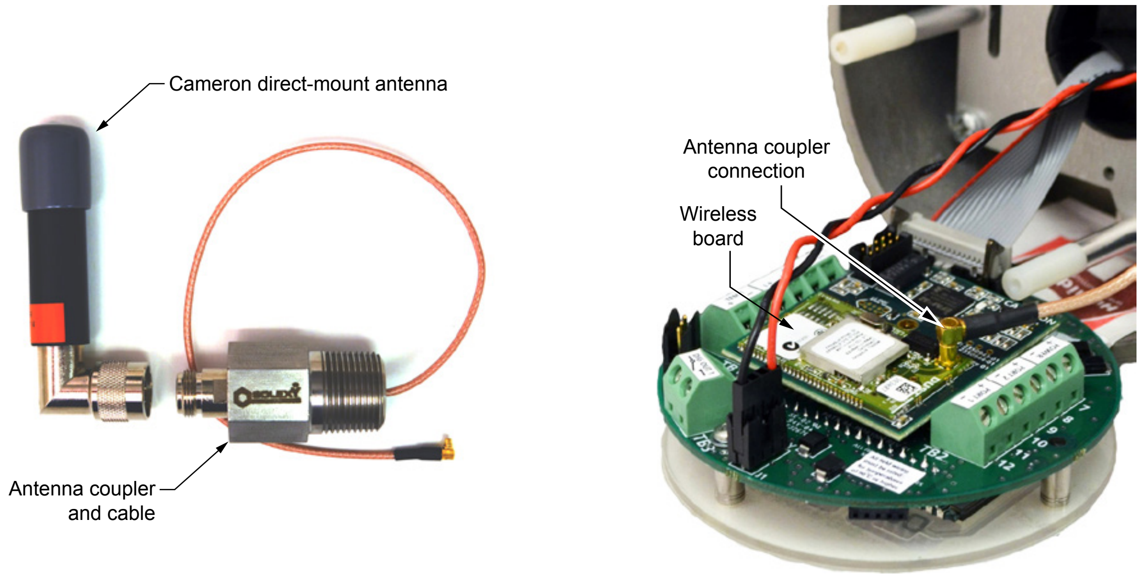


Figure 1.10—Direct-mount antenna, explosion-proof antenna coupler, and coupler cable connection to the wireless radio module

Direct-Mount Antenna

The Cameron-supplied right-angle antenna connects directly to the explosion-proof coupler. When installing the antenna, ensure that it is in a vertical position and positioned away from large structures that could interfere with signal transmission and reception.

Cameron's direct-mount antenna is rated for a maximum of 1 watt of power and a maximum antenna gain of 10 dB in North America, and has a frequency range of 2400 to 2483.5 MHz. Antennas with equivalent ratings may also be used with the coupler. For part numbers, see Table 6.2—Scanner 2100 Wireless Components, page 84.

Remote-Mount Antenna

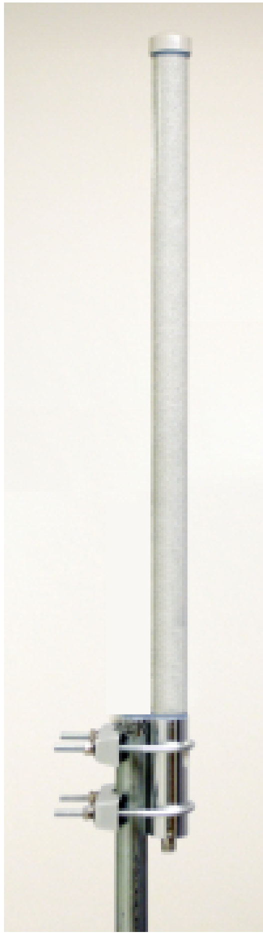
In locations where a physical barrier restricts the use of a direct-connect antenna or where a longer transmission distance is required, a remote-mount antenna (Figure 1.11, page 15 may be installed up to 30 ft (10 m) away and connected by cable to the antenna coupler.

A remote-mount antenna and connecting cable may be purchased from Cameron (see Table 6.2—Scanner 2100 Wireless Components, page 84). If purchasing equipment elsewhere, verify that the antenna does not exceed gain requirements (10 dB max for North America), and the cable does not exceed a maximum inductance of 2 μH/ft (6.5 μH/m). See Specifications, page 16 for additional details.

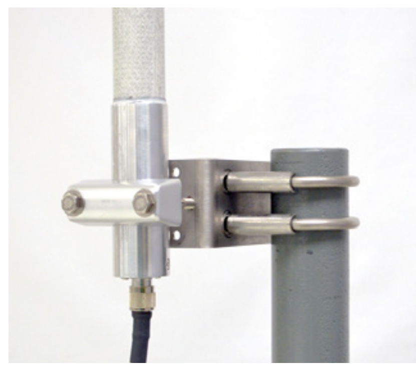
For CSA or ATEX compliance, the installation of the antenna coupler, antennas, and antenna cable must meet the requirements shown in Figure 2.4 and Figure 2.5, page 32.

For installation instructions, see

- Remote-Mount Antenna (for use with pole outside diameters up to 2 inches), page 34
- Remote-Mount Antenna (for use with pipe outside diameters of 2 3/8 inches), page 35



Mounting hardware supplied with
the Cameron remote-mount antenna
(fits pole outside diameters up to 2 inches)



Optional hardware kit for mounting the
Cameron remote-mount antenna to a
2-in. pipe (fits outside diameter of 2 3/8-in.)

Figure 1.11—Remote-mount antenna mounting options

Specifications

Table 1.1—General Specifications

Approvals	CSA (US and Canada) Class I, Div. 1, Groups C and D (explosion-proof), T6 Class I, Div. 2, Groups A,B,C,D (non-sparking)	
	ATEX 15ATEX1123X—Ex d [ia Ga] ib IIC T5 Gb (Tamb -40 degC to 70 degC) IECEx SIR 15.0050X—Ex tb [ia Da] ib IIIC T100 degC Db (Tamb -40 degC to 70 degC) IP66 protection from dust and water	
	Type 4 enclosure	
	ANSI 12.27.01 single seal (0 to 3000 psi)	
	ASME Pressure Vessel Code (0 to 3000 psi); CRN 0F10472.5C	
Environmental Safety	Relative humidity 0% to 90% non-condensing	
	Altitude: Up to 2100 meters	
Enclosure	Cast aluminum (less that 0.05% copper), painted with epoxy and polythyrene, double-ended with single window	
	Dimensions: 5.43 in. wide, 11.27 in. deep, 10.76 in. tall with MVT	
	5 conduit ports (including bottom sensor port), 3/4-in FNPT connections	
Weight	*Base unit (no MVT or batteries)*	7.4 lb (3.36 kg)
	Base + MVT and 2 batteries	16.7 lb (7.57 kg)
	Base + MVT, direct-mount antenna, and 2 batteries	17.3 lb (7.85 kg)
System Power	CSA (North America): External user-provided power supply (6 to 30 VDC at 150 mA) with internal lithium battery backup, standard. For Mexico installations, the power supply is limited to 6 to 24 VDC.	
	ATEX: External user-provided power supply (9 to 30 VDC at 50 mA) with internal lithium battery backup, standard.	
	7.2 V lithium battery pack containing two "D" batteries in series; device accommodates two packs	
Operating Temperature	-40 degC to 70 degC (-40 degF to 158 degF)	
	LCD contrast is reduced below -30 degC (-22 degF)	
WARNING: EXPLOSION RISK. Housing temperature must not exceed 70 degC (158 degF). Excessive temperatures, which could result from ambient conditions combined with radiated and conductive heat from the process, could cause the internal lithium battery to ignite or explode.		
LCD Display/ Keypad	8-digit readout of values (7-segment characters)	
	6-digit bottom readout of scrolling parameters and associated engineering units (11-segment characters for easy-to-read prompts)	
	View up to 12 user-defined parameters	
	View daily log data (see Viewing Daily and Hourly Logs, page 64 for log viewing switch option)	
	User-selectable units of measurement	
	0.3" character height	
	Configurable scan parameters and duration	
	Adjustable contrast and update period	
	3-key membrane switch	
	Password-protected security available	
Memory	Non-volatile memory for configuration and log data	
	256 KB standard	

Table 1.1—General Specifications

Supported Meter Types	Turbine meter	
	Cone meter	
	Orifice meter	
	Ultrasonic meter	
	Positive displacement (PD) meter	
	Coriolis meter	
	Venturi meter	
Logging	Daily records: 768 (>2 years)	
	Interval records: 2304 (>3 months of 1-hour intervals), with main board; 6392 (up to 9 months of hourly logs), with expansion board; Adjustable from 5 seconds to 12 hours	
	Event/alarm records: 1152	
	Logs stored in non-volatile memory for up to 10 years	
Communications/ Archive Retrieval	Wired	RTU Modbus
		Two on-board RS-485 communications ports (300 to 38.4 K baud)
		Full download from main board in approximately 3 minutes
		Enron Modbus compliant downloads
		User-definable Modbus map with up to 25 floating point values
	Wireless	Optional SmartMesh wireless radio module available with or without external antenna. See Table 1.2—Hardware Options, page 20.
		One onboard RS-485 communication port (300 to 38.4 K baud) available for wired communications
		*See Table 1.2—Hardware Options, page 20 for explosion-proof RS-485 or USB communications adapter specifications.
Flow Rate Calculations	Natural Gas	AGA 3 (1992 and 2012), ISO 5167-2 (2003), ASME MFC-14M (2003), AGA 7 (2006), ASME MFC-12M (2006)
	Steam	ASME MFC-12M (2006), AGA 3 (1992 and 2012), ISO 5167 (2003)
	Liquids	API MPMS 5.3 (2009), AGA 3 (1992 and 2012), ISO 5167, AGA 7 (2006)
Fluid Property Calculations	Natural Gas	AGA 8 (1994), AGA 3, Appendix F (1992), GPA 2145 (2008)
	Steam	IAPWS Industrial Formulation 1997 (IF-97), ISO/TR 11582 (2012), Chisholm-Steven Wet Correction Method (for orifice and NuFlo cone), James Wet Correction Method (for orifice)
	Liquids	API MPMS 11.1 (2004)
I/O Summary	Main Board Only	Differential pressure input (1) via optional MVT sensor
		Static pressure input (1) via optional MVT sensor
		Turbine input (1)
		Process temperature input (1)
		Digital output (1)
	With Optional Expansion Board (Wired Units Only)	Pulse/frequency input (1)
		Analog input (2)
		Analog output (1)

Table 1.1—General Specifications

MVT Specifications	Linearized static pressure and differential pressure		
	Bottom ports, standard; side ports available by special order		
	NACE-compliant units available (See Table 2.1—MVT Materials and Bolt Specifications, page 27 for bolt specifications.)		
	Process temperature: -40 degC to 121 degC (-40 degF to 250 degF)		
	User-adjustable sample time and damping		
	Stability: Long-term drift < ±0.05% of upper range limit (URL) per year over a 5-year period		
MVT Accuracy	Differential Pressure	± 0.05% of range except for 30 in. H2O range, which is 0.1%	
	Static Pressure	± 0.05% of range	
	Temperature Performance	± 0.25% of full scale over operating range	
	Stability	long-term drift less than ± 0.05% of URL per year over a 5-year period	
	Resolution	24 bits	
	Effect on Differential Pressure for a 100–psi Pressure Change		
	Differential Pressure Range (in. H20)	**Zero Shift (% URL)**	**Span Shift (% reading)**
	± 30*	.05	.01
	± 200**	.01	.01
	± 400	.04	.01
	± 840	.04	.01
	± Indicates bidirectional capabilities (for example, a range of 30 in. H2O is -30 to +30 H20).* * Exception: 200 x 300 psi has a zero shift of .007% and a span shift of 0.01%.*		
MVT Pressure Ranges	**Effect on Differential Pressure for a 100-psi Static Pressure Change**		
	Static Pressure/SWP (psia)	**Differential Pressure (in. H2O)**	**Maximum Overrange Pressure (psia)**
	100	± 30	150
	300	± 200 or 840	450
	500	± 30 or 200	750
	1500	± 200, 400, or 840	2250
	3000	± 200, 400, or 840	4500
	5300	± 200, 400, or 840	7420
	** Custom ranges available by special order.* *For materials of construction, see Table 2.1—MVT Materials and Bolt Specifications, page 27.*		
Inputs (Main Board)	Turbine Meter Input	Configurable sensitivity adjustment: 20 to 200 mV, peak-to-peak	
		Frequency range: 0 to 3500 Hz	
		Input amplitude: 20 to 3000 mV, peak-to-peak	
	Process Temperature Input	100-ohm platinum RTD with 2-wire, 3-wire, or 4-wire interface	
		Sensing range: -40 degC to 427 degC (-40 degF to 800 degF)	
		Accuracy: 0.2 degC (0.36 degF) over sensing range at calibrated temperature	
		Temperature effect: 0.3 degC (0.54 degC) over operating range	

Table 1.1—General Specifications

Output (Main Board)	Digital Output	Configurable as pulse output or alarm output
		Solid-state relay
		Output rating: 60 mA max @ 30 VDC
	Configured as Pulse Output	Maximum frequency: 50 Hz
		Configurable pulse duration (65,535 msec max)
		Configurable pulse representation (1 pulse = 1 MCF)
		Based on any accumulator (flow run or turbine meter run)
	Configured as Alarm Output	Low/high
		Out-of-range
		Status/Diagnostic
		Latched/Unlatched
		Normally open/Normally closed
Inputs (Expansion Board, Wired Units Only)	Pulse/Frequency Input	Accepts signal from turbine or PD meter
		Optically isolated
		Input: 3 to 30 VDC or contact closure
	Analog Inputs	Three-wire sensor interface (0 to 5 V, 1 to 5 V, 4 to 20 mA)
		Sensor power (CSA). 6 to 30 VDC (same as external power supply for main board); For Mexico installations, the sensor power is limited to 6 to 24 VDC.
		Sensor power (ATEX). 9 to 30 VDC (same as external power supply for main board)
		Accuracy: 0.1% of full scale
		Temperature effect: 0.25% of full scale over operating range
		Resolution: 24 bits
		User-adjustable sample time and damping
Output (Expansion Board, Wired Units Only)	Analog Output	4-20 mA, externally powered
		Accuracy: 0.1% of full scale at 25 degC (77 degF)
		Temperature drift: ±50 PPM/ degC (±27.8 PPM/degF)
		Maximum Voltage: 30 VDC
		Maximum Output Load Resistance (Ohms) = [Supply (volts) - 8] / 0.02
		Represents any measured variable (e.g., differential pressure) or calculated parameter (e.g., flow rate)
		Regulates control valve in PID applications (wired devices only)
		Optically isolated
		Resolution: 16 bits

Table 1.2—Hardware Options

<table>
<tr><td rowspan="2">Communications Adapters</td><td colspan="3">RS-485 (explosion-proof with cover in place)</td></tr>
<tr><td colspan="3">USB (explosion-proof with cover in place)</td></tr>
<tr><td>Expansion Board</td><td colspan="3">Provides additional functionality for wired Scanner 2100 devices (not available with wireless Scanner 2100 devices)</td></tr>
<tr><td rowspan="2">4-Port MVT Adapter</td><td colspan="3">Replaces standard MVT adapter and provides for additional conduit entries</td></tr>
<tr><td colspan="3">Factory installation required</td></tr>
<tr><td rowspan="2">RTD Temperature Sensor</td><td colspan="3">One-piece RTD and cable assembly</td></tr>
<tr><td colspan="3">See Table 6.1—Scanner 2100 EFM (Wired) Parts List, page 83 and Table 6.3—RTD and Cable Assemblies (CSA-Approved), page 85 for available cable lengths and probe sizes.</td></tr>
<tr><td rowspan="4">Wireless SmartMesh Radio</td><td colspan="3">2.4 GHz, self-healing and self-sustaining network</td></tr>
<tr><td colspan="3">Factory installed with stainless steel, explosion-proof antenna coupler, N female x 3/4 MNPT, with 12-in. coaxial cable and MMCX male connector</td></tr>
<tr><td colspan="3">Transmits up to 985 ft (300 m) node-to-node</td></tr>
<tr><td colspan="3">Supports communications with up to 20 remote Scanner 2000 Series devices (each Scanner node can transmit and receive data)</td></tr>
<tr><td>Radio Certifications</td><td colspan="3">Argentina: CNC
Australia/New Zealand: ACMA, R-NZ (Z571 Limited), C-Tick
Bahrain: TRA
Ecuador
Egypt: NRTA
Europe: CE Mark, R&TTE
India
Indonesia: SDPPI
Mexico: IFETEL
North America: FCC/IC
Oman, TRA
Qatar
Thailand
United Arab Emirates, TRA
Venezuela</td></tr>
<tr><td rowspan="15">Antenna</td><td></td><td>Direct-Mount</td><td>Remote-Mount</td></tr>
<tr><td colspan="3">Electrical Properties</td></tr>
<tr><td>Frequency Range</td><td>2.35 to 2.50 GHz</td><td>2.4 to 2.5 GHz</td></tr>
<tr><td>Impedance</td><td>50 Ohms nominal @ 2.4 GHz</td><td>50 Ohms nominal @ 2.4 GHz</td></tr>
<tr><td>Voltage Standing Wave Range (VSWR)</td><td>1.13:1</td><td><1.5</td></tr>
<tr><td>Radiation</td><td>Omni-directional</td><td>Omni-directional</td></tr>
<tr><td>Polarization</td><td>Vertical</td><td>Vertical</td></tr>
<tr><td>Gain</td><td>>2.5 dBi</td><td>9 dBi</td></tr>
<tr><td colspan="3">Mechanical Properties</td></tr>
<tr><td>Connector</td><td>N male brass nickel-plated connector for use with N female explosion-proof coupler</td><td>N female brass nickel-plated connector, cable required for connection to N female explosion-proof coupler</td></tr>
<tr><td>Height</td><td>3.75 in. (95.25 mm)</td><td>32.28 in. (800 mm)</td></tr>
<tr><td>Shape</td><td>Right-angle</td><td>Straight</td></tr>
<tr><td>Material</td><td>UV-resistant ABS</td><td>Fiberglass</td></tr>
<tr><td>Operating Temperature</td><td>-40 degC to 80 degC (-40 degF to 178 degF)</td><td>-40 degC to 80 degC (-40 degF to 178 degF)</td></tr>
</table>

Table 1.2—Hardware Options

Antenna Cable		**Direct-Mount**	**Remote-Mount**
	Length	N/A	10-, 20-, and 30-ft with connectors
	Type	N/A	Type 400
	Temperature Range	N/A	-40 degC to 70 degC (-40 degF to 158 degF)
	Pole Mount Hardware		
	—	N/A	Standard hardware (included with antenna) fits poles with outside diameters up to 2 in.
	—	N/A	Alternate pole mount kit available for pipe with outside diameter of 2 3/8 in.
Control Switch	Explosion-proof switch, momentary contact, fits 3/4-in. female pipe thread, available with or without mechanical lockout mechanism*; may be used as a keypad alternative		
	Explosion-proof switch, toggle action, fits 3/4-in. female pipe thread, available with or without mechanical lockout mechanism*; may be used to remove power from Scanner 2100 for radio silencing		
Pole Mount Kit	Stainless steel pole mount kit for 2-in. pipe (2 3/8-in. outside diameter)		

** Mechanical lockout mechanism prevents unauthorized users from changing the switch position.*

Table 1.3—Scanner Companion Software

Important	**To download software or software user manuals, visit the Cameron website at products.slb.com/flowcomputers, select Scanner 2000 Series Wired and Wireless, and click on the link for the desired software install/manual.**	
ModWorX Pro	Features	Easy-to-use interface for field calibration, flow run maintenance, archive data downloads and reporting
		Real-time data polling
		Complete configuration
		Configuration upload for configuring multiple units
		Multi-level security
	Field Calibration	1 to 12 calibration points for each parameter
		Three methods: multi-point, set zero point, and verify (API compliant)
		Inputs automatically locked during calibration
	Maintenance	Change plate, cone (1 to 12 point linearization), gas composition, steam properties, flow coefficients, K-factor (1 to 12 point linearization), turbine flowmeter and generic API liquid parameters
	Archive Data Downloads and Reporting	Configurable downloads of “all” or “new” records
		Download types: daily, interval, and event/alarm records
		Downloads automatically saved in uneditable binary (.sdf) files
		Exports to .xls, .csv, .rtf, .html, Flow-Cal and PGAS formats
	Report Types	Daily logs (table or graph)
		Interval logs (table or graph)
		Event/Alarm logs
		Configuration settings
		Calibration settings
		Snapshot (current status data and calculated parameters)
Scanner Data Manager	Data analysis, reporting, export and conversion tool	
	Tabular and trend presentations	
	Customized reports	
ScanFlash	Firmware management utility	
PC Requirements		
Windows 7 or later operating system		
1 GHz or faster 32-bit (×86) or 64-bit (×64) processor		
1 GB RAM (32-bit) or 2 GB RAM (64-bit) available hard disk space (135 MB for companion software installation, 30 MB for Adobe Reader, adequate space for data files)		
DirectX 9 graphics device with WDDM 1.0 or later driver		

Flow Rate and Fluid Property Calculations

The Scanner 2100 calculates flow rates and fluid properties for natural gas and liquid flow in accordance with the following industry standards. The calculations compensate for the effects of pressure, temperature, and fluid composition to determine mass and volume at specified base conditions. The fluid corrections typically require configuration of inputs including static pressure and temperature; the flow calculation requires configuration of differential pressure or pulse (frequency) inputs.

Table 1.4—Flow Rate Standards

		Orifice	NuFlo Cone	Linear Pulse Output	Averaging Pitot Tube (Annubar)
FLOW RATE STANDARDS					
AGA 3 (1992)	The Scanner 2100 supports the orifice metering calculations described in AGA Report No. 3 (1992). This meter covers pipe sizes of nominal 2 inch and larger; there is no stated maximum limit, but the largest size listed in the standard is nominal 36 inch. Beta ratio must be between 0.1 and 0.75. The AGA 3 orifice meter can be used to measure natural gas, hydrocarbon fuel gas and liquids.	♦			
AGA 3 (2012)	The Scanner 2100 supports the orifice metering calculations described in AGA Report No. 3 (2012). The AGA 3 orifice meter covers pipe sizes of nominal 2 inch and larger; there is no stated maximum limit, but the largest size listed in the standard is nominal 36 inch. Beta ratio must be between 0.1 and 0.75. The 2012 report offers an improved expansion factor correction and is recommended for use except where contractual or regulatory requirements specify the 1992 standard. The AGA 3 orifice meter can be used to measure natural gas, hydrocarbon fuel gas and liquids.	♦			
ISO 5167-2 (2003)	The Scanner 2100 supports the orifice metering calculations described in Part 2 of ISO 5167 (2003). This meter covers pipe sizes of nominal 50 mm (2 inch) to a maximum of 1000 mm (39 inch). Beta ratio must be between 0.1 and 0.75. The ISO orifice meter can be used to measure natural gas, hydrocarbon fuel gas and liquids.	♦			
ASME MFC-14M (2003)	For low flow applications, the Scanner 2100 supports the small-bore orifice described in ASME MFC-14M (2003). Meter sizes between nominal 1/2 inch to 1-1/2 inch pipe size are covered by this standard. Beta ratio must be between 0.1 and 0.75. The ASME small-bore orifice meter can be used to measure natural gas, hydrocarbon fuel gas and liquids.	♦			
NuFlo Cone Meter User Manual	The Scanner 2100 calculates fluid flow rate of cone meters using industry-recognized algorithms identified in the NuFlo Cone Meter User Manual. The cone meter can be used to measure natural gas, steam, and liquids.		♦		
AGA 7 (2006)	AGA 7 provides the measurement standards used to calculate natural gas flow rates from linear pulse output meters, including turbine meters, vortex shedding meters, pulser-equipped positive displacement (PD) meters, Coriolis meters having volumetric pulse output, and other types. Linear pulse output meters can be used to measure natural gas and liquids.			♦	
Miller Handbook, Third Ed.	The Flow Measurement Engineering Handbook by Richard Miller provides definitive information on selecting, sizing, and performing pipe-flow-rate calculations, using ISO and ANSI standards in both SI and US equivalents. This reference also presents physical property data, support material for important fluid properties, accuracy estimation and installation requirements for all commonly used flowmeters.		♦		

Table 1.5—Fluid Property and Energy Flow Calculations

		Natural Gas	Hydrocarbon Liquid	Steam
FLUID PROPERTY STANDARDS				
AGA 3:3 (1992), Appendix F	The heating value for energy measurement is calculated according to Part 3 of AGA Report No. 3 (1992), Appendix F, "Heating Value Calculation," using the data from GPA-2145 (2008).	♦	♦	
AGA 8 Detailed (1992)	Use of AGA 8-92DC requires a gas analysis (ie: knowledge of the mole fractions of 21 gas components: the alkanes methane through decane, common diluents including nitrogen, carbon dioxide, hydrogen sulfide, and assorted trace components). This equation is most accurate between temperatures of 17 degF and 143 degF (-8 degC to 62 degC) and at pressures up to 1750 psia (12 MPa). If lesser accuracy is acceptable, the range can be extended from -200 degF to 400 degF (-130 degC to 200 degC) and pressures up to 20,000 psi (140 MPa).	♦		
AGA 8 Gross (1994) **SGerg-88 (1988)**	When the detailed composition of the gas is unknown, an alternative method of characterizing the gas is available. It is based on the gross properties: real gas relative density (gas gravity), and content of carbon dioxide and nitrogen. This method detailed in AGA Report No. 8 and ISO 12213-3, is based on the SGerg-88 equation. The Gross Characterization method should only be used at temperatures between 17 degF and 143 degF (-8 degC to 62 degC) and at pressures below 1750 psia (12 MPa). Gravity range is from 0.554 to 0.87; up to 28.94% carbon dioxide, and up to 53.6% nitrogen. This method should not be used outside of these limits.	♦		
IAPWS IF-97 (1997)	Saturated steam properties, including density (inverse specific volume), enthalpy (heat content) and viscosity are computed in accordance with the International Steam Tables, IF-97 (1997), for regions 2 and 4. The temperature range is from 32 degF to 662 degF (0 degC to 350 degC) and pressures up to 2380 psi (16.4 MPa) can be used. For saturated steam, only a pressure input is required; temperature is a calculated value. Steam mass and energy measurement can be accomplished with any meter type that can withstand the high temperatures involved. By use of proper installation methods, orifice meters, NuFlo cone meters, averaging pitot tubes, and some vortex-shedding meters can be used.			♦
API MPMS Chapter 11.1 (2004)	*The temperature and pressure correction factors for hydrocarbon liquids including crude oil, refined products (gasoline, jet fuel, fuel oils), lubricating oils, and special products are calculated according to API MPMS 11.1 (2004).* *For crude oils, the density range is 610.6 to 1163.5 kg/m³, temperature range is from -58 degF to 302 degF (-50 degC to 150 degC), and pressure range is from 0 to 1500 psig (0 to 10340 kPa).* *For DP meters, the viscosity at operating temperature is a required input to the flow computer, and it must be determined as accurately as possible.*		♦	
ISO/TR 11583 (Chisholm-Steven Method)	The Chisholm-Steven method described in ISO/TR 11583 is applicable when using an orifice or NuFlo Cone meter to measure steam with a quality less than 100%. Note: The Chisholm-Steven method is not applicable to the ASME small-bore orifice, averaging pitot tube, or turbine meter.			♦
James Equation	The James equation is a well-known method that can be used to correct orifice meters for the quality of saturated steam. Note: The James method is not applicable to the ASME small-bore orifice meter.			♦
ENERGY FLOW STANDARDS				
AGA 3:3 (1992), Appendix F	The heating value for energy measurement is calculated according to Part 3 of AGA Report No. 3 (1992), Appendix F, "Heating Value Calculation," using the data from GPA-2145 (2008).	♦	♦	

Section 2—Installing the Scanner 2100 EFM

Hazardous Area Installations

The Scanner 2100 is CSA-certified for Class I, Divisions 1 and 2 hazardous area use and ATEX-certified for Zone 1 hazardous area use. It is fully assembled at the time of shipment. Carefully review the following hazardous area requirements before installing a Scanner 2100 in a hazardous area. Once the instrument is mounted in a hazardous area, the cover should not be removed unless the area is void of combustible gas and vapors.

ATEX Installations (Conditions for Safe Use)

The ATEX-certified standard Scanner 3100 is fully compliant with European ATEX Directive 2014/34/EU and has been evaluated per the following standards:

- IECEx: IEC 60079-0, Edition 6, IEC 60079-1, Edition 6, IEC 60079-11, Edition 6, and IEC 60079-31, Edition 2
- ATEX: EN 60079-0, EN 60079-1, EN 60079-11, EN 60079-31

The following instructions apply to equipment covered by certificate numbers Sira 15ATEX1123X and IECEx SIR 15.0050X:

- When removing the conduit plug to fit the data transfer socket to the communication adaptor and during data transfer, the user/installer shall ensure that no explosive atmosphere is present. After data transfer has finished, the conduit plug shall be re-fitted in accordance with the relevant Code of Practice.
- Under rated conditions, the branching point at the entry point may reach 80 degC, therefore, when choosing cables and cable glands, this shall be taken into account.
- When removing or replacing the internal battery packs, this shall be done in accordance with the user instructions provided by the manufacturer, and the user/installer shall ensure that no explosive atmosphere is present.
- The user/installer shall install this equipment taking into account any restrictions or special conditions for safe use that are applicable to the previously certified devices that are used in its construction.

Wiring Precautions

CAUTION **In accordance with EN60079-0, Clause 16.6, all cable and cable glands must be rated for 80ºC. The Scanner 3100 may be fitted as a remote unit when all the cable entries are fitted with flameproof glands that have been suitably certified by a notified body.**

RTD Assembly Options (for Gas and Liquid Flow Runs Only)

The process temperature input is typically supplied by an RTD installed in a thermowell downstream of the primary differential pressure source. The location of the thermowell should conform to the relative standard to ensure accurate measurement. Use only an RTD assembly that is fitted with a suitably certified, Ex d IIC cable entry gland, such as the flameproof RTD (Part No. 9A-X-TTXR-0003) listed in Table 6.1—Scanner 2100 EFM (Wired) Parts List, page 83.

Class I, Div. 1 (CSA) Installations

The Scanner 2100 is CSA-certified as explosion-proof for Class I, Division 1, Groups C and D hazardous locations.

Wiring Precautions

CAUTION **All field wiring must conform to the National Electrical Code, NFPA 70, Article 501-4(b) for installations within the United States or the Canadian Electric Code for installations within Canada. Local wiring ordinances may also apply. The cable used between the Scanner 2100 and other devices must be either armored MC-HL cable or standard cable routed through conduit. If standard cable is used, a conduit seal must be installed within 6 inches of the Scanner.**

RTD Assembly Options (for Gas and Liquid Flow Runs Only)

The process temperature input is typically supplied by an RTD installed in a thermowell downstream of the primary DP source using a 2-wire, 3-wire, or 4-wire RTD assembly. To ensure accurate measurement, the location of the thermowell should conform to the relative standard.

Cameron's Barton Model 21 RTD, a 4-wire, 100-ohm explosion-proof RTD assembly, can be connected to the Scanner 2100 enclosure without conduit or a conduit seal. For details, see Explosion-Proof RTD Assembly (CSA, Class I, Div. 1), page A-9. RTDs that do not carry the explosion-proof rating can be used if they are routed through conduit and a conduit seal is installed within 6 inches of the Scanner 2100.

Class I, Div. 2 (CSA) Installations

The Scanner 2100 is CSA-certified as weatherproof for Class I, Division 2, Groups A, B, C, and D hazardous locations.

Wiring Precautions

CAUTION **All field wiring must conform to the National Electrical Code, NFPA 70, Article 501-4(b) for installations within the United States or the Canadian Electric Code for installations within Canada. Local wiring ordinances may also apply. All field wiring must be rated for temperatures of 90 degC or higher, and have a wire range of 22 to 14 AWG. Terminal block screws must be tightened to a minimum torque of 5 to 7 in-lbs. to secure the wiring within the terminal block. Only personnel who are experienced with field wiring should perform these procedures.**

RTD Assembly Options (for Gas and Liquid Flow Runs Only)

The process temperature input is typically supplied by an RTD installed in a thermowell downstream of the primary differential pressure source. The location of the thermowell should conform to the relative standard to ensure accurate measurement. A 2-wire, 3-wire, or 4-wire RTD assembly may be used. A weatherproof RTD fitted with a weatherproof Type 4 strain relief is recommended for Div. 2 installations. For details, see Flameproof RTD Assembly, page A-9.

Pressure Precautions

WARNING: Before connecting the Scanner 2100 to a flow line, consider the pressure rating of the sensor and the presence of harmful gases. The tubing and fixtures used to connect the sensor to the manifold in the flow line must be manufactured from materials that are appropriate for the pressure ratings of the sensor used. If H2S is present, use a NACE sensor and take appropriate precautions to avoid exposure to this hazardous gas.

Table 2.1—MVT Materials and Bolt Specifications

MVT Materials of Construction	
Process Cover	316 SS (other materials available by special order)
Process Cover Gasket	Glass-filled PTFE
Diaphragm	316L SS (other materials available by special order)
Vent/drain	SS bleed (316SS plug optional for NACE and coastal applications)

Body Bolts and Nuts (non-process wetted)					
	B7/2H ❶ alloy steel	**B7M/2HM ❶ alloy steel**	**316SS ❷**	**17-4 PH SS**	**Inconel 718**
Configuration					
Standard	Yes	No	Yes	Yes	Yes
NACE	No	Yes	No	No	Yes
Coastal	Yes ❶	Yes ❶	Yes	No	Yes
Max. Pressure Range	5300 ❸❹	1500	1500	3000	5300
Coating	Plated	Black oxide	None	None	None

[1] B7 and B7M alloy steel is susceptible to rust. Other materials may be preferred for offshore use.

[2] 316 SS bolts have a CRN safe working pressure limit of 2725 psi.

[3] 5300-psi ranges require transducer code HP and have a CRN safe working pressure limit of 3625 psi. Single seal is limited to 3000 psi.

[4] 5300-psi ranges require transducer code HP and are not available with a Canadian CRN. 5300-psi range has a CRN SWP limit of 3710 psi. Therefore, it is possible to measure to 3710 psi and remain in CRN compliance. Single seal is limited to 3000 psi.

Mounting Options

The Scanner 2100 can be mounted using the following methods:

- ***Direct-mount to an orifice or cone type DP meter.*** The integral multi-variable sensor may be connected to the pressure taps with stabilizers or a heavy wall nipple with adapter flanges, and a 5-valve manifold (Figure 2.8, page 34). A bottom-port MVT is recommended for gas measurement; a side-mount MVT is recommended for liquid or steam measurement. An optional four-port MVT is available for installations requiring additional conduit entries (not suitable for ATEX-approved devices).
- ***Pole-mount*** (Figure 2.3, page 30). The instrument can be mounted on a 2-in. pole using the mounting bosses on the side of the enclosure and a Cameron pole mount kit. Tubing is used to connect the integral MVT to the orifice meter or cone meter.

The following accessories are also recommended:

- A 5-valve manifold for connecting process lines to the integral MVT
- An RTD assembly for process temperature input on gas flow runs and compensated liquid flow runs (not recommended for steam flow runs). See RTD Assembly Options (for Gas and Liquid Flow Runs Only), page 26 for a description of RTD options to meet specific hazardous area requirements.
- Tubing and/or pipe for plumbing process connections
- Explosion-proof signal cable for remote turbine connections (stranded, shielded cable is recommended)

Dimensions

Dimensions shown are for CSA-approved components. Dimensions for ATEX-approved components may be slightly different.

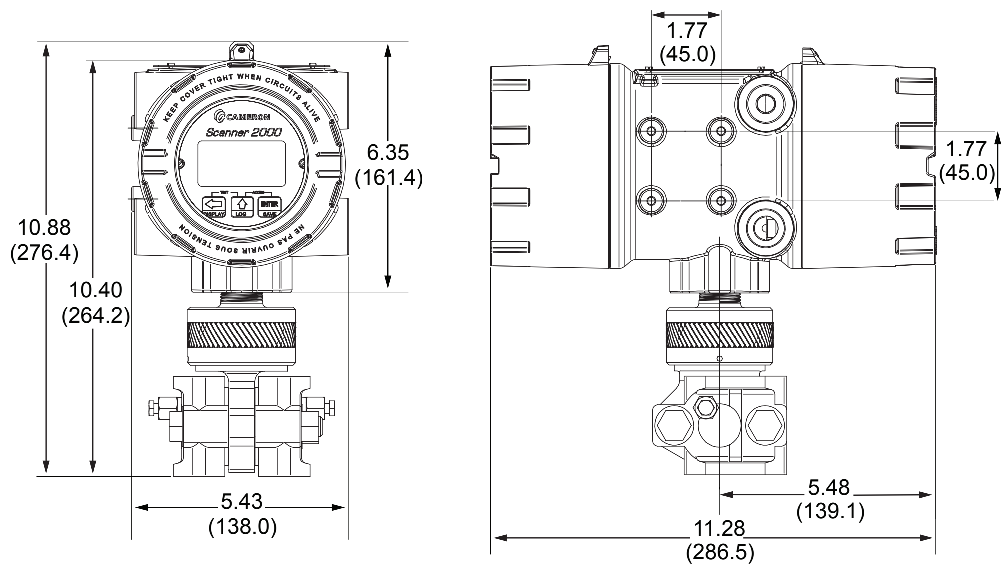
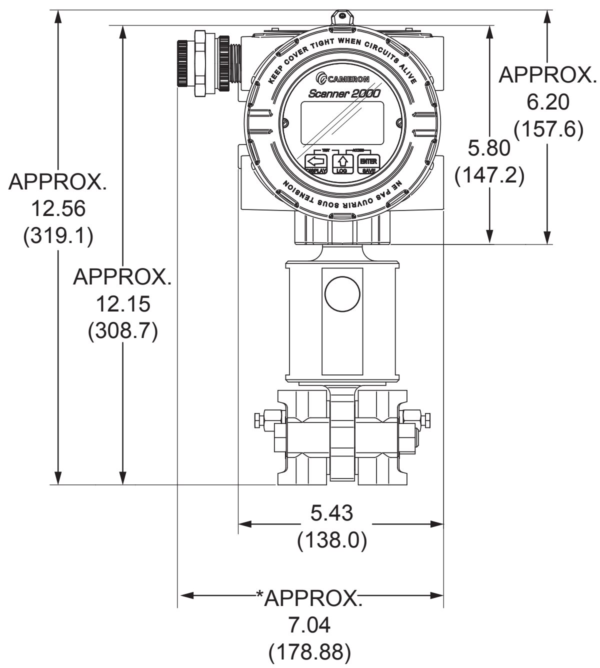
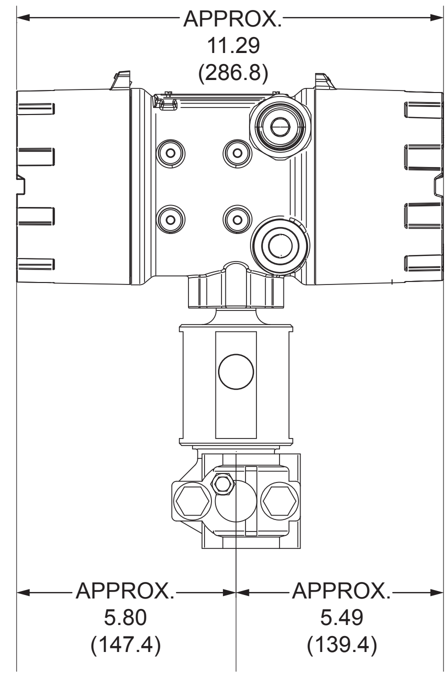


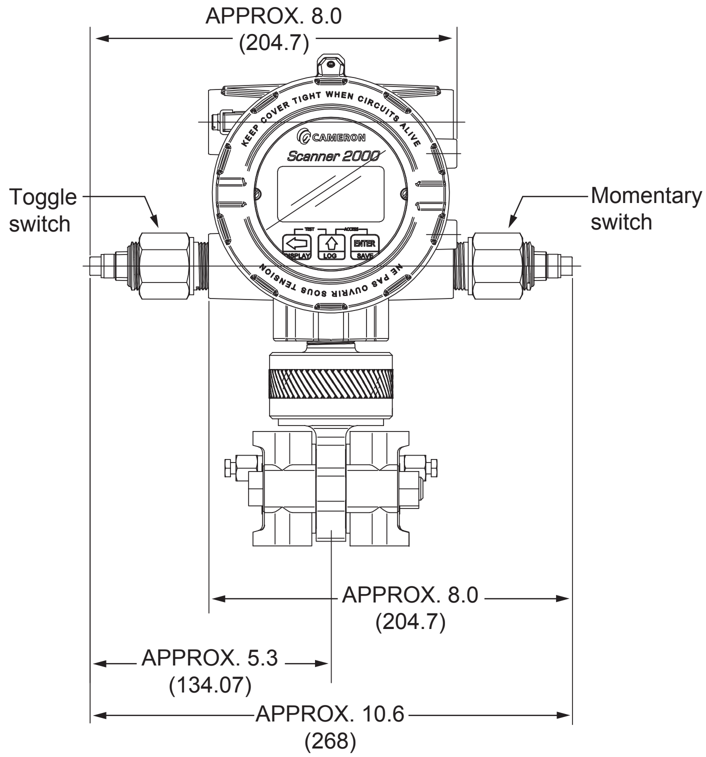
Figure 2.1—Scanner 2100 (wired) with direct-mount MVT; dimensions are shown in inches (mm)

Scanner 2100 with 4-port MVT Adapter
Front and Side Views

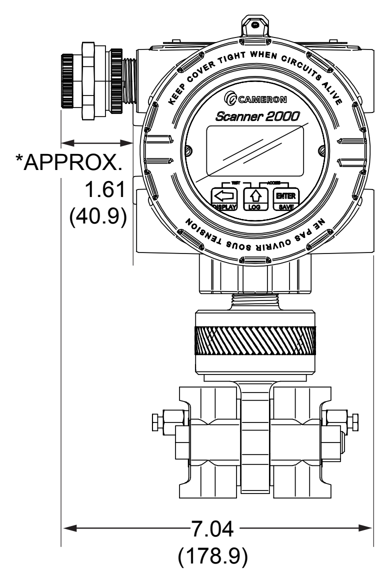




Scanner 2100 with
Explosion-proof Control Switch



Scanner 2100 with
Communications Adapter



* The dimensions shown above are for the CSA-approved COM adapter. The ATEX model is approx. 0.88 in. (22.4 mm) longer.

Figure 2.2—Scanner 2100 (wired) with hardware options; dimensions in inches (mm); for dimensions with antenna, see *Figure 2.4, page 31.*

Pole-Mounting the Scanner 2100

Cameron's pole-mount kit is recommended for mounting any Scanner 2100 configuration to a 2-in. pole (Figure 2.3). The kit consists of a stainless steel "L" mounting bracket with four mounting holes, two U-bolts, and four 10-mm M6 screws.

To install, perform the following steps:

1. Locate the mounting bosses on the side of the Scanner 2100 enclosure.
2. Attach the mounting bracket to the bosses using the four 10 mm screws provided. For best strength, orient the bracket so that the flat surface of the "L" bracket is near the front of the Scanner 2100.
3. Position the device with bracket against the pole so that the bracket is directly in front of the pole.
4. Install the two U-bolts around the pole and through the mounting holes in the bracket.
5. Tighten the U-bolts securely. As a general torque guide, the U-bolts can be safely torqued to 25-30 ft-lbs.
6. Install and connect process piping between the Scanner 2100 and the turbine meter with appropriate fittings. Process piping installation procedures vary with each application.

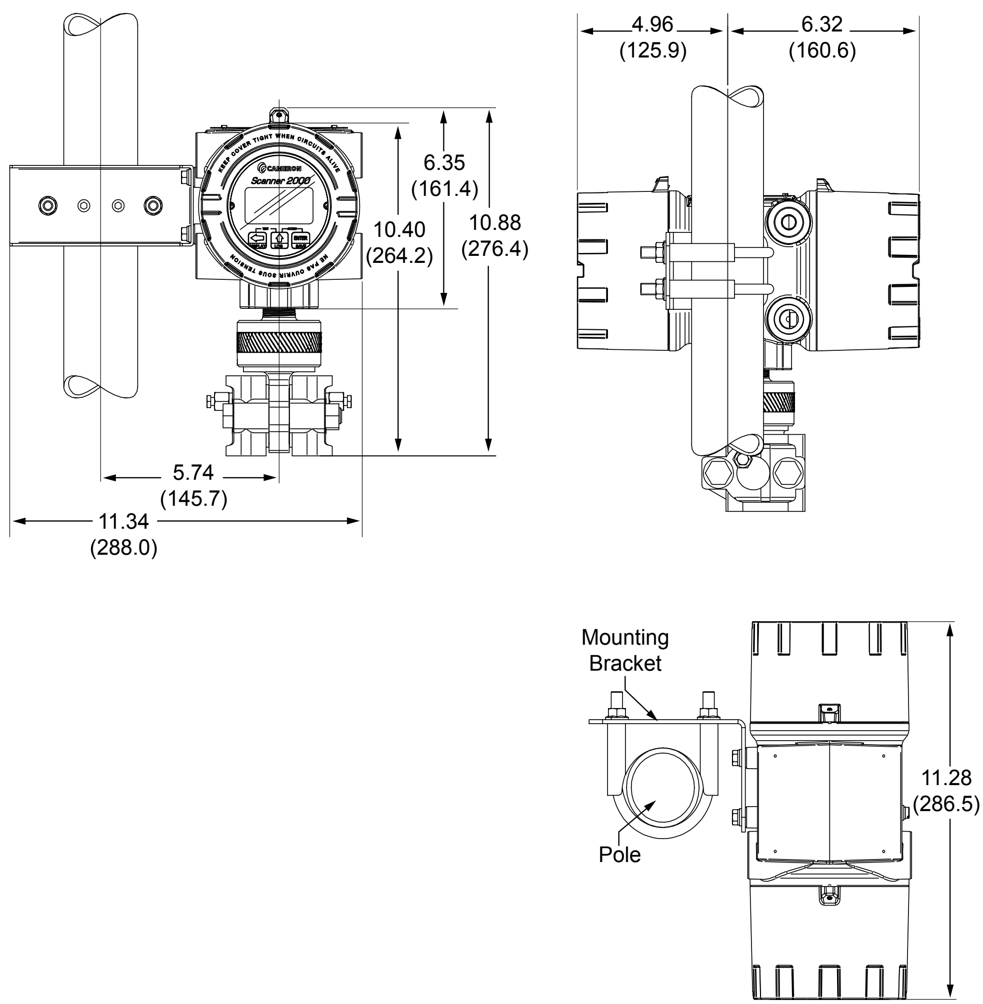


Figure 2.3—Scanner 2100 with MVT, remote-mounted on a 2-in. pole using a Cameron hardware kit; dimensions are shown in inches (mm)

Important	**For liquid or steam installations requiring a side-port MVT and a block manifold, make sure the mounting hardware selected provides adequate clearance for process piping.**

Hazardous Area Requirements for Wireless Communications

Each Scanner 2100 wireless device is equipped with a wireless module connected to the main circuit board and an explosion-proof coupler that threads into an enclosure port. Antennas and antenna cable are optionally available. Figure 2.4 shows installation dimensions for a Scanner 2100 equipped with the direct-mount, right-angle antenna supplied by Cameron.

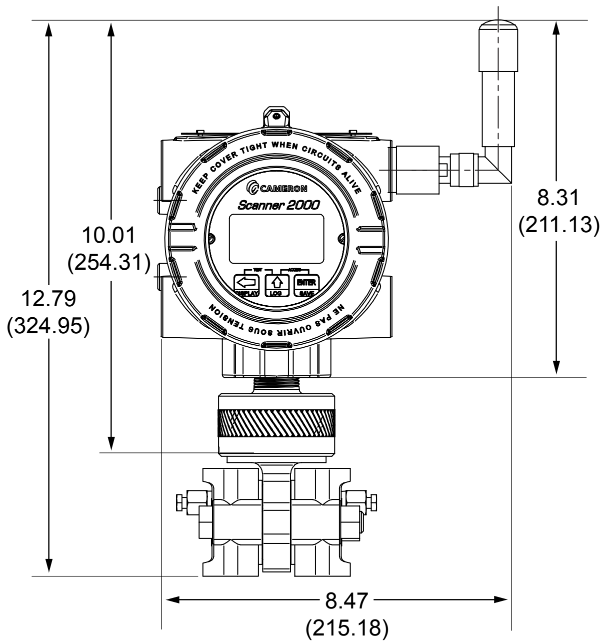


Figure 2.4—Scanner 2100 with direct-mount MVT and external antenna; dimensions are shown in inches (mm)

For CSA compliance, the installation of the antenna coupler, antennas, and antenna cable must meet the requirements shown in Figure 2.5 and Figure 2.6, page 32.

Cameron supplies the following antenna and antenna cable options:

- Direct-mount, right-angle antenna with N male connector
- Remote-mount antenna with N female connector
- Type 400 male-to-male antenna cable in three lengths - 10, 20, and 30 feet

See Table 6.2—Scanner 2100 Wireless Components, page 84 for ordering details.

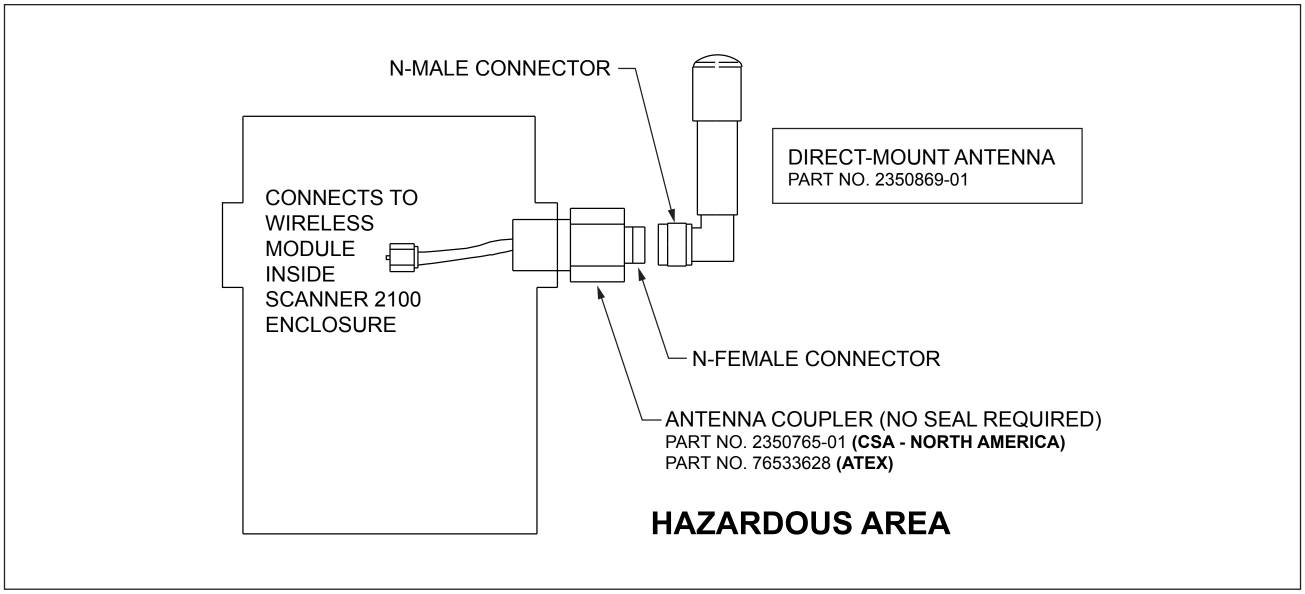


Figure 2.5—Installation requirements for a direct-mount Cameron-supplied antenna

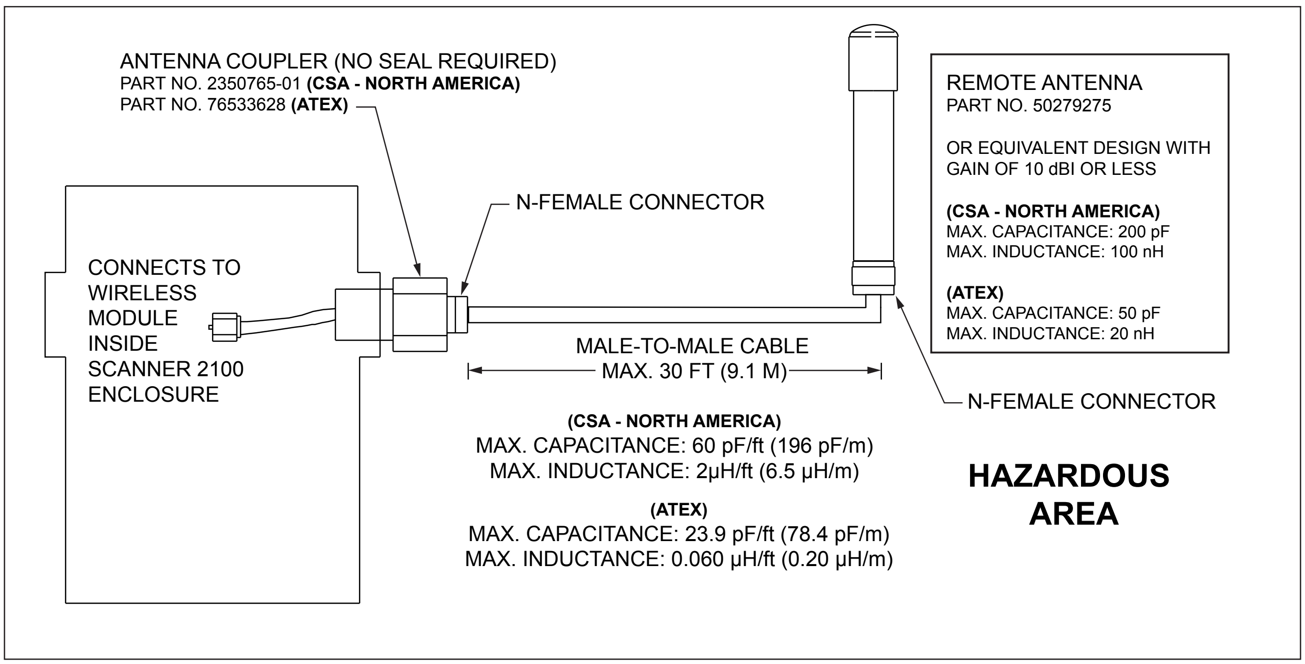


Figure 2.6—Installation requirements for a remote-mount antenna

FCC Radio Frequency Compliance

Scanner 2100s that include the optional SmartMesh radio comply with Federal Communications Commission (FCC) radio frequency (RF) exposure compliance requirements when the following requirements are met.

Important **To comply with FCC and IC RF exposure compliance requirements, the antenna must be installed to provide a separation distance of at least 20 cm from all persons. Changes or modifications to the installation that violate this requirement and are not authorized by the radio manufacturer could void the user's authority to operate the equipment.**

The SmartMesh radio has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment to an outlet on a circuit different from that used with the receiver.
- Consult the dealer or an experienced radio/TV technician for help.

IC Radio Frequency Compliance

Scanner 2100s that include the optional SmartMesh radio comply with Industry Canada (IC) license-exempt RSS standards. Operation is subject to the following conditions:

- The device may not cause interference.
- The device must accept any interference, including interference that may cause undesired operation of the device.

Radio Frequency Compliance Labeling

Scanner 2100s that include the optional SmartMesh radio module comply with a broad range of country-specific radio frequency standards. The Scanner 2100 wireless radio is approved for use in all of the regions listed on a radio compliance label (Figure 2.7) applied to the Scanner 2100 enclosure.

Figure 2.7—Radio frequency compliance label applied to the Scanner 2100 enclosure (content may change without notice)

Antenna Installation Options

Direct-Mount Antenna

Each Scanner 2100 wireless device is equipped with a wireless module (installed on an advanced communications circuit board) and an explosion-proof coupler that threads into an enclosure port. Antennas and antenna cable are optionally available.

For CSA or ATEX compliance, the installation of the antenna coupler, antennas, and antenna cable must meet the requirements shown in Figure 2.5 and Figure 2.6, page 32.

Remote-Mount Antenna (for use with pole outside diameters up to 2 inches)

The standard hardware supplied with Cameron's remote-mount antenna can be used to mount the antenna to a pole with an outside diameter of 2 in. or less. The supplied hardware includes two U-bolts, two toothed brackets, four lock washers, and four nuts.

Note If a 2-in. pipe with a 2 3/8-in. outside diameter is to be used, consider using Cameron's 2-in. pipe mount hardware kit.

To install the antenna, reference Figure 2.8 while following the instructions below:

1. Position the antenna with the shiny metal base against the vertical pole so that the capped end of the antenna is vertical in the air. Note the N-female cable connector is at the bottom of the metal base for connecting antenna cable.
2. Position a U-bolt around the antenna and pole, placing the bend of the U-bolt against the antenna base.
3. Place a toothed bracket over the threaded ends of the U-bolt with the teeth facing the pole and slide the bracket snugly against the pole.
4. Install a lock washer and a nut on each of the two U-bolt legs extending through the toothed bracket.
5. Repeat Steps 2 through 4 to install the second U-bolt and toothed bracket to secure the base of the antenna.
6. Attach the antenna cable to the N-female cable connector at the bottom of the antenna.

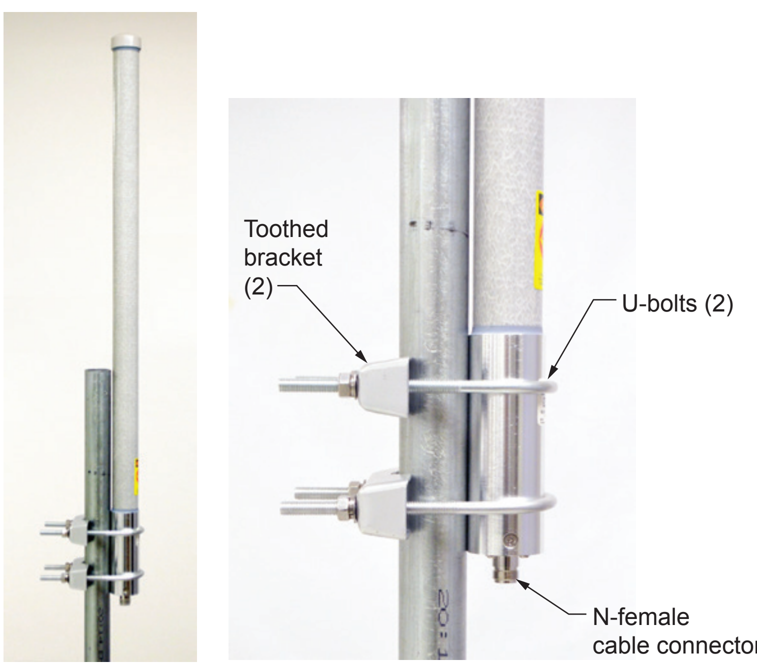


Figure 2.8—Standard pole mount bracket (fits poles with an outside diameter of 2 inches or less)

Remote-Mount Antenna (for use with pipe outside diameters of 2 3/8 inches)

Cameron's optional pipe mount kit accommodates mounting the remote antenna to a 2-in. pipe with a 2 3/8-in. outer diameter. The hardware kit includes a stainless steel L-shaped bracket, two U-bolts, four U-bolt nuts, two stainless steel 5/16-18 bolts (3.25-in. long), two 5/16-in. lock washers, two 5/16-in. flat washers, and two 5/16-in. nuts.

Important **One of the toothed brackets shipped with the standard pole-mount kit is also required for this installation. Do not discard the standard pole-mount kit antenna packaging before locating the bag of supplied mounting hardware that includes the toothed brackets.**

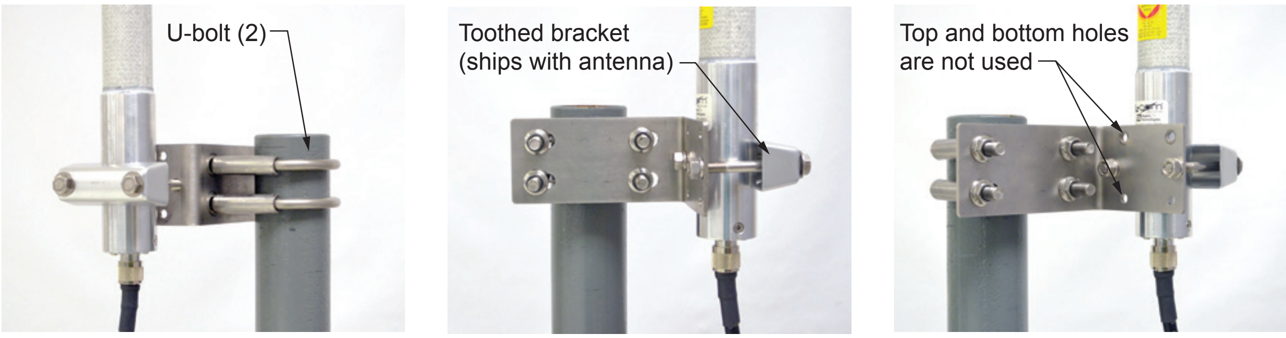


Figure 2.9—Optional 2-in. pipe mount bracket

To install the antenna, reference Figure 2.9 while following the instructions below:

1. Remove one of the toothed brackets from the standard pole-mount kit antenna packaging for use with the optional hardware kit. The remaining hardware in the antenna package will not be used for this installation.
2. Position the L-shaped bracket against the pipe so that the pipe is on the outside of the "L" and secure it to the pipe with the two U-bolts and four U-bolt nuts (Figure 2.9, left). The U-bolts will pass through the longest of the two bracket panels.
3. Position the antenna against the bracket so that the shiny metal base is touching the bracket and the capped end of the antenna is vertical in the air. Note the N-female cable connector at the bottom of the metal base for connecting antenna cable.
4. Place the toothed bracket against the adjacent L-bracket panel (shortest of the two panels) so that the toothed, rounded edge faces the L-bracket panel and the holes in the toothed bracket align with the center holes in the L-bracket.
5. Place a flat washer over each of the 5/16-in. bolts and insert the bolts through the holes in the toothed bracket and through the center holes in the L-bracket panel (Figure 2.9, center and right).
6. Attach a lock washer and a nut to each of the bolts on the inside of the L-bracket to hold the toothed bracket loosely in place.
7. Position the antenna between the toothed bracket and the L-bracket so that the rounded edge of the toothed bracket fits snugly against the curvature of the shiny antenna base and brackets clamp around the approximate center of the antenna base.
8. Holding the antenna in place, tighten the two 5/16-in. nuts on the inside of the L-bracket to secure the antenna (Figure 2.9, right).
9. Attach the antenna cable to the N-female connector at the bottom of the antenna.

Industry Standard Compliance

To ensure measurement accuracy, flow runs and turbine meter runs must be installed in accordance with industry standards. Table 2.2 below references the sections in these standards that apply specifically to flow run and hardware installation.

For a complete list of industry reference standards that serve as the basis for flow rate and fluid property calculations in the Scanner 2100, see Appendix C—Modbus Communications Protocol, page C-1.

Table 2.2—Industry Standards for Meter Installation

Meter Type	Standard	Description
Orifice Meter	AGA 3, Section 2.6	Specifications for orifice meters (to include beta ratios)
		Installation requirements for orifice plates, meter tubes, flow conditioners, and thermometer wells
		This standard is also distributed under the following names: API MPMS Chapter 14.3, Part 2; ANSI/API 14.3, Part 2-3100; and GPA 8185, Part 2.
	ISO 5167, Part 1	Installation of orifice plates inserted into a circular cross-section conduit running full
		Limitation of pipe size and Reynolds number
		ISO 5167 is applicable only to flow that remains subsonic throughout the measuring section and where the fluid can be considered single-phase. It is not applicable to the measurement of pulsating flow. It does not cover the use of orifice plates in pipe sizes less than 50 mm (2 in.) or more than 1000 mm (39 in.), or for pipe Reynolds numbers below 5000.
	ISO 5167, Part 2	Specifies orifice plates that can be used with flange pressure tappings, corner pressure tappings, D and D/2 pressure tappings.
	API MPMS 21.1, Section 1.7	Installation of electronic gas measurement devices and associated communications, gauge/impulse lines, and cabling
	API MPMS 21.1, Section 1.8	Requirements for calibrating and verifying the accuracy of electronic gas measurement devices
	ASME MFC-14M, All sections	Specifies low-flow orifice meters smaller than 2 inch pipe size, that can be used with flange taps and corner taps.
		Nominal pipe sizes (1/2 inch to 1-1/2 inch only)
		Beta ratio from 0.1 to 0.75
		Suitable for single-phase fluids only
		Subsonic flow only
		Not suitable for pulsating flow
Cone Meter	NuFlo™ Cone Meter User Manual, Cameron Part No. 9A-85165000, Sections 2 through 5	System components, impulse tubing considerations, best practices for installation, and installation procedures/diagrams for liquid and gas service
	ISO 5167, Part 1	Installation of orifice plates inserted into a circular cross-section conduit running full
		Limitation of pipe size and Reynolds number
		ISO 5167 is applicable only to flow that remains subsonic throughout the measuring section and where the fluid can be considered single-phase. It is not applicable to the measurement of pulsating flow. It does not cover the use of orifice plates in pipe sizes less than 50 mm (2 in.) or more than 1000 mm (39 in.), or for pipe Reynolds numbers below 5000.

Table 2.2—Industry Standards for Meter Installation

Meter Type	Standard	Description
Turbine Meter	AGA 7, Section 7	Installation of gas turbine meters to include flow direction, meter orientation, meter run connections, internal surfaces, temperature well location, pressure tap location, and flow conditioning
		Illustrations of recommended installation configurations
		Environmental considerations, the use of other devices to improve meter performance, and precautionary measures
		This specification applies to axial-flow turbine flowmeters for measurement of natural gas, typically 2-in. and larger bore diameter, in which the entire gas stream flows through the meter rotor
	API MPMS 21.1, Section 1.7	Installation of electronic gas measurement devices and associated communications, gauge/impulse lines, and cabling
	API MPMS 21.1, Section 1.8	Requirements for calibrating and verifying the accuracy of electronic gas measurement devices
	API MPMS 5, Section 3	Description of unique installation requirements and performance characteristics of turbine meters in liquid hydrocarbon service *(This section does not apply to the measurement of two-phase fluids.)*
	ISO 5167, Part 1	Installation of orifice plates inserted into a circular cross-section conduit running full
		Limitation of pipe size and Reynolds number
		ISO 5167 is applicable only to flow that remains subsonic throughout the measuring section and where the fluid can be considered single-phase. It is not applicable to the measurement of pulsating flow. It does not cover the use of orifice plates in pipe sizes less than 50 mm (2 in.) or more than 1000 mm (39 in.), or for pipe Reynolds numbers below 5000.

Measuring Natural Gas via a Differential Pressure Meter

Note This section contains installation guidelines for orifice and cone meters. If installing the Scanner 2100 with an averaging pitot tube meter, refer to manufacturer instructions for installation.

Best Practices for Orifice and Cone Meter Installation

To ensure measurement accuracy, ensure that the meter run complies with the following AGA 3 and ISO 5167 guidelines, as applicable:

- Do not place unit near vents or bleed holes that discharge corrosive vapors or gases.
- Consider the orientation of the meter run when determining the best position for mounting the Scanner 2100.
- If the Scanner 2100 is mounted to a horizontal pipeline, make sure process connections are at the top of the line, and mount the Scanner 2100 above the pressure connections at the pipe.
- If the Scanner 2100 is mounted to a vertical pipeline, install the sensor above the differential pressure source connections, or install a condensate (drip) pot to prevent the accumulation of liquid in interconnecting tubes. Slope all tubing upward at least 1-inch/linear foot to avoid liquid entrapment.
- Mount the Scanner 2100 as near level as possible such that the operator has a clear view of the LCD, and can access the keypad easily when the enclosure cover is removed. The location should be as free from vibration as possible.
- Make sure the high port of the sensor (marked “H”) is connected to the upstream side of the meter run.
- Flow should remain subsonic throughout the measuring section and should be single phase.
- Pipe diameters (D) should be between 2 in. (50 mm) and 39 in. (1000 mm) per ISO 5167; or greater than 2 in. (50 mm) per AGA 3.

- Pipe Reynolds numbers must be above 5000.
- *d* (orifice diameter) must be greater than or equal to 0.45 in. (11.5 mm).
- β (diameter ratio) must be greater than or equal to 0.1 and less than or equal to 0.75.
- Gauge lines should be of uniform internal diameter and constructed of material compatible with the fluid being measured. For most applications, the bore should be no smaller than ¼ in. (6 mm) and preferably, 3/8 in. (10 mm) in diameter. The internal diameter should not exceed 1 in. (25 mm). If high-temperature fluids are likely to be encountered, make sure the measuring tube used is rated for the anticipated temperature range. See also the temperature warning on page 35.
- Gauge line length should be minimized to help prevent pulsation-induced errors.
- Gauge lines should slope downward to the meter at a minimum of one inch per foot.
- If gauge lines must slope in more than one direction, do not allow more than one bend and install a liquid or gas trap, as applicable. A liquid trap should be installed at the lowest point in a gas service installation.
- Gauge lines should be supported to prevent sag and vibration.
- Where pulsation is anticipated, full-port manifold valves with a nominal internal diameter consistent with the gauge lines are recommended.

If the Scanner 2100 is mounted to a cone meter, consider the following best practices in addition to the best practices listed above.

- Position the cone meter so that there are zero to five pipe diameters upstream of the meter and zero to three pipe diameters downstream of the meter.
- Install the meter so that the static pressure tap is upstream of the differential pressure tap. The high side of the integral Scanner 2100 sensor must also be situated upstream.
- Install shut-off valves directly on the DP meter pressure taps. Choose a shut-off valve that is rated for the ambient temperatures of the location and the operating pressure of the pipe in which it will be installed, and for use with dangerous or corrosive fluids or gases, if applicable. The valves must not affect the transmission of the differential pressure signal.

Installation Procedure—Direct Mount to Orifice Meter or Cone Meter

A Scanner 2100 can be mounted directly to an orifice meter or cone meter for gas measurement. The setup of the meter run and plumbing configurations can vary widely, depending upon the challenges existing on location. Figure 2.10, page 39 shows a typical direct-mount installation.

WARNING–HAZARDOUS AREA USE: The Scanner 2100 is certified for hazardous area use only when installed in accordance with applicable standards and local wiring practices. Carefully review Hazardous Area Installations, page 25, to determine specific installation requirements (cable glands, conduit seals, signal cable, RTD, etc.).

1. Verify that the meter is properly installed in the flow line (per manufacturer's instructions).
2. Bolt a flange-by-flange 5-valve manifold (as recommended by Cameron) to the Scanner 2100 MVT sensor.
3. Locate the "H" and "L" markings on the integral MVT sensor body and position the MVT/manifold assembly so that the upstream side of the flow line can easily be connected to the sensor's "High" port and the downstream side of the flow line can be connected to the sensor's "Low" port. The Scanner 2100 enclosure can be rotated to face the desired direction.
4. Position the manifold so that all valves are accessible from the front of the instrument.

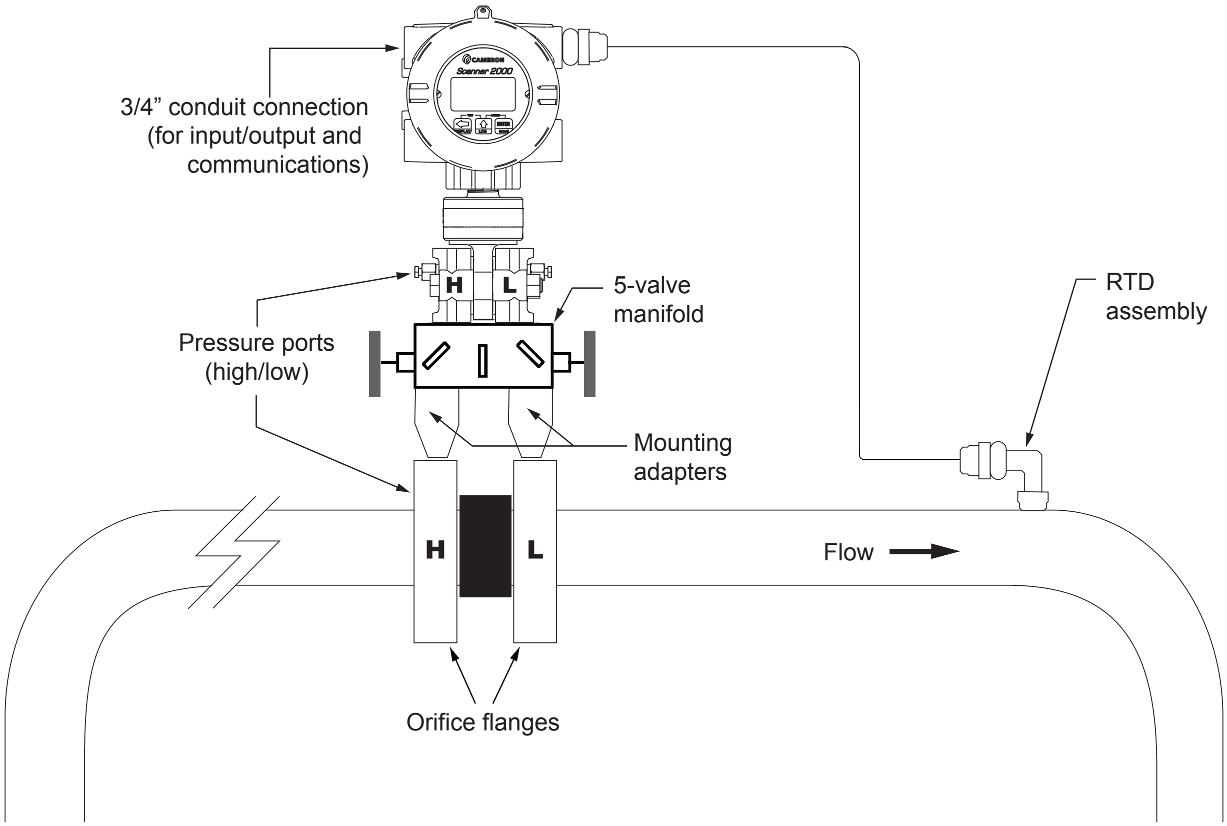


Figure 2.10—Direct-mount installation in an orifice meter run (shown here with an orifice meter). The direct-mount method can be used with a cone meter as well.

5. Connect the Scanner 2100 and manifold assembly to the differential pressure meter. Hardware requirements will vary, depending upon the installation configuration. However, minimally, an adapter is required that can span between the threaded pressure tap/orifice flange connector and the non-threaded manifold. This adapter can be a one-piece stabilizer (often preferred for added strength and stability) or a short heavy wall pipe nipple attached to a futbol flange (available from Cameron). Use a suitable compound or tape on all threaded process connections.

CAUTION **Do not use Teflon tape on the threads of the union, adapter, or pipe plugs. Use of Teflon tape will void the explosion-proof rating of the instrument.**

6. Install the RTD assembly in the thermowell. Route the RTD assembly cable through the conduit opening in the top of the Scanner 2100 to connect to the main circuit board. The wiring diagram for the RTD assembly is provided in Figure 3.7, page 57. For hazardous areas, review Hazardous Area Installations, page 25.
7. Route any additional inputs/outputs or communications connections, etc. through the conduit opening in the top of the Scanner 2100. For hazardous areas, review Hazardous Area Installations, page 25.
8. Perform a manifold leak test as described on page 49.
9. Verify the zero offset, if required (and other calibration points, if desired). See the ModWorX Pro Software User Manual for complete instructions. See also Zero Offset (Static Pressure or Differential Pressure), page 50, Static Pressure Calibration and Verification, page 50, and Differential Pressure Calibration and Verification, page 51.

CAUTION **Do not put the Scanner into operation until the valves are positioned properly so that pressure is supplied to both sides of the MVT. For instructions on proper valve positions, see Placing the Scanner into Operation, page 52.**

Installation Procedure—Remote Mount to Orifice Meter or Cone Meter

A Scanner 2100 can be mounted remotely and connected to an orifice meter or cone meter with tubing for gas measurement. The setup of the meter run and plumbing configurations can vary widely, depending upon the challenges existing on location. Figure 2.11, page 41 shows a typical remote-mount installation.

WARNING—HAZARDOUS AREA USE: The Scanner 2100 is certified for hazardous area use only when installed in accordance with applicable standards and local wiring practices. Carefully review Hazardous Area Installations, page 25, to determine specific installation requirements (cable glands, conduit seals, signal cable, RTD, etc.).

Note To prevent fittings from turning and/or to avoid putting tension on stainless steel tubing, use a backup wrench to attach stainless steel tubing to a manifold, shut-off valves, or sensor ports.

1. Verify that the meter is properly installed in the flow line (per manufacturer's instructions).
2. Mount the Scanner 2100 to a 2-in. pipe or to a flat, vertical surface using bolts and the mounting holes in the enclosure.
3. Bolt a 5-valve flange-by-NPT manifold (as recommended by Cameron) to the Scanner 2100 MVT sensor.
4. Locate the "H" and "L" markings on the integral MVT sensor body and position the MVT/manifold assembly so that the upstream side of the flow line can easily be connected to the sensor's "High" port and the downstream side of the flow line can be connected to the sensor's "Low" port. The Scanner 2100 enclosure can be rotated to face the desired direction.
5. Position the manifold so that all valves are accessible from the front of the instrument.
6. Install tubing and fittings to connect the Scanner 2100 and manifold assembly to the differential pressure meter, sloping the gauge lines downward to the meter at a minimum of one inch per foot. Use a suitable compound or tape on all threaded process connections.

CAUTION Do not use Teflon tape on the threads of the union, adapter, or pipe plugs. Use of Teflon tape will void the explosion-proof rating of the instrument.

7. Install the RTD assembly in the thermowell. Route the RTD assembly cable through the conduit opening in the top of the Scanner 2100 to connect to the main circuit board. The wiring diagram for the RTD assembly is provided by Figure 3.7. For hazardous areas, review Hazardous Area Installations, page 25.
8. Route any additional inputs/outputs or communications connections, etc. through the conduit opening in the top of the Scanner 2100. For hazardous areas, review Hazardous Area Installations, page 25.
9. Perform a manifold leak test as described on page 49.
10. Verify the zero offset, if required (and other calibration points, if desired). See the ModWorX Pro Software User Manual for complete instructions. See also Zero Offset (Static Pressure or Differential Pressure), page 50, Static Pressure Calibration and Verification, page 50, and Differential Pressure Calibration and Verification, page 51.

CAUTION Do not put the Scanner into operation until the valves are positioned properly so that pressure is supplied to both sides of the MVT. For instructions on proper valve positions, see Placing the Scanner into Operation, page 52.

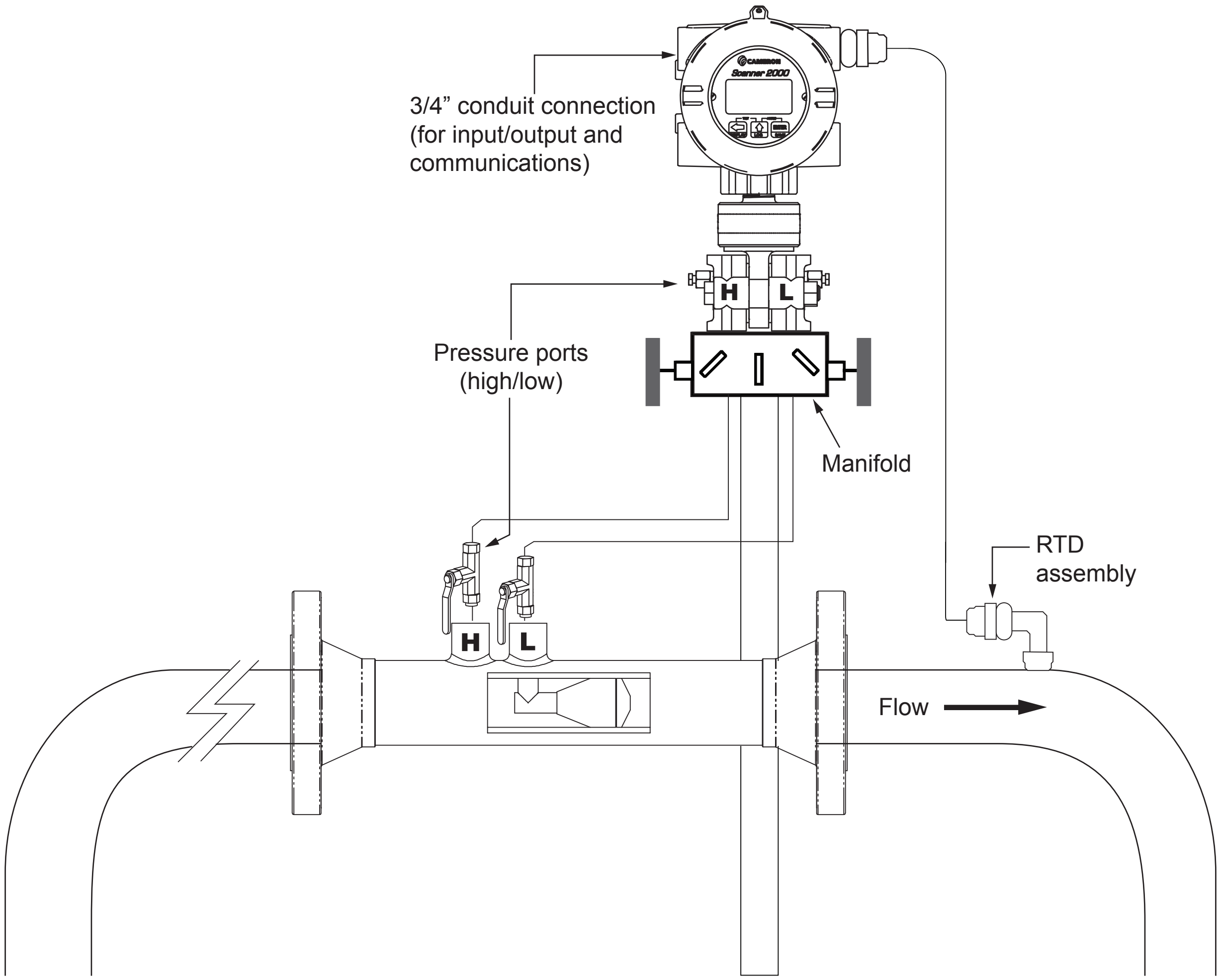


Figure 2.11—Remote-mount gas run installation (shown here with a cone meter). The remote-mount method can be used with an orifice meter as well.

Measuring Steam via a Differential Pressure Meter

Note This section contains installation guidelines for orifice and cone meters. If installing the Scanner 2100 with an averaging pitot tube meter, refer to manufacturer instructions for installation.

Best Practices

The Scanner 2100 calculates steam flow in accordance with IF-97, AGA 3, and ISO 5167 industry standards. For optimum performance, ensure that the installation complies with the following industry recommendations:

Condensate Pots

A condensate pot for a small-volume transducer like the Scanner 2100 MVT can be a simple pipe tee, oriented so that one port extends downward (into the cold leg), the opposite port extends upward and is closed by a pipe cap or blowdown valve, and the tee extends horizontally into the hot leg.

- The pots should be the highest point in the system.
- The pots should be mounted at the same level, and one or both should be adjustable vertically to remove zero shifts in the differential pressure measurement.

Hot Legs

- Hot legs should be large diameter (3/8 in. or 1/2 in., if possible)
- Hot legs should be as short as possible. If these sections must be more than 1 ft in length, insulate them.
- Elbows and bends should not form any traps in which liquid can accumulate.
- Hot legs should be sloped along their entire length to allow liquids to drain back into the pipe.

Cold Legs

- Cold legs should enter the multi-variable sensor through its side ports.
- Cold legs should be a minimum of 2 ft in length to allow proper convection cooling and should be run horizontally with a slope of approximately 1 inch per foot to allow air bubbles to float up into the pots.
- Elbows and bends should not form any traps for air bubbles.
- Cold legs should be filled with a suitable antifreeze. Dibutyl phthalate is recommended.

Antifreeze

Dibutyl phthalate (DBP) has the following advantages over glycol antifreeze:

- DBP doesn't mix with water, and so doesn't become dilute over time; its specific gravity doesn't shift.
- It is slightly denser than water, so it will stay in the pot permanently.
- It is non-flammable.
- It is much less toxic than glycol.
- It is available from industrial suppliers.

Valves

- Use only full-opening block valves that are rated for steam service.
- Use only blowdown valves that are rated for steam service. Periodic blowdowns are recommended for preventing buildup of scale.

CAUTION **Before starting the system, remove the caps and add water or antifreeze if necessary to completely fill the pots and cold legs. Air trapped in the lines will produce errors in differential pressure measurements.**

⚠ **WARNING–EXPLOSION RISK: Housing temperature must not exceed 70 degC (158 degF). Excessive temperatures, which could result from ambient conditions combined with radiated and conductive heat from the process, could cause the internal lithium battery to ignite or explode.**

Installation Procedure—Remote Mount to Orifice Meter or Cone Meter

A Scanner 2100 can be mounted remotely and connected to an orifice meter or cone meter with tubing for steam measurement. The setup of the meter run and plumbing configurations can vary widely, depending upon the challenges existing on location.

⚠ **WARNING–HAZARDOUS AREA USE: The Scanner 2100 is certified for hazardous area use only when installed in accordance with applicable standards and local wiring practices. Carefully review Hazardous Area Installations, page 25 to determine specific installation requirements (cable glands, conduit seals, signal cable, RTD, etc.).**

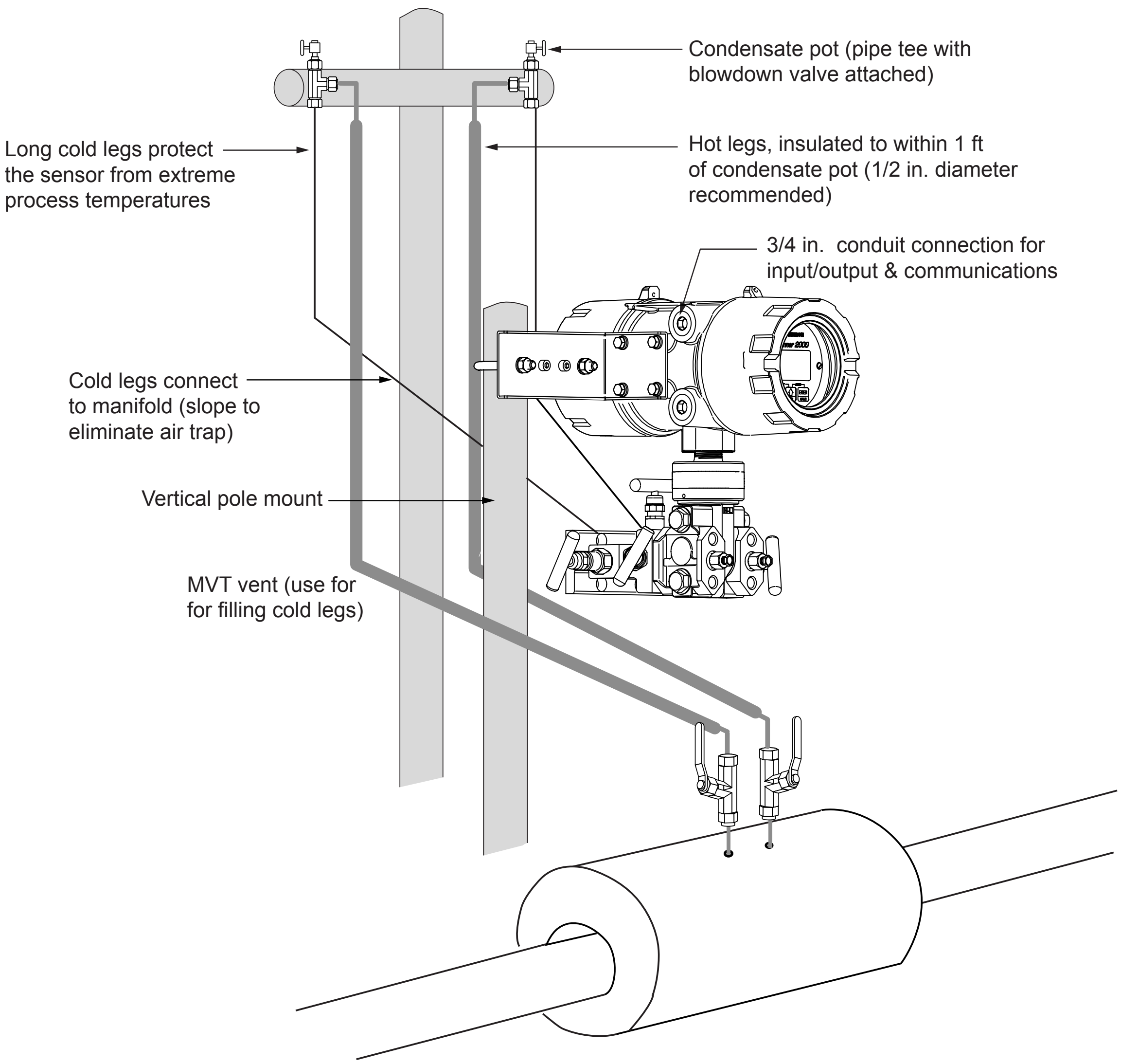


Figure 2.12—Remote-mount steam run installation (shown here with a cone meter). The remote-mount method can be used with an orifice meter as well.

CAUTION **When measuring steam, process connections must be designed to eliminate air pockets. This is achieved by making sure all tubing in the cold legs slopes upward. A side-port MVT and block manifold (shown in Figure 2.12) is recommended to help prevent air bubbles from being trapped in the sensor.**

If a bottom-port MVT is used, the bottom process ports must be plugged or replaced with a drain valve, and side vents must be used for process connections. A block manifold is not recommended for use with bottom port MVTs. Contact a Cameron field representative for assistance.

1. Verify that the meter is properly installed in the flow line (per manufacturer's instructions).
2. Mount the Scanner 2100 to a 2-in. pipe using the pole-mounting kit described on page 13.
3. Mount a set of pipe tees (which serve as condensate pots) typically on either side of the Scanner 2100 at an elevation above the process connections of the Scanner 2100 MVT (for proper drainage). They should be a considerable distance (4 ft) from the sensor ports, but as close as possible to the pressure taps on the meter.
4. Install a pipe cap or a blowdown valve that is rated for steam service at the top of each pipe tee. A blowdown valve is recommended when the steam passing through the meter is known to be dirty.

5. Install tubing and fittings to connect the high-pressure and low-pressure taps of the DP meter to the pipe tees. This section is typically referred to as the hot legs of the installation, as this section of tubing encounters steam at its highest temperature. Install a shut-off valve near the high and low ports of the DP meter. Use a suitable compound or tape on all threaded process connections.
6. Route any additional inputs/outputs or communications connections, etc. through the conduit opening in the top of the Scanner 2100. For hazardous areas, review Hazardous Area Installations, page 25.

Note To prevent fittings from turning and/or to avoid putting tension on stainless steel tubing, use a backup wrench to attach stainless steel tubing to shut-off valves or sensor ports.

CAUTION Whenever possible, locate the hot legs of a steam installation behind the Scanner 2100 safely out of the operator's normal reach. This will help prevent accidental burns.

7. Install tubing to connect the high-pressure and low-pressure process connections of the block manifold to the pipe tees installed in Step 3. This tubing section is typically referred to as the ***cold legs*** of the installation, since it is filled with water.
8. To eliminate air bubbles, fill the cold legs with water or other fill fluid from the lowest point in the system, typically the MVT, using the following steps:
   a. Open the blowdown valve or remove the filling plug from one of the pipe tees/condensate pots.
   b. Open the equalizer and bypass/block valves on the block manifold. Make sure the vent valve is closed.
   c. Remove the corresponding (high pressure or low pressure) vent screw from the side of the MVT and insert a fitting to allow connection of a hand pump or funnel. If a funnel is used, attach a length of Tygon tubing that is long enough to elevate the funnel well above the condensate pot to force the fluid up the legs.
   d. Connect a hand pump or funnel to the fitting.
   e. Pour fill liquid into the funnel or pump it into the cold leg, tapping the cold leg occasionally to dislodge any bubbles.
   f. Observe the pipe tee/condensate pot and stop pouring when the fill liquid is visible at the top and no air bubbles can be seen.
   g. Remove the fitting from the vent of the MVT and quickly replace the vent screw and tighten.
   h. Close the blowdown valve or replace the filling plug from one of the pipe tees/condensate pots.
   i. Repeat Steps a through h for the other cold leg.
9. To eliminate an offset of the differential pressure reading, open the equalizer valves on the block manifold, remove the caps from the seal pots, and adjust either seal pot vertically to bring the water levels to the exact same elevation.
10. Perform a manifold leak test as described on page 49.
11. Verify the zero offset, if required (and other calibration points, if desired). See the ModWorX Pro Software User Manual for complete instructions. See also Zero Offset (Static Pressure or Differential Pressure), page 50, Static Pressure Calibration and Verification, page 50, and Differential Pressure Calibration and Verification, page 51.

CAUTION Do not put the Scanner into operation until the valves are positioned properly so that pressure is supplied to both sides of the MVT. For instructions on proper valve positions, see Hazardous Area Installations, page 25.

Measuring Liquid via a Differential Pressure Meter

Note This section contains installation guidelines for orifice and cone meters. If installing the Scanner 2100 with an averaging pitot tube meter, refer to manufacturer instructions for installation.

Best Practices

To ensure measurement accuracy, ensure that the meter run complies with the following AGA 3 and ISO 5167 guidelines, as applicable:

- Do not place unit near vents or bleed holes that discharge corrosive vapors or gases.
- Consider the orientation of the meter run when determining the best position for mounting the Scanner.
- If the Scanner 2100 is mounted to a horizontal pipeline, make sure process connections are horizontal with the pipeline, or sloped downwards towards the Scanner. Mount the Scanner 2100 below the pressure taps at the pipe. Use the side (upper) ports as process connections and the bottom ports for draining and filling the DP housings.
- If the Scanner 2100 is mounted to a vertical pipeline, install the sensor below the differential pressure source connections. Slope all tubing downward at least 1-inch/linear foot to avoid gas entrapment.
- Mount the Scanner 2100 as near level as possible such that the operator has a clear view of the LCD, and can access the keypad easily when the enclosure cover is removed. The location should be as free from vibration as possible.
- Make sure the high port of the sensor (marked “H”) is connected to the upstream side of the meter run.
- Pipe diameters (D) should be between 2 in. (50 mm) and 39 in. (1000 mm) per ISO 5167; or greater than 2 in. (50 mm) per AGA 3.
- Pipe Reynolds numbers must be above 5000. Avoid high-viscosity liquids (greater than 15 cP).
- *d* (orifice diameter) must be greater than or equal to 0.45 in. (11.5 mm).
- β (diameter ratio) must be greater than or equal to 0.1 and less than or equal to 0.75.
- Gauge lines should be of uniform internal diameter and constructed of material compatible with the fluid being measured. For most applications, the bore should be no smaller than ¼ in. (6 mm) and preferably, 3/8 in. (10 mm) in diameter. The internal diameter should not exceed 1 in. (25 mm). If high-temperature fluids are likely to be encountered, make sure the measuring tube used is rated for the anticipated temperature range.

WARNING–EXPLOSION RISK: Housing temperature must not exceed 70 degC (158 degF). Excessive temperatures, which could result from ambient conditions combined with radiated and conductive heat from the process, could cause the internal lithium battery to ignite or explode.

- If there is possibility of freezing, the gauge lines can be filled with a suitable seal liquid. The seal liquid should be somewhat denser than the process fluid, should not dissolve in it, should have a sufficiently low freezing point, and should be non-toxic. Alternatively, heat tracing can be used.
- Gauge line length should be minimized to help prevent pulsation-induced errors.
- Gauge lines should slope upward to the meter at a minimum of one inch per foot.
- If gauge lines must slope in more than one direction, do not allow more than one bend and install a gas trap.
- Gauge lines should be supported to prevent sag and vibration.
- Where pulsation is anticipated, full-port manifold valves with a nominal internal diameter consistent with the gauge lines are recommended.

If the Scanner 2100 is mounted to a cone meter, consider the following guidelines in addition to the best practices listed above.

- Position the cone meter so that there are zero to five pipe diameters upstream of the meter and zero to three pipe diameters downstream of the meter.
- Install the meter so that the static pressure tap is upstream of the differential pressure tap. The high side of the integral Scanner 2100 sensor must also be situated upstream.
- Install shut-off valves directly on the DP meter pressure taps.
  - Choose a shut-off valve that is rated for the ambient temperatures of the location and the operating pressure of the pipe in which it will be installed, and for use with dangerous or corrosive fluids or gases, if applicable.
  - The valves must not affect the transmission of the differential pressure signal.

Installation Procedure—Direct Mount to Orifice Meter or Cone Meter

A Scanner 2100 can be mounted directly to an orifice meter or cone meter for liquid measurement using a side-port MVT, a block manifold and two football flange adapters (Figure 2.13). The setup of the meter run and plumbing configurations can vary widely, depending upon existing onsite challenges.

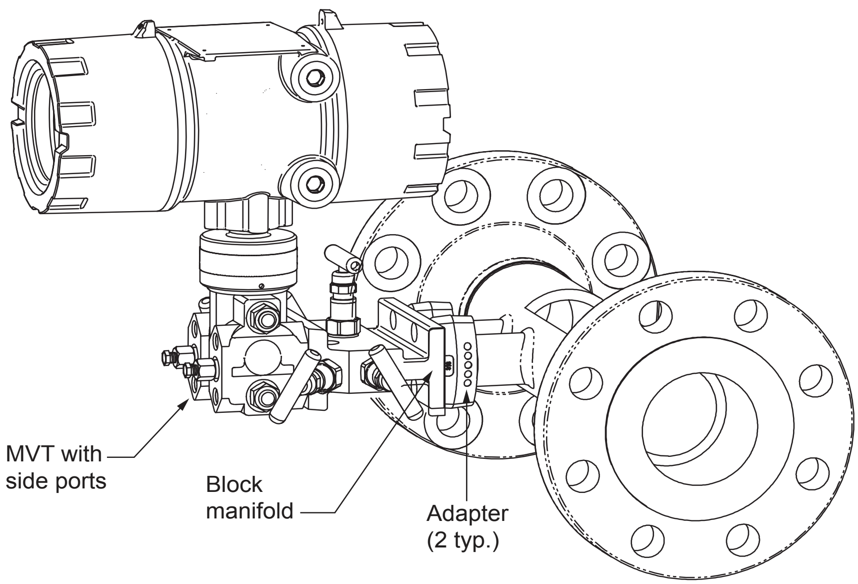


Figure 2.13—Direct-mount liquid run installation (shown here with a cone meter). Downstream RTD is not shown.

CAUTION **When measuring liquid with a direct-mount Scanner 2100, process connections must be parallel to the horizontal center line of the meter, or below the center line to eliminate air pockets.**

1. Verify that the meter is properly installed in the flow line (per manufacturer's instructions).
2. Screw a football flange adapter onto each meter pressure tap using pipe tape or pipe dope to seal the threads.
3. Align the bolt holes in the Scanner 2100 MVT and manifold, and install bolts to mate these components to the football flanges, using O-rings as appropriate. Torque the bolts to the manufacturer's specification.
4. Route any additional inputs/outputs or communications connections, etc. through the conduit opening in the top of the Scanner 2100. For hazardous areas, review Hazardous Area Installations, page 25.
5. Verify that all manifold valves are closed, and fill the meter with process fluid.
6. Loosen one of the vent screws in the side of the MVT.
7. Open the equalizer valves and the vent valve on the manifold.
8. Slowly open one of the bypass/block valves on the manifold. Process fluid should immediately spurt from the MVT vent.

9. When air bubbles are no longer visible around the MVT vent, tighten the MVT vent screw.
10. Loosen the other vent screw in the side of the MVT, and repeat Steps 7 through 9.
11. Perform a manifold leak test as described on page 49.
12. Verify the zero offset, if required (and other calibration points, if desired). See the ModWorX Pro Software User Manual for complete instructions. See also Zero Offset (Static Pressure or Differential Pressure), page 50, Static Pressure Calibration and Verification, page 50, and Differential Pressure Calibration and Verification, page 51.

CAUTION **Do not put the Scanner into operation until the valves are positioned properly so that pressure is supplied to both sides of the MVT. For instructions on proper valve positions, see Placing the Scanner into Operation, page 52.**

Installation Procedure—Remote Mount to Orifice Meter or Cone Meter

A Scanner 2100 can be mounted remotely and connected to an orifice meter or cone meter with tubing for liquid measurement (Figure 2.14). The setup of the meter run and plumbing configurations can vary widely, depending upon the challenges existing on location.

WARNING–HAZARDOUS AREA USE: The Scanner 2100 is certified for hazardous area use only when installed in accordance with applicable standards and local wiring practices. Carefully review Hazardous Area Installations, page 25 to determine specific installation requirements (cable glands, conduit seals, signal cable, RTD, etc.).

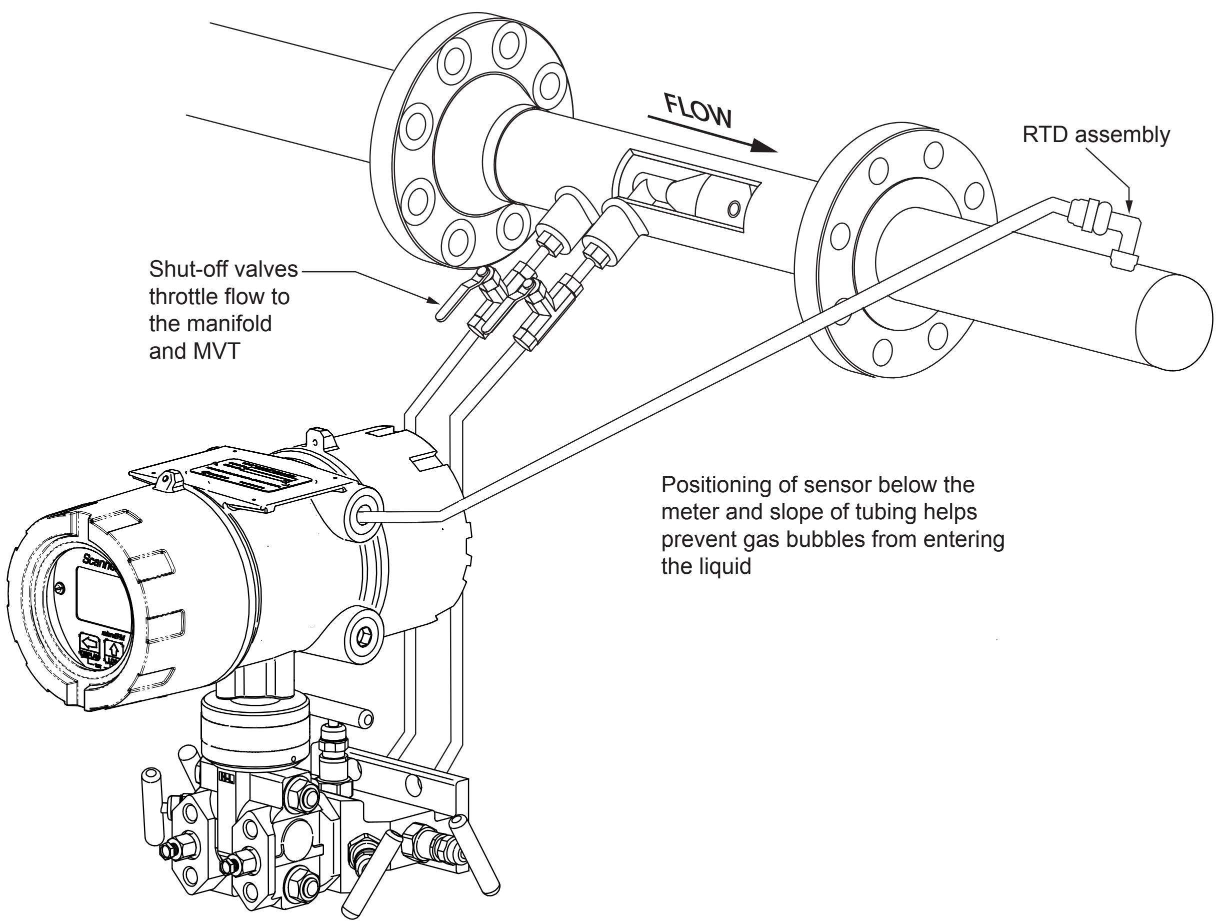


Figure 2.14—Remote-mount liquid run installation (shown here with a cone meter). The remote-mount method can be used with an orifice meter as well.

CAUTION **When measuring liquid, process connections must be designed to eliminate air pockets. This is achieved by mounting the sensor below the metering device and sloping all tubing downward from the meter to the sensor. A side-port MVT and block manifold (shown in Figure 2.14, page 47) is recommended to help prevent air bubbles from being trapped in the sensor.**

If a bottom-port MVT is used, the bottom process ports must be plugged or replaced with a drain valve, and side vents must be used for process connections. A block manifold is not recommended for use with bottom port MVTs. Contact a Cameron field representative for assistance.

1. Verify that the meter is properly installed in the flow line (per manufacturer's instructions).
2. Mount the Scanner 2100 to a 2-in. pipe or to a flat, vertical surface using bolts and the mounting holes in the enclosure. A horizontal pipe is recommended, as additional hardware may be required for a vertical pipe mount to provide clearance for the manifold block.
3. Install tubing and fittings to connect the high-pressure and low-pressure taps of the DP meter to the process connections of the block manifold. Install a pair of shut-off valves near the high and low ports of the DP meter. Use a suitable compound or tape on all threaded process connections.
4. Install the RTD assembly in the thermowell. Remove the plug from a conduit opening in the top of the Scanner 2100 enclosure, route the RTD assembly cable through the conduit opening and connect it to the main circuit board. The wiring diagram for the RTD assembly is provided in Figure 3.7, page 57. For hazardous areas, review Hazardous Area Installations, page 25.
5. Route any additional inputs/outputs or communications connections, etc. through the conduit opening in the top of the Scanner 2100. For hazardous areas, review Hazardous Area Installations, page 25.

Note To prevent fittings from turning and/or to avoid putting tension on stainless steel tubing, use a backup wrench to attach stainless steel tubing to shut-off valves, or sensor ports.

6. To eliminate air bubbles in the MVT, manifold, and legs connecting them to the meter, fill the legs with fluid. Choose a fluid that is safe for the environment, and stable when depressurized.

Important **If the process fluid does not present an environmental risk and is stable when depressurized, it may be used to bleed air from the lines. If the process fluid can contaminate the environment, or is highly volatile when depressurized as with liquefied gases, a different seal fluid should be used to fill the legs. An ideal seal fluid is one that does not dissolve in the process fluid.**

Bleeding with Process Fluid

1. Make sure the shut-off valves in the tubing near the meter pressure taps are closed, and the meter is filled with process fluid.
2. Open the equalizer and bypass/block valves on the block manifold. Make sure the vent valve is closed.
3. Open one of the shut-off valves near the meter.
4. Slowly loosen the corresponding vent screw on the MVT, and throttle the rate of flow from the vent with the shut-off valve.
5. When air bubbles are no longer visible around the MVT vent, tighten the MVT vent screw.
6. Repeat Steps 1 through 5 for the other leg.

Bleeding with a Different Seal Fluid

1. Make sure the shut-off valves in the tubing near the pressure taps are open.
2. Open the equalizer and bypass/block valves on the block manifold. Make sure the vent valve is closed.

3. Remove the vent screw from one side of the MVT and insert a fitting to allow connection of a hand pump or funnel. If a funnel is used, attach a length of Tygon tubing that is long enough to elevate the funnel well above the meter pressure taps to force the fluid up the legs.
4. Connect a hand pump or funnel to the fitting.
5. Estimate the amount of fill fluid required to fill the tubing and push any air bubbles into the meter.
6. Pour fill liquid into the funnel, tapping the tubing occasionally to dislodge any bubbles.
7. When the leg is full of fluid, remove the fitting from the vent of the MVT and quickly replace the vent screw and tighten.
8. Repeat Steps 1 through 7 for the other leg.
9. Perform a manifold leak test as described on page 49.
10. Verify the zero offset, if required (and other calibration points, if desired). See the ModWorX Pro Software User Manual for complete instructions. See also Zero Offset (Static Pressure or Differential Pressure), page 50, Static Pressure Calibration and Verification, page 50, and Differential Pressure Calibration and Verification, page 51.

CAUTION **Do not put the Scanner into operation until the valves are positioned properly so that pressure is supplied to both sides of the MVT. For instructions on proper valve positions, see Placing the Scanner into Operation, page 52.**

Preparations for Putting the Scanner 2100 with MVT into Service

Manifold Leak Test

A manifold leak test is recommended prior to operating any differential pressure meter into service. Check the manifold for leaks as follows:

1. Verify that the instrument is approximately level and is properly connected to the pressure source.
2. Make sure the vent valve in the manifold is closed. (The bypass/block valves should be open.)
3. Close both bypass/block valves on the manifold to isolate pressure between the block valve and the MVT (Figure 2.15).

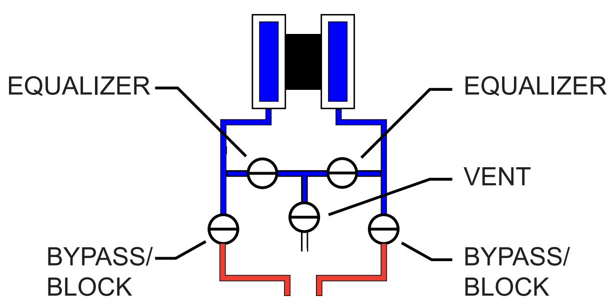


Figure 2.15—Valve positions for manifold leak test

4. Open both equalizer valves to distribute pressure throughout.
5. Monitor the pressure readout and watch for a steady decrease in pressure. If leakage is indicated, depressurize the system by opening both bypass/block valves, then check all manifold and piping joints. Tighten connections as necessary.
6. If desired, spray all connections and valves with soapy water and observe for bubbling to detect the location of any leak(s). If leakage is indicated, depressurize the system by opening both bypass/block valves, then check all manifold and piping joints. Tighten connections and/or replace seals as necessary.
7. Repeat Steps 3 through 6 to retest the manifold for leaks.

An additional test can verify the condition of the equalizing valves. Assuming the above test has confirmed the system is leak free,

1. Close both equalizing valves and open the vent. Monitor the differential pressure reading for any change.
2. Repair or replace the manifold as required if the differential pressure varies.

Zero Offset (Static Pressure or Differential Pressure)

The static pressure input for the Scanner 2100 is zeroed at the factory before shipment. However, changes in temperature and atmospheric pressure can cause the static pressure and differential pressure readings to vary. The inputs can be easily zeroed in the field, if necessary, prior to putting the Scanner 2100 into service.

To zero the static pressure or differential pressure, perform the following tasks:

1. Close the bypass valves to isolate the pressure below the manifold (Figure 2.16).
2. Open the equalizer and vent valves.
3. Connect to the Scanner 2100 with the ModWorX Pro software, and apply zero pressure from the Calibrate Inputs screen (see the ModWorX Pro Software User Manual for complete instructions).

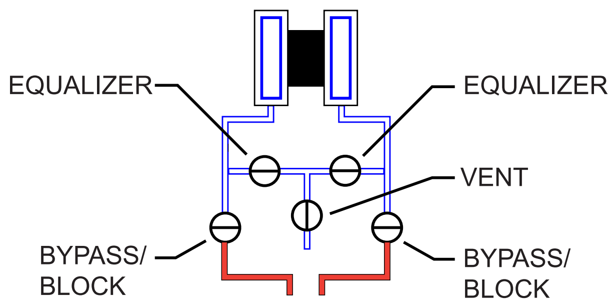


Figure 2.16—Valve positions for zero offset

Static Pressure Calibration and Verification

Note The pressure range stamped on the MVT is expressed as psia (absolute). However, Scanner 2100 pressure inputs are recalibrated as psig (gauge) at the factory before the device is shipped. Therefore, pressure readings displayed on the LCD and in the ModWorX Pro software are in terms of psig.

The static pressure and differential pressure inputs are calibrated and verified before the Scanner 2100 leaves the factory, and recalibration in the field may or may not be required. To comply with API standards for verification, “as found” readings should be recorded at approximately 0, 50, and 100 percent of the operating pressure range, increasing, and at 80, 20 and 0 percent of the operating pressure range, decreasing. For example, the static pressure measurements of a 1500-psi sensor should be verified at 0, 750, and 1500 psi, then at 1200, 300, and 0 psi.

WARNING: Do not subject the Scanner 2100 to unnecessary shock or over-range pressure during maintenance operations.

To calibrate the static pressure, perform the following tasks:

1. Close the bypass valves to isolate the pressure below the manifold (Figure 2.17, page 51).
2. Open the equalizer valves and vent valve to purge the lines.
3. Close the vent valve.

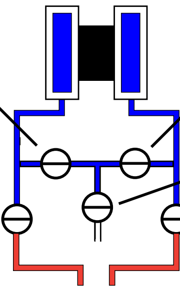


Figure 2.17—Valve positions for static pressure calibration

4. Connect a static pressure simulator to the manifold (either side).
5. Connect to the Scanner 2100 with the ModWorX Pro software. Click on the ***Calibrate Inputs*** menu button and proceed through the calibration per instructions in the ModWorX Pro Software User Manual.
6. At the appropriate software prompt, enter a known pressure.
7. Apply the same amount of pressure to the MVT using the simulator (see the ModWorX Pro Software User Manual, Part No. 9A-30165025 for complete instructions). The ModWorX Pro software will display a measured value and a percentage of change.
8. Repeat Steps 6 and 7 as necessary to enter multiple calibration points.
9. When all calibration points have been entered, click ***Save Changes*** to apply the new calibration settings.
10. To verify the static pressure, perform the steps described in the calibration procedure above, except instead of choosing ***Calibrate*** from the Change Calibration Task window, choose ***Verify***. You will be prompted to enter an applied value, and you will apply the same amount of pressure to the MVT, just as in the calibration process. The ModWorX Pro software will display a measured value and a percentage of error. When you click ***Save Changes***, the measured values are written to memory for reference.

Differential Pressure Calibration and Verification

The static pressure and differential pressure inputs are calibrated and verified before the Scanner 2100 leaves the factory, and recalibration in the field may or may not be required. To comply with API standards for verification, “as found” readings should be recorded at approximately 0, 50, and 100 percent of the operating pressure range, increasing, and at 80, 20 and 0 percent of the operating pressure range, decreasing. For example, the differential pressure measurements of a 200-inches H2O sensor should be verified at 0, 100, and 200 inches H2O, then at 160, 40, and 0 inches H2O.

WARNING: Do not subject the Scanner 2100 to unnecessary shock or over-range pressure during maintenance operations.

To calibrate the differential pressure, perform the following tasks:

1. Close the bypass valves to isolate the pressure below the manifold (Figure 2.18).

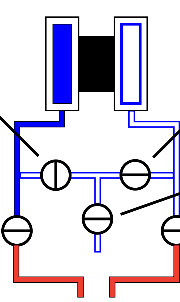


Figure 2.18—Valve positions for differential pressure calibration

2. Open the equalizer valves and vent valve to purge the lines.
3. Close the high-pressure side equalizer valve, leaving the low-pressure side vented.
4. Connect a pressure simulator to the high-pressure side of the manifold.
5. Connect to the Scanner 2100 with the ModWorX Pro software. Click on the ***Calibrate Inputs*** menu button and proceed through the calibration per instructions in the ModWorX Pro Software User Manual.
6. At the appropriate software prompt, enter a known pressure.
7. Apply the same amount of pressure to the high side of the MVT using the simulator (see the ModWorX Pro Software User Manual for complete instructions). The ModWorX Pro software will display a measured value.
8. Repeat Steps 6 and 7 as necessary, to enter multiple calibration points, and apply the new measured values from the ModWorX Pro interface.
9. When all calibration points have been entered, click ***Save Changes*** to apply the new calibration settings.
10. To verify the differential pressure, perform the steps described in the calibration procedure above, except instead of choosing ***Calibrate*** from the Change Calibration Task window, choose ***Verify***. You will be prompted to enter an applied value, and you will apply the same amount of pressure to the MVT, just as in the calibration process. The ModWorX Pro software will display a measured value and a percentage of error. When you click ***Save Changes***, the measured values are written to memory for reference.

Placing the Scanner into Operation

To put the Scanner into operation, perform the following tasks:

1. Close the vent valve (Figure 2.19).
2. Open the equalizer valves.
3. Open the bypass/block valves to allow pressure to be supplied to both sides of the MVT.
4. Close the equalizer valves.
5. Open the vent valve (optional, some users may choose to leave the vent closed).

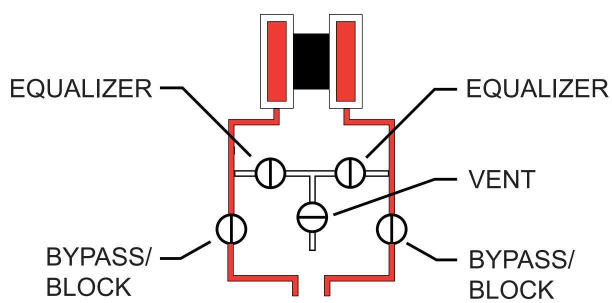


Figure 2.19—Valve positions for closing the vent valve

Section 3—Wiring the Scanner 2100 EFM

Field Wiring Connections

WARNING: Do not connect/disconnect equipment or change batteries unless the area is known to be non-hazardous. The Scanner 2100 poses no hazard when opened in a safe area.

CAUTION **All field wiring must conform to the National Electrical Code, NFPA 70, Article 501-4(b) for installations within the United States or the Canadian Electric Code for installations within Canada. Local wiring ordinances may also apply. All field wiring must be rated for temperatures of 90 degC or higher, and have a wire range of 22 to 14 AWG. Terminal block screws must be tightened to a minimum torque of 5 to 7 in-lbs. to secure the wiring within the terminal block. Only personnel who are experienced with field wiring should perform these procedures.**

To wire the Scanner 2100 for operation, complete the following field connections:

1. Disconnect the external power supply that will power the Scanner 2100 using a disconnect breaker switch or other means of locking out power.
2. Unscrew the cover of the enclosure counter-clockwise until it separates from the main body of the enclosure.
3. Using a small standard blade screwdriver, remove the two #4-40 × 7/8” screws located to the right and left side of the display.
4. Lift the display/keypad assembly from the enclosure, making sure the circuit assembly does not contact the enclosure.
5. Connect J5 connector of the battery board to the J1 connector on the circuit assembly. See Figure 3.2, page 54.
6. Complete wiring of the circuit board as follows:
    a. Connect wiring for external power, if appropriate. See Figure 3.3, page 55 for a wiring diagram.
    b. If the device is externally powered, route the protective earth grounding conductor into the enclosure with the incoming power conductors and terminate it to the screw in the top of the enclosure (Figure 3.1). Alternatively, connect an earth ground conductor to the external stainless steel ground lug of the enclosure and to a ground rod or other suitable system earth ground, as shown in (Figure 3.1).

Figure 3.1—Ground screw locations

c. Connect the flowmeter input wiring to terminal block TB1, if appropriate. See Figure 3.6, page 57.

d. Connect the process temperature input wiring to terminal block TB1, if appropriate. See Figure 3.7, page 57.

e. Connect wiring for output signals, if appropriate. See Figure 3.8, page 58, Figure 3.9, page 59, and Figure 3.10, page 59, for wiring diagrams.

7. Place the circuit assembly over the standoffs and fasten with the two #4-40 × 7/8" screws, ensuring that all connector wiring is inside the enclosure and in no position where it may be damaged when the enclosure cover is replaced.
8. Recalibrate the Scanner 2100 (if necessary).
9. If external and internal power supplies were removed, reset the clock to ensure that the time stamps in the log data are accurate. The clock can be reset using the instrument keypad or ModWorX Pro software.
10. Replace the enclosure cover by threading it onto the enclosure in a clockwise direction.

Power Supply Wiring

Internal Power Supply

The Scanner 2100 is shipped with dual lithium battery packs. To supply power to the instrument, three cables must be connected.

- One cable connects the main circuit assembly (accessed from the windowed end of the enclosure) to a small battery board installed in the rear compartment (solid end) of the enclosure. This cable should be connected to the J1 connector on the main circuit assembly and to the J5 connector on the battery board (Figure 3.2).
- The other two cable connections are located at the top of the battery board in the rear compartment. One battery pack is connected to the J1 connector, and the other is connected to the J2 connector.

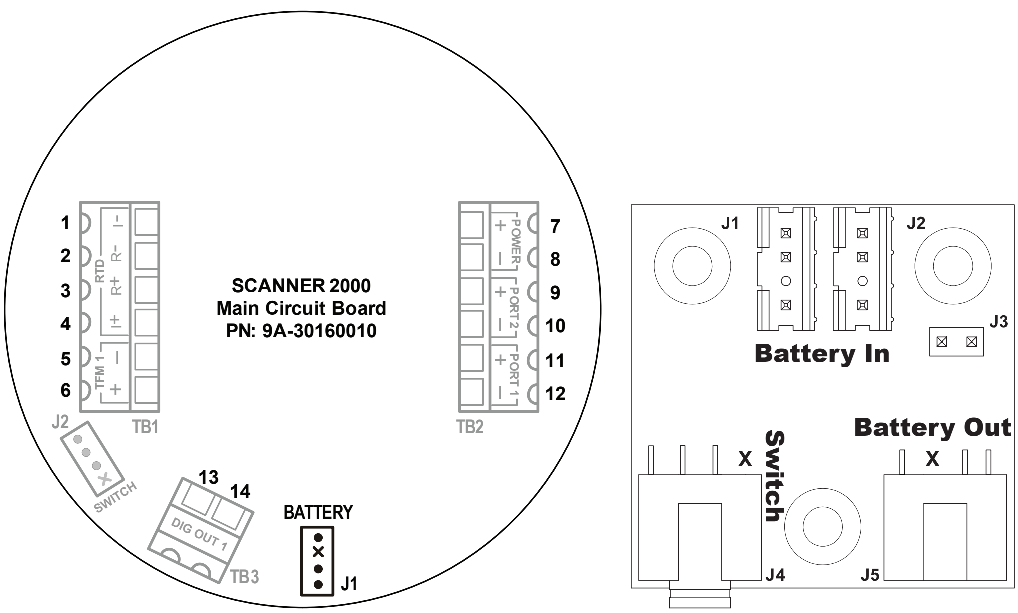


Figure 3.2—Battery connections include two battery pack connections on the small battery board ("battery in", right) and a cable connecting J1 on the main board (left) to J5 on the battery board ("battery out", right)

Low-power microprocessor technology enables the Scanner 2100 to operate for up to one year on a lithium battery pack with default configuration settings. Extreme cold temperatures may reduce battery life.

To maximize battery life, adhere to the following power conservation practices:

- Configure the calculation frequency to be 1 minute or longer.
- Configure the logging frequency to be 1 hour or longer.

- Use an RTD sample time no less than 5 seconds.
- Disconnect the Scanner 2100 from the RS-232 to RS-485 converter when ModWorX Pro software is not in use. When ModWorX Pro is running, the computer powers the converter. When the software is not running, the Scanner 2100 powers the converter, causing a current drain to the Scanner battery packs.
- Avoid operating the device at extremely cold temperatures.
- Avoid the use of digital outputs (pulse or alarm).
- Consider using "non-routing mode" for wireless devices to extend battery life of the slave device(s).

When an external power supply is used as the primary power source, the lithium battery pack serves as a backup power supply. The use of an alternate power source extends battery life and helps ensure that timekeeping and volume accumulation will not be interrupted during a power failure.

External Power Supply (CSA-Approved Devices)

The CSA-approved Scanner 2100 can be connected to a remote power supply by a two-conductor cable (Figure 3.3). The power supply and cable must be capable of supplying 6 to 30 VDC at 150 mA (6 to 24 VDC at 150 mA for installations in Mexico).

The external power supply must be an approved SELV source, insulated from the AC main by double/reinforced insulation per CSA C22.2 No. 61010-1-04/UL 61010-1, 2nd Edition.

Important **In all applications using an external power supply, a switch or circuit breaker must be included in the safe area external power supply installation within easy reach of the operator. The switch or circuit breaker must be marked as the “disconnect” for the safe area external DC power supply.**

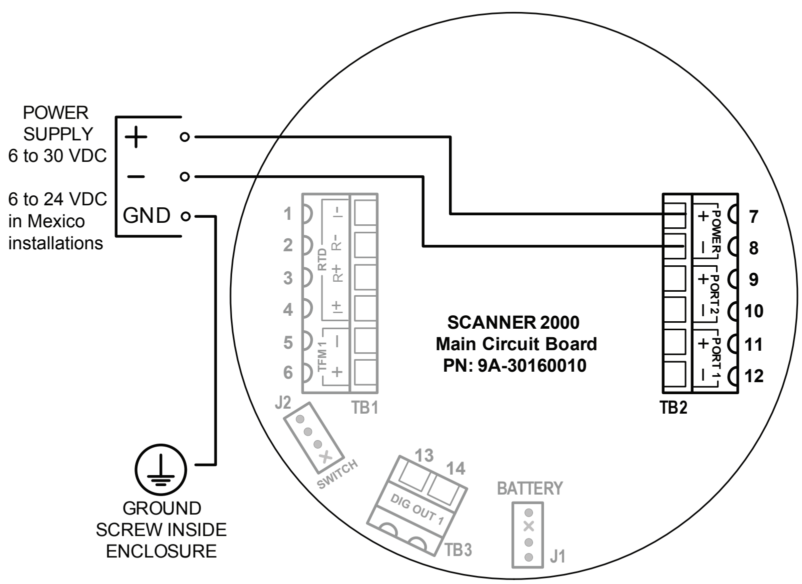


Figure 3.3—External power supply wiring (CSA)

External Power Supply (ATEX-Approved Devices)

Wired Devices

The ATEX-approved Scanner 2100 can be connected to a remote power supply by a two-conductor cable (Figure 3.4). The power supply and cable must be capable of supplying 9-30 VDC at 50 mA.

The device is powered by an external SELV Power Supply (Um = 30 VDC) with an internal 7.2V battery pack as backup. When using external power, include a switch or circuit breaker in the safe area near the external power supply, within easy reach of the operator. Mark the switch or circuit breaker as the "disconnect" for the safe area external DC power supply.

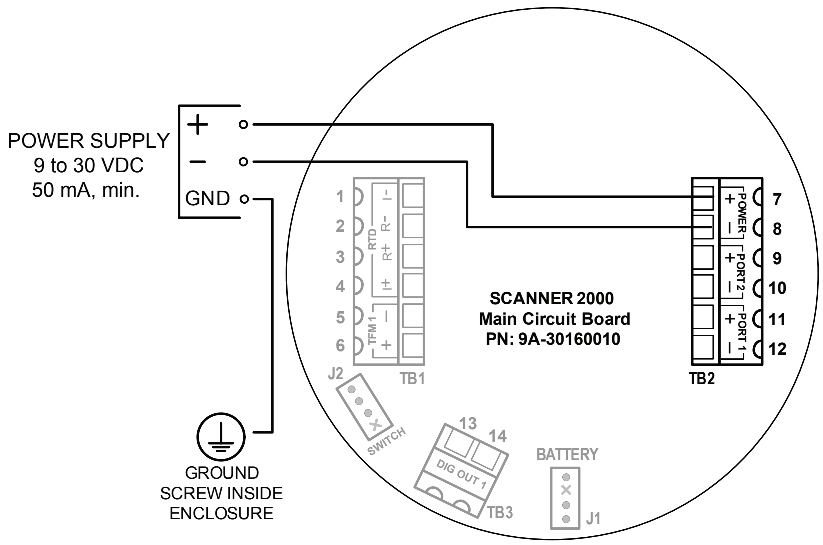


Figure 3.4—External power supply wiring (ATEX wired)

Wireless Devices

The external power supply for an ATEX-approved Scanner 2100 with the wireless communications option must be wired to TB1 on the power conditioning board (Figure 3.5), located just beneath the main circuit board (Figure 3.4).

Caution **To maintain the ATEX hazardous area rating for a wireless device, power must be wired to TB1 on the power conditioning board. TB2 on the power conditioning board is factory-wired to the main circuit board. Do not remove this wire or attempt to connect power directly to the main board terminals.**

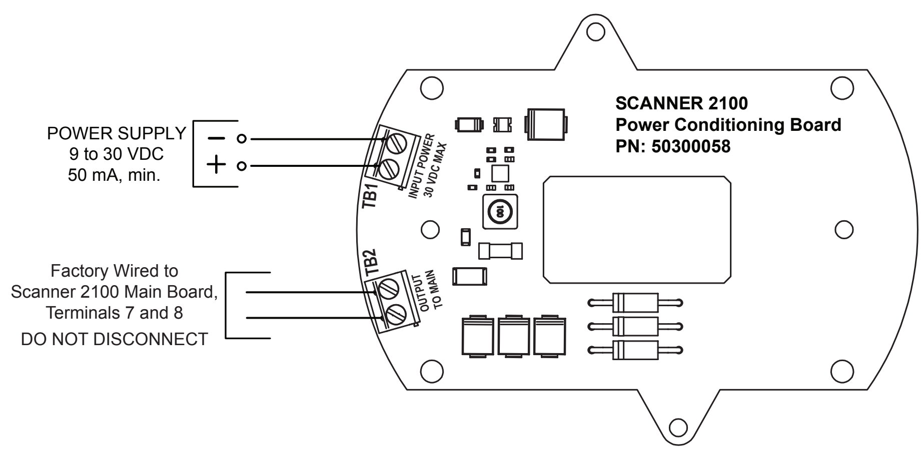


Figure 3.5—External power supply wiring (ATEX wireless)

Input Wiring

Turbine Flowmeter Input

TFM1 on the main circuit board provides the turbine flowmeter input signal generated by a magnetic pickup, enabling the Scanner 2100 to calculate and display instantaneous flow rates and accumulated totals. Wire as shown in Figure 3.6.

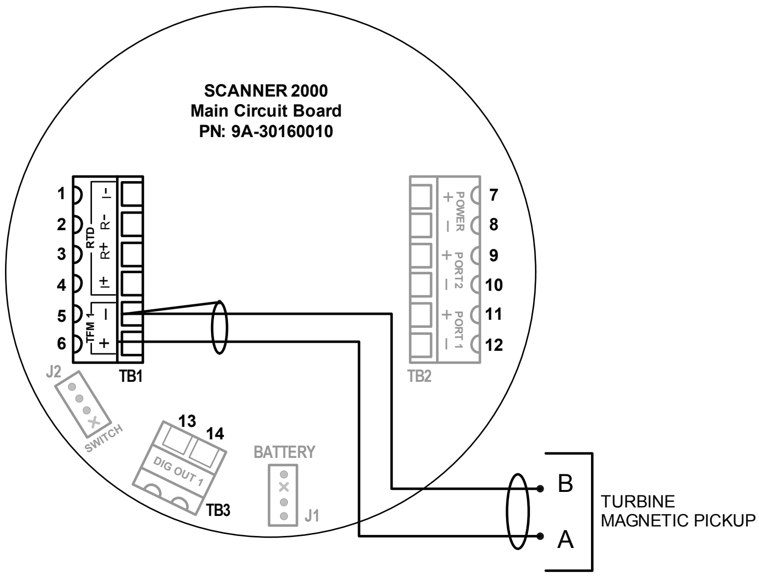


Figure 3.6—Flowmeter input wiring

RTD Input

The RTD assemblies described in Appendix A of this manual are recommended for measuring temperature for use in temperature-compensated gas and liquid calculations, though a 2- or 3-wire RTD may prove functional. Wiring is essentially the same for all three models, though wire color may vary as indicated. Wire as shown in Figure 3.7.

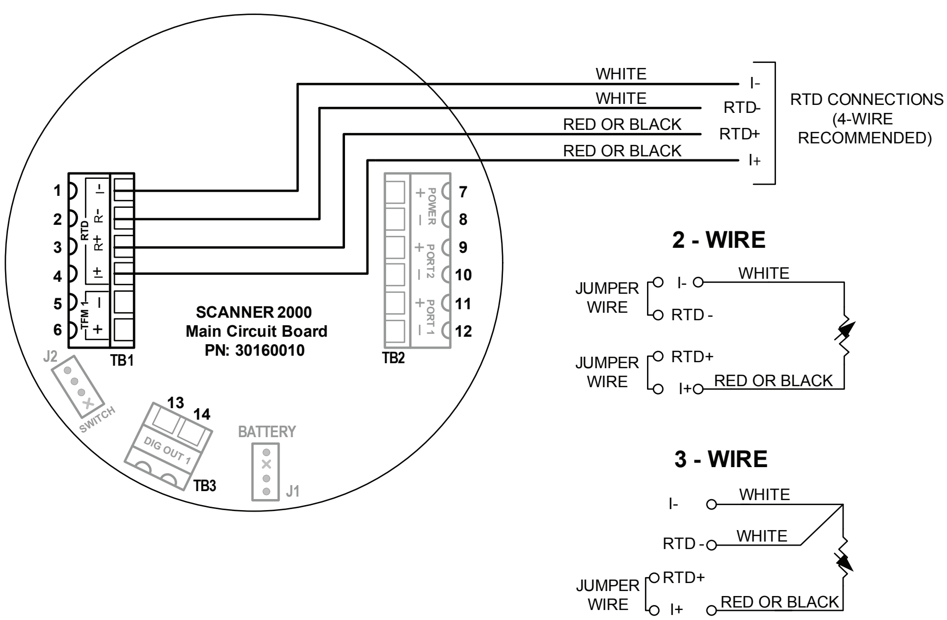


Figure 3.7—Process temperature input wiring

Output Wiring

Digital Output (Pulse or Alarm)

The standard Scanner 2100 supports a solid-state digital output that is configurable as either a pulse output or an alarm output. As a pulse output, the pulse width duration and pulse representation are both configurable. Because the circuit is isolated, it can be used in conjunction with any other feature on the Scanner 2100. A two-conductor cable from the Scanner 2100 to the remote location is required. The maximum rating of the digital output circuit is 60 mA at 30 VDC. Maximum frequency is 50 Hz. Wire as shown in Figure 3.8.

For reduced power consumption, turn the digital output feature off when it is not in use.

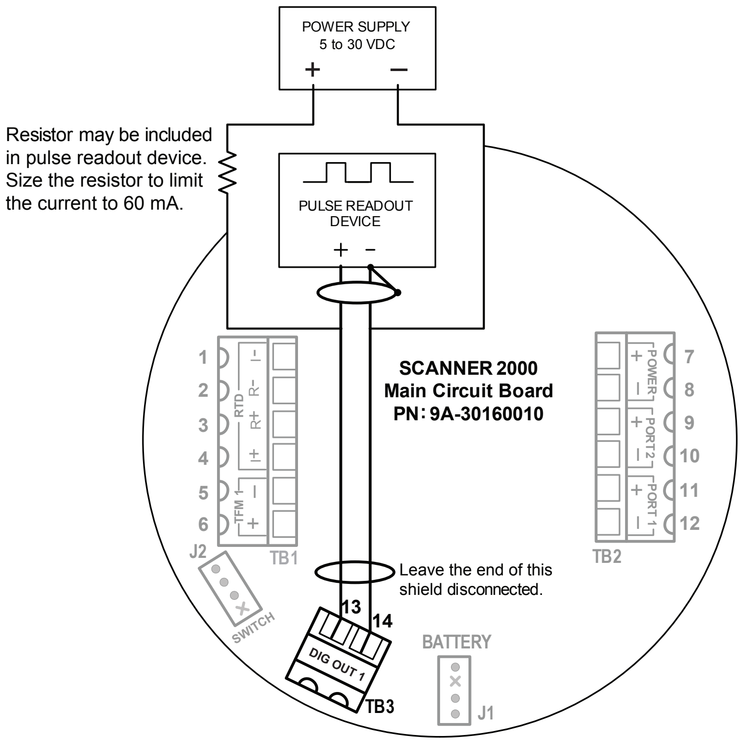


Figure 3.8—Pulse output wiring

RS-485 Output—Permanent Computer Connection

The RS-485 output is required for communication with the interface software. The wiring diagram in Figure 3.9, page 59 supports a permanent connection.

Important **If configuring a wireless Scanner 2100, connect to Port 1. In a wireless device, Port 2 supports wireless communications only and is unavailable for serial communications.**

For optional walk-up connectivity, see RS-485 Adapter (CSA, Class I, Div. 1 and Div. 2; ATEX, Zone 1), page A-9 and USB Adapter (CSA, Class I, Div. 1 and Div. 2), page A-11.

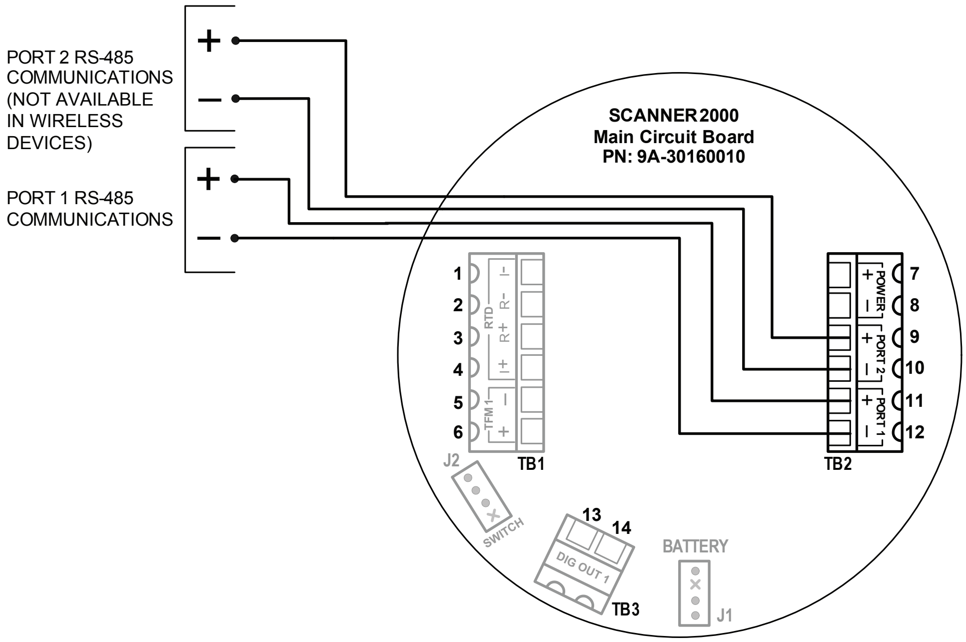


Figure 3.9—RS-485 output (permanent connection)

RS-485 Output—Laptop Computer Connection

The RS-485 output is required for communication with the interface software. The wiring diagram in Figure 3.10 supports a temporary laptop connections using an RS-232 to RS-485 converter.

For optional walk-up connectivity, see RS-485 Adapter (CSA, Class I, Div. 1 and Div. 2; ATEX, Zone 1), page A-9 and USB Adapter (CSA, Class I, Div. 1 and Div. 2), page A-11.

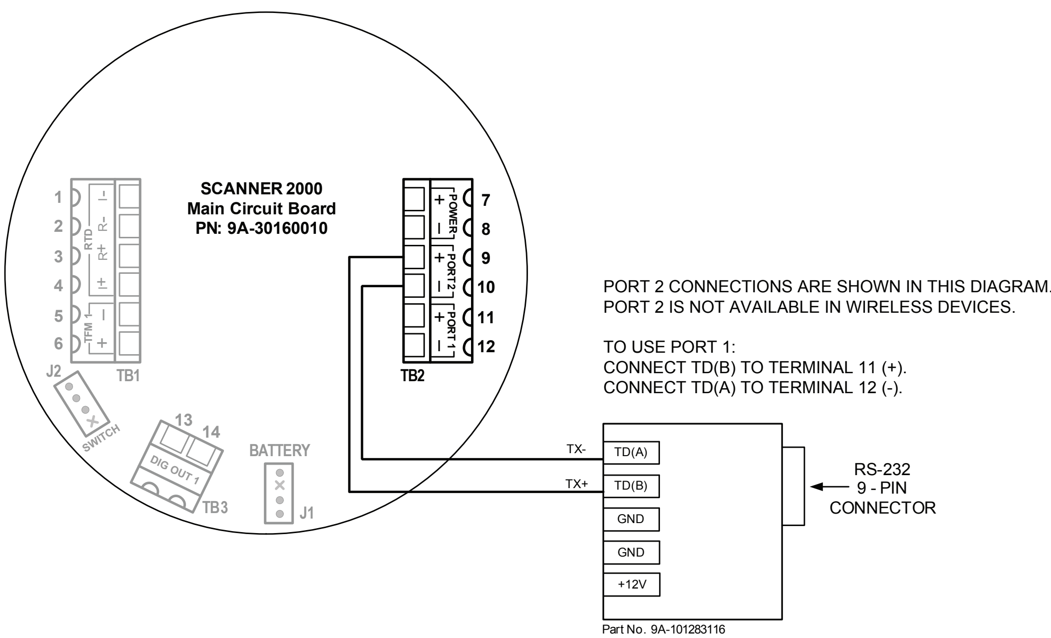


Figure 3.10—RS-485 output (connection to laptop with 9-pin converter)

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Section 4—Configuration and Maintenance

Configuration Tools

The Scanner 2100 can be configured two ways:

- Cameron's free ModWorX Pro interface software (PC installation) provides menus for configuring all functions supported by the Scanner 2100 and is recommended for first-time use. See Appendix A—Installation of Scanner 2100 Hardware Options, page A-1 for instructions on connecting your laptop or PC to the instrument.
- The device keypad supports the most commonly used features for device maintenance. See LCD/Keypad Functions, page 62 for details.

ModWorX Pro Software

ModWorX Pro interface software is a full-featured complimentary software program for calibrating and configuring the Scanner 2100. Up to 16 user-selectable parameters can be logged.

The software interface is designed around the most common needs of the field operator. A read-only Main screen (Figure 4.1) provides a quick reference to real-time totals and flow rates, input data, and system data. It is also home to four task-based menus: Calibrate, Maintain Flow Run, Maintain Turbine, or Configure. User manuals are linked to the software interface via tabs at the bottom of the screen for quick and easy access.

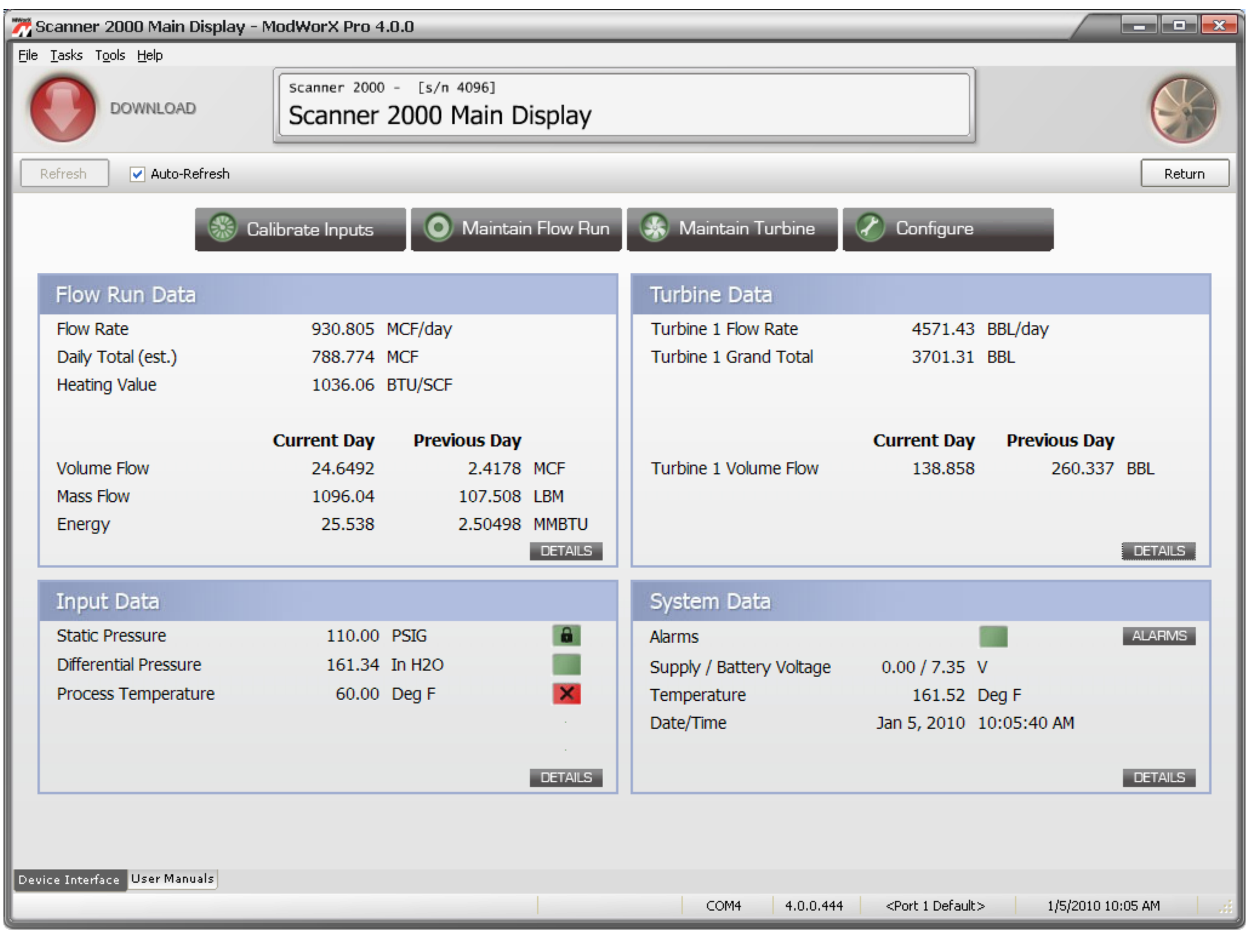


Figure 4.1—ModWorX Pro software interface

ModWorX Pro Interface Software Functions

A laptop connection and the ModWorX Pro software provided with the Scanner 2100 are required for the calibration and configuration of the instrument. The Scanner 2100's natural gas and steam calculations typically require configuration of inputs including differential pressure, static pressure, process temperature, and for AGA 7, a turbine meter input.

The Scanner 2100 supports digital serial communications using EIA-RS-485 hardware with Modicon Modbus protocol. Either of two Modbus slave ports facilitates communications with a laptop or PC. The baud rate range for both ports is 300 to 38.4 K. Both ports are protected from high-voltage transients.

An RS-232 to RS-485 converter or NuFlo USB adapter is required for connecting the EFM to a laptop or PC. The converters available from Cameron require no handshaking or external power to operate. See Section 6—Spare Parts, page 83 for ordering information; see Figure 3.9, page 59 and Figure 3.10, page 59 for wiring instructions.

The NuFlo USB adapter provides an external USB port for connecting to a laptop, and is available as a kit for upgrading a Scanner 2100. See USB Adapter (CSA, Class I, Div. 1 and Div. 2), page A-11 for details; see Section 6—Spare Parts, page 83 for ordering information.

WARNING: To prevent ignition of hazardous atmospheres, do not remove the Scanner 2100 cover while circuits are alive. The Scanner 2100 poses no hazard when opened in a safe area.

Password-Protected Security

A keypad security access code prevents unauthorized personnel from altering the calibration or accumulated volume data in the instrument. The security feature may be disabled if this protection is not required.

Password-protected security access is enabled using the ModWorX Pro software. When this feature is enabled, the user will be prompted for a four-digit password each time he attempts to enter a menu from the keypad (Figure 4.2). The ModWorX Pro software is required for establishing or changing the password.

Figure 4.2—LCD display of security password menu

LCD/Keypad Functions

From the three-button keypad on the front of the instrument, the user can perform the following tasks:

- scroll through display parameters to view real-time measurements
- view daily flow totals
- configure basic parameters such as slave address, baud rate, time, turbine K-factor, and orifice plate size
- enter network ID and slave ID (for wireless communications only)
- save the current total (recommended when changing batteries)
- expedite a wireless connection to a Scanner 3100 network
- check the firmware version, time, date, temperature, and battery and system voltage levels

Configuring Basic Parameters, page 64 guides users step-by-step through the configuration of these parameters using the keypad. Figure 4.3, page 63 summarizes the functions that can be accessed with each button.

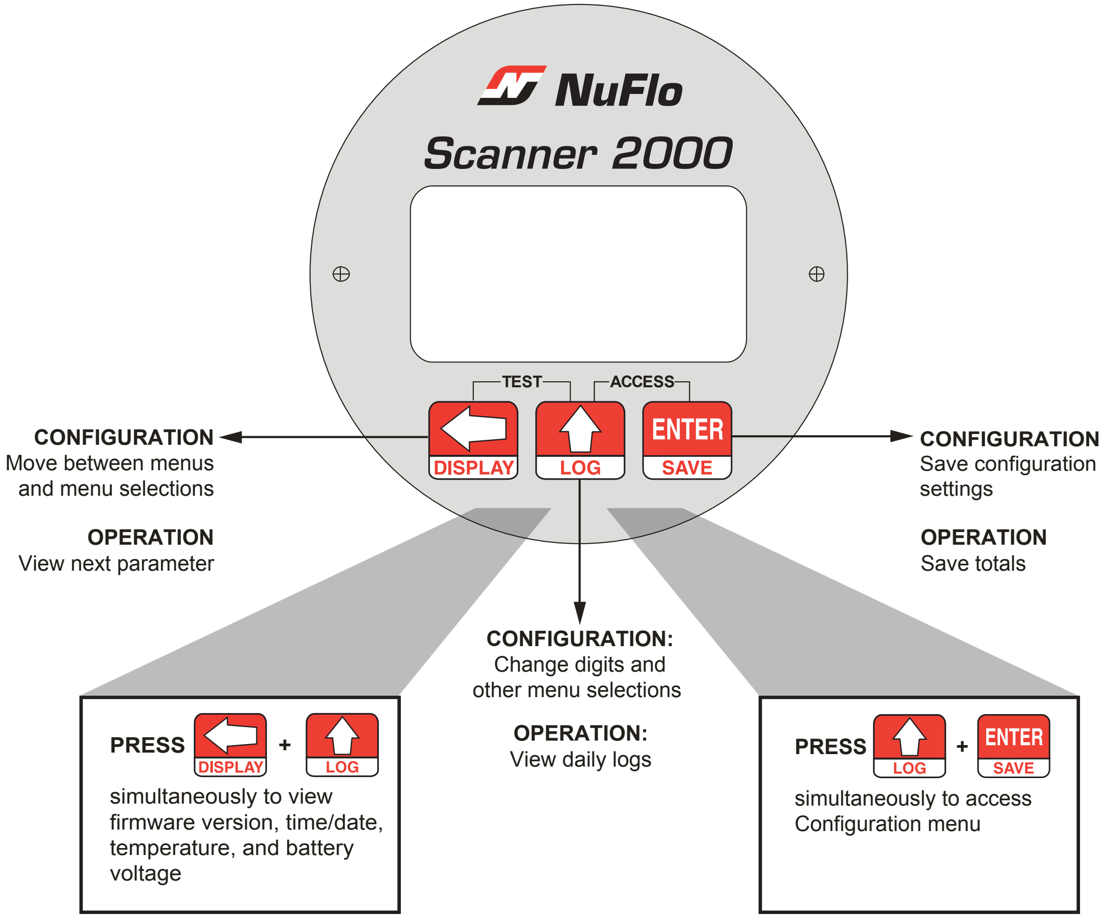


Figure 4.3—Keypad functions

Viewing Real-Time Measurements

Up to 12 parameters can be configured for display on the LCD using ModWorX Pro software. During normal operation, the LCD displays the selected parameters in a continuous scroll.

A user can stop the scrolling action and manually advance the parameter displayed on the screen by removing the cover of the instrument and pressing the LEFT ARROW button on the keypad (Figure 4.3). The parameter selected for display will appear as shown in Figure 4.4.

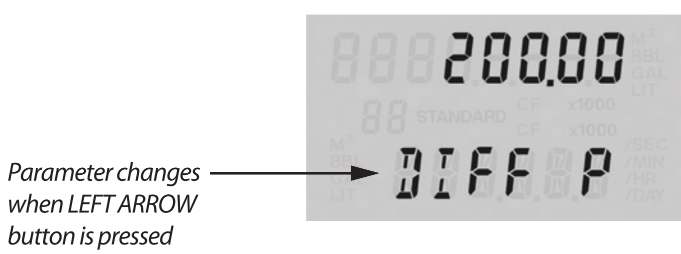


Figure 4.4—LCD display of real-time measurements

Note: If the instrument is equipped with an explosion-proof switch, the user can manually control the parameter displayed without removing the instrument cover. See Explosion-Proof Switch, page 11 for more information.

Viewing Daily and Hourly Logs

Up to 99 consecutive daily logs can be viewed using the keypad.

Pressing the LOG button changes the LCD display mode from normal operation (scrolling) to a daily log view mode (Figure 4.5). The two-digit flashing number or "log index" on the left side of the LCD represents the number of days that have passed since the log was saved. The user can increment or decrement the number by clicking the UP ARROW or DOWN ARROW buttons. For example, "01" will display the last daily log saved. An index of "05" will display the daily log saved 5 days ago.

By default, the top display shows flow volume, however the user can configure the display to show any of the 16 parameters available using ModWorX Pro software. The bottom display shows the date. The entire log archive—up to 768 daily logs, 2304 adjustable interval logs, and 1152 event/alarm logs— can be viewed using ModWorX Pro software.

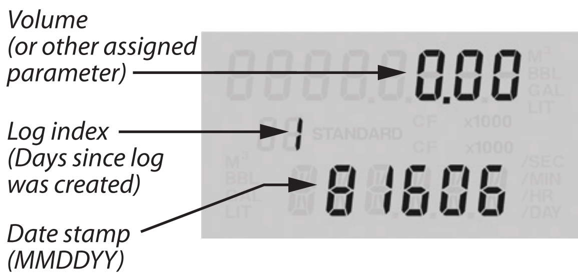


Figure 4.5—LCD display of daily logs

Configuring Basic Parameters

Pressing the UP ARROW and ENTER buttons simultaneously allows the user to enter the configuration mode (Figure 4.6).

Figure 4.6—In configuration mode, the parameter to be configured is displayed at the bottom of the LCD and the setting for that parameter is displayed in the top LCD.

The following parameters can be configured using the three-button keypad on the front of the instrument, as shown in Figure 4.3, page 63:

- slave address
- baud rate
- date and time
- contract hour
- plate size
- PID settings
- network ID (appears only when the Scanner 2100 is equipped with a wireless radio module)
- slave ID (appears only when the Scanner 2100 is equipped with a wireless radio module)
- K-Factor

All other instrument configuration is performed via the ModWorX Pro software.

Because the keypad is protected beneath the lid of the instrument, the enclosure must be opened to access the keypad. For this reason, it is important to configure these settings before installing it in a hazardous area.

WARNING: To prevent ignition of hazardous atmospheres, do not remove the cover while circuits are alive. The Scanner 2100 poses no hazard when opened in a safe area.

Entering the Slave Address

The slave address is a setting used in Modbus communications. It is a number that ranges from 1 to 65535, excluding 252 to 255 and 64764, which are reserved. If the Modbus request message contains the matching address, the device will respond to the request. In network arrangements, the device must have a unique slave address. See Table 4.1—Entering a Port 1 Slave Address for information about entering slave addresses. For more information about Modbus communications, refer to Appendix C—Modbus Communications Protocol, page C-1. If Modbus communications are not used, leave the slave address at the factory setting.

Table 4.1—Entering a Port 1 Slave Address

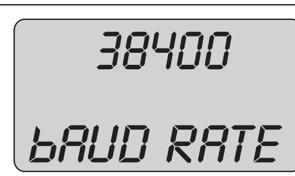
Enter the Access menu.	Press UP ARROW and ENTER simultaneously.	
Locate the Slave Address setting.	PORT 1 SLAVE ADDRESS will appear in the lower display, and the rightmost digit in the top display will begin blinking.	
Enter the Slave Address. (Range: 1 to 65535; excluding 252 to 255 and 64764)	Press UP ARROW until the correct digit is displayed. Then press LEFT ARROW to select the next digit to the left. Repeat using UP and LEFT arrows to enter all remaining digits. Press ENTER.	

The Baud Rate menu prompt will appear immediately following the entry of the slave address. See *Entering the Baud Rate* below for the baud rate entry procedure.

Entering the Baud Rate

The baud rate is the number of bits per second that are on the serial port. This setting must match the setting of the master device polling the Scanner 2100 or the serial port. This only applies to the Modbus communications; if Modbus communications are not used, leave the baud rate at the factory setting (9600). For more information about entering the baud rate, see Table 4.2—Entering the Port 1 Baud Rate.

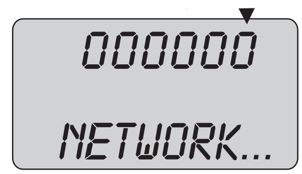
Table 4.2—Entering the Port 1 Baud Rate

Enter the Access menu.	Press UP ARROW and ENTER simultaneously.	
Locate the Baud Rate setting.	Press ENTER. The words "PORT 1 BAUD RATE" will appear in the lower display.	
Enter the baud rate.	Press UP ARROW until the correct baud rate is displayed. Press ENTER. "PORT 2 SLAVE ADDRESS" will appear in the bottom display.	

Entering the Network ID (Appears Only with Wireless Firmware S2100W)

The network ID is a user-specified number that uniquely identifies the network in which a Scanner 2100 is used to communicate wirelessly. The number must be between 1 and 65535. Use of the default value of 1 is NOT recommended, as this could cause a conflict with other networks using the same transmitter, resulting in failed communications with network nodes. See Table 4.3—Entering the Network ID for instructions on entering a network ID.

Table 4.3—Entering the Network ID

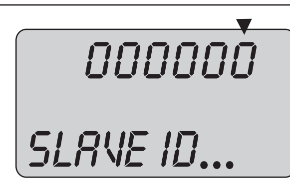
Enter the Access menu.	Press UP ARROW and ENTER simultaneously.		LOG + ENTER SAVE
Locate the Network ID setting.	Press ENTER twice. The words "NETWORK ID" will appear in the lower display.	ENTER SAVE	
Enter the network ID. (Range: 1 to 65535)	Press UP ARROW until the correct digit is displayed.	LOG	
	Then press LEFT ARROW to select the next digit to the left.	DISPLAY	
	Repeat using UP and LEFT arrows to enter all remaining digits.		
	Press ENTER. "SLAVE ID" will appear in the bottom display.	ENTER SAVE	

The Slave ID menu prompt will appear immediately following the entry of the network ID. See *Entering the Slave ID* below for the slave ID entry procedure.

Entering the Slave ID (Appears Only with Wireless Firmware S2100W)

The slave ID is a unique Scanner 2100 identifier used in establishing wireless communications with a Scanner 3100, and is equivalent to the slave address in serial communications. The number must be between 1 and 65535. See Table 4.4—Entering the Slave ID for instructions on entering a slave ID.

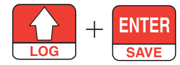
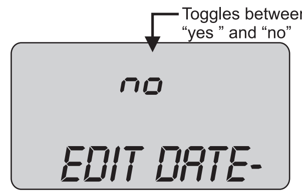
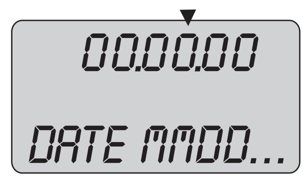
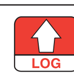
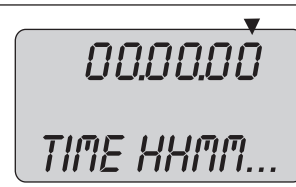
Table 4.4—Entering the Slave ID

Enter the Access menu.	Press UP ARROW and ENTER simultaneously.		LOG + ENTER SAVE
Locate the Slave ID setting.	Press ENTER three times. The words "SLAVE ID" will appear in the lower display.	ENTER SAVE	
Enter the slave ID. (Range: 1 to 65535)	Press UP ARROW until the correct digit is displayed.	LOG	
	Then press LEFT ARROW to select the next digit to the left.	DISPLAY	
	Repeat using UP and LEFT arrows to enter all remaining digits.		
	Press ENTER.	ENTER SAVE	

Editing the Date and Time

A user can change the date and time from the keypad, as shown in Table 4.5—Editing the Date and Time.

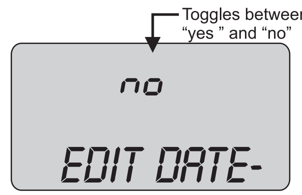
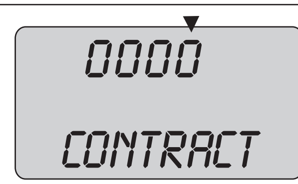
Table 4.5—Editing the Date and Time

Enter the Access menu.	Press UP ARROW and ENTER simultaneously.	
Locate the Date and Time setting.	Press ENTER four times. The words “EDIT DATE-TIME” will appear in the lower display and the word “no” or “yes” will begin flashing in the top display (default is “no”).  Press the UP ARROW to change the setting in the top display to “YES.”  Press ENTER. “DATE MMDDYY” will appear in the bottom display, and the last two digits, representing the year, will begin flashing. 	
Enter the month, day and year. The format is MM.DD.YY.	To change the year, press the UP ARROW, repeatedly if necessary, until the last two digits of the year are displayed (for example, for 2006, enter “06”).  To change the day, press the LEFT ARROW. The two middle digits will begin flashing. Press the UP arrow until the correct day is displayed.  Repeat the previous Step to select the first two digits and enter the month. Press ENTER. ”TIME HHMMSS” will appear in the bottom display, and the last two digits, representing seconds, will begin flashing. 	 
Enter the time (hour, minute, and seconds). The format is HH.MM.SS.	To change the seconds displayed, press the UP ARROW, repeatedly if necessary, until the correct time (seconds) is displayed.  To change the minutes displayed, press the LEFT ARROW. The middle two digits will begin flashing. Press the UP ARROW until the correct time (minutes) is displayed.  Repeat the previous Step to select the first two digits and enter the hour (military time: Ex. 1 p.m. = 13). Press ENTER. ”CONTRACT HOUR” will appear in the bottom display. 	 

Editing the Contract Hour

A user can set the contract hour from the keypad, as shown in Table 4.6—Editing the Contract Hour. The contract hour determines the exact time the daily flow is logged, and is represented by a four-digit number displayed in military time.

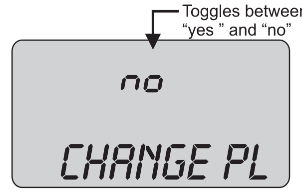
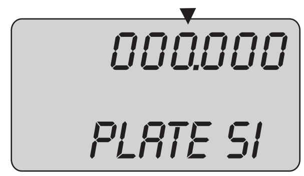
Table 4.6—Editing the Contract Hour

Enter the Access menu.	Press UP ARROW and ENTER simultaneously.	LOG + ENTER SAVE	
Locate the Contract Hour setting.	Press ENTER four times. The words "EDIT DATE-TIME" will appear in the lower display and the word "no" or "yes" will begin flashing in the top display (default is "no").	ENTER SAVE	
	Press the UP ARROW to change the setting in the top display to "YES."	LOG	
	Press ENTER. "DATE MMDDYY" will appear in the bottom display.	ENTER SAVE	
	Press ENTER a second time. "CONTRACT HOUR" will appear in the bottom display.	ENTER SAVE	
Enter the contract hour.	Press the UP ARROW, repeatedly if necessary, to change the contract hour. Each press of the button will increment the time by 1 hour.	LOG	
	Press ENTER. "SAVING" will appear in the bottom display. "PLATE CHANGE" will appear in the display.	ENTER SAVE	

Editing the Plate Size

When Flow Run 1 is configured as an orifice type and security controls allow, a user can change the size of the orifice plate from the keypad, as shown in Table 4.7—Editing the Plate Size, page 69. The plate size is displayed in inches. If "Strict API compliance" is enabled in the Security menu of the ModWorX Pro software, this parameter can be configured only from the ModWorX Pro interface, which allows the operator to put the instrument into maintenance mode (locked inputs) while the plate change is in process. See Section 3 of the ModWorX Pro Software User Manual for details.

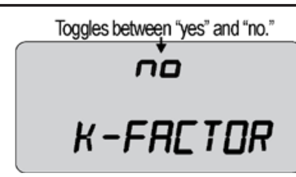
Table 4.7—Editing the Plate Size

Enter the Access menu.	Press UP ARROW and ENTER simultaneously.	
Locate the Plate Size setting.	Press ENTER five times. The words “CHANGE PLATE” will appear in the lower display and the word “no” or “yes” will begin flashing in the top display (default is “no”).	
	Press the UP ARROW to change the setting in the top display to “YES.”	
	Press ENTER. “PLATE SIZE - INCHES” will appear in the bottom display.	
Enter the new plate size.	Press UP ARROW until the correct digit is displayed.	
	Then press LEFT ARROW to select the next digit to the left.	
	Repeat using UP and LEFT arrows to enter all remaining digits.	
	Press ENTER.	

Editing the K-Factor

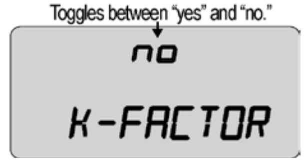
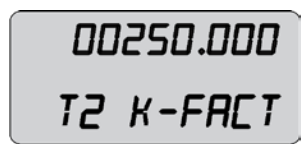
The K-Factor is the meter calibration factor, which is entered in terms of pulses/unit of volume. In firmware version 4.35 or greater, the user can set the linear K-Factor from the keypad if the “Strict API Compliance” setting is enabled in the Security menu of the ModWorX Pro software. Note that the current K-Factor entry must be linear, not multipoint, or the K-Factor menu will not appear on the display. The K-Factor on the front panel of the device is displayed in terms of the units selected within the ModWorX Pro software, and is typically displayed in pulses/gal. Please refer to the ModWorX Software User Manual for additional information about Strict API Compliance or meter calibration.

To Enter the K-Factor for Input 1:

Enter the Access menu.	Press UP ARROW and ENTER simultaneously.	
Locate the K-Factor setting.	Press ENTER six times. The words “K-FACTOR CHANGE” will appear in the lower display and the word “no” or “yes” will begin flashing in the top display (default is “no”).	
	Press UP ARROW to change the setting in the top display to “YES.”	
	Press ENTER. ”T1 K-FACTOR PER [UNITS]” will appear in the bottom display. [UNITS] will be the units configured from ModWorX (typically GAL).	

Enter the new K-Factor.	Press UP ARROW until the correct digit is displayed.	LOG	
	Then press LEFT ARROW to select the next digit to the left.	DISPLAY	
	Repeat using UP and LEFT arrows to enter all remaining digits.		
	Press ENTER.	ENTER SAVE	

To Enter the K-Factor for Input 2:

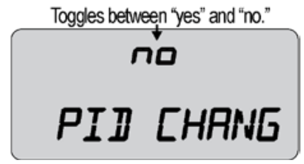
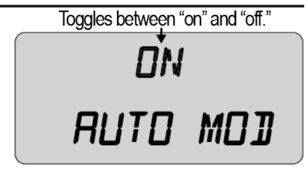
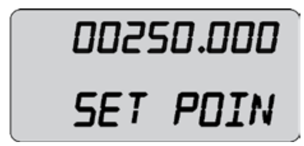
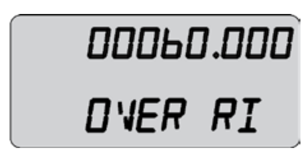
Enter the Access menu.	Press UP ARROW and ENTER simultaneously.		LOG + ENTER SAVE
Locate the K-Factor setting.	Press ENTER seven times. The words “K-FACTOR CHANGE” will appear in the lower display and the word “no” or “yes” will begin flashing in the top display (default is “no”).	ENTER SAVE	Toggles between “yes” and “no.” 
	Press UP ARROW to change the setting in the top display to “YES.”	LOG	
	Press ENTER. ”T2 K-FACTOR PER [UNITS]” will appear in the bottom display. [UNITS] will be the units configured from ModWorX (typically GAL).	ENTER SAVE	
Enter the new K-Factor.	Press UP ARROW until the correct digit is displayed.	LOG	
	Then press LEFT ARROW to select the next digit to the left.	DISPLAY	
	Repeat using UP and LEFT arrows to enter all remaining digits.		
	Press ENTER.	ENTER SAVE	

Configuring the PID Operational Mode

When a PID controller is configured and security controls allow, a user can change the basic operation of the controller from the keypad. The controller must be first configured and tuned using ModWorX Pro Software. The menu will first prompt for the entry to determine if the controller should be Auto Mode: ON = Auto or OFF = Manual. If auto mode is selected, the controller Set Point can also be entered before exiting the PID menu section. If Manual mode is selected, a prompt for changing the override value is shown.

To Configure the PID Operational Mode:

Enter the Access menu.	Press UP ARROW and ENTER simultaneously.	LOG + ENTER SAVE

Locate the PID Change setting.	Press ENTER eight times. The words “PID CHANGE” will appear in the lower display and the word “no” or “yes” will begin flashing in the top display (default is “no”).	ENTER SAVE	
	Press the UP ARROW to change the setting in the top display to “YES.”	LOG	
	Press ENTER.	ENTER SAVE	
Locate the Mode setting.	The words “AUTO MODE” will appear in the lower display and the word “on” or “off” will begin flashing in the top display, depending on the current configuration.	ENTER SAVE	
	Press the UP ARROW to change the setting in the top display to “ON” for Auto Mode or “OFF” for Manual Mode.	LOG	
	Press ENTER. The words “SET POINT” will appear in the bottom display.	ENTER SAVE	
If Auto Mode was selected, enter the Set Point.	The decimal point should be blinking. Press the UP ARROW until the decimal point is in the desired position, the press the LEFT ARROW.	LOG	
	Press UP ARROW until the correct digit is displayed.	LOG	
	Then press LEFT ARROW to select the next digit to the left.	DISPLAY	
	Repeat using UP and LEFT arrows to enter all remaining digits.		
	Press ENTER. ”SAVING” will appear in the bottom display.	ENTER SAVE	
If Auto Mode was NOT selected, enter the override value.	The decimal point should be blinking. Press the UP ARROW until the decimal point is in the desired position, the press the LEFT ARROW.	LOG	
	Press UP ARROW until the correct digit is displayed.	LOG	
	Then press LEFT ARROW to select the next digit to the left.	DISPLAY	
	Repeat using UP and LEFT arrows to enter all remaining digits.		
	Press ENTER. ”SAVING” will appear in the bottom display.	ENTER SAVE	

Saving a Current Total

Press the ENTER/SAVE key on the keypad to save accumulated grand totals and previous day totals for flow run and turbine volume, energy, and mass to nonvolatile memory. Saving totals is recommended before removing power from the device. However, with dual lithium battery packs, battery packs can be changed one at a time to eliminate interruptions in operation. If power is removed and then restored to the unit, the last saved accumulated totals will be displayed in the LCD.

Expediting a Wireless Network Connection

The connection of a wireless Scanner 2100 to a Scanner 3100 network can take several minutes to complete. To expedite a connection, press the ENTER/SAVE key on the keypad. This step is recommended only for devices that have been trying to connnect for more than 2 minutes. If the device is not already connected, the connection process will be reinitiated. The connection status of a wireless device is automatically confirmed when the ENTER/SAVE button is pressed to save accumulated totals as discussed above. In the event the device is already connected, pressing the ENTER/SAVE key will have no affect on the device's network connection.

Similarly, when an optional momentary switch is installed in a wireless Scanner 2100, pressing the switch for any duration will also check the network connection status of the device and reinitiate the connection process if the device is not connected to the Scanner 3100 network.

Checking System Status Parameters

Press and release the DISPLAY and LOG buttons simultaneously to view a series of scrolling system status parameters:

- device firmware version and model number
- time (HHMMSS)
- date (MMDDYY)
- device temperature in degF
- device temperature in degC
- battery voltage level
- system voltage level

When the system voltage is displayed, the device will show "SAVING" and then return to displaying real-time parameters.

Selecting a Calculation Period

Selecting an appropriate calculation period in the ModWorX Pro software interface is an important step in configuring a Scanner 2100 that is to be networked to a Scanner 3100. A calculation period of a minute is recommended. This period allows for optimization of power usage and management of high-traffic periods in large networks.

It is important to recognize that the calculation period controls only the frequency with which the Scanner 2100 transmits real-time values to the Scanner 3100 network manager, not the input sampling period. Input sampling occurs each second, so the value transmitted at the end of a 1-minute calculation period is actually the average of 60 samples collected over the previous 60 seconds. Choosing a calculation period of 1 minute or longer in no way compromises the accuracy of the input data.

Device Downloads

Archive files can be downloaded from a Scanner 2100 using the ModWorX Pro software supplied with the device.

When a Scanner 2100 is networked to a Scanner 3100 network manager, a user can download Scanner 2100 data over wired or wireless communications using the Scanner 3100 web interface or an FTP client. See the Scanner Web Interface User Manual for instructions.

Reporting Tools

The proprietary .sdf files used to store Scanner 2100 data can be opened with either ModWorX Pro or Scanner Data Manager software. To download software or software user manuals, visit the Cameron website at products.slb.com/flowcomputers, select **Scanner 2000 Series Wired and Wireless**, and click on the link for the desired software install/manual.

ModWorX Pro

Users can download, view, export and print data logs within ModWorX Pro using RS-485 communications.

Scanner Data Manager

While Scanner Data Manager performs the same basic reporting functions supported by ModWorX Pro, it differs in two ways:

- Scanner Data Manager automatically opens proprietary download files with the click of a mouse.
- Scanner Data Manager provides the tools to create a professional, customized report and to create custom templates for repeated use. See the Scanner Data Manager User Manual for details.

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Section 5—Scanner 2100 Hardware Maintenance

The Scanner 2100 is engineered to provide years of dependable service with minimal maintenance. Batteries require periodic replacement, and battery life depends on whether battery power is the primary or secondary power source, the configuration settings of the Scanner 2100, ambient temperature conditions, and wireless network parameters where applicable.

All configuration settings are stored in nonvolatile memory; therefore, configuration settings will not be lost in the event of battery failure.

The circuit assembly or keypad may also require replacement over the life of the instrument. Replacement procedures are provided in this section.

WARNING: Before servicing the Scanner 2100, disconnect all power/signal sources and verify that the atmosphere is free of hazardous gases.

Lithium Battery Pack Replacement

The Scanner 2100 uses dual lithium battery packs with a typical life expectancy of 1 year. Because the flat discharge characteristics of the lithium battery, it is difficult to determine how much life remains in a battery at any given time. To preserve configuration and accumulated volume data, replace both battery packs at 1-year intervals.

WARNING: To prevent ignition of hazardous atmospheres, do not remove the cover while circuits are alive. The Scanner 2100 poses no hazard when opened in a safe area.

WARNING: The lithium battery pack that powers the Scanner 2100 is a sealed unit; however, should a lithium battery develop a leak, toxic fumes could escape upon opening the enclosure. Ensure that the instrument is in a well-ventilated area before opening the enclosure to avoid breathing fumes trapped inside the enclosure. Exercise caution in handling and disposing of spent or damaged battery packs. See additional information in Appendix A—Installation of Scanner 2100 Hardware Options, page A-1.

Important **When two battery packs are used to power the device, it is recommended that both packs be replaced at regular intervals. Replacing the packs one at a time will ensure power retention to the unit and eliminate the loss of accumulated totals.**

If both packs are to be removed at the same time for any reason, press the ENTER/SAVE key on the keypad before removing the packs to save accumulated grand totals and previous day totals for flow run and turbine volume, energy, and mass to nonvolatile memory. Once the battery packs are replaced and power is restored to the unit, the last saved accumulated totals will be displayed in the LCD. The instrument clock will need to be reset following battery replacement. All configuration and calibration settings are automatically saved to non-volatile memory and are not affected by a temporary loss of battery power.

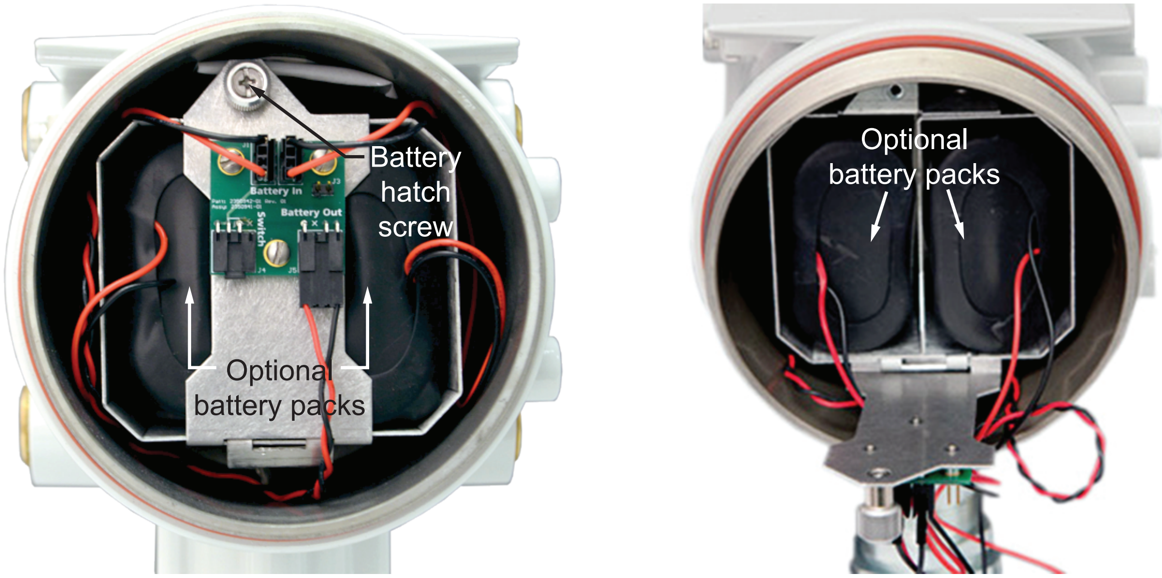
The lithium battery packs are secured inside the enclosure by a battery hatch on which a small battery board is mounted. There is no need to access the main circuit board for battery connections. All of the necessary connections for battery replacement are found on the battery board.

Note To retain power to the Scanner 2100, change the batteries one at a time.

To replace a lithium battery pack in the Scanner 2100, perform the following steps:

1. Unscrew the cover of the enclosure counter-clockwise until it separates from the main body of the enclosure.
2. Loosen the battery hatch screw with a screwdriver (Figure 5.1, page 76).

3. Open the door of the battery hatch to access the lithium battery packs.
4. Disconnect the battery from the J1 connector on the battery board and remove one of the spent battery packs from the enclosure (Figure 5.1). For sustained power, replacing one battery pack at a time is recommended.



Battery hatch, closed position Battery hatch, open position

Figure 5.1—Removal of the battery pack from the enclosure

5. Insert the new battery pack in the enclosure in the same position as the original battery pack, ensuring that the connector end of the battery cable is accessible once the hatch door is closed.
6. Connect the replacement battery pack to the battery board connector nearest the pack (J1 or J2).
7. Repeat steps 4 through 6 to replace the second battery pack.
8. Close the door to the battery hatch and tighten the hatch screw to secure it.
9. Check the Battery Out connector to confirm it is securely connected to connector J5 in the lower right corner of the battery board.
10. Replace the enclosure cover, threading it in a clockwise direction.

Important **An interruption of power to the Scanner 2100 will cause the internal clock time to be incorrect. Reset the time using the keypad on the switchplate or the ModWorX Pro software. See Table 4.5—Editing the Date and Time, page 67, for details.**

Circuit Assembly Replacement

WARNING: To prevent ignition of hazardous atmospheres, do not remove the cover while circuits are alive. The Scanner 2100 poses no hazard when opened in a safe area.

Important **Static electricity can damage a circuit board. Handle new boards only by their edges, and use proper anti-static techniques (such as wearing anti-static wrist strap or touching metal to establish an earth ground) prior to handling a board.**

Important **If possible, download the configuration settings and all archive logs before replacing the circuit board.**

To replace the circuit assembly, perform the following steps:

1. Unscrew the cover of the enclosure counter-clockwise until it separates from the main body of the enclosure.
2. Remove the two #4-40 × 7/8” screws located to the right and left side of the display (Figure 5.2).

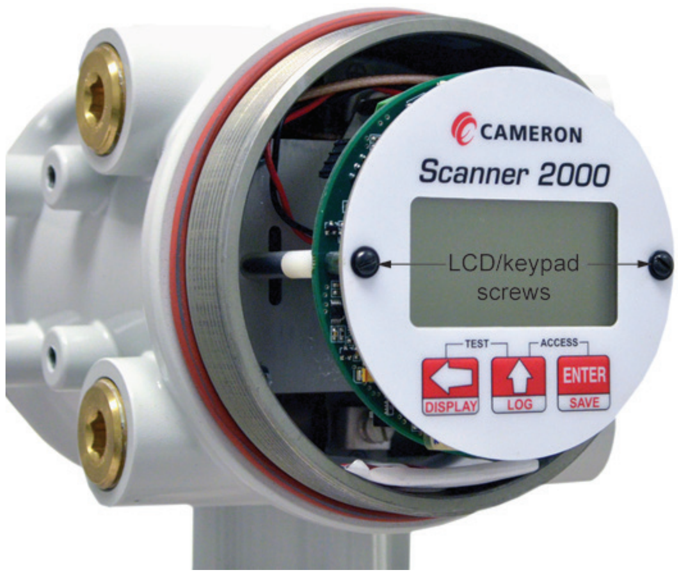


Figure 5.2—LCD/keypad screw locations

3. Remove the display/keypad assembly from the enclosure.
4. Record the locations of all cable connections to the circuit board.
5. Remove all wiring from terminal blocks TB1, TB2, and TB3, and J2, ensuring that all wiring that is connected to powered circuits is insulated with tape.
6. Unplug the battery cable from connector J1 on the circuit board.

Note The battery out cable should only be disconnected during circuit board replacement.

7. If a wireless board or an expansion board is present, remove the standoff securing the board to the main circuit assembly and set the wireless board or expansion board aside. If the standoff is difficult to remove, consider pinching the standoff prongs together with a pair of needle-nose pliers while lifting the board with the other hand.
8. Disconnect the sensor ribbon cable from the J5 connector on the circuit board as follows:
   a. Lift the latch from the black clip securing the ribbon cable (Figure 5.3, page 78).
   b. When the latch is fully open, the ribbon cable will release freely.

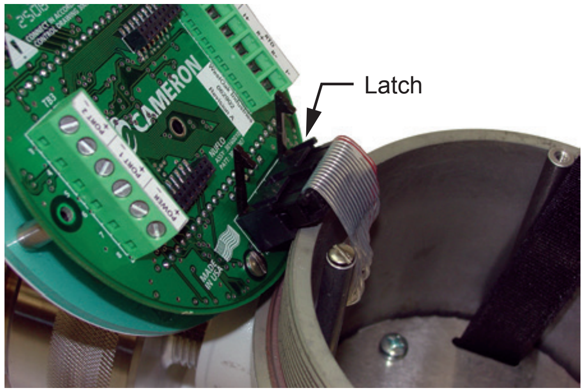


Figure 5.3—Latch securing the ribbon cable

9. Remove the original circuit board/keypad assembly from the enclosure.
10. Remove the two #4-40 × 5/16” screws fastening the circuit board to the keypad (Figure 5.4).
11. Remove the keypad ribbon cable from the J7 connector on the LCD side of the circuit board by pressing in on the sides of the black plastic clip and pulling gently on the clip. Do not pull on the ribbon cable; the cable will release freely when the clip opens (Figure 5.5, page 79).
12. Remove the replacement circuit board from its packaging.
13. Connect the keypad ribbon cable to the J7 connector on the LCD side of the new circuit board by sliding the end of the ribbon into the black clip as far as it will go and pressing the black plastic clip into the connector until it snaps.
14. Connect the circuit board to the keypad with the two #4-40 × 5/16” screws removed in Step 9.
15. Reconnect the sensor ribbon cable to the J5 connector at the top of the circuit board, by inserting the ribbon cable into the black clip and securing the latch on the clip to hold it tightly in place.
16. If a wireless board or expansion board was removed in step 7, replace it using the standoff provided with the new circuit board.
17. Reconnect the battery cable to connector J1 on the circuit board. Verify that the battery out connection is secure.

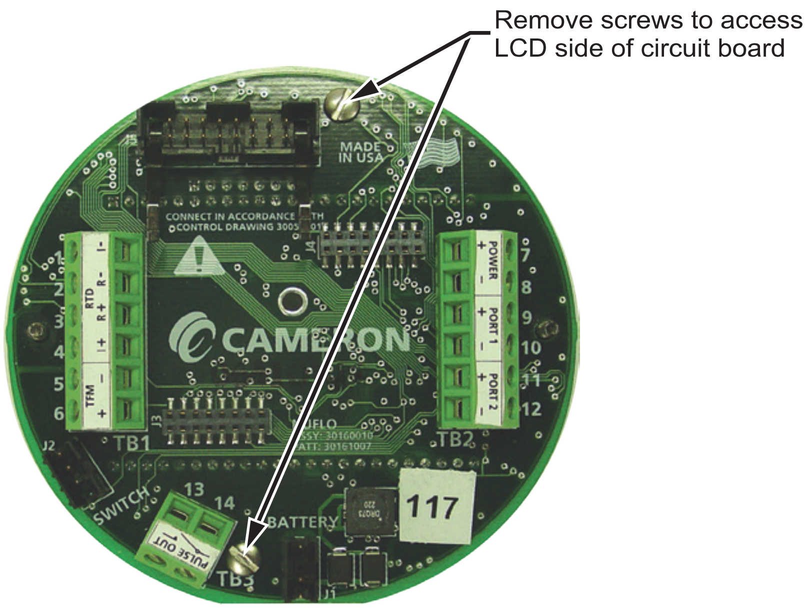
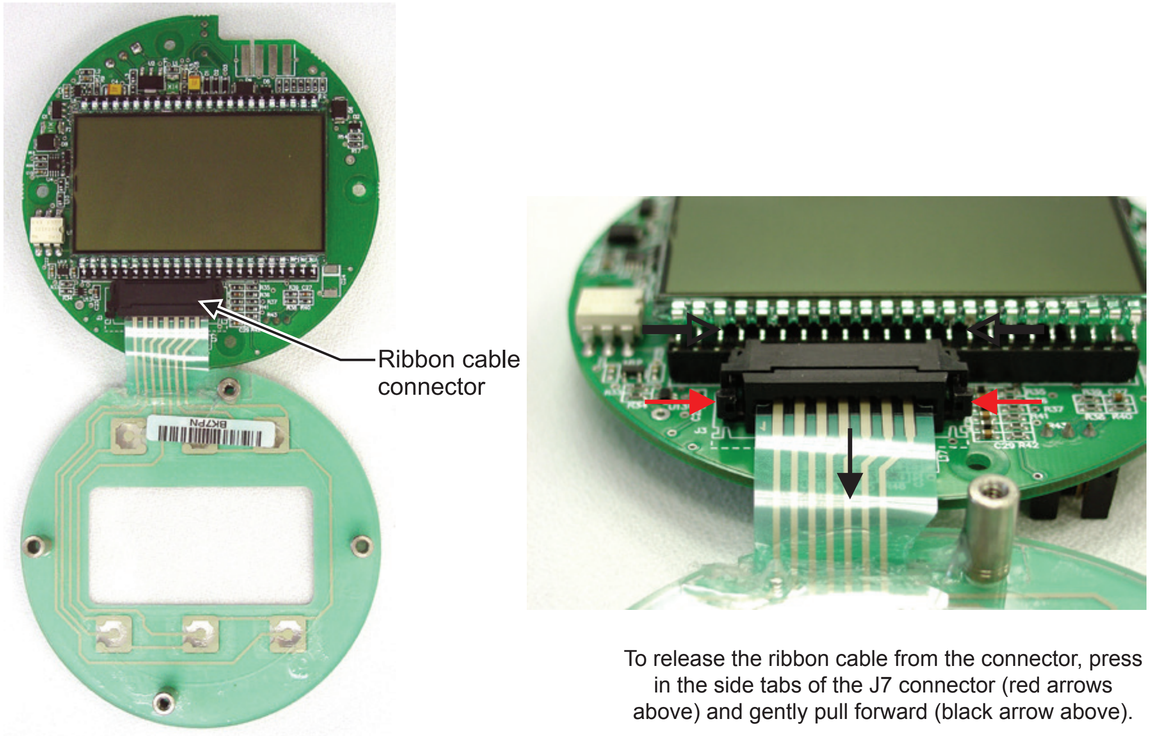


Figure 5.4—Disassembly of circuit board/keypad assembly



To release the ribbon cable from the connector, press in the side tabs of the J7 connector (red arrows above) and gently pull forward (black arrow above).

Figure 5.5—Keypad ribbon cable connector showing location of removal clips

18. Reconnect all wiring to terminal blocks TB1, TB2 and TB3 (and J2, if applicable).
19. Reattach the display/keypad assembly to the standoffs inside the enclosure with the two #4-40 × 7/8" screws removed in Step 2.
20. Recalibrate the Scanner 2100 and replace the enclosure cover.

Important **Do not overlook the need to recalibrate the Scanner 2100. Boards that are shipped independently of a Scanner 2100 are not calibrated to compensate for atmospheric pressure; therefore, a Scanner 2100 will not display accurate pressure readings until it is recalibrated.**

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21. Re-establish power to the peripheral circuitry.

Display/Keypad Replacement

⚠ **WARNING: To prevent ignition of hazardous atmospheres, do not remove the cover while circuits are alive. The Scanner 2100 poses no hazard when opened in a safe area.**

To replace the keypad of the Scanner 2100, perform the following steps:

1. Unscrew the cover of the enclosure counter-clockwise until it separates from the main body of the enclosure.
2. Remove the two #4-40 × 7/8" screws located to the right and left side of the display (Figure 5.2, page 77).
3. Remove the display/keypad assembly from the enclosure.
4. Remove the two #4-40 × 5/16" screws fastening the circuit assembly to the keypad (Figure 5.3, page 78).
5. Disconnect the keypad ribbon cable from the J7 connector on the LCD side of the circuit assembly as follows:
   a. Grasp the black clip between the thumb and forefinger (Figure 5.5).

   b. Squeeze both sides of the clip and gently pull to release the clip from the plastic connector that holds it in place. DO NOT PULL on the ribbon cable. When the black plastic clip is properly disengaged, the cable will release freely.

6. Remove the old keypad.
7. Connect the ribbon cable of the replacement keypad to the J7 connector on the LCD side of the circuit assembly as follows:
   a. Insert the end of the ribbon cable into the plastic clip.
   b. While holding the ribbon cable in place, press the black plastic clip into the connector until it snaps.
8. Verify that the "battery out" cable is secured.
9. Mount the circuit assembly to the keypad with the two #4-40 × 5/16” screws removed in Step 4.
10. Mount the display/keypad assembly to the enclosure with the two #4-40 × 7/8” screws removed in Step 2.
11. Replace the enclosure cover and tighten.

Wireless Module Replacement (Wireless Devices Only)

Important **Before replacing the wireless module, remove all power from the Scanner 2100 (battery and external power). Remove wiring from the main circuit board if necessary to guide the wireless module into position.**

The wireless module (Figure 5.6, page 81) attaches to two headers positioned between the two large green terminal blocks on the main circuit board.

Important **Pay close attention to the alignment of pins and headers before pressing boards together. Failure to correctly align pins and headers can result in broken pins or other damage to a circuit board.**

1. Remove the damaged wireless board as follows.
   a. Disconnect the antenna coupler cable from the wireless module.
   b. Remove the standoff securing the board to the main circuit assembly and set the wireless board aside. If the standoff is difficult to remove, consider pinching the standoff prongs together with a pair of needle-nose pliers while lifting the board with the other hand.
2. Install a new wireless module as follows.
   a. Remove the standoff from the wireless module packaging and push it into the hole near the middle of the main board until it snaps into place.
   b. Guide the wireless module over the standoff and carefully align the pins on the underside of the wireless module with the headers on the main board. When the board is positioned correctly, the text on both boards should face the same direction.
   c. Ensure that the pins and headers are properly aligned, then gently press the wireless board and the main board together until the wireless board snaps into place over the standoff.
   d. Restore field wiring connections to the main board, if applicable.
   e. Reattach the antenna cable coupler to the wireless module.
   f. Restore power to the Scanner 2100 and allow it to detect the wireless module.
   g. Confirm the network ID and slave ID values in the device are acceptable using the keypad menu. Change the values if necessary. See Entering the Network ID (Appears Only with Wireless Firmware S2100W) and Entering the Slave Address, page 65 for detailed instructions.

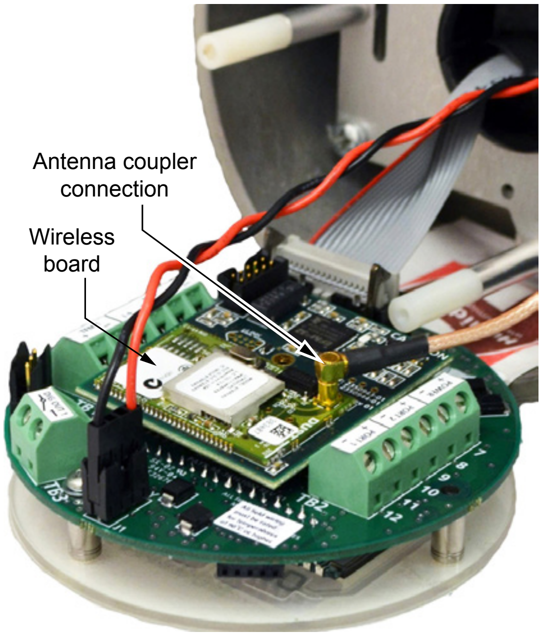

Figure 5.6—Replacement of a Scanner 2100 wireless module

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Section 6—Spare Parts

WARNING: EXPLOSION HAZARD – Substitution of components may impair suitability for CSA, Class I, Division 1 or Division 2. Use of spare parts other than those identified by Cameron voids hazardous area certification. Cameron bears no legal responsibility for the performance of a product that has been serviced or repaired with parts that are not authorized by Cameron.

Spare Parts Overview

Spare parts are presented in three tables below.

- Table 6.1 contains "common" parts—parts that are used in both CSA-approved and ATEX-approved devices, as well as separate groupings for parts that have been evaluated and approved for use with CSA-approved or ATEX-approved devices.
- Table 6.2 contains parts that are specific to Scanner 2100 devices equipped with wireless communications.
- Table 6.3 contains RTD and cable assemblies for use with CSA-approved devices.

MVT Replacement

During factory calibration, the device is calibrated over temperature with the MVT attached and performance is adjusted accordingly. Replacing an MVT or circuit board in the field individually negates this fine-tuning and may result in some degradation of accuracy. If this is a concern, consult your Cameron representative to arrange for the device to be returned to the factory for MVT or circuit board replacement and recalibration.

Table 6.1—Scanner 2100 EFM (Wired) Parts List

Qty.	Part Number	Description
Common Parts		
1	9A-30160010	Circuit Assembly, CPU Board (field replacement in devices equipped with an MVT can result in accuracy degradation)
1	9A-30166005	Assembly, Switchplate
1	9A-100002605	Desiccant, Humidisorb, Self Regenerate, 2 in. × 2 in. Packet with Adhesive
2	9A-99189002	O-Ring, 120 mm × 4 mm, XD-I, for Explosion-Proof Enclosure
2	9A-100025380	Screw, Pan Head, Slotted, #4-40 X 7/8 Steel Black Oxide for Switchplate Assembly
2	9A-100025381	Washer, Flat, #4 Steel Black Oxide, for Switchplate Assembly
1	50268179	Kit, Pole Mount, Stainless Steel
1	50263697	Assembly, Installation Software CD, contains ModWorX Pro, Scanner Data Manager, ScanMap™, and ScanFlash™ Software with electronic manuals
1	9A-30188004	Scanner 2000 Expansion Board (TFM Input, Pulse Input, Dual Analog Input, Analog Output, 256 KB Memory), Quick Start Guide
1	SCANNER-2X00-PID	PID Control Firmware (Aftermarket Upgrade); available only with wired Scanner 2100s
For wireless components, see Table 6.2—Scanner 2100 Wireless Components, page 84.		
CSA-Approved Parts		
2	9A-30099004	Battery Pack, 2 “D” Batteries in Series, 7.2 V, Lithium, with Current Limiting Resistor and Diode, Block Style, CSA-approved
1	9A-21-XX-YY (see Table 6.3—RTD and Cable Assemblies (CSA-Approved), page 85)	Assembly, RTD and Cable, Explosion-Proof (Div. 1), Model 21, CSA-approved

Table 6.1—Scanner 2100 EFM (Wired) Parts List

Qty.	Part Number	Description
1	9A-1100-1025B-xx (see Table 6.3—RTD and Cable Assemblies (CSA-Approved), page 85)	Assembly, RTD and Cable, Weatherproof (Div. 2), CSA-approved (XX=cable length) Available cable lengths: 5, 10, 20, or 30 ft Probe adjustable up to 6 in.
1	9A-90017004	External RS-485 Communications Adapter, 3/4 in. NPT, Explosion-Proof Union, 2-Pin Connector, CSA-approved
1	2295524-01	External USB Communications Connector, 3/4 in. NPT, Explosion-Proof Union, 2-Conductor Wire, 12 in., CSA-approved
1	9A-30054001	Assembly, External Explosion-Proof Switch, CSA-approved, with Extension, Fits 3/4 in. Female Pipe Thread, Momentary Contact (Keypad Alternative)
1	50271476	Assembly, External Explosion-Proof Switch, CSA-approved, with Extension, Fits 3/4 in. Female Pipe Thread, Momentary Contact (Keypad Alternative), with Lockout Mechanism
1	50267635	Assembly, External Explosion-Proof Switch, CSA-approved, with Extension, Fits 3/4 in. Female Pipe Thread, Toggle (Power Control)
1	50271473	Assembly, External Explosion-Proof Switch, CSA-approved, with Extension, Fits 3/4 in. Female Pipe Thread, Toggle (Power Control), with Lockout Mechanism
ATEX-Approved Parts		
2	9A-30099006	Battery Pack, 2 “D” Batteries in Series, 7.2 V, Lithium, with Current Limiting Resistor and Diode, Block Style, ATEX-approved
1	9A-X-TTXR-0003	Assembly, RTD and Cable, Flameproof, 3500-mm Cable, 50-mm Probe, for Line Sizes from 2 to 12 inches, ATEX-approved
1	9A-90017008	External RS-485 Communications Adapter, 3/4 in. NPT, Explosion-Proof Union, 2-Pin Connector, ATEX-approved
1	9A-30054002	Assembly, External Explosion-Proof Switch, ATEX-approved, with Extension, Fits 3/4 in. Female Pipe Thread, Momentary Contact (Keypad Alternative)
1	50302002	Assembly, External Explosion-Proof Switch, ATEX-approved, with Extension, Fits 3/4 in. Female Pipe Thread, Momentary Contact (Keypad Alternative), with Lockout Mechanism
1	50301997	Assembly, External Explosion-Proof Switch, ATEX-approved, with Extension, Fits 3/4 in. Female Pipe Thread, Toggle (Power Control)
1	50301999	Assembly, External Explosion-Proof Switch, ATEX-approved, with Extension, Fits 3/4 in. Female Pipe Thread, Toggle (Power Control), with Lockout Mechanism

Table 6.2—Scanner 2100 Wireless Components

Qty.	Part Number	Description
Common Parts		
1	50279728	Assembly, Circuit, Scanner 2100, Wireless Board
1	2350869-01	Antenna, Short-haul, 2.4 GHz, 1/2 Wave Dipole, N Male, Right-Angle
1	50279275	Antenna, Short-Haul, Remote-Mount, 9 dBi 2.4 GHz Omni-directional, 32-in. long, N Female with pole-mount bracket (fits pole outside diameters up to 2-in.)

Table 6.2—Scanner 2100 Wireless Components

Qty.	Part Number	Description
1	50278052	Antenna Bracket, 2-in. Pipe (2.375-in. Outside Diameter) for Remote-Mount Antenna Part No. 50279275
1	76527410	Antenna Cable with Connectors, Type 400, -40 degC to 70 degC (-40 degF to 158 degF), 10 ft
1	76527411	Antenna Cable with Connectors, Type 400, -40 degC to 70 degC (-40 degF to 158 degF), 20 ft
1	76527412	Antenna Cable with Connectors, Type 400, -40 degC to 70 degC (-40 degF to 158 degF), 30 ft
CSA-Approved Parts		
1	2350765-01	Antenna Coupler, N Coax, Male-to-Male (Female Thread), CSA-approved
ATEX-Approved Parts		
1	76533628	Antenna Coupler, N Coax, Male-to-Male (Female Thread), ATEX-approved

Table 6.3—RTD and Cable Assemblies (CSA-Approved)

Select assemblies based on specific application. For Model 21 RTDs, cable length and probe length are specified in the part number: 9A-21-XX-YY where XX is the cable length and YY is the probe length. Available cable lengths: 5, 10, or 30 ft Probe nominally adjustable up to 6 in. or 12 in.

Qty.	Part No.	Description
1	9A-21-05-06	Model 21 RTD, Explosion-proof, 5-ft Cable, 7.625-in. Probe for 6-in. Thermowell
1	9A-21-05-12	Model 21 RTD, Explosion-proof 5-ft Cable, 11.625-in. Probe for 12-in. Thermowell
1	9A-21-10-06	Model 21 RTD, Explosion-proof 10-ft Cable, 7.625-in. Probe for 6-in. Thermowell
1	9A-21-10-12	Model 21 RTD, Explosion-proof 10-ft Cable, 11.625-in. Probe for 12-in. Thermowell
1	9A-21-30-06	Model 21 RTD, Explosion-proof 30-ft Cable, 7.625-in. Probe for 6-in. Thermowell
1	9A-21-30-12	Model 21 RTD, Explosion-proof 30-ft Cable, 11.625-in. Probe for 12-in. Thermowell
1	9A-1100-1025B-05	Assembly, RTD and Cable, Weatherproof (Div. 2), 5-ft Cable, 6-in. Probe
1	9A-1100-1025B-10	Assembly, RTD and Cable, Weatherproof (Div. 2), 10-ft Cable, 6-in. Probe
1	9A-1100-1025B-20	Assembly, RTD and Cable, Weatherproof (Div. 2), 20-ft Cable, 6-in. Probe
1	9A-1100-1025B-30	Assembly, RTD and Cable, Weatherproof (Div. 2), 30-ft Cable, 6-in. Probe

For ATEX-approved RTD and Cable information, see the "ATEX-Approved Parts" section of Table 6.1—Scanner 2100 EFM (Wired) Parts List, page 83.

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Appendix A—Installation of Scanner 2100 Hardware Options

Input/Output Expansion Board (Wired Scanner 2100 Only)

With the installation of the Scanner 2100 input/output expansion board, the instrument can support up to three flow runs simultaneously—a flow run and two turbine meter runs. All inputs and outputs are configured with ModWorX Pro software provided with each Scanner 2100 EFM. See the ModWorX Pro Software User Manual for details.

Important **The input/output expansion board can be used only with a wired Scanner 2100 model.**

The expansion board shown in Figure A.1, page A-2, includes the following inputs and outputs:

- 2 analog inputs (can be configured for 0-5 V, 1-5 V or 4-20 mA)
- 1 turbine meter input
- 1 pulse input
- 1 analog output (4-20 mA)

If the expansion board is ordered with a Scanner 2100, it is installed at the factory. If the board is purchased separately, the user will need to install it on the Scanner 2100 main board using the following instructions.

Field Installation

Important **Before installing the expansion board, remove all power from the Scanner 2100 (battery and external power). Remove wiring from the main board if necessary to guide the expansion board into position.**

The expansion board attaches to two headers positioned between the two large green terminal blocks on the main board.

Important **Pay close attention to the alignment of pins and headers before pressing boards together. Failure to correctly align pins and headers can result in broken pins, and ultimately, the replacement of a circuit board.**

To install, perform the following steps:

1. Remove the standoff from packaging and push it into the hole near the middle of the main board until it snaps into place.
2. Guide the expansion board over the standoff and align the pins on the under side of the expansion board with the headers on the main board. When the board is positioned correctly, the text on both boards should face the same direction.
3. Gently press the expansion board and the main board together until the expansion board snaps into place over the standoff.
4. Restore field wiring connections to the main board, if applicable, and install field wiring on the expansion board.
5. Restore power to the Scanner 2100 and reboot the Scanner to allow it to detect the expansion board.

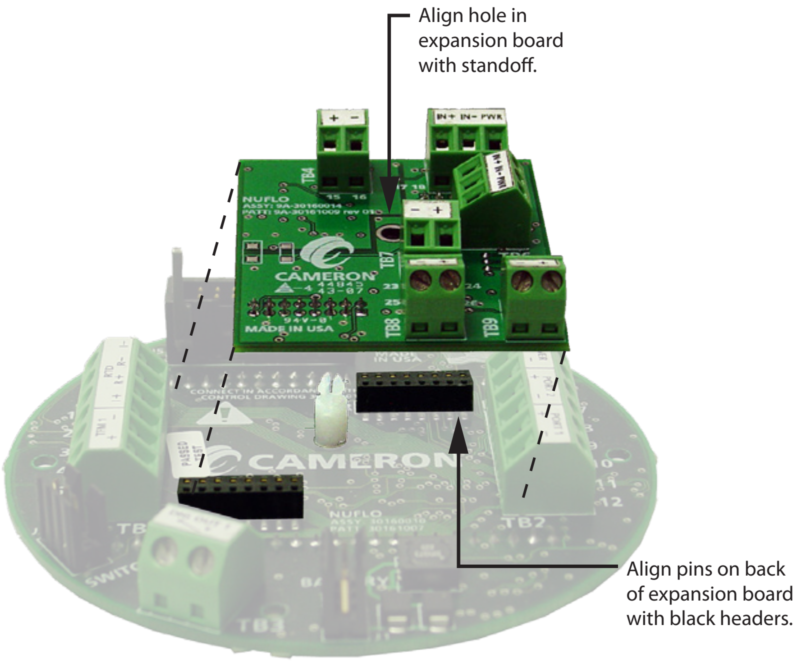


Figure A.1—Scanner 2100 input/output expansion board

Wiring Diagrams

Analog Inputs 1 and 2

The analog inputs, which can be configured for a 0-5 V, 1-5 V or 4-20 mA signal (as shown in Figure A.2, page A-3), can be used to receive readings from a pressure or temperature transmitter for use in AGA 7 gas calculations. Alternatively, they can be used to log measurements from any device with a 0-5 V, 1-5 V or 4-20 mA output.

Transmitter power is provided by the Scanner 2100 only when the Scanner is externally powered. The output voltage equals the input voltage less 0.25 VDC, and is limited to 20 mA.

If a 4-20 mA transmitter is used, a resistor must be added to the circuit, as shown in Figure A.2, page A-3. The expansion board circuit will support a resistor range of 200 to 300 ohms; 250 ohms is recommended.

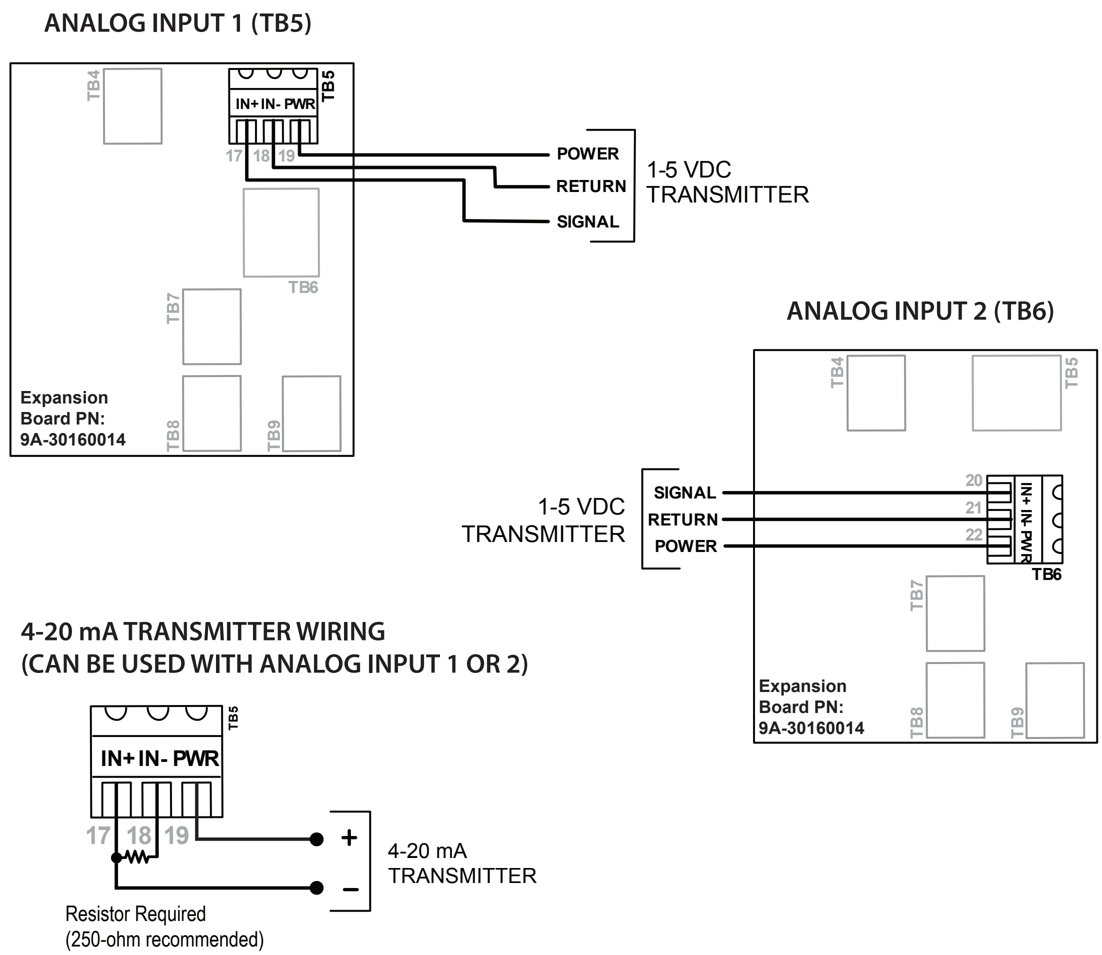


Figure A.2—0 to 5 V, 1 to 5 V and 4 to 20 mA analog input wiring

Pulse Input

The pulse input provides an optically isolated input for high-amplitude pulse (frequency) signals, which includes signals from a turbine meter equipped with a preamplifier (Figure A.3, page A-4, top diagram) or signals from a positive displacement meter (Figure A.3, page A-4, bottom diagram).

The Scanner 2100 can calculate flow from no more than two pulse (frequency) inputs at a time. Therefore, a pulse input can be used simultaneously with only one turbine input (main board or expansion board).

The pulse input can also be used as a status input for monitoring a parameter via Modbus registers.

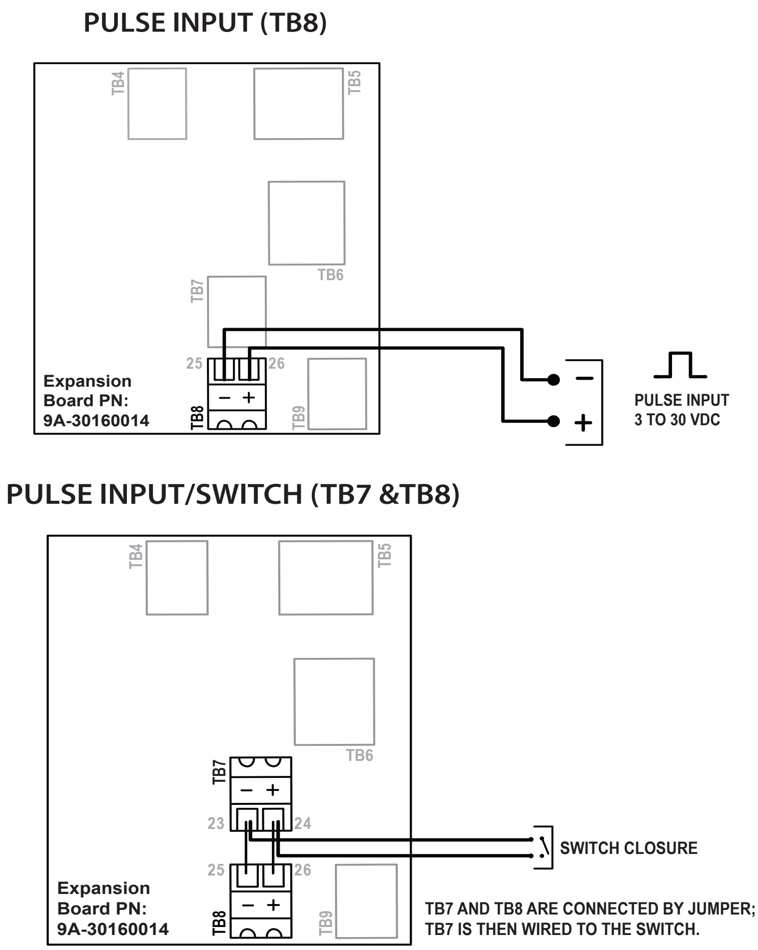


Figure A.3—Pulse input wiring

Turbine Flowmeter Input 2

Turbine Input 2 (Figure A.4) accepts a turbine flowmeter input signal generated by a magnetic pickup. The Scanner 2100 can be configured to use this signal to calculate and display instantaneous flow rates and accumulated totals. Turbine Input 2 is in addition to the turbine input on the main circuit board. When the expansion board is installed, a differential pressure flow run and two turbine runs can be monitored and logged simultaneously.

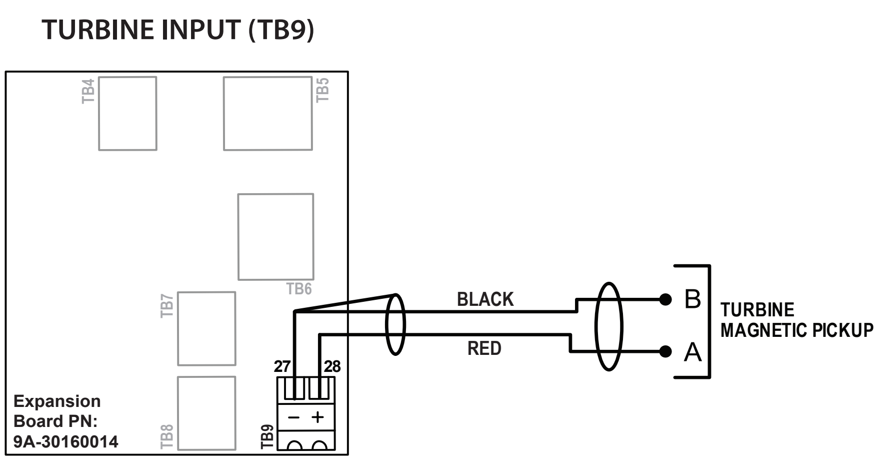
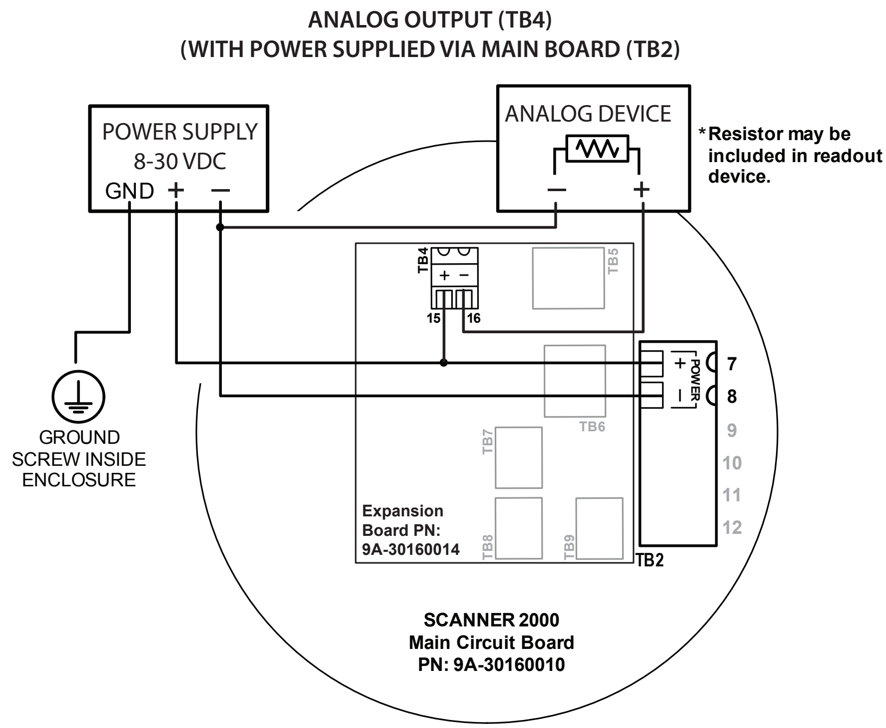


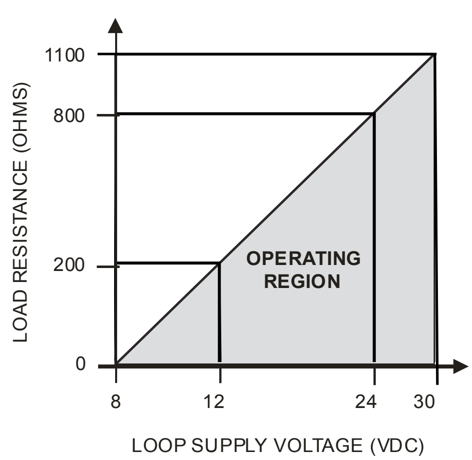
Figure A.4—Turbine Input 2 wiring

Analog (4 to 20 mA) Output

The 4 to 20 mA output provides a linear current output that can be configured using ModWorX Pro software to represent any parameter in the holding registers. This output requires a two-conductor cable to be connected to an 8 to 30 VDC power supply (voltage required is dependent on loop resistance) and a current readout device to be located in the remote location. See the ModWorX Pro Software User Manual for information on configuring and calibrating zero and full-scale values using ModWorX Pro software.

The graph below the wiring diagram in Figure A.5 shows the minimum voltage required to power the instrument for a given loop resistance. In addition, the mathematical relationship between loop voltage and load resistance is given. For example, if a power supply voltage of 24 volts is available to power the current loop, the maximum load resistance would be 800 ohms.





$$R_L \ MAX = \frac{(V \ loop - 8V)}{20 \ mA}$$

$$R_L \ MAX = \frac{(24V \ loop - 8V)}{20 \ mA}$$

$$R_L \ MAX = 800 \ ohms$$

Figure A.5—Analog (4-20 mA) output wiring

Explosion-proof Control Switches

Momentary Switch (CSA, Class I, Div. 1 and 2; ATEX, Zone 1)

An alternative to the automatic scroll display of parameters on the LCD, a momentary explosion-proof control switch (Figure A.6) allows the user to clear (zero) grand totals for flow run and turbine inputs, manually pace parameters displayed on the LCD, and view daily logs instantaneously without removing the instrument cover or connecting the instrument to a laptop computer. For wireless devices, it can also expedite connection to a Scanner 3100 network (see Expediting a Wireless Network Connection, page 72). The switch is available in both a CSA-approved model for Div. 1 and Div. 2 installations and an ATEX-approved model for Zone 1 installations. It can also be purchased with a mechanical lockout device to prohibit unauthorized users from changing the position of the switch. See Lockout Mechanism, page 11, for details.

Figure A.6—Momentary explosion-proof control switch

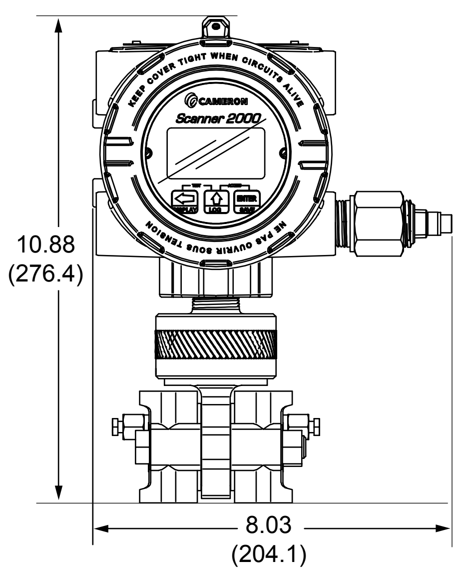


Figure A.7—Scanner 2100 dimensions with momentary explosion-proof control switch

The switch mounts in either threaded conduit opening in the instrument housing. If the switch is ordered with a Scanner 2100, it will be installed prior to shipment. To add a switch to an existing Scanner 2100, plug the switch into connector J2 on the main circuit board (Figure A.8).

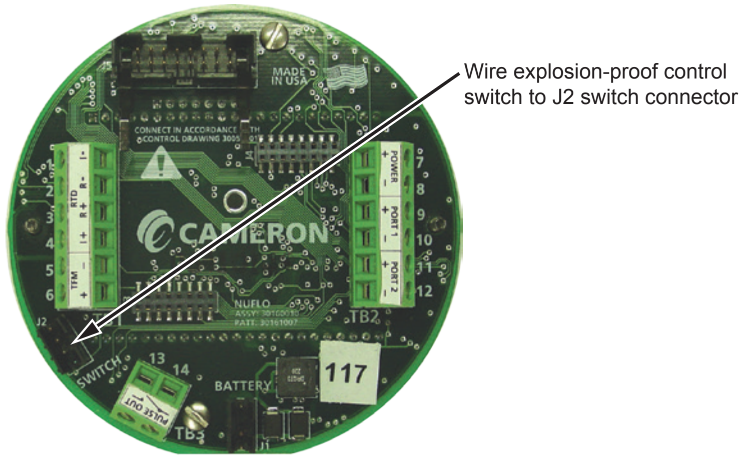


Figure A.8—Wiring of momentary switch

To select a display parameter for viewing, press and release the push-button switch. With each subsequent press of the switch, the LCD will display a new parameter (Figure A.9). Parameters will appear in the order specified by the user when he configured the display. If the user does not press the button to manually advance to the next parameter, each parameter will be displayed for 30 seconds before the LCD resumes its automatic scroll.

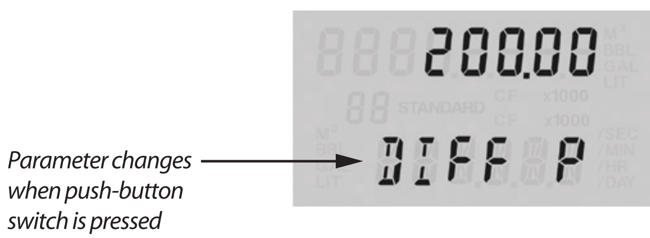


Figure A.9—LCD display of real-time measurements

To access daily logs, press and hold the push-button switch for approximately 4 seconds. In the daily log viewing mode, the LCD will display the daily volume recorded (at the top), the date stamp (bottom), and a two-digit index that indicates the number of days since the log was created (Figure A.10). When you enter this mode, the LCD automatically displays the daily log value from the previous day, which is marked by an index value of "01."

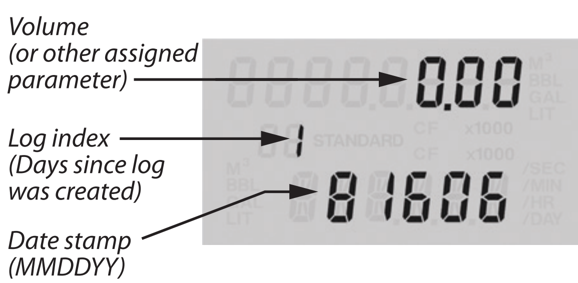


Figure A.10—LCD display of daily logs

To view logs recorded prior to this date, press the push-button switch repeatedly. The index number will increase in value (02, 03, etc.) as the logs progress back in time, and the corresponding daily log volumes and dates will appear on the LCD. The log display will remain in view for 30 seconds before the LCD resumes its automatic scroll of display parameters. To clear (zero) grand totals for Flow Run 1, Turbine 1, and Turbine 2, press and hold the push-button switch for approximately 10 seconds and release.

Toggle Switch (CSA, Class I, Div. 1 and Div. 2; ATEX, Zone 1)

A toggle explosion-proof control switch allows the user to temporarily terminate power to the Scanner 2100 during radio-sensitive operations such as casing perforation. The switch is available in both a CSA-approved model for Div. 1 and Div. 2 installations and an ATEX-approved model for Zone 1 installations.

If the switch is ordered with a Scanner 2100, it will be installed prior to shipment. To add a switch to an existing Scanner 2100, plug the switch into connector J4 on the small battery board in the rear battery hatch compartment (Figure A.11).

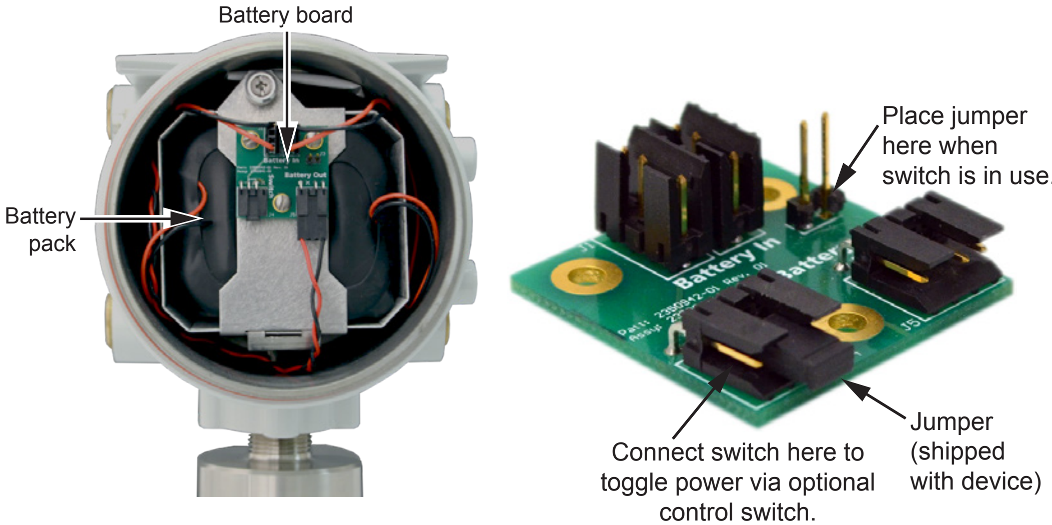


Figure A.11—Battery board installed and close up

Once the switch is wired, simply push the push-button switch to terminate power, and push it again to restore power. The switch can also be purchased with a mechanical lockout device to prohibit unauthorized users from changing the position of the switch. See Lockout Mechanism, page 11, for details.

Uninstalling a Toggle Switch

To uninstall a switch, remove the switch connector from the J4 connector on the battery board. Remove the jumper from the J3 connector on the battery board and insert it into Pins 2 and 3 on the J4 connector, leaving the left pin unused. See Figure A.12 for proper jumper placement.

Important **Failure to replace the jumper or improperly placing the jumper will de-power the device. If you lose device power after uninstalling the control switch, check the position of the jumper, and realign the jumper if necessary.**

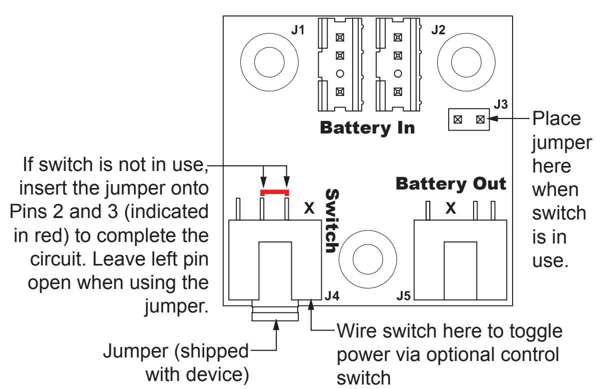


Figure A.12—Battery board drawing detailing jumper positioning

RTD Assemblies

Explosion-Proof RTD Assembly (CSA, Class I, Div. 1)

The Barton Model 21 RTD, shown in Figure A.13 is a 4-wire, 100-ohm weatherproof and explosion-proof RTD assembly that can be connected to the Scanner 2100 enclosure without conduit in a Class I, Div. 1 installation. Factory-sealed, armored leads are covered in PVC. The RTD assembly can be ordered with tech cable lengths of 5, 10, or 30 ft, and is available with a 6-in. or 12-in. RTD probe. Cable length and probe length are specified in the model part number: 9A-21-XX-YY where XX is the cable length and YY is the probe length.

The Model 21 RTD is CSA-certified for use in Class I, Groups B, C, and D; Class II, Groups E, F and G; and Class III hazardous area environments.

Each RTD assembly is fitted with 1/2-in. and 3/4-in. connectors for adapting to various size conduit openings and threadolets. The RTD is field-adjustable for insertion lengths of up to 12 in. For wiring instructions, see Figure 3.7, page 57. For part numbers, see Table 6.3—RTD and Cable Assemblies (CSA-Approved), page 85.

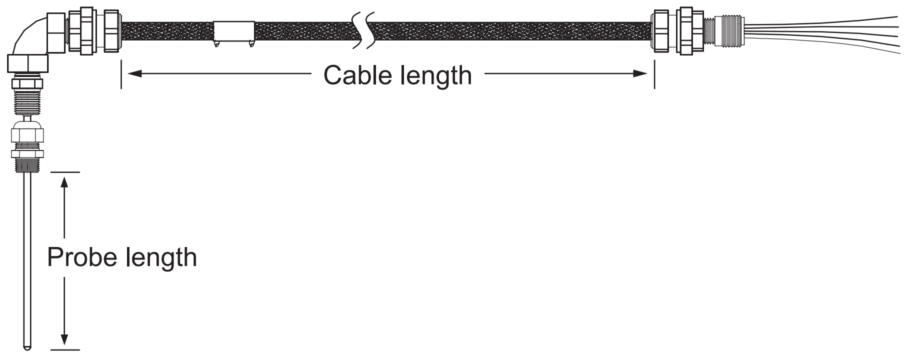


Figure A.13—Explosion-proof (Div. 1) RTD assembly

Flameproof RTD Assembly

Cameron offers a flameproof RTD that is ATEX-certified for use in Zone 1 installations. The 4-wire, Class A sensor is encapsulated in a stainless steel sheath long enough to accommodate line sizes from 2 to 12 inches. It is attached to a 3500-mm armored cable. For wiring instructions, see Figure 3.7, page 57. For part numbers, see Table 6.3—RTD and Cable Assemblies (CSA-Approved), page 85.

Weatherproof RTD Assembly (CSA, Class I, Div. 2)

Cameron's weatherproof RTD is CSA-certified for use in Class I, Div. 2 hazardous area installations. This 4-wire, 100-ohm RTD assembly has a standard 6-in. adjustable probe and can be ordered with cable lengths of 5, 10, 20, or 30 ft. It is fitted with two 1/2-in. MNPT strain reliefs and a 1/2-in. × 3/4-in. reducer for adapting to various size conduit openings and threadolets. For wiring instructions, see Figure 3.7, page 57. For part numbers, see Table 6.3—RTD and Cable Assemblies (CSA-Approved), page 85.

Communications Adapters

RS-485 Adapter (CSA, Class I, Div. 1 and Div. 2; ATEX, Zone 1)

The explosion-proof communications adapter (Figure A.14, page A-10) provides an RS-485 connection for connecting a laptop or PC to the instrument without removing the instrument cover. When the adapter is ordered with a Scanner 2100, it is factory installed. It may be relocated to either conduit opening in the instrument housing. Separate part numbers are provided for CSA and ATEX models, as the ATEX model is constructed with ATEX-approved materials and is approximately 0.9 inches longer than the CSA-approved model. Dimensions are shown in Figure 2.2, page 29.

An RS-232 to RS-485 converter cable (available from Cameron's Measurement Systems Division) is required for connecting the adapter to a laptop computer. A variety of converter cable options are listed in the Spare Parts list of this manual (page 83).

The adapter is shipped pre-assembled in the Scanner 2100 when it is ordered with the unit. The installed adapter is comprised of an RS-485 adapter socket, a blanking plug, and a union nut. A plug connector that mates with the RS-485 adapter socket when the adapter is in use is shipped with the device (uninstalled). This plug connector should be wired to an RS-485 converter cable, and stored with the cable when the COM adapter is not in use. Wiring instructions for connecting the plug connector to an RS-485 converter cable are provided in Figure A.15.

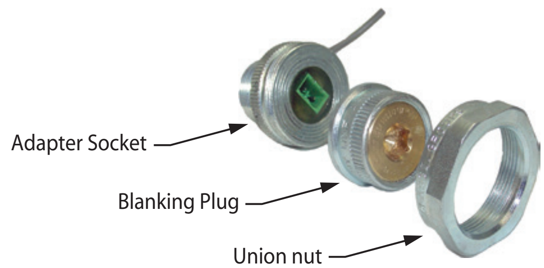


Figure A.14—Explosion-proof communications adapter

WARNING: When a hazardous area is present, ensure the union nut and blanking plug are properly fitted in the conduit opening. The hazardous location rating applies only when the union nut and blanking plug are secured in place. When the union is broken, the device is no longer explosion-proof. Before disassembling the union nut and blanking plug, make sure the area is non-hazardous.

To connect a PC or laptop to the communications adapter, perform the following steps:

1. Unscrew the union nut to expose the connector socket shown in Figure A.15. A blanking plug will be removed with the union nut. Store the union nut and blanking plug in a safe place. (They will need to be reinstalled when the adapter is not in use.)
2. Connect the plug connector to an RS-485 converter cable, if it is not already attached (Figure A.15).

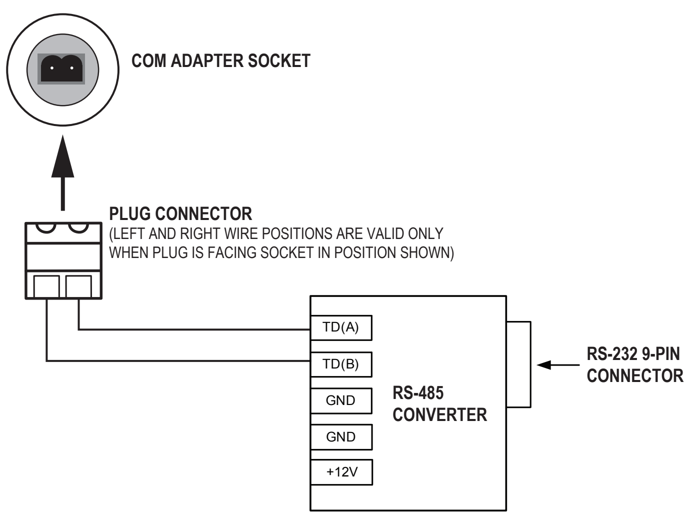


Figure A.15—Wiring of plug connector to Cameron 9-pin RS-232 to RS-485 converter cable

3. Insert the plug connector into the adapter socket.
4. Connect the converter cable to the PC or laptop.

Disconnecting the RS-485 Adapter

To disconnect the adapter, remove the plug connector (with converter cable attached) from the socket, place the blanking plug inside the union nut (removed in Step 1 of the installation procedure) and screw the union nut onto the union half to cover the socket. Hand-tighten to ensure a snug connection.

Note It is not necessary to disconnect the plug connector from the RS-232 to RS-485 converter cable when it is not in use. For best results, store the plug connector with the converter cable in a dry and easily accessible area.

RS-485 Adapter Field Installation

⚠ **WARNING: If the communications adapter is purchased separately from the Scanner 2100, the conduit openings in the Scanner 2100 enclosure will be sealed with brass or stainless steel plugs. Do not remove the plug from the enclosure to install the adapter unless the area is known to be non-hazardous.**

To install a communications adapter purchased as an aftermarket accessory to an installed Scanner 2100, perform the following steps:

1. Thread the cable of the adapter through a conduit opening in the instrument housing and screw the adapter into place.
2. Connect the adapter cable to a communications port on the main circuit board. For wireless devices, the cable must be connected to Port 1. See Figure 3.9 or Figure 3.10, page 59 for wiring diagrams.
3. Connect the plug connector to an RS-485 converter cable.
4. To connect to the Scanner 2100 via the adapter, insert the plug connector into the adapter socket and connect the converter cable to the PC or laptop.

USB Adapter (CSA, Class I, Div. 1 and Div. 2)

The NuFlo USB Adapter (Figure A.16, page A-12) allows a user to connect a computer to the Scanner 2100 using a standard off-the-shelf USB connector cable for quick and easy downloads without opening the Scanner enclosure.

The USB adapter is comprised of a USB adapter socket, a blanking plug, and a union nut (Figure A.16, page A-12). A CD containing the software for installing the driver is included with the adapter.

When the USB connection is ordered with a Scanner 2100, the USB adapter is pre-installed at the factory. No field wiring is required. If the USB adapter is purchased as a kit, see USB Adapter Kit Installation, page A-12, for installation instructions.

Important **Do not connect the USB adapter to a computer until a USB driver is installed using the CD provided. ModWorX Pro cannot connect to a Scanner 2100 without these files. See Using the Adapter below.**

Disconnecting the USB Adapter

When the USB port is not in use, nest the blanking plug inside the union nut and screw the union nut onto the adapter to cover the USB socket (Figure A.16, page A-12). Hand-tighten to ensure a snug connection.

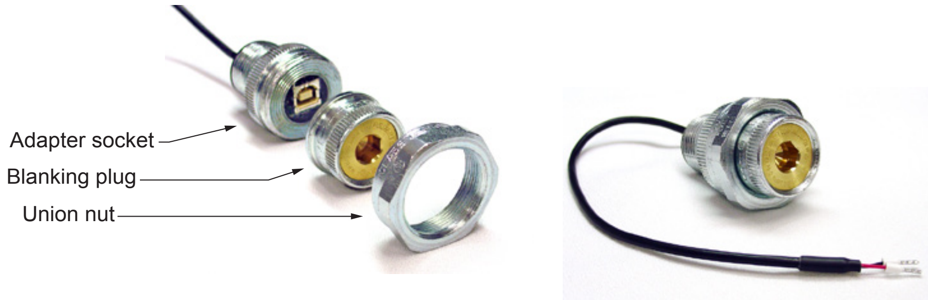


Figure A.16—NuFlo USB adapter and components

Using the Adapter

The CD supplied with the NuFlo USB Adapter contains the drivers required to enable USB communications for a Scanner 2100 when the NuFlo USB Adapter is installed.

For step-by-step installation instructions, insert the CD in your computer and follow the instructions in the NuFlo USB Adapter_Readme file. The software will install the driver compatible with your computer's operating system.

To complete installation and connect to a Scanner 2100, a user-supplied universal serial bus USB A/B cable is required (Figure A.17).

Figure A.17—User-supplied USB A/B cable

When the software is fully installed, the adapter can be connected to the computer and used to connect to the Scanner 2100 via ModWorX Pro (Tools/Select COM Port). For more information on ModWorX Pro, see the ModWorX Pro User Manual.

WARNING: When a hazardous area is present, ensure the union nut and blanking plug are properly fitted in the conduit opening. The explosion-proof rating applies only when the union nut and blanking plug are secured in place. When the union is broken, the device is no longer explosion-proof. Before disassembling the union nut and blanking plug, make sure the area is non-hazardous.

USB Adapter Kit Installation

The USB adapter is comprised of a USB adapter socket, a blanking plug, and a union nut. The blanking plug and union nut are connected to the adapter only when the USB port is not in use.

If the NuFlo USB adapter is purchased as a kit, install it in the Scanner 2100 according to the steps below:

1. Remove the plug from a conduit opening in the Scanner 2100 enclosure.
2. Thread the cable of the adapter through the conduit opening and screw the adapter into place.
3. Wire the adapter cable to either communications port on the Scanner 2100 main circuit board as shown in Figure A.18, page A-13 (black wire to negative terminal).
4. If the USB port will not be used immediately, nest the blanking plug inside the union nut and screw the union nut onto the adapter to cover the USB socket. Hand-tighten to ensure a snug connection.

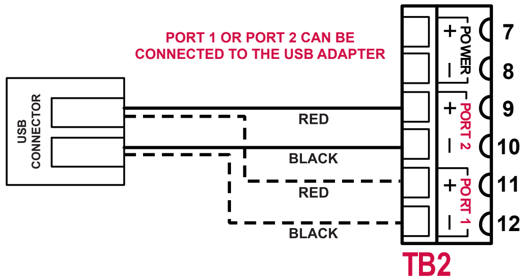


Figure A.18—Wiring of NuFlo USB adapter (required only when purchased as a kit)

Important **If a wireless radio module is installed, use Port 1 for wiring the NuFlo USB adapter. Port 2 supports wireless communications only in wireless devices.**

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Appendix B—Lithium Battery Information

Transportation Information

WARNING: The Scanner 2100 contains lithium batteries. The internal component (thionyl chloride) is hazardous under the criteria of the Federal OHSA Hazard Communication Standard 29 CFR 1920.1200. Before shipping a lithium battery or equipment containing a lithium battery, verify that the packaging and labeling conforms with the latest version of all applicable regulations.

The transport of the lithium batteries is regulated by the United Nations, "Model Regulations on Transport of Dangerous Goods," (special provisions 188, 230, and 310), latest revision.

Within the US the lithium batteries and cells are subject to shipping requirements under Part 49 of the Code of Federal Regulations (49 CFR, Parts 171, 172, 173, and 175) of the US Hazardous Materials Regulations (HMR), latest revision.

Shipping of lithium batteries in aircraft is regulated by the International Civil Aviation Organization (ICAO) and the International Air Transport Association (IATA) requirements in Special Provisions A45, A88 and A99, latest revision.

Shipping of lithium batteries on sea is regulated the International Maritime Dangerous Goods (IMDG) requirements in special provisions 188, 230 and 310, latest revision.

Shipping of lithium batteries on road and rail is regulated by requirements in special provisions 188, 230 and 310, latest revision.

Lithium Battery Disposal

Once a lithium battery is removed from a device and/or is destined for disposal, it is classified as solid waste under EPA guidelines. Depleted lithium batteries are also considered to be hazardous waste because they meet the definition of Reactivity, as per 40 CFR 261.23(a)(2), (3) and (5). This document describes how the lithium reacts violently with water, forms potentially explosive mixtures with water, and when exposed to certain pH conditions, generates toxic cyanide or sulfide gases.

Federal law requires that depleted lithium battery packs be sent to a fully permitted Treatment, Storage and Disposal Facility (TSDF) or to a permitted recycling/reclamation facility.

WARNING: EXPLOSION/FIRE RISK. Never handle or store the lithium battery in an environment that will exceed 100º C (212º F). Consult the MSDS for complete handling instructions.

Important **Do not ship lithium battery packs to Cameron's Measurement Systems Division. Cameron facilities are not permitted recycling/ reclamation facilities.**

CAUTION **Profiling and waste characterization procedures must be followed prior to shipping a lithium battery to a disposal site. It is the shipper's responsibility to comply with all applicable federal transportation regulations (see below).**

Battery Safety Datasheet

For a link to the current MSDS for the lithium batteries used to power the Scanner 2100, see the Measurement Systems Division section of the Cameron website: products.slb.com/flowcomputers, **select Scanner 2000 Series Wired and Wireless**, and click on the appropriate link.

Appendix C—Modbus Communications Protocol

Firmware Version for Scanner 2100 Wireless: S2100W_EFM_435

Firmware Version for Scanner 2100 Wired: S2100_EFM_435

Register Table Version: 16

Note Scanner 2100 wireless devices and Scanner 2100 wired devices each have unique firmware, but most registers are common to both devices. This appendix presents a combined register set shared by these firmware versions. Registers that are specific to the wireless product are clearly marked. All unmarked registers are supported by both firmware versions where applicable.

Introduction

The communications protocol for the Scanner 2100 is in accordance with Modicon, Inc. RTU Mode Modbus as described in *Modicon Modbus Protocol Reference Guide*, PI-MBUS-300 Rev. J, June 1996. All registers are implemented as 4X or holding registers. Reading of registers is implemented via function code 03H (Read Holding Registers). Writing to registers is implemented via function code 10H (Preset Multiple Registers). The instrument provides Enron Modbus compliant downloads for interval, daily and event records. For details on Enron Modbus, refer to *Specifications and Requirements for an Electronic Flow Measurement Remote Terminal Unit for Enron Corp*., Dec. 5, 1994.

Supported Commands

The Modbus functions supported by the Scanner 2100 are as follows:

Function Code (Hex)	Description
03	Read Holding Registers
05	Preset Boolean (for Enron event record acknowledgement)
10	Preset Multiple Registers
11	Report Slave ID

For the read holding and preset multiple registers, the instrument supports the full 250 bytes of data in a message. This corresponds to 125 registers in 16-bit holding register size and 62 registers in 32-bit holding register size.

The report slave ID function code returns the following registers:

- Product Code
- Register Table Number
- Firmware Version
- Manufacture Date
- Sales Date
- Serial Number 1
- Serial Number 2
- Connected Port
  - 0 = connected to Port 1
  - 1 = connected to Port 2
- Power Mode
- Port Mode
- Port Slave Address
- Port Baud Rate
- Port Bus Delay
- Port Bus Timeout
- Real Date
- Real Time

Data Types

Various data types are implemented in the Scanner 2100. The following table lists the formats and the numbers of bytes and registers associated with each type.

Data Type	Byte Count	Register Count
Floating Point (FP)	4	2
Floating Point (FP32)	4	1
Unsigned Word (U16)	2	1
Unsigned Long (U32)	4	2
Packed ASCII (PA)	2	1

The word ordering for multiple register data types, such as floating-point numbers or long integers, is for the most significant word to appear first in the message.

The Unsigned Word (U16) type is used for 16-bit integers and fits into one register.

The Packed ASCII (PA) type contains two bytes that are two unsigned characters. Generally, multiple Packed ASCII types are arranged consecutively for implementing strings. For example, the Device Name is a string of 20 unsigned characters that is implemented as 10 Packed ASCII registers. Here is an example of a device name that contains the string, "Test Well 413."

Register	Hexadecimal #	ASCII Characters
240	54 65	Te
241	73 74	st
242	20 57	<SPACE>W
243	65 6C	el
244	6C 20	l<SPACE>
245	34 31	41
246	33 FF	3<UNUSED>
247	FF FF	<UNUSED><UNUSED>
248	FF FF	<UNUSED><UNUSED>
249	FF FF	<UNUSED><UNUSED>

Unused characters at the end of each string will report 0xFF hexadecimal.

Security

To communicate with a Scanner 2100 without the use of ModWorX Pro software (i.e. via a third-party polling device), security permissions for the applicable Scanner 2100 communications port must be set to the default (unrestricted) state. If a different security level is required, contact Cameron technical support for details. Security levels can be restored to default permissions with ModWorX Pro software.

Registers

Each register has an Access type: read-only or read-write, as described below.

Access Type	Description
Read Only (RO)	Register can only be read
Read/Write (RW)	Register can be read and written

The registers are grouped into Modbus map blocks according to function. The Scanner 2100 contains the following map functions.

Map	Starting Register	Firmware Supported
Control Registers	70	All
System Configuration	1000	All
Communications Configuration	1100	All
Real Time	1200	All
Power Configuration	1300	All
Archive Configuration	1400	All
Turbine 1 Configuration	2000	All
Turbine 1 Calibration	2030	All
Turbine 2 Configuration	2100	Wired 2100 Only
Turbine 2 Calibration	2130	Wired 2100 Only
Static Pressure Configuration	2200	All
Static Pressure Calibration	2230	All
RTD Configuration	2300	All
RTD Calibration	2330	All
Differential Pressure Configuration	2400	All
Differential Pressure Calibration	2430	All
Analog Input 1 Configuration	2500	Wired 2100 Only
Analog Input 1 Calibration	2530	Wired 2100 Only
Analog Input 2 Configuration	2600	Wired 2100 Only
Analog Input 2 Calibration	2630	Wired 2100 Only
Digital Input Configuration	2900	All
Flow Run 1 Configuration	3000	All
Flow Run 1 Calibration	3200	All
Flow Run Alarms	3600	All
Output Configuration	4000	All
Holding Registers (32-bit)	7000	All
Archive Preview Registers (32-bit)	7400	All
Holding Registers	8000	All
Archive Preview Registers	8800	All
User-Defined Register Pointers	9000	All
User-Defined Holding Registers	9100	All
Device Status Registers	9900	All

Note All registers cited in this document refer to the address of the register that appears in the actual Modbus message. For example, register 8000 has an address of 0x1F40 hexadecimal in the message.

Control Registers

Register (Decimal)	Register (Hex)	Description	Data Type	Access
70	46	Control Register 1	U16	RW

The Control Registers allow specific functions to be implemented via the communications port. The following table shows the value to be written to the control register to implement the desired function.

Code	Function
20000	Transfers the polling totals and averages and polling run times to the previous polling totals, averages and previous run-time registers, increments the polling index register, and resets the polling totals, averages and polling run-time registers.
30000	Clears all flow totals
30001	Clears Flow Run 1 totals
30003	Clears Turbine 1 totals
30004	Clear Turbine 2 totals
30050	Clears all pulse output latches
30051	Clears a Pulse Output 1 latch
30061	Adds pulses specified in Control Register 2 to Pulse Output 1 Accumulator
30100	Clear all Alarm States
30101	Clear Flow Run Alarm Status
30102	Clear Input Alarm Status
40000	Loads factory defaults
40040	Resets the microcontroller (watchdog)
50050	Creates a partial archive record (daily and interval)

System Configuration

Register (Decimal)	Register (Hex)	Description	Data Type	Access
1000	3E8	Product Code and Feature Privileges	U16	RO
1001	3E9	Register Table Version	U16	RO
1002	3EA	Firmware Version	U16	RO
1003	3EB	Manufacture Date	U16	RO
1004	3EC	Sales Date	U16	RO
1005	3ED	Serial Number High	U16	RO
1006	3EE	Serial Number Low	U16	RO
1007	3EF	Sensor Serial Number[0]	PA	RO
1008	3F0	Sensor Serial Number[1]	PA	RO
1009	3F1	Sensor Serial Number[2]	PA	RO
1010	3F2	Sensor Serial Number[3]	PA	RO
1011	3F3	Sensor Serial Number[4]	PA	RO
1012	3F4	Sensor Serial Number[5]	PA	RO
1013	3F5	Expansion Board Manufacture Date	U16	RO
1014	3F6	Expansion Board Sales Date	U16	RO
1015	3F7	Expansion Serial Number High	U16	RO
1016	3F8	Expansion Serial Number Low	U16	RO
1017	3F9	Expansion Board Configuration	U16	RO

Product Code

The Product Code is a read-only parameter used for identifying a Scanner 2100 device and its enabled advanced features (such as PID controller and Modbus Master) using the ModWorX Pro software. This parameter is defined at the factory.

Firmware Version/Register Table Version

The Firmware Version and Register Table Version numbers are set by the factory and are read-only. To determine the version number, read the appropriate register and divide the value by 100. The general format for version numbers is A.BC. For example the firmware register number is read as 0xA7 hexadecimal. This represents the value 167 and a firmware version of 1.67.

Manufacture Date/Sales Date

These parameters are set at the factory and are read-only. These registers are formatted as MMYY. For example, a value of 0912 represents the date September 2012.

Communications Configuration (Wired Scanner 2100)

Register (Decimal)	Register (Hex)	Description		Data Type	Access	Default
1100	44C	Port 1 - Port Usage 0 - Slave 1 - Master		U16	RW	0
1101	44D	Port 1 Slave Address [1 to 65535, excluding 252 to 255 and 64764]		U16	RW	1
1102	44E	Port 1 - Baud Rate 0 - 300 1 - 600 2 - 1200 3 - 2400 4 - 4800	 5 - 9600 6 - 19200 7 - 38400 8 - 57600 9 - 115200	U16	RW	5
1103	44F	Port 1 - Bus Delay mS of delay before transmitting data		U16	RW	10
1104	450	Port 1 - Bus Timeout mS of delay before resetting communications		U16	RW	50
1105	451	Port 2 - Port Usage 0 - Slave 1 - Master		U16	RW	0
1106	452	Port 2 Slave Address [1 to 65535, excluding 252 to 255 and 64764]		U16	RW	1
1107	453	Port 2 - Baud Rate 0 - 300 1 - 600 2 - 1200 3 - 2400 4 - 4800	 5 - 9600 6 - 19200 7 - 38400 8 - 57600 9 - 115200	U16	RW	5
1108	454	Port 2 - Bus Delay mS of delay before transmitting data		U16	RW	10
1109	455	Port 2 - Bus Timeout mS of delay before resetting communications		U16	RW	50

Communications Configuration (Wireless Scanner 2100)

Register (Decimal)	Register (Hex)	Description	Data Type	Access	Default
1100	44C	Port 1 - Port Usage 0 - Slave 1 - Master	U16	RW	0
1101	44D	Port 1 Slave Address [1 to 65535, excluding 252 to 255 and 64764]	U16	RW	1
1102	44E	Port 1 - Baud Rate 0 - 300 5 - 9600 1 - 600 6 - 19200 2 - 1200 7 - 38400 3 - 2400 8 - 57600 4 - 4800 9 - 115200	U16	RW	5
1103	44F	Port 1 - Bus Delay mS of delay before transmitting data	U16	RW	10
1104	450	Port 1 - Bus Timeout mS of delay before resetting communications	U16	RW	50
1105	451	Port 2 - Port Usage 0 - Slave Only	U16	RW	0
1106	452	Port 2 Network ID [1 to 65535]	U16	RW	1
1107	453	Port 2 - Slave ID [1 to 65535]	U16	RW	1
1108	454	Port 2 - Bus Delay mS of delay before transmitting data	U16	RW	10
1109	455	Port 2 - Bus Timeout mS of delay before resetting communications	U16	RW	50

Real Time

This block of registers is used to set the instrument's internal clock. To set the time, it is recommended that all registers be written in one message. The time and date can also be read in the holding register groups as floating-point data.

Register (Decimal)	Register (Hex)	Description	Data Type	Access
1200	4B0	Year (Real Year = register value plus 2100)	U16	RW
1201	4B1	Month [1-12]	U16	RW
1202	4B2	Day [1-31]	U16	RW
1203	4B3	Hour [0-23]	U16	RW
1204	4B4	Minute [0-59]	U16	RW
1205	4B5	Second [0-59]	U16	RW

Power Configuration

Register (Decimal)	Register (Hex)	Description	Data Type	Access	Default
1300	514	Power Mode 0 - High Power 1 - Low Power	U16	RW	1
1301	515	Clock Override	U16	RW	0
1302	516	Internal System Sample Period [number of seconds between battery voltage and electronics temperature measurements]	U16	RW	3600
1303	517	External Sensor Power Control Sensor Warmup Time [0 – 2048 sec] Add 32768 to lock sensor power on.	U16	RW	32770

Archive Configuration

Register (Decimal)	Register (Hex)	Description	Data Type	Access	Default
1400	578	Archive Reference Number	U16	RO	10000
1401	579	Contract Hour [0-23]	U16	RW	8 (AM)
1402	57A	Interval Period [5 seconds to 12 hours]	U16	RW	3600 seconds (1 hour)
1403	57B	Partial Records 0 - Not Enabled 1 – Enabled	U16	RW	0
1404	57C	Number of Daily Records	U16	RO	768
1405	57D	Number of Interval Records	U16	RO	2304 (Std) 6392 (Exp. Board; WIRED ONLY)
1406	57E	Number of Events Records	U16	RO	1152
1407	57F	Number of Parameters	U16	RW	11
1408	580	Archive Field 1	U16	RO	Date
1409	581	Archive Field 2	U16	RO	Time
1410	582	Archive Field 3	U16	RW	FR1 Volume
1411	583	Archive Field 4	U16	RW	FR1 Mass
1412	584	Archive Field 5	U16	RW	FR1 Energy
1413	585	Archive Field 6	U16	RW	Differential Pressure
1414	586	Archive Field 7	U16	RW	Static Pressure
1415	587	Archive Field 8	U16	RW	Process Temp
1416	588	Archive Field 9	U16	RW	FR1 Run Time
1417	589	Archive Field 10	U16	RW	T1 Volume
1418	58A	Archive Field 11	U16	RW	T1 Run Time
1419	58B	Archive Field 12	U16	RW	Unused
1420	58C	Archive Field 13	U16	RW	Unused
1421	58D	Archive Field 14	U16	RW	Unused
1422	58E	Archive Field 15	U16	RW	Unused
1423	58F	Archive Field 16	U16	RW	Unused

Turbine 1 Configuration

Register (Decimal)	Register (Hex)	Description	Data Type	Access	Default
2000	7D0	T1 - Units See Units of Measurement, page C-49	U16	RW	102 – BBL
2001	7D1	T1 - Time Base 0 = Second 1 = Minute 2 = Hour 3 = Day	U16	RW	3
2002	7D2	T1 - Sampling Period (sec)	U16	RW	5
2003	7D3	T1 - Dampening Factor	U16	RW	0
2004	7D4	T1 - Input Configuration 0 - TFM Low (20 mV @ <1000 Hz) 1 - TFM Med (50 mV @ <1000 Hz) 2 - TFM High (100 mV @ <1000 Hz) 3 - TFM Max (200 mV @ <1000 Hz) 4 - Pulse Input (with expansion board; WIRED ONLY)	U16	RW	1
2005	7D5	T1 - Override Enable 0 - Disabled 1 - Enabled	U16	RW	0
2006	7D6	T1 - Override Value	FP	RW	0.00
2008	7D8	T1 - Fail Value	FP	RW	0.00
2010	7DA	T1 - Low Frequency Cutoff	FP	RW	5.00
2012	7DC	T1 - Low Flow Cutoff	FP	RW	0.00
2014	7DE	T1 - Sensor Range Low	FP	RW	0.00
2016	7E0	T1 - Sensor Range High	FP	RW	0.833333333
2018	7E2	T1 - Units Scale Factor	FP	RW	0.023809524
2020	7E4	T1 - Units Offset Factor	FP	RW	0
2022	7E6	T1 - Unit Description 1	LCD	RW	—
2023	7E7	T1 - Unit Description 2	LCD	RW	—
2024	7E8	T1 - Unit Description 3	LCD	RW	—

Turbine 1 Calibration

Register (Decimal)	Register (Hex)	Description	Data Type	Access	Default
2030	7EE	T1 - Calibration Type[1]	U16	RW	1
2031	7EF	T1 - Linear Factor	FP	RW	900.00
2033	7F1	T1 - Calibration Absolute Offset	FP	RW	0.00
2035	7F3	T1 - Factor 1	FP	RW	900.00
2037	7F5	T1 - Factor 2	FP	RW	1.00
2039	7F7	T1 - Factor 3	FP	RW	1.00
2041	7F9	T1 - Factor 4	FP	RW	1.00
2043	7FB	T1 - Factor 5	FP	RW	1.00
2045	7FD	T1 - Factor 6	FP	RW	1.00
2047	7FF	T1 - Factor 7	FP	RW	1.00
2049	801	T1 - Factor 8	FP	RW	1.00
2051	803	T1 - Factor 9	FP	RW	1.00

Register (Decimal)	Register (Hex)	Description	Data Type	Access	Default
2053	805	T1 - Factor 10[2]	FP	RW	1.00
2055	807	T1 - Factor 11[2]	FP	RW	1.00
2057	809	T1 - Factor 12[2]	FP	RW	1.00
2059	80B	T1 - Frequency 1	FP	RW	1.00
2061	80D	T1 - Frequency 2	FP	RW	1.00
2063	80F	T1 - Frequency 3	FP	RW	1.00
2065	811	T1 - Frequency 4	FP	RW	1.00
2067	813	T1 - Frequency 5	FP	RW	1.00
2069	815	T1 - Frequency 6	FP	RW	1.00
2071	817	T1 - Frequency 7	FP	RW	1.00
2073	819	T1 - Frequency 8	FP	RW	1.00
2075	81B	T1 - Frequency 9	FP	RW	1.00
2077	81D	T1 - Frequency 10[2]	FP	RW	1.00
2079	81F	T1 - Frequency 11[2]	FP	RW	1.00
2081	821	T1 - Frequency 12[2]	FP	RW	1.00

[1] The Calibration Type register must be configured using ModWorX Pro. This register defines the type and number of calibration points used. If altered manually, calibration points must be entered in ascending order.

[2] When the Scanner 2100 is connected to a Scanner 3100, calibration points 10 through 12 will not be transmitted to the Scanner 3100.

Turbine 2 Configuration (Wired Scanner 2100)

Register (Decimal)	Register (Hex)	Description	Data Type	Access	Default
2100	834	T2 - Units See Units of Measurement, page C-49	U16	RW	102 – BBL
2101	835	T2 - Time Base	U16	RW	3 – Day
2102	836	T2 - Sampling Period (sec)	U16	RW	5
2103	837	T2 - Dampening Factor	U16	RW	0
2104	838	T2 - Input Configuration 0 - TFM Low (20 mV @ <1000 Hz) 1 - TFM Med (50 mV @ <1000 Hz) 2 - TFM High (100 mV @ <1000 Hz) 3 - TFM Max (200 mV @ <1000 Hz)	U16	RW	1
2105	839	T2 - Override Enable 0 - Disabled 1 - Enabled	U16	RW	0
2106	83A	T2 - Override Value	FP	RW	0.00
2108	83C	T2 - Fail Value	FP	RW	0.00
2110	83E	T2 - Low Frequency Cutoff	FP	RW	5.00
2112	840	T2 - Low Flow Cutoff	FP	RW	0.00
2114	842	T2 - Sensor Range Low	FP	RW	0.00
2116	844	T2 - Sensor Range High	FP	RW	0.83333333
2118	846	T2 - Units Scale Factor	FP	RW	0.02380952
2120	848	T2 - Units Offset Factor	FP	RW	0.00
2122	84A	T2 - Unit Description 1	LCD	RW	—

Register (Decimal)	Register (Hex)	Description	Data Type	Access	Default
2123	84B	T2 - Unit Description 2	LCD	RW	—
2124	84C	T2 - Unit Description 3	LCD	RW	—

Turbine 2 Calibration (Wired Scanner 2100)

Register (Decimal)	Register (Hex)	Description	Data Type	Access	Default
2130	852	T2 - Calibration Type[1]	U16	RW	1
2131	853	T2 - Linear Factor	FP	RW	900.00
2133	855	T2 - Calibration Absolute Offset	FP	RW	0.00
2135	857	T2 - Factor 1	FP	RW	900.00
2137	859	T2 - Factor 2	FP	RW	1.00
2139	85B	T2 - Factor 3	FP	RW	1.00
2141	85D	T2 - Factor 4	FP	RW	1.00
2143	85F	T2 - Factor 5	FP	RW	1.00
2145	861	T2 - Factor 6	FP	RW	1.00
2147	863	T2 - Factor 7	FP	RW	1.00
2149	865	T2 - Factor 8	FP	RW	1.00
2151	867	T2 - Factor 9	FP	RW	1.00
2153	869	T2 - Factor 10[2]	FP	RW	1.00
2155	86B	T2 - Factor 11[2]	FP	RW	1.00
2157	86D	T2 - Factor 12[2]	FP	RW	1.00
2159	86F	T2 - Frequency 1	FP	RW	1.00
2161	871	T2 - Frequency 2	FP	RW	1.00
2163	873	T2 - Frequency 3	FP	RW	1.00
2165	875	T2 - Frequency 4	FP	RW	1.00
2167	877	T2 - Frequency 5	FP	RW	1.00
2169	879	T2 - Frequency 6	FP	RW	1.00
2171	87B	T2 - Frequency 7	FP	RW	1.00
2173	87D	T2 - Frequency 8	FP	RW	1.00
2175	87F	T2 - Frequency 9	FP	RW	1.00
2177	881	T2 - Frequency 10[2]	FP	RW	1.00
2179	883	T2 - Frequency 11[2]	FP	RW	1.00
2181	885	T2 - Frequency 12[2]	FP	RW	1.00

[1] The Calibration Type register must be configured using ModWorX Pro. This register defines the type and number of calibration points used. If altered manually, calibration points must be entered in ascending order.

[2] When the Scanner 2100 is connected to a Scanner 3100, calibration points 10 through 12 will not be transmitted to the Scanner 3100.

Static Pressure Configuration

Register (Decimal)	Register (Hex)	Description	Data Type	Access	Default
2200	898	SP - Units See Units of Measurement, page C-49	U16	RW	301
2201	899	SP - Time Base	U16	RW	0

Register (Decimal)	Register (Hex)	Description	Data Type	Access	Default
2202	89A	SP - Sampling Period	U16	RW	1
2203	89B	SP - Dampening Factor	U16	RW	0
2204	89C	SP - Input Configuration	U16	RW	1
2205	89D	SP - Override Enable 0 - Disabled 1 - Enabled 2 - Flow Dependent Averaging	U16	RW	2
2206	89E	SP - Override Value	FP	RW	0.00
2208	8A0	SP - Fail Value	FP	RW	0.00
2210	8A2	SP - Low Input Cutoff	FP	RW	0.00
2212	8A4	SP - Low Flow Cutoff	FP	RW	0.00
2214	8A6	SP - Sensor Range Low	FP	RO	from MVT
2216	8A8	SP - Sensor Range High	FP	RO	from MVT
2218	8AA	SP - Units Scale Factor	FP	RW	1.00
2220	8AC	SP - Units Offset Factor	FP	RW	0.00
2222	8AE	SP - Unit Description 1	LCD	RW	
2223	8AF	SP - Unit Description 2	LCD	RW	
2224	8B0	SP - Unit Description 3	LCD	RW	

Static Pressure Calibration

Register (Decimal)	Register (Hex)	Description	Data Type	Access	Default
2230	8B6	SP - Calibration Type[1]	U16	RW	0
2231	8B7	SP - Nominal Value	FP	RW	1.00
2233	8B9	SP - Calibration Absolute Offset	FP	RW	0.00
2235	8BB	SP - Calibration Actual 1	FP	RW	0.00
2237	8BD	SP - Calibration Actual 2	FP	RW	0.00
2239	8BF	SP - Calibration Actual 3	FP	RW	0.00
2241	8C1	SP - Calibration Actual 4	FP	RW	0.00
2243	8C3	SP - Calibration Actual 5	FP	RW	0.00
2245	8C5	SP - Calibration Actual 6	FP	RW	0.00
2247	8C7	SP - Calibration Actual 7	FP	RW	0.00
2249	8C9	SP - Calibration Actual 8	FP	RW	0.00
2251	8CB	SP - Calibration Actual 9	FP	RW	0.00
2253	8CD	SP - Calibration Actual 10[2]	FP	RW	0.00
2255	8CF	SP - Calibration Actual 11[2]	FP	RW	0.00
2257	8D1	SP - Calibration Actual 12[2]	FP	RW	0.00
2259	8D3	SP - Calibration Measured 1	FP	RW	0.00
2261	8D5	SP - Calibration Measured 2	FP	RW	0.00
2263	8D7	SP - Calibration Measured 3	FP	RW	0.00
2265	8D9	SP - Calibration Measured 4	FP	RW	0.00
2267	8DB	SP - Calibration Measured 5	FP	RW	0.00
2269	8DD	SP - Calibration Measured 6	FP	RW	0.00
2271	8DF	SP - Calibration Measured 7	FP	RW	0.00

Register (Decimal)	Register (Hex)	Description	Data Type	Access	Default
2273	8E1	SP - Calibration Measured 8	FP	RW	0.00
2275	8E3	SP - Calibration Measured 9	FP	RW	0.00
2277	8E5	SP - Calibration Measured 10[2]	FP	RW	0.00
2279	8E7	SP - Calibration Measured 11[2]	FP	RW	0.00
2281	8E9	SP - Calibration Measured 12[2]	FP	RW	0.00

[1] The Calibration Type register must be configured using ModWorX Pro. This register defines the type and number of calibration points used. If altered manually, calibration points must be entered in ascending order.

[2] When the Scanner 2100 is connected to a Scanner 3100, calibration points 10 through 12 will not be transmitted to the Scanner 3100.

RTD Configuration

Register (Decimal)	Register (Hex)	Description	Data Type	Access	Default
2300	8FC	PT - Units See Units of Measurement, page C-49	U16	RW	501
2301	8FD	PT - Time Base 0 = Second 1 = Minute 2 = Hour 3 = Day	U16	RW	0
2302	8FE	PT - Sampling Period (sec)	U16	RW	5
2303	8FF	PT - Dampening Factor	U16	RW	0
2304	900	PT - Input Configuration	U16	RW	0
2305	901	PT - Override Enable 0 - Disabled 1 - Enabled 2 - Flow Dependent Averaging	U16	RW	2
2306	902	PT - Override Value	FP	RW	0.00
2308	904	PT - Fail Value	FP	RW	60.00 degF
2310	906	PT - Low Input Cutoff	FP	RW	-100.00 degF
2312	908	PT - Low Flow Cutoff	FP	RW	-100.00
2314	90A	PT - Sensor Range Low	FP	RO	-40.00 degF
2316	90C	PT - Sensor Range High	FP	RO	300.00 degF
2318	90E	PT - Units Scale Factor	FP	RW	1.80
2320	910	PT - Units Offset Factor	FP	RW	32.00
2322	912	PT - Unit Description 1	LCD	RW	—
2323	913	PT - Unit Description 2	LCD	RW	—
2324	914	PT - Unit Description 3	LCD	RW	—

RTD Calibration

Register (Decimal)	Register (Hex)	Description	Data Type	Access	Default
2330	91A	PT - Calibration Type[1]	U16	RW	0
2331	91B	PT - Nominal Value	FP	RW	1.00
2333	91D	PT - Calibration Absolute Offset	FP	RW	0.00

Register (Decimal)	Register (Hex)	Description	Data Type	Access	Default
2335	91F	PT - Calibration Actual 1	FP	RW	0.00
2337	921	PT - Calibration Actual 2	FP	RW	0.00
2339	923	PT - Calibration Actual 3	FP	RW	0.00
2341	925	PT - Calibration Actual 4	FP	RW	0.00
2343	927	PT - Calibration Actual 5	FP	RW	0.00
2345	929	PT - Calibration Actual 6	FP	RW	0.00
2347	92B	PT - Calibration Actual 7	FP	RW	0.00
2349	92D	PT - Calibration Actual 8	FP	RW	0.00
2351	92F	PT - Calibration Actual 9	FP	RW	0.00
2353	931	PT - Calibration Actual 10[2]	FP	RW	0.00
2355	933	PT - Calibration Actual 11[2]	FP	RW	0.00
2357	935	PT - Calibration Actual 12[2]	FP	RW	0.00
2359	937	PT - Calibration Measured 1	FP	RW	0.00
2361	939	PT - Calibration Measured 2	FP	RW	0.00
2363	93B	PT - Calibration Measured 3	FP	RW	0.00
2365	93D	PT - Calibration Measured 4	FP	RW	0.00
2367	93F	PT - Calibration Measured 5	FP	RW	0.00
2369	941	PT - Calibration Measured 6	FP	RW	0.00
2371	943	PT - Calibration Measured 7	FP	RW	0.00
2373	945	PT - Calibration Measured 8	FP	RW	0.00
2375	947	PT - Calibration Measured 9	FP	RW	0.00
2377	949	PT - Calibration Measured 10[2]	FP	RW	0.00
2379	94B	PT - Calibration Measured 11[2]	FP	RW	0.00
2381	94D	PT - Calibration Measured 12[2]	FP	RW	0.00

[1] The Calibration Type register must be configured using ModWorX Pro. This register defines the type and number of calibration points used. If altered manually, calibration points must be entered in ascending order.
[2] When the Scanner 2100 is connected to a Scanner 3100, calibration points 10 through 12 will not be transmitted to the Scanner 3100.

Differential Pressure Configuration

Register (Decimal)	Register (Hex)	Description	Data Type	Access	Default
2400	960	DP - Units See Units of Measurement, page C-49	U16	RW	401
2401	961	DP - Time Base 0 = Second 1 = Minute 2 = Hour 3 = Day	U16	RW	0
2402	962	DP - Sampling Period (seconds)	U16	RW	1
2403	963	DP - Dampening Factor	U16	RW	0
2404	964	DP - Input Configuration	U16	RW	0
2405	965	DP - Override Enable 0 - Disabled 1 - Enabled 2 - Flow Dependent Averaging	U16	RW	2

Register (Decimal)	Register (Hex)	Description	Data Type	Access	Default
2406	966	DP - Override Value	FP	RW	0.00
2408	968	DP - Fail Value	FP	RW	0.00
2410	96A	DP - Low Input Cutoff	FP	RW	0.00
2412	96C	DP - Low Flow Cutoff	FP	RW	0.00
2414	96E	DP - Sensor Range Low	FP	RO	from MVT
2416	970	DP - Sensor Range High	FP	RO	from MVT
2418	972	DP - Units Scale Factor	FP	RW	1.00
2420	974	DP - Units Offset Factor	FP	RW	0.00
2422	976	DP - Unit Description 1	LCD	RW	—
2423	977	DP - Unit Description 2	LCD	RW	—
2424	978	DP - Unit Description 3	LCD	RW	—

Differential Pressure Calibration

Register (Decimal)	Register (Hex)	Description	Data Type	Access	Default
2430	97E	DP - Calibration Type[1]	U16	RW	0
2431	97F	DP - Nominal Value	FP	RW	1.00
2433	981	DP - Calibration Absolute Offset	FP	RW	0.00
2435	983	DP - Calibration Actual 1	FP	RW	0.00
2437	985	DP - Calibration Actual 2	FP	RW	0.00
2439	987	DP - Calibration Actual 3	FP	RW	0.00
2441	989	DP - Calibration Actual 4	FP	RW	0.00
2443	98B	DP - Calibration Actual 5	FP	RW	0.00
2445	98D	DP - Calibration Actual 6	FP	RW	0.00
2447	98F	DP - Calibration Actual 7	FP	RW	0.00
2449	991	DP - Calibration Actual 8	FP	RW	0.00
2451	993	DP - Calibration Actual 9	FP	RW	0.00
2453	995	DP - Calibration Actual 10[2]	FP	RW	0.00
2455	997	DP - Calibration Actual 11[2]	FP	RW	0.00
2457	999	DP - Calibration Actual 12[2]	FP	RW	0.00
2459	99B	DP - Calibration Measured 1	FP	RW	0.00
2461	99D	DP - Calibration Measured 2	FP	RW	0.00
2463	99F	DP - Calibration Measured 3	FP	RW	0.00
2465	9A1	DP - Calibration Measured 4	FP	RW	0.00
2467	9A3	DP - Calibration Measured 5	FP	RW	0.00
2469	9A5	DP - Calibration Measured 6	FP	RW	0.00
2471	9A7	DP - Calibration Measured 7	FP	RW	0.00
2473	9A9	DP - Calibration Measured 8	FP	RW	0.00
2475	9AB	DP - Calibration Measured 9	FP	RW	0.00
2477	9AD	DP - Calibration Measured 10[2]	FP	RW	0.00
2479	9AF	DP - Calibration Measured 11[2]	FP	RW	0.00
2481	9B1	DP - Calibration Measured 12[2]	FP	RW	0.00

[1] The Calibration Type register must be configured using ModWorX Pro. This register defines the type and number of calibration points used. If altered manually, calibration points must be entered in ascending order.

[2] When the Scanner 2100 is connected to a Scanner 3100, calibration points 10 through 12 will not be transmitted to the Scanner 3100.

Analog Input 1 Configuration (Wired Scanner 2100)

Register (Decimal)	Register (Hex)	Description	Data Type	Access	Default
2500	9C4	A1 - Units	U16	RW	0
2501	9C5	A1 - Time Base	U16	RW	0
2502	9C6	A1 - Sampling Period	U16	RW	1
2503	9C7	A1 - Dampening Factor	U16	RW	0
2504	9C8	A1 - Input Configuration	U16	RW	0
2505	9C9	A1 - Override Enable	U16	RW	0
2506	9CA	A1 - Override Value	FP	RW	0.00
2508	9CC	A1 - Fail Value	FP	RW	0.00
2510	9CE	A1 - Low Input Cutoff	FP	RW	2.00
2512	9D0	A1 - Low Flow Cutoff	FP	RW	0.00
2514	9D2	A1 - Sensor Range Low	FP	RO	0.00
2516	9D4	A1 - Sensor Range High	FP	RO	0
2518	9D6	A1 - Units Scale Factor	FP	RW	1
2520	9D8	A1 - Units Offset Factor	FP	RW	0
2522	9DA	A1 - Unit Description 1	LCD	RW	—
2523	9DB	A1 - Unit Description 2	LCD	RW	—
2524	9DC	A1 - Unit Description 3	LCD	RW	—

Analog Input 1 Calibration (Wired Scanner 2100)

Register (Decimal)	Register (Hex)	Description	Data Type	Access	Default
2530	9E2	A1 - Calibration Type[1]	U16	RW	0
2531	9E3	A1 - Nominal Value	FP	RW	—
2533	9E5	A1 - Calibration Absolute Offset	FP	RW	0.00
2535	9E7	A1 - Calibration Actual 1	FP	RW	0.00
2537	9E9	A1 - Calibration Actual 2	FP	RW	0.00
2539	9EB	A1 - Calibration Actual 3	FP	RW	0.00
2541	9ED	A1 - Calibration Actual 4	FP	RW	0.00
2543	9EF	A1 - Calibration Actual 5	FP	RW	0.00
2545	9F1	A1 - Calibration Actual 6	FP	RW	0.00
2547	9F3	A1 - Calibration Actual 7	FP	RW	0.00
2549	9F5	A1 - Calibration Actual 8	FP	RW	0.00
2551	9F7	A1 - Calibration Actual 9	FP	RW	0.00
2553	9F9	A1 - Calibration Actual 10[2]	FP	RW	0.00
2555	9FB	A1 - Calibration Actual 11[2]	FP	RW	0.00
2557	9FD	A1 - Calibration Actual 12[2]	FP	RW	0.00
2559	9FF	A1 - Calibration Measured 1	FP	RW	0.00
2561	A01	A1 - Calibration Measured 2	FP	RW	0.00
2563	A03	A1 - Calibration Measured 3	FP	RW	0.00
2565	A05	A1 - Calibration Measured 4	FP	RW	0.00

Register (Decimal)	Register (Hex)	Description	Data Type	Access	Default
2567	A07	A1 - Calibration Measured 5	FP	RW	0.00
2569	A09	A1 - Calibration Measured 6	FP	RW	0.00
2571	A0B	A1 - Calibration Measured 7	FP	RW	0.00
2573	A0D	A1 - Calibration Measured 8	FP	RW	0.00
2575	A0F	A1 - Calibration Measured 9	FP	RW	0.00
2577	A11	A1 - Calibration Measured 10[2]	FP	RW	0.00
2579	A13	A1 - Calibration Measured 11[2]	FP	RW	0.00
2581	A15	A1 - Calibration Measured 12[2]	FP	RW	0.00

[1] The Calibration Type register must be configured using ModWorX Pro. This register defines the type and number of calibration points used. If altered manually, calibration points must be entered in ascending order.
[2] When the Scanner 2100 is connected to a Scanner 3100, calibration points 10 through 12 will not be transmitted to the Scanner 3100.

Analog Input 2 Configuration (Wired Scanner 2100)

Register (Decimal)	Register (Hex)	Description	Data Type	Access	Default
2600	A28	A2 - Units	U16	RW	0
2601	A29	A2 - Time Base	U16	RW	0
2602	A2A	A2 - Sampling Period	U16	RW	1
2603	A2B	A2 - Dampening Factor	U16	RW	0
2604	A2C	A2 - Input Config	U16	RW	0
2605	A2D	A2 - Override Enable	U16	RW	0
2606	A2E	A2 - Override Value	FP	RW	0.00
2608	A30	A2 - Fail Value	FP	RW	0.00
2610	A32	A2 - Low Input Cutoff	FP	RW	2.00
2612	A34	A2 - Low Flow Cutoff	FP	RW	0.00
2614	A36	A2 - Sensor Range Low	FP	RO	0.00
2616	A38	A2 - Sensor Range High	FP	RO	0
2618	A3A	A2 - Units Scale Factor	FP	RW	1
2620	A3C	A2 - Units Offset Factor	FP	RW	0
2622	A3E	A2 - Unit Description 1	LCD	RW	—
2623	A3F	A2 - Unit Description 2	LCD	RW	—
2624	A40	A2 - Unit Description 3	LCD	RW	—

Analog Input 2 Calibration (Wired Scanner 2100)

Register (Decimal)	Register (Hex)	Description	Data Type	Access	Default
2630	A46	A2 - Calibration Type[1]	U16	RW	0
2631	A47	A2 - Nominal Value	FP	RW	—
2633	A49	A2 - Calibration Absolute Offset	FP	RW	0.00
2635	A4B	A2 - Calibration Actual 1	FP	RW	0.00
2637	A4D	A2 - Calibration Actual 2	FP	RW	0.00
2639	A4F	A2 - Calibration Actual 3	FP	RW	0.00
2641	A51	A2 - Calibration Actual 4	FP	RW	0.00

Register (Decimal)	Register (Hex)	Description	Data Type	Access	Default
2643	A53	A2 - Calibration Actual 5	FP	RW	0.00
2645	A55	A2 - Calibration Actual 6	FP	RW	0.00
2647	A57	A2 - Calibration Actual 7	FP	RW	0.00
2649	A59	A2 - Calibration Actual 8	FP	RW	0.00
2651	A5B	A2 - Calibration Actual 9	FP	RW	0.00
2653	A5D	A2 - Calibration Actual 10[2]	FP	RW	0.00
2655	A5F	A2 - Calibration Actual 11[2]	FP	RW	0.00
2657	A61	A2 - Calibration Actual 12[2]	FP	RW	0.00
2659	A63	A2 - Calibration Measured 1	FP	RW	0.00
2661	A65	A2 - Calibration Measured 2	FP	RW	0.00
2663	A67	A2 - Calibration Measured 3	FP	RW	0.00
2665	A69	A2 - Calibration Measured 4	FP	RW	0.00
2667	A6B	A2 - Calibration Measured 5	FP	RW	0.00
2669	A6D	A2 - Calibration Measured 6	FP	RW	0.00
2671	A6F	A2 - Calibration Measured 7	FP	RW	0.00
2673	A71	A2 - Calibration Measured 8	FP	RW	0.00
2675	A73	A2 - Calibration Measured 9	FP	RW	0.00
2677	A75	A2 - Calibration Measured 10[2]	FP	RW	0.00
2679	A77	A2 - Calibration Measured 11[2]	FP	RW	0.00
2681	A79	A2 - Calibration Measured 12[2]	FP	RW	0.00

[1] The Calibration Type register must be configured using ModWorX Pro. This register defines the type and number of calibration points used. If altered manually, calibration points must be entered in ascending order.
[2] When the Scanner 2100 is connected to a Scanner 3100, calibration points 10 through 12 will not be transmitted to the Scanner 3100.

Digital Input Configuration

Register (Decimal)	Register (Hex)	Description	Data Type	Access	Default
2900	B54	Digital Mode	U16	RW	0

Flow Run 1 Configuration

Register (Decimal)	Register (Hex)	Description	Data Type	Access	Default
3000	BB8	FR1 Volume Units See Units of Measurement, page C-49	U16	RW	201
3001	BB9	FR1 Time Base	U16	RW	3
3002	BBA	FR1 Flow Calculation Period (Number of seconds for each calculation)	U16	RW	60
3003	BBB	FR1 Dampening Factor	U16	RW	0
3004	BBC	FR1 Flow Rate Calculation See Flow Rate Calculation Register, page C-20	U16	RW	0
3005	BBD	FR1 Override Enable 0 - Disabled 1 - Enabled	U16	RW	0

Register (Decimal)	Register (Hex)	Description	Data Type	Access	Default
3006	BBE	FR1 Fluid Properties See Fluid Property Register, page C-21	U16	RW	12288
3007	BBF	FR1 Fluid Property Calculation (Number of flow rate calculation periods before each fluid property calculation)	U16	RW	1
3008	BC0	FR1 Material Type: Pipe 0 - SS (304/316), AGA 3 1992 1 - Carbon Steel 2 - Monel 3 - Brass 4 - Inconel 5 - Nickel 6 - HastC22 7 - Titanium 8 - SS (304), AGA 3 2012 9 - SS (316), AGA 3 2012 10 - Monel 400, AGA 3 2012	U16	RW	1
3009	BC1	FR1 Material Type: Plate 0 - SS (304/316), AGA 3 1992 1 - Carbon Steel 2 - Monel 3 - Brass 4 - Inconel 5 - Nickel 6 - HastC22 7 - Titanium 8 - SS (304), AGA 3 2012 9 - SS (316), AGA 3 2012 10 - Monel 400, AGA 3 2012	U16	RW	0
3010	BC2	FR1 Tap Type See Tap Type Register, page C-22	U16	RW	0
3011	BC3	FR1 Static Pressure Selection	U16	RW	32768
3012	BC4	FR1 Differential Pressure Selection	U16	RW	32768
3013	BC5	FR1 Process Temperature Selection	U16	RW	32768
3014	BC6	FR1 Turbine Source	U16	RW	0
3015	BC7	FR1 Mass Units	U16	RW	601
3016	BC8	FR1 Energy Units	U16	RW	701
3017	BC9	FR1 Override Value	FP	RW	0.00
3019	BCB	FR1 Fail Value	FP	RW	0.00
3021	BCD	FR1 Low Flow Cutoff	FP	RW	0.00
3023	BCF	FR1 Low Cutoff	FP	RW	0.00
3025	BD1	FR1 Base Temperature	FP	RW	60.00 degF
3027	BD3	FR1 Base Pressure	FP	RW	14.73 psi
3029	BD5	FR1 Atmospheric Pressure	FP	RW	14.73 psi
3031	BD7	FR1 Pipe Size	FP	RW	2.067 in.
3033	BD9	FR1 Pipe Reference Temp	FP	RW	68.00 degF
3035	BDB	FR1 Plate Size	FP	RW	1.00 in.
3037	BDD	FR1 Plate Reference Temp	FP	RW	68.00 degF

Register (Decimal)	Register (Hex)	Description	Data Type	Access	Default
3039	BDF	FR1 Isentropic Exponent - k	FP	RW	1.30
3041	BE1	FR1 Viscosity	FP	RW	0.010268 cP
3043	BE3	FR1 Cone Beta	FP	RW	0.500
3045	BE5	FR1 Cone Flow Coefficient	FP	RW	1.000
3047	BE7	FR1 Low Pressure Cutoff	FP	RW	1.000 in H2O
3049	BE9	FR1 Specific Gravity	FP	RW	0.60
3051	BEB	FR1 Heating Value	FP	RW	1031.426
3053	BED	FR1 Gas Fraction/Quality	FP	RW	1.00
3055	BEF	FR1 Configuration Parameter 1 (Absolute Density - Liquids) Base Liquid Density Fluid = Liquid : Base Density Fluid = Ngas : Base Liquid Oil Density	FP	RW	53.06376
3057	BF1	FR1 Configuration Parameter 2 Fluid = Liquid : Flowing Density Fluid = NGas : Base Liquid Water Density	FP	RW	62.30385
3059	BF3	FR1 Configuration Parameter 3 Oil Fraction	FP	RW	0.00
3061	BF5	FR1 Configuration Parameter 4	FP	RW	0.00
3063	BF7	FR1 GC - Methane (C1)	FP	RW	0.965222
3065	BF9	FR1 GC - Nitrogen (N2)	FP	RW	0.002595
3067	BFB	FR1 GC - Carbon Dioxide (CO2)	FP	RW	0.005956
3069	BFD	FR1 GC - Ethane (C2)	FP	RW	0.018186
3071	BFF	FR1 GC - Propane (C3)	FP	RW	0.004596
3073	C01	FR1 GC - Water (H2O)	FP	RW	0.00
3075	C03	FR1 GC - Hydrogen Sulfide (H2S)	FP	RW	0.00
3077	C05	FR1 GC - Hydrogen (H2)	FP	RW	0.00
3079	C07	FR1 GC - Carbon Monoxide (CO)	FP	RW	0.00
3081	C09	FR1 GC - Oxygen (O2)	FP	RW	0.00
3083	C0B	FR1 GC - I-Butane (i-C4)	FP	RW	0.000977
3085	C0D	FR1 GC - N-Butane (n-C4)	FP	RW	0.001007
3087	C0F	FR1 GC - I-Pentane (i-C5)	FP	RW	0.000473
3089	C11	FR1 GC - N-Pentane (n-C5)	FP	RW	0.000324
3091	C13	FR1 GC - N-Hexane (n-C6)	FP	RW	0.000664
3093	C15	FR1 GC - N-Heptane (n-C7)	FP	RW	0.00
3095	C17	FR1 GC - N-Octane (n-C8)	FP	RW	0.00
3097	C19	FR1 GC - N-Nonane (n-C9)	FP	RW	0.00
3099	C1B	FR1 GC - N-Decane (n-C10)	FP	RW	0.00
3101	C1D	FR1 GC - Helium (He)	FP	RW	0.00
3103	C1F	FR1 GC - Argon (Ar)	FP	RW	0.00
3105	C21	FR1 Unit Scale	FP	RW	1.00
3107	C23	FR1 Unit Offset	FP	RW	0.00
3109	C25	FR1 Unit Description 1	LCD	RW	—
3110	C26	FR1 Unit Description 2	LCD	RW	—
3111	C27	FR1 Unit Description 3	LCD	RW	—

Register (Decimal)	Register (Hex)	Description	Data Type	Access	Default
3112	C28	FR1 Mass Scale	FP	RW	1.00
3114	C2A	FR1 Mass Description 1	LCD	RW	—
3115	C2B	FR1 Mass Description 2	LCD	RW	—
3116	C2C	FR1 Mass Description 3	LCD	RW	—
3117	C2D	FR1 Energy Scale	FP	RW	1.00
3119	C2F	FR1 Energy Description 1	LCD	RW	—
3120	C30	FR1 Energy Description 2	LCD	RW	—
3121	C31	FR1 Energy Description 3	LCD	RW	—

Flow Rate Calculation Register

The flow rate calculation register is shown below.

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
—			LE	Wet Correction				—			Flow Rate Calculation				

LE - Liquid Estimation Selection (STEAM ONLY)	
0	Do not include Liquid Estimate
1	Include Liquid Estimate

Wet Correction	
0	No Wet Correction
1	Orifice - Chisholm-Steven
2	Orifice - James (STEAM ONLY)
3	Cone - Chisholm-Steven
6	Do Not Use
7	Correction Override

Flow Rate Calculation	
0	AGA 3 1992
1	Cone Spool
2	Cone Wafer
3	AGA 7
4	ISO 5167 - Orifice
8	Averaging Pitot Tube (Annubar)
9 to 10	Reserved
11	Venturi Meter
12	ISO 5167 Foxboro Integral Orifice
13	ASME MFC-14M (2003), Small-bore Orifice
14	AGA 3 2012

Fluid Property Register

The fluid property calculation register is shown below.

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
HV	SG	V	Isen	LiqDC	—		GPA	SGRef			Fluid Property Calc				

HV - Heating Value Selection	
0	Calculated
1	Manual Entry
SG - Specific Gravity Selection	
0	Calculated
1	Manual Entry
V - Viscosity Selection	
0	Calculated
1	Manual Entry
Isen - Isentropic Exponent Selection	
0	Calculated
1	Manual Entry
LiqDC – Liquid Density Control	
0	For Liquids: Register 3057 contains the flowing density For NGas: Register 3057 contains the base liquid oil density
1	For Liquids: Register 3057 contains the coefficient of thermal expansion For NGas: Register 3057 contains the flowing liquid oil density
GPA - GPA Table Selection	
0	Use 2008 Table
1	Use 1996 Table
SGRef - Specific Gravity Reference	
0	US (AGA) – 14.73 psi, 60 degF
1	Canada, UK – 103.208 kPa, 15 degC
Fluid Property Calculation	
0	AGA 8 Detail
1	AGA 8 Gross
2	(FUTURE)
3	IF-97 (STEAM ONLY)
4	IF-97/James - (STEAM ONLY)
5 to 15	(FUTURE)
16	Generic Liquid
17	MPMS Ch. 11.1 - Crude Oil
18	MPMS Ch. 11.1 - Refined Products
19	MPMS Ch. 11.1 - Lube Oils
20	MPMS Ch. 11.1 - Special Products

Tap Type Register

The tap type calculation register is shown below.

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
—												Loc	Tap Type		

Loc (Pressure Tap Location)	
0	Upstream
1	Downstream

Tap Type	
0	Flange
1	Corner
2	D and D/2
3	Reserved
4	Reserved
5	Reserved
6	Reserved
7	Reserved

Flow Run 1 Calibration

Register (Decimal)	Register (Hex)	Description	Data Type	Access	Default
3200	C80	FR1 Calibration Type[1]	U16	RW	512
3201	C81	FR1 Nominal Flow Coefficient	FP	RW	0.88
3203	C83	FR1 Coefficient Offset	FP	RW	0.00
3205	C85	FR1 Flow Coefficient 1	FP	RW	0.88
3207	C87	FR1 Flow Coefficient 2	FP	RW	0.00
3209	C89	FR1 Flow Coefficient 3	FP	RW	0.00
3211	C8B	FR1 Flow Coefficient 4	FP	RW	0.00
3213	C8D	FR1 Flow Coefficient 5	FP	RW	0.00
3215	C8F	FR1 Flow Coefficient 6	FP	RW	0.00
3217	C91	FR1 Flow Coefficient 7	FP	RW	0.00
3219	C93	FR1 Flow Coefficient 8	FP	RW	0.00
3221	C95	FR1 Flow Coefficient 9	FP	RW	0.00
3223	C97	FR1 Flow Coefficient 10[2]	FP	RW	0.00
3225	C99	FR1 Flow Coefficient 11[2]	FP	RW	0.00
3227	C9B	FR1 Flow Coefficient 12[2]	FP	RW	0.00
3229	C9D	FR1 Flow Coefficient 13[2]	FP	RW	0.00
3231	C9F	FR1 Flow Coefficient 14[2]	FP	RW	0.00
3233	CA1	FR1 Flow Coefficient 15[2]	FP	RW	0.00
3235	CA3	FR1 Flow Coefficient 16[2]	FP	RW	0.00
3237	CA5	FR1 Reynolds Number 1	FP	RW	1.00
3239	CA7	FR1 Reynolds Number 2	FP	RW	0.00
3241	CA9	FR1 Reynolds Number 3	FP	RW	0.00
3243	CAB	FR1 Reynolds Number 4	FP	RW	0.00
3245	CAD	FR1 Reynolds Number 5	FP	RW	0.00
3247	CAF	FR1 Reynolds Number 6	FP	RW	0.00
3249	CB1	FR1 Reynolds Number 7	FP	RW	0.00

Register (Decimal)	Register (Hex)	Description	Data Type	Access	Default
3251	CB3	FR1 Reynolds Number 8	FP	RW	0.00
3253	CB5	FR1 Reynolds Number 9	FP	RW	0.00
3255	CB7	FR1 Reynolds Number 10[2]	FP	RW	0.00
3257	CB9	FR1 Reynolds Number 11[2]	FP	RW	0.00
3259	CBB	FR1 Reynolds Number 12[2]	FP	RW	0.00
3261	CBD	FR1 Reynolds Number 13[2]	FP	RW	0.00
3263	CBF	FR1 Reynolds Number 14[2]	FP	RW	0.00
3265	CC1	FR1 Reynolds Number 15[2]	FP	RW	0.00
3267	CC3	FR1 Reynolds Number 16[2]	FP	RW	0.00

[1] The Calibration Type register must be configured using ModWorX Pro. This register defines the type and number of calibration points used. If altered manually, calibration points must be entered in ascending order.
[2] When the Scanner 2100 is connected to a Scanner 3100, flow coefficients 10 through 16 and Reynolds numbers 10 through 16 will not be transmitted to the Scanner 3100.

Flow Run Alarms

Register (Decimal)	Register (Hex)	Description	Data Type	Access	Default
3600	0E10	High Alarm Mask	U16	RW	65535
3601	0E11	Low Alarm Mask	U16	RW	35535
3602	0E12	FR Alarm Configuration 1	U16	RW	4095
3603	0E13	FR Alarm Configuration 2	U16	RW	4095
3604	0E14	FR Alarm Configuration 3	U16	RW	4095
3605	0E15	FR Alarm Configuration 4	U16	RW	4095
3606	0E16	FR Alarm Configuration 5	U16	RW	4095
3607	0E17	FR Alarm Configuration 6	U16	RW	4095
3608	0E18	FR Alarm Configuration 7	U16	RW	4095
3609	0E19	FR Alarm Configuration 8	U16	RW	4095
3610	0E1A	FR Alarm Configuration 9	U16	RW	4095
3611	0E1B	FR Alarm Configuration 10	U16	RW	4095
3612	0E1C	FR Alarm Configuration 11	U16	RW	4095
3613	0E1D	FR Alarm Configuration 12	U16	RW	4095
3614	0E1E	FR Alarm Configuration 13	U16	RW	4095
3615	0E1F	FR Alarm Configuration 14	U16	RW	4095
3616	0E20	FR Alarm Configuration 15	U16	RW	4095
3617	0E21	FR Alarm Configuration 16	U16	RW	4095
3618	0E22	FR Alarm High Setpoint 1	FP32	RW	100
3620	0E24	FR Alarm High Setpoint 2	FP32	RW	100
3622	0E26	FR Alarm High Setpoint 3	FP32	RW	100
3624	0E28	FR Alarm High Setpoint 4	FP32	RW	100
3626	0E2A	FR Alarm High Setpoint 5	FP32	RW	100
3628	0E2C	FR Alarm High Setpoint 6	FP32	RW	100
3630	0E2E	FR Alarm High Setpoint 7	FP32	RW	100
3632	0E30	FR Alarm High Setpoint 8	FP32	RW	100
3634	0E32	FR Alarm High Setpoint 9	FP32	RW	100
3636	0E34	FR Alarm High Setpoint 10	FP32	RW	100
3638	0E36	FR Alarm High Setpoint 11	FP32	RW	100

Register (Decimal)	Register (Hex)	Description	Data Type	Access	Default
3640	0E38	FR Alarm High Setpoint 12	FP32	RW	100
3642	0E3A	FR Alarm High Setpoint 13	FP32	RW	100
3644	0E3C	FR Alarm High Setpoint 14	FP32	RW	100
3646	0E3E	FR Alarm High Setpoint 15	FP32	RW	100
3648	0E40	FR Alarm High Setpoint 16	FP32	RW	100
3650	0E42	FR Alarm Low Setpoint 1	FP32	RW	0.00
3652	0E44	FR Alarm Low Setpoint 2	FP32	RW	0.00
3654	0E46	FR Alarm Low Setpoint 3	FP32	RW	0.00
3656	0E48	FR Alarm Low Setpoint 4	FP32	RW	0.00
3658	0E4A	FR Alarm Low Setpoint 5	FP32	RW	0.00
3660	0E4C	FR Alarm Low Setpoint 6	FP32	RW	0.00
3662	0E4E	FR Alarm Low Setpoint 7	FP32	RW	0.00
3664	0E50	FR Alarm Low Setpoint 8	FP32	RW	0.00
3666	0E52	FR Alarm Low Setpoint 9	FP32	RW	0.00
3668	0E54	FR Alarm Low Setpoint 10	FP32	RW	0.00
3670	0E56	FR Alarm Low Setpoint 11	FP32	RW	0.00
3672	0E58	FR Alarm Low Setpoint 12	FP32	RW	0.00
3674	0E5A	FR Alarm Low Setpoint 13	FP32	RW	0.00
3676	0E5C	FR Alarm Low Setpoint 14	FP32	RW	0.00
3678	0E5E	FR Alarm Low Setpoint 15	FP32	RW	0.00
3680	0E60	FR Alarm Low Setpoint 16	FP32	RW	0.00
3682	0E62	FR Alarm Deadband 1	FP32	RW	10
3684	0E64	FR Alarm Deadband 2	FP32	RW	10
3686	0E66	FR Alarm Deadband 3	FP32	RW	10
3688	0E68	FR Alarm Deadband 4	FP32	RW	10
3690	0E6A	FR Alarm Deadband 5	FP32	RW	10
3692	0E6C	FR Alarm Deadband 6	FP32	RW	10
3694	0E6E	FR Alarm Deadband 7	FP32	RW	10
3696	0E70	FR Alarm Deadband 8	FP32	RW	10
3698	0E72	FR Alarm Deadband 9	FP32	RW	10
3700	0E74	FR Alarm Deadband 10	FP32	RW	10
3702	0E76	FR Alarm Deadband 11	FP32	RW	10
3704	0E78	FR Alarm Deadband 12	FP32	RW	10
3706	0E7A	FR Alarm Deadband 13	FP32	RW	10
3708	0E7C	FR Alarm Deadband 14	FP32	RW	10
3710	0E7E	FR Alarm Deadband 15	FP32	RW	10
3712	0E80	FR Alarm Deadband 16	FP32	RW	10

Output Configuration

Register (Decimal)	Register (Hex)	Description	Data Type	Access	Default	Wired Only
4000	FA0	Pulse Out 1 - Source	U16	RW	16384	
4001	FA1	Pulse Out 1 - Duration	U16	RW	10	
4002	FA2	Pulse Out 1 - Decimal Location	U16	RW	2	
4003	FA3	Pulse Out 1 - Data Pointer	U16	RW	108	
4004	FA4	Pulse Out 1 - Scale Factor	FP	RW	1	

Register (Decimal)	Register (Hex)	Description	Data Type	Access	Default	Wired Only
4006	FA6	Pulse Out 1 - Low Level	FP	RW	0	
4008	FA8	Pulse Out 1 - High Level	FP	RW	0	
4010 to 4039	Reserved					
4040	FC8	Analog Out 1 - Source	U16	RW	0	✓
4041	FC9	Analog Out 1 - Low Value	FP	RW	0	✓
4043	FCB	Analog Out 1 - High Value	FP	RW	1700	✓
4045	FCD	Analog Out 1 - Low Adjust	U16	RW	32768	✓
4046	FCE	Analog Out 1 - High Adjust	U16	RW	32768	✓

Holding Registers

Register (Decimal)	Register (Hex)	Description	Data Type	Access	Wired Only
8000	1F40	Interval Pointer	FP	RO	
8002	1F42	Daily Pointer	FP	RO	
8004	1F44	Event Counter	FP	RO	
8006	1F46	Real Date	FP	RO	
8008	1F48	Real Time	FP	RO	
8010	1F4A	Flow Run Alarms	FP	RO	
8012	1F4C	Flow Run Alarm Low	FP	RO	
8014	1F4E	Flow Run Alarm High	FP	RO	
8016	1F50	Diagnostic 1	FP	RO	
8018	1F52	Diagnostic 2	FP	RO	
8020	1F54	Diagnostic 3	FP	RO	
8022	1F56	Diagnostic 4	FP	RO	
8024	1F58	Polling Index	FP	RO	
8026	1F5A	FR1 Grand Total	FP	RO	
8028	1F5C	FR1 Instantaneous Flow Rate	FP	RO	
8030	1F5E	FR1 Daily Total	FP	RO	
8032	1F60	FR1 Interval Total	FP	RO	
8034	1F62	FR1 Polling Total	FP	RO	
8036	1F64	FR1 Previous Day Total	FP	RO	
8038	1F66	FR1 Previous Interval	FP	RO	
8040	1F68	FR1 Previous Polling Total	FP	RO	
8042	1F6A	FR1 Grand Mass Total	FP	RO	
8044	1F6C	FR1 Instantaneous Mass Flow Rate	FP	RO	
8046	1F6E	FR1 Daily Mass Total	FP	RO	
8048	1F70	FR1 Interval Mass Total	FP	RO	
8050	1F72	FR1 Polling Mass Total	FP	RO	
8052	1F74	FR1 Previous Day Mass	FP	RO	
8054	1F76	FR1 Previous Interval Mass	FP	RO	
8056	1F78	FR1 Previous Polling Mass	FP	RO	
8058	1F7A	FR1 Grand Energy Total	FP	RO	
8060	1F7C	FR1 Instantaneous Energy Flow Rate	FP	RO	
8062	1F7E	FR1 Daily Energy Total	FP	RO	

Register (Decimal)	Register (Hex)	Description	Data Type	Access	Wired Only
8064	1F80	FR1 Interval Energy Total	FP	RO	
8066	1F82	FR1 Polling Energy Total	FP	RO	
8068	1F84	FR1 Previous Day Energy	FP	RO	
8070	1F86	FR1 Previous Interval Energy	FP	RO	
8072	1F88	FR1 Previous Polling Energy	FP	RO	
8074	1F8A	FR1 Daily Estimated Total	FP	RO	
8076	1F8C	FR1 Monthly Total	FP	RO	
8078	1F8E	FR1 Previous Month Total	FP	RO	
8080	1F90	FR1 Daily Run Time	FP	RO	
8082	1F92	FR1 Interval Run Time	FP	RO	
8084	1F94	FR1 Polling Run Time	FP	RO	
8086	1F96	FR1 Previous Daily Run Time	FP	RO	
8088	1F98	FR1 Previous Interval Run Time	FP	RO	
8090	1F9A	FR1 Previous Polling Run Time	FP	RO	
8092	1F9C	FR1 Static Pressure	FP	RO	
8094	1F9E	FR1 Differential Pressure	FP	RO	
8096	1FA0	FR1 Process Temperature	FP	RO	
8098	1FA2	FR1 UnCorrected Volume	FP	RO	
8100	1FA4	FR1 SqrtDP	FP	RO	
8102	1FA6	FR1 Compressibility (Natural Gas); FR1 CTPL - Complete Correction Factor (Liquids)	FP	RO	
8104	1FA8	FR1 Density	FP	RO	
8106	1FAA	FR1 Base Compressibility (Natural Gas) FR1 CTL - Temperature Correction Factor (Liquids)	FP	RO	
8108	1FAC	FR1 Base Density	FP	RO	
8110	1FAE	FR1 Average Molecular Weight	FP	RO	
8112	1FB0	FR1 Molar Fraction Sum	FP	RO	
8114	1FB2	FR1 Mass Heating Value	FP	RO	
8116	1FB4	FR1 Heating Value Volume Basis	FP	RO	
8118	1FB6	FR1 Specific Gravity	FP	RO	
8120	1FB8	FR1 Viscosity	FP	RO	
8122	1FBA	FR1 Isentropic Exponent	FP	RO	
8124	1FBC	FR1 Reynolds Number	FP	RO	
8126	1FBE	FR1 Calculation Parameter 1	FP	RO	
8128	1FC0	FR1 Calculation Parameter 2	FP	RO	
8130	1FC2	FR1 Calculation Parameter 3	FP	RO	
8132	1FC4	FR1 Calculation Parameter 4	FP	RO	
8134	1FC6	FR1 Calculation Parameter 5	FP	RO	
8136	1FC8	FR1 Calculation Parameter 6	FP	RO	
8138	1FCA	FR1 Calculation Parameter 7	FP	RO	
8140	1FCC	FR1 Calculation Parameter 8	FP	RO	
8142	1FCE	FR1 Calculation Parameter 9	FP	RO	
8144	1FD0	FR1 Calculation Parameter 10	FP	RO	
8146	1FD2	FR1 Calculation Parameter 11	FP	RO	
8148	1FD4	FR1 Calculation Parameter 12	FP	RO	

Register (Decimal)	Register (Hex)	Description	Data Type	Access	Wired Only
8150	1FD6	FR1 Calculation Parameter 13	FP	RO	
8152	1FD8	FR1 Calculation Parameter 14	FP	RO	
8154	1FDA	FR1 Calculation Parameter 15	FP	RO	
8156	1FDC	FR1 Calculation Parameter 16	FP	RO	
8158	1FDE	FR1 Grand Total [MCF]	FP	RO	
8160	1FE0	FR1 Instantaneous Flow Rate [MCF]	FP	RO	
8162	1FE2	FR1 Daily Total [MCF]	FP	RO	
8164	1FE4	FR1 Interval Total [MCF]	FP	RO	
8166	1FE6	FR1 Polling Total [MCF]	FP	RO	
8168	1FE8	FR1 Previous Day [MCF]	FP	RO	
8170	1FEA	FR1 Previous Interval [MCF]	FP	RO	
8172	1FEC	FR1 Previous Polling Total [MCF]	FP	RO	
8174	1FEE	FR1 Grand Mass Total [LBM]	FP	RO	
8176	1FF0	FR1 Instantaneous Mass Rate [LBM]	FP	RO	
8178	1FF2	FR1 Daily Mass Total [LBM]	FP	RO	
8180	1FF4	FR1 Interval Mass Total [LBM]	FP	RO	
8182	1FF6	FR1 Polling Mass Total [LBM]	FP	RO	
8184	1FF8	FR1 Previous Day Mass [LBM]	FP	RO	
8186	1FFA	FR1 Previous Interval Mass [LBM]	FP	RO	
8188	1FFC	FR1 Previous Polling Mass [LBM]	FP	RO	
8190	1FFE	FR1 Grand Energy Total [MMBTU]	FP	RO	
8192	2100	FR1 Instantaneous Energy Rate [MMBTU]	FP	RO	
8194	2002	FR1 Daily Energy Total [MMBTU]	FP	RO	
8196	2004	FR1 Interval Energy Total [MMBTU]	FP	RO	
8198	2006	FR1 Polling Energy Total [MMBTU]	FP	RO	
8200	2008	FR1 Previous Day Energy [MMBTU]	FP	RO	
8202	200A	FR1 Previous Interval Energy [MMBTU]	FP	RO	
8204	200C	FR1 Previous Polling Energy [MMBTU]	FP	RO	
8206	200E	FR1 Daily Estimated Total [MCF]	FP	RO	
8208	2010	FR1 Monthly Total [MCF]	FP	RO	
8210	2012	FR1 Previous Month Total [MCF]	FP	RO	
8212	2014	FR1 Mass Heating Value [BASE]	FP	RO	
8214	2016	FR1 Volumetric Heating Value [BASE]	FP	RO	
8216	2018	T1 Grand Total	FP	RO	
8218	201A	T1 Instantaneous Flow Rate	FP	RO	
8220	201C	T1 Daily Total	FP	RO	
8222	201E	T1 Interval Total	FP	RO	
8224	2020	T1 Polling Total	FP	RO	
8226	2022	T1 Previous Day	FP	RO	
8228	2024	T1 Previous Interval	FP	RO	
8230	2026	T1 Previous Polling Total	FP	RO	
8232	2028	T1 Daily Estimated Total	FP	RO	
8234	202A	T1 Monthly Total	FP	RO	
8236	202C	T1 Previous Month Total	FP	RO	
8238	202E	T1 Daily Run Time	FP	RO	

Register (Decimal)	Register (Hex)	Description	Data Type	Access	Wired Only
8240	2030	T1 Interval Run Time	FP	RO	
8242	2032	T1 Polling Run Time	FP	RO	
8244	2034	T1 Previous Daily Run Time	FP	RO	
8246	2036	T1 Previous Interval Run Time	FP	RO	
8248	2038	T1 Previous Polling Run Time	FP	RO	
8250	203A	T1 Grand Total [GAL]	FP	RO	
8252	203C	T1 Instantaneous Flow Rate [GAL]	FP	RO	
8254	203E	T1 Daily Total [GAL]	FP	RO	
8256	2040	T1 Interval Total [GAL]	FP	RO	
8258	2042	T1 Polling Total [GAL]	FP	RO	
8260	2044	T1 Previous Day [GAL]	FP	RO	
8262	2046	T1 Previous Interval [GAL]	FP	RO	
8264	2048	T1 Previous Polling Total [GAL]	FP	RO	
8266	204A	T1 Daily Estimated Total [GAL]	FP	RO	
8268	204C	T1 Monthly Total [GAL]	FP	RO	
8270	204E	T1 Previous Month Total [GAL]	FP	RO	
8272	2050	T1 Frequency	FP	RO	
8274	2052	T1 Active K-Factor	FP	RO	
8276	2054	T2 Grand Total	FP	RO	✓
8278	2056	T2 Instantaneous Flow Rate	FP	RO	✓
8280	2058	T2 Daily Total	FP	RO	✓
8282	205A	T2 Interval Total	FP	RO	✓
8284	205C	T2 Polling Total	FP	RO	✓
8286	205E	T2 Previous Day	FP	RO	✓
8288	2060	T2 Previous Interval	FP	RO	✓
8290	2062	T2 Previous Polling Total	FP	RO	✓
8292	2064	T2 Daily Estimated Total	FP	RO	✓
8294	2066	T2 Monthly Total	FP	RO	✓
8296	2068	T2 Previous Month Total	FP	RO	✓
8298	206A	T2 Daily Run Time	FP	RO	✓
8300	206C	T2 Interval Run Time	FP	RO	✓
8302	206E	T2 Polling Run Time	FP	RO	✓
8304	2070	T2 Previous Daily Run Time	FP	RO	✓
8306	2072	T2 Previous Interval Run Time	FP	RO	✓
8308	2074	T2 Previous Polling Run Time	FP	RO	✓
8310	2076	T2 Grand Total [GAL]	FP	RO	✓
8312	2078	T2 Instantaneous Flow Rate [GAL]	FP	RO	✓
8314	207A	T2 Daily Total [GAL]	FP	RO	✓
8316	207C	T2 Interval Total [GAL]	FP	RO	✓
8318	207E	T2 Polling Total [GAL]	FP	RO	✓
8320	2080	T2 Previous Day Total [GAL]	FP	RO	✓
8322	2082	T2 Previous Interval [GAL]	FP	RO	✓

Register (Decimal)	Register (Hex)	Description	Data Type	Access	Wired Only
8324	2084	T2 Previous Polling Total [GAL]	FP	RO	✓
8326	2086	T2 Daily Estimated Total [GAL]	FP	RO	✓
8328	2088	T2 Monthly Total [GAL]	FP	RO	✓
8330	208A	T2 Previous Month Total [GAL]	FP	RO	✓
8332	208C	T2 Frequency	FP	RO	✓
8334	208E	T2 Active K-Factor	FP	RO	✓
8336	2090	SP Instantaneous Reading	FP	RO	
8338	2092	SP Rate Of Change	FP	RO	
8340	2094	SP Daily Average	FP	RO	
8342	2096	SP Interval Average	FP	RO	
8344	2098	SP Polling Average	FP	RO	
8346	209A	SP Previous Daily Average	FP	RO	
8348	209C	SP Previous Interval Average	FP	RO	
8350	209E	SP Previous Polling Average	FP	RO	
8352	20A0	SP Daily Run Time	FP	RO	
8354	20A2	SP Interval Run Time	FP	RO	
8356	20A4	SP Polling Run Time	FP	RO	
8358	20A6	SP Previous Daily Run Time	FP	RO	
8360	20A8	SP Previous Interval Run Time	FP	RO	
8362	20AA	SP Previous Polling Run Time	FP	RO	
8364	20AC	SP Instantaneous Reading [PSI]	FP	RO	
8366	20AE	SP Rate of Change [PSI]	FP	RO	
8368	20B0	SP Daily Average [PSI]	FP	RO	
8370	20B2	SP Interval Average [PSI]	FP	RO	
8372	20B4	SP Polling Average [PSI]	FP	RO	
8374	20B6	SP Previous Daily Average [PSI]	FP	RO	
8376	20B8	SP Previous Interval Average [PSI]	FP	RO	
8378	20BA	SP Previous Polling Average [PSI]	FP	RO	
8380	20BC	DP Instantaneous Reading	FP	RO	
8382	20BE	DP Rate Of Change	FP	RO	
8384	20C0	DP Daily Average	FP	RO	
8386	20C2	DP Interval Average	FP	RO	
8388	20C4	DP Polling Average	FP	RO	
8390	20C6	DP Previous Daily Average	FP	RO	
8392	20C8	DP Previous Interval Average	FP	RO	
8394	20CA	DP Previous Polling Average	FP	RO	
8396	20CC	DP Daily Run Time	FP	RO	
8398	20CE	DP Interval Run Time	FP	RO	
8400	20D0	DP Polling Run Time	FP	RO	
8402	20D2	DP Previous Daily Run Time	FP	RO	
8404	20D4	DP Previous Interval Run Time	FP	RO	
8406	20D6	DP Previous Polling Run Time	FP	RO	
8408	20D8	DP Instantaneous Reading [INH2O]	FP	RO	
8410	20DA	DP Rate of Change [INH2O]	FP	RO	

Register (Decimal)	Register (Hex)	Description	Data Type	Access	Wired Only
8412	20DC	DP Daily Average [INH2O]	FP	RO	
8414	20DE	DP Interval Average [INH2O]	FP	RO	
8416	20E0	DP Polling Average [INH2O]	FP	RO	
8418	20E2	DP Previous Daily Average [INH2O]	FP	RO	
8420	20E4	DP Previous Interval Average [INH2O]	FP	RO	
8422	20E6	DP Previous Polling Average [INH2O]	FP	RO	
8424	20E8	PT Instantaneous Reading	FP	RO	
8426	20EA	PT Rate Of Change	FP	RO	
8428	20EC	PT Daily Average	FP	RO	
8430	20EE	PT Interval Average	FP	RO	
8432	20F0	PT Polling Average	FP	RO	
8434	20F2	PT Previous Daily Average	FP	RO	
8436	20F4	PT Previous Interval Average	FP	RO	
8438	20F6	PT Previous Polling Average	FP	RO	
8440	20F8	PT Daily Run Time	FP	RO	
8442	20FA	PT Interval Run Time	FP	RO	
8444	20FC	PT Polling Run Time	FP	RO	
8446	20FE	PT Previous Daily Run Time	FP	RO	
8448	2100	PT Previous Interval Run Time	FP	RO	
8450	2102	PT Previous Polling Run Time	FP	RO	
8452	2104	PT Instantaneous Reading [DEGF]	FP	RO	
8454	2106	PT Rate of Change [DEGF]	FP	RO	
8456	2108	PT Daily Average [DEGF]	FP	RO	
8458	210A	PT Interval Average [DEGF]	FP	RO	
8460	210C	PT Polling Average [DEGF]	FP	RO	
8462	210E	PT Previous Daily Average [DEGF]	FP	RO	
8464	2110	PT Previous Interval Average [DEGF]	FP	RO	
8466	2112	PT Previous Polling Average [DEGF]	FP	RO	
8468	2114	A1 Instantaneous Reading	FP	RO	✓
8470	2116	A1 Rate Of Change	FP	RO	✓
8472	2118	A1 Daily Average	FP	RO	✓
8474	211A	A1 Interval Average	FP	RO	✓
8476	211C	A1 Polling Average	FP	RO	✓
8478	211E	A1 Previous Daily Average	FP	RO	✓
8480	2120	A1 Previous Interval Average	FP	RO	✓
8482	2122	A1 Previous Polling Average	FP	RO	✓
8484	2124	A1 Daily Run Time	FP	RO	✓
8486	2126	A1 Interval Run Time	FP	RO	✓
8488	2128	A1 Polling Run Time	FP	RO	✓
8490	212A	A1 Previous Daily Run Time	FP	RO	✓
8492	212C	A1 Previous Interval Run Time	FP	RO	✓
8494	212E	A1 Previous Polling Run Time	FP	RO	✓
8496	2130	A1 Instantaneous Reading [VOLT]	FP	RO	✓

Register (Decimal)	Register (Hex)	Description	Data Type	Access	Wired Only
8498	2132	A1 Rate of Change [VOLT]	FP	RO	✓
8500	2134	A1 Daily Average [VOLT]	FP	RO	✓
8502	2136	A1 Interval Average [VOLT]	FP	RO	✓
8504	2138	A1 Polling Average [VOLT]	FP	RO	✓
8506	213A	A1 Previous Daily Average [VOLT]	FP	RO	✓
8508	213C	A1 Previous Interval Average [VOLT]	FP	RO	✓
8510	213E	A1 Previous Polling Average [VOLT]	FP	RO	✓
8512	2140	A2 Instantaneous Reading	FP	RO	✓
8514	2142	A2 Rate Of Change	FP	RO	✓
8516	2144	A2 Daily Average	FP	RO	✓
8518	2146	A2 Interval Average	FP	RO	✓
8520	2148	A2 Polling Average	FP	RO	✓
8522	214A	A2 Previous Daily Average	FP	RO	✓
8524	214C	A2 Previous Interval Average	FP	RO	✓
8526	214E	A2 Previous Polling Average	FP	RO	✓
8528	2150	A2 Daily Run Time	FP	RO	✓
8530	2152	A2 Interval Run Time	FP	RO	✓
8532	2154	A2 Polling Run Time	FP	RO	✓
8534	2156	A2 Previous Daily Run Time	FP	RO	✓
8536	2158	A2 Previous Interval Run Time	FP	RO	✓
8538	215A	A2 Previous Polling Run Time	FP	RO	✓
8540	215C	A2 Instantaneous Reading [VOLT]	FP	RO	✓
8542	215E	A2 Rate of Change [VOLT]	FP	RO	✓
8544	2160	A2 Daily Average [VOLT]	FP	RO	✓
8546	2162	A2 Interval Average [VOLT]	FP	RO	✓
8548	2164	A2 Polling Average [VOLT]	FP	RO	✓
8550	2166	A2 Previous Daily Average [VOLT]	FP	RO	✓
8552	2168	A2 Previous Interval Average [VOLT]	FP	RO	✓
8554	216A	A2 Previous Polling Average [VOLT]	FP	RO	✓
8556	216C	Internal Temperature	FP	RO	
8558	216E	Supply Voltage	FP	RO	
8560	2170	Battery Voltage	FP	RO	
8562	2172	Live FR1 Instantaneous Flow Rate [BASE]	FP	RO	
8564	Reserved				
8566	2176	Live T1 Instantaneous Flow Rate [GAL]	FP	RO	
8568	2178	Live T2 Instantaneous Flow Rate [GAL]	FP	RO	✓
8570	217A	Live Turbine Frequency Differential	FP	RO	✓
8572	217C	Live Turbine Frequency Ratio	FP	RO	✓
8574	217E	Live Static Pressure	FP	RO	
8576	2180	Live Differential Pressure	FP	RO	
8578	2182	Live MVT Temperature	FP	RO	
8580	2184	Live Bridge Voltage	FP	RO	

Register (Decimal)	Register (Hex)	Description	Data Type	Access	Wired Only
8582	2186	Live Analog 1	FP	RO	✓
8584	2188	Live Analog 2	FP	RO	✓
8586	218A	Live Production Temperature	FP	RO	
8588	218C	Live RTD Resistance	FP	RO	
8590	218E	PID Stage 1 Status	FP	RO	✓
8592	2190	PID Stage 1 Output	FP	RO	✓
8594	2192	PID Stage 2 Status	FP	RO	✓
8596	2194	PID Stage 2 Output	FP	RO	✓
8598	2196	PO1 Pulses	FP	RO	
8600 to 8605	Reserved				
8606	219E	AO1 Output Current	FP	RO	✓
8614	21A6	AO1 DAC Output	FP	RO	✓
8622 to 8625	Reserved				
8626	21B2	PI2 State	FP	RO	✓
8628	21B4	PI2 Count	FP	RO	✓
8630 to 8637	Reserved				
8638	21BE	Daily Archive Date	FP	RO	
8640	21C0	Interval Archive Date	FP	RO	
8642	21C2	Daily Archive Time	FP	RO	
8644	21C4	Interval Archive Time	FP	RO	
8646	21C6	Slave Data Point 01	FP	RO	
8648	21C8	Slave Data Point 02	FP	RO	
8650	21CA	Slave Data Point 03	FP	RO	
8652	21CC	Slave Data Point 04	FP	RO	
8654	21CE	Slave Data Point 05	FP	RO	
8656	21D0	Slave Data Point 06	FP	RO	
8658	21D2	Slave Data Point 07	FP	RO	
8660	21D4	Slave Data Point 08	FP	RO	
8662	21D6	Slave Data Point 09	FP	RO	
8664	21D8	Slave Data Point 10	FP	RO	
8666	21DA	Slave Data Point 11	FP	RO	
8668	21DC	Slave Data Point 12	FP	RO	
8670	21DE	Slave Data Point 13	FP	RO	
8672	21E0	Slave Data Point 14	FP	RO	
8674	21E2	Slave Data Point 15	FP	RO	
8676	21E4	Slave Data Point 16	FP	RO	
8678	21E6	Calc Block 0, Current Day [Default: Flow Extension]	FP	RO	
8680	21E8	Calc Block 0, Current Interval [Default: Flow Extension]	FP	RO	
8682	21EA	Calc Block 0, Current Polling [Default: Flow Extension]	FP	RO	
8684	21EC	Calc Block 0, Previous Day [Default: Flow Extension]	FP	RO	

Register (Decimal)	Register (Hex)	Description	Data Type	Access	Wired Only
8686	21EE	Calc Block 0, Previous Interval [Default: Flow Extension]	FP	RO	
8688	21F0	Calc Block 0, Previous Polling [Default: Flow Extension]	FP	RO	
8690	21F2	Calc Block 1, Current Day	FP	RO	
8692	21F4	Calc Block 1, Current Interval	FP	RO	
8694	21F6	Calc Block 1, Current Polling	FP	RO	
8696	21F8	Calc Block 1, Previous Day	FP	RO	
8698	21FA	Calc Block 1, Previous Interval	FP	RO	
8700	21FC	Calc Block 1, Previous Polling	FP	RO	
8702	21FE	Calc Block 2, Current Day	FP	RO	
8704	2200	Calc Block 2, Current Interval	FP	RO	
8706	2202	Calc Block 2, Current Polling	FP	RO	
8708	2204	Calc Block 2, Previous Day	FP	RO	
8710	2206	Calc Block 2, Previous Interval	FP	RO	
8712	2208	Calc Block 2, Previous Polling	FP	RO	
8714	220A	Calc Block 3, Current Day	FP	RO	
8716	220C	Calc Block 3, Current Interval	FP	RO	
8718	220E	Calc Block 3, Current Polling	FP	RO	
8720	2210	Calc Block 3, Previous Day	FP	RO	
8722	2212	Calc Block 3, Previous Interval	FP	RO	
8724	2214	Calc Block 3, Previous Polling	FP	RO	
8726	2216	Polling Date	FP	RO	
8728	2218	Polling Time	FP	RO	
8730	221A	Previous Day FR1 Grand Total Volume [MCF]	FP	RO	
8732	221C	Previous Interval FR1 Grand Total Volume [MCF]	FP	RO	
8734	221E	Previous Polling FR1 Grand Total Volume	FP	RO	
8736	2220	Previous Day FR1 Grand Total Mass [LBM]	FP	RO	
8738	2222	Previous Interval FR1 Grand Total Mass [LBM]	FP	RO	
8740	2224	Previous Polling FR1 Grand Total Mass	FP	RO	
8742	2226	Previous Day FR1 Grand Total Energy [MMBTU]	FP	RO	
8744	2228	Previous Interval FR1 Grand Total Energy [MMBTU]	FP	RO	
8746	222A	Previous Polling FR1 Grand Total Energy	FP	RO	
8748	222C	Previous Day T1 Grand Total Volume [GAL]	FP	RO	
8750	222E	Previous Interval T1 Grand Total Volume [GAL]	FP	RO	
8752	2230	Previous Polling T1 Grand Total Volume	FP	RO	
8754	2232	Previous Day T2 Grand Total Volume [GAL]	FP	RO	✓
8756	2234	Previous Interval T2 Grand Total Volume [GAL]	FP	RO	✓
8758	2236	Previous Polling T2 Grand Total Volume [GAL]	FP	RO	✓

Flow Calculation Parameter Registers (1-16)

The Flow Calculation Parameter Registers definition is dependent upon the flow rate calculation method that is implemented. The following table describes the function of each of these registers for each of the supported calculation methods.

Reg. Num	AGA 3	ISO 5167	Cone –Spool, Cone -Wafer	AGA 7
1	Pipe Size (Corrected)	Pipe Size (Corrected)	Pipe Size (Corrected)	Pipe Size (Corrected)
2	Plate Size (Corrected)	Plate Size (Corrected)	Plate Size (Corrected)	Temperature Ratio
3	Beta (Corrected)	Beta (Corrected)	Beta (Corrected)	Pressure Ratio
4	Plate Size (configured)	Plate Size (configured)	Plate Size (configured)	Supercompressibilty
5	Stability Index	Stability Index	Stability Index	<Reserved>
6	Y	Y	Y	<Reserved>
7	Cd	Cd	Cd	<Reserved>
8	Ev	Ev	Ev	<Reserved>
9	Flow Extension (sqrt["H20*lbm/cf3])	Flow Extension (sqrt[pa*kg/m3])	Flow Extension (sqrt[pa*kg/m3])	<Reserved>
10	Flowing Density (kg/m3)	Flowing Density (kg/m3)	Flowing Density (kg/m3)	Flowing Density (kg/m3)
11	Quality (Vapor Liquid Fraction) FR1 CPL - Pressure Correction Factor (Liquids)	Quality (Vapor Liquid Fraction) FR1 CPL - Pressure Correction Factor (Liquids)	Quality (Vapor Liquid Fraction) FR1 CPL - Pressure Correction Factor (Liquids)	<Reserved for Non-Liquids> FR1 CPL - Pressure Correction Factor (Liquids)
12	Liquid Heating Value	Liquid Heating Value	Liquid Heating Value	<Reserved>
13	Liquid Flowing Density	Liquid Flowing Density	Liquid Flowing Density	<Reserved>
14	Estimated Liquid Mass Flow Rate	Estimated Liquid Mass Flow Rate	Estimated Liquid Mass Flow Rate	<Reserved>
15	Apparent Mass Flow Rate	Apparent Mass Flow Rate	Apparent Mass Flow Rate	Apparent Mass Flow Rate
16	Lockhart-Martinelli	Lockhart-Martinelli	Lockhart-Martinelli	<Reserved>

Base Units/Configured Units

The holding registers allow users to read data in terms of *configured* units of measurement and *base* units. The configured units follow the settings based on the Unit setting register and the unit scale and offset registers. The base units will always have the same unit of measurement independent of the unit, scale and offset settings. Also note that the log data is always in terms of base units. It is recommended to configure the units of measurement using the software.

Polling Registers

The Scanner 2100 stores volumes, averaged values, and flow times since the last polling sequence in a set of polling registers. Additionally, the instrument stores the number of polls requested in the polling index.

The polling sequence is started by writing a value of 20,000 to the Control Register. This transfers the polling totals, averages, and run times to the previous polling registers, increments the polling index and resets the polling totals, averages and run-time registers. Note that the polling registers are displayed in base units and configured units.

Interval/Daily/Event Pointer Registers

These registers provide an index of the last record that was stored in the log data. These values start at 1 and increment with each newly created log. When the maximum number of records is reached, the pointer resets to 1 and starts incrementing again.

Archive Preview Registers

Register (Decimal)	Register (Hex)	Description	Data Type	Access
8800	2260	Daily Record 1, Parameter 1 (Date)	FP	RO
8802	2262	Daily Record 1, Parameter 2 (Time)	FP	RO
8804	2264	Daily Record 1, Parameter 3	FP	RO
8806	2266	Daily Record 1, Parameter 4	FP	RO
8808	2268	Daily Record 1, Parameter 5	FP	RO
8810	226A	Daily Record 1, Parameter 6	FP	RO
8812	226C	Daily Record 1, Parameter 7	FP	RO
8814	226E	Daily Record 1, Parameter 8	FP	RO
8816	2270	Daily Record 1, Parameter 9	FP	RO
8818	2272	Daily Record 1, Parameter 10	FP	RO
8820	2274	Daily Record 1, Parameter 11	FP	RO
8822	2276	Daily Record 1, Parameter 12	FP	RO
8824	2278	Daily Record 1, Parameter 13	FP	RO
8826	227A	Daily Record 1, Parameter 14	FP	RO
8828	227C	Daily Record 1, Parameter 15	FP	RO
8830	227E	Daily Record 1, Parameter 16	FP	RO
8832	2280	Daily Record 2, Parameter 1 (Date)	FP	RO
8834	2282	Daily Record 2, Parameter 2 (Time)	FP	RO
8836	2284	Daily Record 2, Parameter 3	FP	RO
8838	2286	Daily Record 2, Parameter 4	FP	RO
8840	2288	Daily Record 2, Parameter 5	FP	RO
8842	228A	Daily Record 2, Parameter 6	FP	RO
8844	228C	Daily Record 2, Parameter 7	FP	RO
8846	228E	Daily Record 2, Parameter 8	FP	RO
8848	2290	Daily Record 2, Parameter 9	FP	RO
8850	2292	Daily Record 2, Parameter 10	FP	RO
8852	2294	Daily Record 2, Parameter 11	FP	RO
8854	2296	Daily Record 2, Parameter 12	FP	RO
8856	2298	Daily Record 2, Parameter 13	FP	RO
8858	229A	Daily Record 2, Parameter 14	FP	RO
8860	229C	Daily Record 2, Parameter 15	FP	RO
8862	229E	Daily Record 2, Parameter 16	FP	RO
8864	22A0	Interval Record 1, Parameter 1 (Date)	FP	RO
8866	22A2	Interval Record 1, Parameter 2 (Time)	FP	RO
8868	22A4	Interval Record 1, Parameter 3	FP	RO
8870	22A6	Interval Record 1, Parameter 4	FP	RO
8872	22A8	Interval Record 1, Parameter 5	FP	RO
8874	22AA	Interval Record 1, Parameter 6	FP	RO
8876	22AC	Interval Record 1, Parameter 7	FP	RO
8878	22AE	Interval Record 1, Parameter 8	FP	RO
8880	22B0	Interval Record 1, Parameter 9	FP	RO
8882	22B2	Interval Record 1, Parameter 10	FP	RO
8884	22B4	Interval Record 1, Parameter 11	FP	RO

Register (Decimal)	Register (Hex)	Description	Data Type	Access
8886	22B6	Interval Record 1, Parameter 12	FP	RO
8888	22B8	Interval Record 1, Parameter 13	FP	RO
8890	22BA	Interval Record 1, Parameter 14	FP	RO
8892	22BC	Interval Record 1, Parameter 15	FP	RO
8894	22BE	Interval Record 1, Parameter 16	FP	RO
8896	22C0	Interval Record 2, Parameter 1 (Date)	FP	RO
8898	22C2	Interval Record 2, Parameter 2 (Time)	FP	RO
8900	22C4	Interval Record 2, Parameter 3	FP	RO
8902	22C6	Interval Record 2, Parameter 4	FP	RO
8904	22C8	Interval Record 2, Parameter 5	FP	RO
8906	22CA	Interval Record 2, Parameter 6	FP	RO
8908	22CC	Interval Record 2, Parameter 7	FP	RO
8910	22CE	Interval Record 2, Parameter 8	FP	RO
8912	22D0	Interval Record 2, Parameter 9	FP	RO
8914	22D2	Interval Record 2, Parameter 10	FP	RO
8916	22D4	Interval Record 2, Parameter 11	FP	RO
8918	22D6	Interval Record 2, Parameter 12	FP	RO
8920	22D8	Interval Record 2, Parameter 13	FP	RO
8922	22DA	Interval Record 2, Parameter 14	FP	RO
8924	22DC	Interval Record 2, Parameter 15	FP	RO
8926	22DE	Interval Record 2, Parameter 16	FP	RO

Holding Registers (32-bit)

Register (Decimal)	Register (Hex)	Description	Data Type	Access	Wired Only
7000	1B58	Interval Pointer	FP	RO	
7001	1B59	Daily Pointer	FP	RO	
7002	1B5A	Event Counter	FP	RO	
7003	1B5B	Real Date	FP	RO	
7004	1B5C	Real Time	FP	RO	
7005	1B5D	Flow Run Alarms	FP	RO	
7006	1B5E	Flow Run Alarm Low	FP	RO	
7007	1B5F	Flow Run Alarm High	FP	RO	
7008	1B60	Diagnostic 1	FP	RO	
7009	1B61	Diagnostic 2	FP	RO	
7010	1B62	Diagnostic 3	FP	RO	
7011	1B63	Diagnostic 4	FP	RO	
7012	1B64	Polling Index	FP	RO	
7013	1B65	FR1 Grand Volume Total	FP	RO	
7014	1B66	FR1 Instantaneous Flow Rate	FP	RO	
7015	1B67	FR1 Daily Total	FP	RO	
7016	1B68	FR1 Interval Total	FP	RO	
7017	1B69	FR1 Polling Total	FP	RO	
7018	1B6A	FR1 Previous Day Total	FP	RO	

Register (Decimal)	Register (Hex)	Description	Data Type	Access	Wired Only
7019	1B6B	FR1 Previous Interval	FP	RO	
7020	1B6C	FR1 Previous Polling Total	FP	RO	
7021	1B6D	FR1 Grand Mass Total	FP	RO	
7022	1B6E	FR1 Instantanous Mass Flow Rate	FP	RO	
7023	1B6F	FR1 Daily Mass Total	FP	RO	
7024	1B70	FR1 Interval Mass Total	FP	RO	
7025	1B71	FR1 Polling Mass Total	FP	RO	
7026	1B72	FR1 Previous Day Mass	FP	RO	
7027	1B73	FR1 Previous Interval Mass	FP	RO	
7028	1B74	FR1 Previous Polling Mass	FP	RO	
7029	1B75	FR1 Grand Energy Total	FP	RO	
7030	1B76	FR1 Instantaneous Energy Flow Rate	FP	RO	
7031	1B77	FR1 Daily Energy Total	FP	RO	
7032	1B78	FR1 Interval Energy Total	FP	RO	
7033	1B79	FR1 Polling Energy Total	FP	RO	
7034	1B7A	FR1 Previous Day Energy	FP	RO	
7035	1B7B	FR1 Previous Interval Energy	FP	RO	
7036	1B7C	FR1 Previous Polling Energy	FP	RO	
7037	1B7D	FR1 Daily Estimated Total	FP	RO	
7038	1B7E	FR1 Monthly Total	FP	RO	
7039	1B7F	FR1 Previous Month Total	FP	RO	
7040	1B80	FR1 Daily Run Time	FP	RO	
7041	1B81	FR1 Interval Run Time	FP	RO	
7042	1B82	FR1 Polling Run Time	FP	RO	
7043	1B83	FR1 Previous Daily Run Time	FP	RO	
7044	1B84	FR1 Previous Interval Run Time	FP	RO	
7045	1B85	FR1 Previous Polling Run Time	FP	RO	
7046	1B86	FR1 Static Pressure	FP	RO	
7047	1B87	FR1 Differential Pressure	FP	RO	
7048	1B88	FR1 Process Temperature	FP	RO	
7049	1B89	FR1 Uncorrected Volume	FP	RO	
7050	1B8A	FR1 SqrtDP	FP	RO	
7051	1B8B	FR1 Compressibility (Natural Gas); FR1 CTPL - Complete Correction Factor (Liquids)	FP	RO	
7052	1B8C	FR1 Density	FP	RO	
7053	1B8D	FR1 Base Compressibility (Natural Gas) FR1 CTL - Temperature Correction Factor (Liquids)	FP	RO	
7054	1B8E	FR1 Base Density	FP	RO	
7055	1B8F	FR1 Average Molecular Weight	FP	RO	
7056	1B90	FR1 Molar Fraction Sum	FP	RO	
7057	1B91	FR1 Mass Heating Value	FP	RO	
7058	1B92	FR1 Heating Value Volume Basis	FP	RO	
7059	1B93	FR1 Specific Gravity	FP	RO	
7060	1B94	FR1 Viscosity	FP	RO	
7061	1B95	FR1 Isentropic Exponent	FP	RO	

Register (Decimal)	Register (Hex)	Description	Data Type	Access	Wired Only
7062	1B96	FR1 Reynolds Number	FP	RO	
7063	1B97	FR1 Calculation Parameter 1	FP	RO	
7064	1B98	FR1 Calculation Parameter 2	FP	RO	
7065	1B99	FR1 Calculation Parameter 3	FP	RO	
7066	1B9A	FR1 Calculation Parameter 4	FP	RO	
7067	1B9B	FR1 Calculation Parameter 5	FP	RO	
7068	1B9C	FR1 Calculation Parameter 6	FP	RO	
7069	1B9D	FR1 Calculation Parameter 7	FP	RO	
7070	1B9E	FR1 Calculation Parameter 8	FP	RO	
7071	1B9F	FR1 Calculation Parameter 9	FP	RO	
7072	1BA0	FR1 Calculation Parameter 10	FP	RO	
7073	1BA1	FR1 Calculation Parameter 11	FP	RO	
7074	1BA2	FR1 Calculation Parameter 12	FP	RO	
7075	1BA3	FR1 Calculation Parameter 13	FP	RO	
7076	1BA4	FR1 Calculation Parameter 14	FP	RO	
7077	1BA5	FR1 Calculation Parameter 15	FP	RO	
7078	1BA6	FR1 Calculation Parameter 16	FP	RO	
7079	1BA7	FR1 Grand Total [MCF]	FP	RO	
7080	1BA8	FR1 Instantaneous Flow Rate [MCF]	FP	RO	
7081	1BA9	FR1 Daily Total [MCF]	FP	RO	
7082	1BAA	FR1 Interval Total [MCF]	FP	RO	
7083	1BAB	FR1 Polling Total [MCF]	FP	RO	
7084	1BAC	FR1 Previous Day [MCF]	FP	RO	
7085	1BAD	FR1 Previous Interval [MCF]	FP	RO	
7086	1BAE	FR1 Previous Polling Total [MCF]	FP	RO	
7087	1BAF	FR1 Grand Mass Total [LBM]	FP	RO	
7088	1BB0	FR1 Instantaneous Mass Rate [LBM]	FP	RO	
7089	1BB1	FR1 Daily Mass Total [LBM]	FP	RO	
7090	1BB2	FR1 Interval Mass Total [LBM]	FP	RO	
7091	1BB3	FR1 Polling Mass Total [LBM]	FP	RO	
7092	1BB4	FR1 Previous Day Mass [LBM]	FP	RO	
7093	1BB5	FR1 Previous Interval Mass [LBM]	FP	RO	
7094	1BB6	FR1 Previous Polling Mass [LBM]	FP	RO	
7095	1BB7	FR1 Grand Energy Total [MMBTU]	FP	RO	
7096	1BB8	FR1 Instanteous Energy Rate [MMBTU]	FP	RO	
7097	1BB9	FR1 Daily Energy Total [MMBTU]	FP	RO	
7098	1BBA	FR1 Interval Energy Total [MMBTU]	FP	RO	
7099	1BBB	FR1 Polling Energy Total [MMBTU]	FP	RO	
7100	1BBC	FR1 Previous Day Energy [MMBTU]	FP	RO	
7101	1BBD	FR1 Previous Interval Energy [MMBTU]	FP	RO	
7102	1BBE	FR1 Previous Polling Energy [MMBTU]	FP	RO	
7103	1BBF	FR1 Daily Estimated Total [MCF]	FP	RO	
7104	1BC0	FR1 Monthly Total [MCF]	FP	RO	
7105	1BC1	FR1 Previous Month Total [MCF]	FP	RO	
7106	1BC2	FR1 Mass Heating Value [BASE]	FP	RO	

Register (Decimal)	Register (Hex)	Description	Data Type	Access	Wired Only
7107	1BC3	FR1 Volumetric Heating Value [BASE]	FP	RO	
7108	1BC4	T1 Grand Total	FP	RO	
7109	1BC5	T1 Instantaneous Flow Rate	FP	RO	
7110	1BC6	T1 Daily Total	FP	RO	
7111	1BC7	T1 Interval Total	FP	RO	
7112	1BC8	T1 Polling Total	FP	RO	
7113	1BC9	T1 Previous Day	FP	RO	
7114	1BCA	T1 Previous Interval	FP	RO	
7115	1BCB	T1 Previous Polling Total	FP	RO	
7116	1BCC	T1 Daily Estimated Total	FP	RO	
7117	1BCD	T1 Monthly Total	FP	RO	
7118	1BCE	T1 Previous Month Total	FP	RO	
7119	1BCF	T1 Daily Run Time	FP	RO	
7120	1BD0	T1 Interval Run Time	FP	RO	
7121	1BD1	T1 Polling Run Time	FP	RO	
7122	1BD2	T1 Previous Daily Run Time	FP	RO	
7123	1BD3	T1 Previous Interval Run Time	FP	RO	
7124	1BD4	T1 Previous Polling Run Time	FP	RO	
7125	1BD5	T1 Grand Total [GAL]	FP	RO	
7126	1BD6	T1 Instantaneous Flow Rate [GAL]	FP	RO	
7127	1BD7	T1 Daily Total [GAL]	FP	RO	
7128	1BD8	T1 Interval Total [GAL]	FP	RO	
7129	1BD9	T1 Polling Total [GAL]	FP	RO	
7130	1BDA	T1 Previous Day [GAL]	FP	RO	
7131	1BDB	T1 Previous Interval [GAL]	FP	RO	
7132	1BDC	T1 Previous Polling Total [GAL]	FP	RO	
7133	1BDD	T1 Daily Estimated Total [GAL]	FP	RO	
7134	1BDE	T1 Monthly Total [GAL]	FP	RO	
7135	1BDF	T1 Previous Month Total [GAL]	FP	RO	
7136	1BE0	T1 Frequency	FP	RO	
7137	1BE1	T1 Active K-Factor	FP	RO	
7138	1BE2	T2 Grand Total	FP	RO	✓
7139	1BE3	T2 Instantaneous Flow Rate	FP	RO	✓
7140	1BE4	T2 Daily Total	FP	RO	✓
7141	1BE5	T2 Interval Total	FP	RO	✓
7142	1BE6	T2 Polling Total	FP	RO	✓
7143	1BE7	T2 Previous Day	FP	RO	✓
7144	1BE8	T2 Previous Interval	FP	RO	✓
7145	1BE9	T2 Previous Polling Total	FP	RO	✓
7146	1BEA	T2 Daily Estimated Total	FP	RO	✓
7147	1BEB	T2 Monthly Total	FP	RO	✓
7148	1BEC	T2 Previous Month Total	FP	RO	✓
7149	1BED	T2 Daily Run Time	FP	RO	✓
7150	1BEE	T2 Interval Run Time	FP	RO	✓

Register (Decimal)	Register (Hex)	Description	Data Type	Access	Wired Only
7151	1BEF	T2 Polling Run Time	FP	RO	✓
7152	1BF0	T2 Previous Daily Run Time	FP	RO	✓
7153	1BF1	T2 Previous Interval Run Time	FP	RO	✓
7154	1BF2	T2 Previous Polling Run Time	FP	RO	✓
7155	1BF3	T2 Grand Total [GAL]	FP	RO	✓
7156	1BF4	T2 Instantaneous Flow Rate [GAL]	FP	RO	✓
7157	1BF5	T2 Daily Total [GAL]	FP	RO	✓
7158	1BF6	T2 Interval Total [GAL]	FP	RO	✓
7159	1BF7	T2 Polling Total [GAL]	FP	RO	✓
7160	1BF8	T2 Previous Day Total [GAL]	FP	RO	✓
7161	1BF9	T2 Previous Interval [GAL]	FP	RO	✓
7162	1BFA	T2 Previous Polling Total [GAL]	FP	RO	✓
7163	1BFB	T2 Daily Estimated Total [GAL]	FP	RO	✓
7164	1BFC	T2 Monthly Total [GAL]	FP	RO	✓
7165	1BFD	T2 Previous Month Total [GAL]	FP	RO	✓
7166	1BFE	T2 Frequency	FP	RO	✓
7167	1BFF	T2 Active K-Factor	FP	RO	✓
7168	1C00	SP Instantaneous Reading	FP	RO	
7169	1C01	SP Rate Of Change	FP	RO	
7170	1C02	SP Daily Average	FP	RO	
7171	1C03	SP Interval Average	FP	RO	
7172	1C04	SP Polling Average	FP	RO	
7173	1C05	SP Previous Daily Average	FP	RO	
7174	1C06	SP Previous Interval Average	FP	RO	
7175	1C07	SP Previous Polling Average	FP	RO	
7176	1C08	SP Daily Run Time	FP	RO	
7177	1C09	SP Interval Run Time	FP	RO	
7178	1C0A	SP Polling Run Time	FP	RO	
7179	1C0B	SP Previous Daily Run Time	FP	RO	
7180	1C0C	SP Previous Interval Run Time	FP	RO	
7181	1C0D	SP Previous Polling Run Time	FP	RO	
7182	1C0E	SP Instantaneous Reading [PSI]	FP	RO	
7183	1C0F	SP Rate of Change [PSI]	FP	RO	
7184	1C10	SP Daily Average [PSI]	FP	RO	
7185	1C11	SP Interval Average [PSI]	FP	RO	
7186	1C12	SP Polling Average [PSI]	FP	RO	
7187	1C13	SP Previous Daily Average [PSI]	FP	RO	
7188	1C14	SP Previous Interval Average [PSI]	FP	RO	
7189	1C15	SP Previous Polling Average [PSI]	FP	RO	
7190	1C16	DP Instantaneous Reading	FP	RO	
7191	1C17	DP Rate Of Change	FP	RO	
7192	1C18	DP Daily Average	FP	RO	
7193	1C19	DP Interval Average	FP	RO	

Register (Decimal)	Register (Hex)	Description	Data Type	Access	Wired Only
7194	1C1A	DP Polling Average	FP	RO	
7195	1C1B	DP Previous Daily Average	FP	RO	
7196	1C1C	DP Previous Interval Average	FP	RO	
7197	1C1D	DP Previous Polling Average	FP	RO	
7198	1C1E	DP Daily Run Time	FP	RO	
7199	1C1F	DP Interval Run Time	FP	RO	
7200	1C20	DP Polling Run Time	FP	RO	
7201	1C21	DP Previous Daily Run Time	FP	RO	
7202	1C22	DP Previous Interval Run Time	FP	RO	
7203	1C23	DP Previous Polling Run Time	FP	RO	
7204	1C24	DP Instantaneous Reading [INH2O]	FP	RO	
7205	1C25	DP Rate of Change [INH2O]	FP	RO	
7206	1C26	DP Daily Average [INH2O]	FP	RO	
7207	1C27	DP Interval Average [INH2O]	FP	RO	
7208	1C28	DP Polling Average [INH2O]	FP	RO	
7209	1C29	DP Previous Daily Average [INH2O]	FP	RO	
7210	1C2A	DP Previous Interval Average [INH2O]	FP	RO	
7211	1C2B	DP Previous Polling Average [INH2O]	FP	RO	
7212	1C2C	PT Instantaneous Reading	FP	RO	
7213	1C2D	PT Rate Of Change	FP	RO	
7214	1C2E	PT Daily Average	FP	RO	
7215	1C2F	PT Interval Average	FP	RO	
7216	1C30	PT Polling Average	FP	RO	
7217	1C31	PT Previous Daily Average	FP	RO	
7218	1C32	PT Previous Interval Average	FP	RO	
7219	1C33	PT Previous Polling Average	FP	RO	
7220	1C34	PT Daily Run Time	FP	RO	
7221	1C35	PT Interval Run Time	FP	RO	
7222	1C36	PT Polling Run Time	FP	RO	
7223	1C37	PT Previous Daily Run Time	FP	RO	
7224	1C38	PT Previous Interval Run Time	FP	RO	
7225	1C39	PT Previous Polling Run Time	FP	RO	
7226	1C3A	PT Instantaneous Reading [DEGF]	FP	RO	
7227	1C3B	PT Rate of Change [DEGF]	FP	RO	
7228	1C3C	PT Daily Average [DEGF]	FP	RO	
7229	1C3D	PT Interval Average [DEGF]	FP	RO	
7230	1C3E	PT Polling Average [DEGF]	FP	RO	
7231	1C3F	PT Previous Daily Average [DEGF]	FP	RO	
7232	1C40	PT Previous Interval Average [DEGF]	FP	RO	
7233	1C41	PT Previous Polling Average [DEGF]	FP	RO	
7234	1C42	A1 Instantaneous Reading	FP	RO	✓
7235	1C43	A1 Rate Of Change	FP	RO	✓
7236	1C44	A1 Daily Average	FP	RO	✓
7237	1C45	A1 Interval Average	FP	RO	✓

Register (Decimal)	Register (Hex)	Description	Data Type	Access	Wired Only
7238	1C46	A1 Polling Average	FP	RO	✓
7239	1C47	A1 Previous Daily Average	FP	RO	✓
7240	1C48	A1 Previous Interval Average	FP	RO	✓
7241	1C49	A1 Previous Polling Average	FP	RO	✓
7242	1C4A	A1 Daily Run Time	FP	RO	✓
7243	1C4B	A1 Interval Run Time	FP	RO	✓
7244	1C4C	A1 Polling Run Time	FP	RO	✓
7245	1C4D	A1 Previous Daily Run Time	FP	RO	✓
7246	1C4E	A1 Previous Interval Run Time	FP	RO	✓
7247	1C4F	A1 Previous Polling Run Time	FP	RO	✓
7248	1C50	A1 Instantaneous Reading [VOLT]	FP	RO	✓
7249	1C51	A1 Rate of Change [VOLT]	FP	RO	✓
7250	1C52	A1 Daily Average [VOLT]	FP	RO	✓
7251	1C53	A1 Interval Average [VOLT]	FP	RO	✓
7252	1C54	A1 Polling Average [VOLT]	FP	RO	✓
7253	1C55	A1 Previous Daily Average [VOLT]	FP	RO	✓
7254	1C56	A1 Previous Interval Average [VOLT]	FP	RO	✓
7255	1C57	A1 Previous Polling Average [VOLT]	FP	RO	✓
7256	1C58	A2 Instantaneous Reading	FP	RO	✓
7257	1C59	A2 Rate Of Change	FP	RO	✓
7258	1C5A	A2 Daily Average	FP	RO	✓
7259	1C5B	A2 Interval Average	FP	RO	✓
7260	1C5C	A2 Polling Average	FP	RO	✓
7261	1C5D	A2 Previous Daily Average	FP	RO	✓
7262	1C5E	A2 Previous Interval Average	FP	RO	✓
7263	1C5F	A2 Previous Polling Average	FP	RO	✓
7264	1C60	A2 Daily Run Time	FP	RO	✓
7265	1C61	A2 Interval Run Time	FP	RO	✓
7266	1C62	A2 Polling Run Time	FP	RO	✓
7267	1C63	A2 Previous Daily Run Time	FP	RO	✓
7268	1C64	A2 Previous Interval Run Time	FP	RO	✓
7269	1C65	A2 Previous Polling Run Time	FP	RO	✓
7270	1C66	A2 Instantaneous Reading [VOLT]	FP	RO	✓
7271	1C67	A2 Rate of Change [VOLT]	FP	RO	✓
7272	1C68	A2 Daily Average [VOLT]	FP	RO	✓
7273	1C69	A2 Interval Average [VOLT]	FP	RO	✓
7274	1C6A	A2 Polling Average [VOLT]	FP	RO	✓
7275	1C6B	A2 Previous Daily Average [VOLT]	FP	RO	✓
7276	1C6C	A2 Previous Interval Average [VOLT]	FP	RO	✓
7277	1C6D	A2 Previous Polling Average [VOLT]	FP	RO	✓
7278	1C6E	Internal Temperature	FP	RO	

Register (Decimal)	Register (Hex)	Description	Data Type	Access	Wired Only
7279	1C6F	Supply Voltage	FP	RO	
7280	1C70	Battery Voltage	FP	RO	
7281	1C71	Live FR1 Instantaneous Flow Rate [BASE]	FP	RO	
7282	Reserved				
7283	1C73	Live T1 Instantaneous Flow Rate [GAL]	FP	RO	
7284	1C74	Live T2 Instantaneous Flow Rate [GAL]	FP	RO	✓
7285	1C75	Live Turbine Frequency Differential	FP	RO	✓
7286	1C76	Live Turbine Frequency Ratio	FP	RO	✓
7287	1C77	Live Static Pressure	FP	RO	
7288	1C78	Live Differential Pressure	FP	RO	
7289	1C79	Live MVT Temperature	FP	RO	
7290	1C7A	Live Bridge Voltage	FP	RO	
7291	1C7B	Live Analog 1	FP	RO	✓
7292	1C7C	Live Analog 2	FP	RO	✓
7293	1C7D	Live Production Temperature	FP	RO	
7294	1C7E	Live RTD Resistance	FP	RO	
7295	1C7F	PID Stage 1 Status	FP	RO	✓
7296	1C80	PID Stage 1 Output	FP	RO	✓
7297	1C81	PID Stage 2 Status	FP	RO	✓
7298	1C82	PID Stage 2 Output	FP	RO	✓
7299	1C83	PO1 Pulses	FP	RO	
7300 to 7302	Reserved				
7303	1C87	AO1 Output Current	FP	RO	✓
7307	1C8B	AO1 DAC Output	FP	RO	✓
7311 to 7312	Reserved				
7313	1C91	PI2 State	FP	RO	✓
7314	1C92	PI2 Count	FP	RO	✓
7315 to 7318	Reserved				
7319	1C97	Daily Archive Date	FP	RO	
7320	1C98	Interval Archive Date	FP	RO	
7321	1C99	Daily Archive Time	FP	RO	
7322	1C9A	Interval Archive Time	FP	RO	
7323	1C9B	Slave Data Point 01	FP	RO	
7324	1C9C	Slave Data Point 02	FP	RO	
7325	1C9D	Slave Data Point 03	FP	RO	
7326	1C9E	Slave Data Point 04	FP	RO	
7327	1C9F	Slave Data Point 05	FP	RO	
7328	1CA0	Slave Data Point 06	FP	RO	
7329	1CA1	Slave Data Point 07	FP	RO	
7330	1CA2	Slave Data Point 08	FP	RO	
7331	1CA3	Slave Data Point 09	FP	RO	
7332	1CA4	Slave Data Point 10	FP	RO	
7333	1CA5	Slave Data Point 11	FP	RO	

Register (Decimal)	Register (Hex)	Description	Data Type	Access	Wired Only
7334	1CA6	Slave Data Point 12	FP	RO	
7335	1CA7	Slave Data Point 13	FP	RO	
7336	1CA8	Slave Data Point 14	FP	RO	
7337	1CA9	Slave Data Point 15	FP	RO	
7338	1CAA	Slave Data Point 16	FP	RO	
7339	1CAB	Calc Block 0, Current Day [Default: Flow Extension]	FP	RO	
7340	1CAC	Calc Block 0, Current Interval [Default: Flow Extension]	FP	RO	
7341	1CAD	Calc Block 0, Current Polling [Default: Flow Extension]	FP	RO	
7342	1CAE	Calc Block 0, Previous Day [Default: Flow Extension]	FP	RO	
7343	1CAF	Calc Block 0, Previous Interval [Default: Flow Extension]	FP	RO	
7344	1CB0	Calc Block 0, Previous Polling [Default: Flow Extension]	FP	RO	
7345	1CB1	Calc Block 1, Current Day	FP	RO	
7346	1CB2	Calc Block 1, Current Interval	FP	RO	
7347	1CB3	Calc Block 1, Current Polling	FP	RO	
7348	1CB4	Calc Block 1, Previous Day	FP	RO	
7349	1CB5	Calc Block 1, Previous Interval	FP	RO	
7350	1CB6	Calc Block 1, Previous Polling	FP	RO	
7351	1CB7	Calc Block 2, Current Day	FP	RO	
7352	1CB8	Calc Block 2, Current Interval	FP	RO	
7353	1CB9	Calc Block 2, Current Polling	FP	RO	
7354	1CBA	Calc Block 2, Previous Day	FP	RO	
7355	1CBB	Calc Block 2, Previous Interval	FP	RO	
7356	1CBC	Calc Block 2, Previous Polling	FP	RO	
7357	1CBD	Calc Block 3, Current Day	FP	RO	
7358	1CBE	Calc Block 3, Current Interval	FP	RO	
7359	1CBF	Calc Block 3, Current Polling	FP	RO	
7360	1CC0	Calc Block 3, Previous Day	FP	RO	
7361	1CC1	Calc Block 3, Previous Interval	FP	RO	
7362	1CC2	Calc Block 3, Previous Polling	FP	RO	
7363	1CC3	Polling Date	FP	RO	
7364	1CC4	Polling Time	FP	RO	
7365	1CC5	Previous Day FR1 Grand Total Volume [MCF]	FP	RO	
7366	1CC6	Previous Interval FR1 Grand Total Volume [MCF]	FP	RO	
7367	1CC7	Previous Polling FR1 Grand Total Volume	FP	RO	
7368	1CC8	Previous Day FR1 Grand Total Mass [LBM]	FP	RO	
7369	1CC9	Previous Interval FR1 Grand Total Mass [LBM]	FP	RO	
7370	1CCA	Previous Polling FR1 Grand Total Mass	FP	RO	
7371	1CCB	Previous Day FR1 Grand Total Energy [MMBTU]	FP	RO	
7372	1CCC	Previous Interval FR1 Grand Total Energy [MMBTU]	FP	RO	
7373	1CCD	Previous Polling FR1 Grand Total Energy	FP	RO	
7374	1CCE	Previous Day T1 Grand Total Volume [GAL]	FP	RO	

Register (Decimal)	Register (Hex)	Description	Data Type	Access	Wired Only
7375	1CCF	Previous Interval T1 Grand Total Volume [GAL]	FP	RO	
7376	1CD0	Previous Polling T1 Grand Total Volume	FP	RO	
7377	1CD1	Previous Day T2 Grand Total Volume [GAL]	FP	RO	✓
7378	1CD2	Previous Interval T2 Grand Total Volume [GAL]	FP	RO	✓
7379	1CD3	Previous Polling T2 Grand Total Volume [GAL]	FP	RO	✓

Archive Preview Registers (32-bit)

Register (Decimal)	Register (Hex)	Description	Data Type	Access
7400	1CE8	Daily Record 1, Parameter 1 (Date)	FP	RO
7401	1CE9	Daily Record 1, Parameter 2 (Time)	FP	RO
7402	1CEA	Daily Record 1, Parameter 3	FP	RO
7403	1CEB	Daily Record 1, Parameter 4	FP	RO
7404	1CEC	Daily Record 1, Parameter 5	FP	RO
7405	1CED	Daily Record 1, Parameter 6	FP	RO
7406	1CEE	Daily Record 1, Parameter 7	FP	RO
7407	1CEF	Daily Record 1, Parameter 8	FP	RO
7408	1CF0	Daily Record 1, Parameter 9	FP	RO
7409	1CF1	Daily Record 1, Parameter 10	FP	RO
7410	1CF2	Daily Record 1, Parameter 11	FP	RO
7411	1CF3	Daily Record 1, Parameter 12	FP	RO
7412	1CF4	Daily Record 1, Parameter 13	FP	RO
7413	1CF5	Daily Record 1, Parameter 14	FP	RO
7414	1CF6	Daily Record 1, Parameter 15	FP	RO
7415	1CF7	Daily Record 1, Parameter 16	FP	RO
7416	1CF8	Daily Record 2, Parameter 1 (Date)	FP	RO
7417	1CF9	Daily Record 2, Parameter 2 (Time)	FP	RO
7418	1CFA	Daily Record 2, Parameter 3	FP	RO
7419	1CFB	Daily Record 2, Parameter 4	FP	RO
7420	1CFC	Daily Record 2, Parameter 5	FP	RO
7421	1CFD	Daily Record 2, Parameter 6	FP	RO
7422	1CFE	Daily Record 2, Parameter 7	FP	RO
7423	1CFF	Daily Record 2, Parameter 8	FP	RO
7424	1D00	Daily Record 2, Parameter 9	FP	RO
7425	1D01	Daily Record 2, Parameter 10	FP	RO
7426	1D02	Daily Record 2, Parameter 11	FP	RO
7427	1D03	Daily Record 2, Parameter 12	FP	RO
7428	1D04	Daily Record 2, Parameter 13	FP	RO
7429	1D05	Daily Record 2, Parameter 14	FP	RO
7430	1D06	Daily Record 2, Parameter 15	FP	RO
7431	1D07	Daily Record 2, Parameter 16	FP	RO
7432	1D08	Interval Record 1, Parameter 1 (Date)	FP	RO
7433	1D09	Interval Record 1, Parameter 2 (Time)	FP	RO
7434	1D0A	Interval Record 1, Parameter 3	FP	RO

Archive Preview Registers (32-bit)

Register (Decimal)	Register (Hex)	Description	Data Type	Access
7435	1D0B	Interval Record 1, Parameter 4	FP	RO
7436	1D0C	Interval Record 1, Parameter 5	FP	RO
7437	1D0D	Interval Record 1, Parameter 6	FP	RO
7438	1D0E	Interval Record 1, Parameter 7	FP	RO
7439	1D0F	Interval Record 1, Parameter 8	FP	RO
7440	1D10	Interval Record 1, Parameter 9	FP	RO
7441	1D11	Interval Record 1, Parameter 10	FP	RO
7442	1D12	Interval Record 1, Parameter 11	FP	RO
7443	1D13	Interval Record 1, Parameter 12	FP	RO
7444	1D14	Interval Record 1, Parameter 13	FP	RO
7445	1D15	Interval Record 1, Parameter 14	FP	RO
7446	1D16	Interval Record 1, Parameter 15	FP	RO
7447	1D17	Interval Record 1, Parameter 16	FP	RO
7448	1D18	Interval Record 2, Parameter 1 (Date)	FP	RO
7449	1D19	Interval Record 2, Parameter 2 (Time)	FP	RO
7450	1D1A	Interval Record 2, Parameter 3	FP	RO
7451	1D1B	Interval Record 2, Parameter 4	FP	RO
7452	1D1C	Interval Record 2, Parameter 5	FP	RO
7453	1D1D	Interval Record 2, Parameter 6	FP	RO
7454	1D1E	Interval Record 2, Parameter 7	FP	RO
7455	1D1F	Interval Record 2, Parameter 8	FP	RO
7456	1D20	Interval Record 2, Parameter 9	FP	RO
7457	1D21	Interval Record 2, Parameter 10	FP	RO
7458	1D22	Interval Record 2, Parameter 11	FP	RO
7459	1D23	Interval Record 2, Parameter 12	FP	RO
7460	1D24	Interval Record 2, Parameter 13	FP	RO
7461	1D25	Interval Record 2, Parameter 14	FP	RO
7462	1D26	Interval Record 2, Parameter 15	FP	RO
7463	1D27	Interval Record 2, Parameter 16	FP	RO

User-Defined Modbus Registers Configuration

The Scanner 2100 provides a block of 25 floating point values that the user can assign to any register in the holding register map. This optimizes communication by allowing the parameters that are of interest for a given application to be organized and read in a single block read. For details on configuring User-Defined Holding Registers, see Section 3 of the ModWorX Pro Software User Manual. Each of the user-defined holding registers is determined by a pointer value in the holding register map. It is easiest to configure the pointer values with the ModWorX Pro software; however the pointer value can be determined with the following calculation: (Holding Register Number – 8000) / 2.

User-Defined Register Pointers

Register (Decimal)	Register (Hex)	Description	Data Type	Access
9000	2328	User-Defined Starting Address (Always 9100)	U16	RO
9001	2329	Register Pointer 1	U16	RW

Register (Decimal)	Register (Hex)	Description	Data Type	Access
9002	232A	Register Pointer 2	U16	RW
9003	232B	Register Pointer 3	U16	RW
9004	232C	Register Pointer 4	U16	RW
9005	232D	Register Pointer 5	U16	RW
9006	232E	Register Pointer 6	U16	RW
9007	232F	Register Pointer 7	U16	RW
9008	2330	Register Pointer 8	U16	RW
9009	2331	Register Pointer 9	U16	RW
9010	2332	Register Pointer 10	U16	RW
9011	2333	Register Pointer 11	U16	RW
9012	2334	Register Pointer 12	U16	RW
9013	2335	Register Pointer 13	U16	RW
9014	2336	Register Pointer 14	U16	RW
9015	2337	Register Pointer 15	U16	RW
9016	2338	Register Pointer 16	U16	RW
9017	2339	Register Pointer 17	U16	RW
9018	233A	Register Pointer 18	U16	RW
9019	233B	Register Pointer 19	U16	RW
9020	233C	Register Pointer 20	U16	RW
9021	233D	Register Pointer 21	U16	RW
9022	233E	Register Pointer 22	U16	RW
9023	233F	Register Pointer 23	U16	RW
9024	2340	Register Pointer 24	U16	RW
9025	2341	Register Pointer 25	U16	RW

User-Defined Holding Registers

Register (Decimal)	Register (Hex)	Description	Data Type	Access
9100	238C	User-Defined Holding Register 1	FP	RO
9102	238E	User-Defined Holding Register 2	FP	RO
9104	2390	User-Defined Holding Register 3	FP	RO
9106	2392	User-Defined Holding Register 4	FP	RO
9108	2394	User-Defined Holding Register 5	FP	RO
9110	2396	User-Defined Holding Register 6	FP	RO
9112	2398	User-Defined Holding Register 7	FP	RO
9114	239A	User-Defined Holding Register 8	FP	RO
9116	239C	User-Defined Holding Register 9	FP	RO
9118	239E	User-Defined Holding Register 10	FP	RO
9120	23A0	User-Defined Holding Register 11	FP	RO
9122	23A2	User-Defined Holding Register 12	FP	RO
9124	23A4	User-Defined Holding Register 13	FP	RO
9126	23A6	User-Defined Holding Register 14	FP	RO
9128	23A8	User-Defined Holding Register 15	FP	RO
9130	23AA	User-Defined Holding Register 16	FP	RO

Register (Decimal)	Register (Hex)	Description	Data Type	Access
9132	23AC	User-Defined Holding Register 17	FP	RO
9134	23AE	User-Defined Holding Register 18	FP	RO
9136	23B0	User-Defined Holding Register 19	FP	RO
9138	23B2	User-Defined Holding Register 20	FP	RO
9140	23B4	User-Defined Holding Register 21	FP	RO
9142	23B6	User-Defined Holding Register 22	FP	RO
9144	23B8	User-Defined Holding Register 23	FP	RO
9146	23BA	User-Defined Holding Register 24	FP	RO
9148	23BC	User-Defined Holding Register 25	FP	RO

Device Status

The device status includes alarm status and diagnostic information such as input status and calculation status. The Scanner 2100 provides 16 user-configurable alarms designated as Flow Run Alarms. The user can assign the alarms to any parameter in the holding register map. Alarms can be defined as low alarms or high alarms. For details on configuring Flow Run Alarms, see Section 3 of the ModWorX Pro Software User Manual. The current status of the alarms can be obtained by reading the Flow Run Alarm registers in the device status map. A bit value of 1 indicates an alarm condition. Also contained in the device status map are diagnostic registers. The bits in these registers provide system status for inputs (under range, above range or failed), calculation status (for confirming whether the flow run is working properly) and details regarding the health of the MVT.

Device Status Registers

Register (Decimal)	Register (Hex)	Description	Data Type	Access
9900	26AC	Flow Run Alarms High	U32	RW
9902	26AE	Input Status	U32	RW
9904	26B0	Calculation Status	U32	RW

Bit Definitions—Alarms and Diagnostics

Bit	Flow Run Alarm High	Flow Run Alarm Low	Diagnostic 1	Diagnostic 2	Diagnostic 3	Diagnostic 4
15	FRA16 High	FRA16 Low	FR1 Fail	FR1 High	Reserved	Reserved
14	FRA15 High	FRA15 Low	T1 Fail	T1 High	Reserved	Reserved
13	FRA14 High	FRA14 Low	T2 Fail	T2 High	T2 Calc Warning	Reserved
12	FRA13 High	FRA13 Low	SP Fail	SP High	T1 Calc Warning	Reserved
11	FRA12 High	FRA12 Low	DP Fail	DP High	Reserved	Reserved
10	FRA11 High	FRA11 Low	PT Fail	PT High	Reserved	Reserved
9	FRA10 High	FRA10 Low	A1 Fail	A1 High	Reserved	Reserved
8	FRA9 High	FRA9 Low	A2 Fail	A2 High	FR1 Calc Warning	Reserved
7	FRA8 High	FRA8 Low	FR1 Override	FR1 Low	NA	Reserved
6	FRA7 High	FRA7 Low	T1 Override	T1 Low	NA	Reserved
5	FRA6 High	FRA6 Low	T2 Override	SP Low	MVT M3 Formula Fail	Reserved
4	FRA5 High	FRA5 Low	SP Override	Reserved	MVT M2 Formula Fail	Power Mode
3	FRA4 High	FRA4 Low	DP Override	DP Low	MVT M1 Formula Fail	Reserved
2	FRA3 High	FRA3 Low	PT Override	PT Low	MVT User Param. CRC Fail	Reserved
1	FRA2 High	FRA2 Low	A1 Override	A1 Low	MVT Fact. Param. CRC Fail	Device Seal
0	FRA1 High	FRA1 Low	A2 Override	A2 Low	MVT Not Present	Ext. Switch

The Scanner 2100 produces low, high and fail conditions for the inputs (not the flow alarms) in accordance with the following table.

Status	Range Check
Low	Lower Range Limit - 20% of span
Fail Low	Lower Range Limit - 500% of span
High	Upper Range Limit + 20% of span
Fail High	Upper Range Limit + 500% of span

Units of Measurement

Value	Units	Scale	Offset
101	GAL - BASE	1.000000000000	0.00
102	BBL	0.023809523810	0.00
103	M3	0.003785411780	0.00
104	LIT	3.785411784000	0.00
105	CF	0.133680555560	0.00
106	ACF	0.133680555560	0.00
107	ACM	0.003785411780	0.00
201	MCF - BASE	1.000000000	0.00
202	SCF	1000.000000000	0.00
203	M3	28.316846592	0.00
204	GAL	7480.519480271	0.00
205	BBL	178.107606673	0.00

Value	Units	Scale	Offset
207	LIT	28316.846592100	0.00
301	PSIG - BASE	1.00000000	0.00
302	Pa	6894.75729317	0.00
303	Kpa	6.89475729317	0.00
304	Mpa	0.00689475729317	0.00
305	Bar	0.06894757	0.00
306	In H2O	27.70500000	0.00
401	In H2O - BASE	1.000000000000	0.00
402	Pa	248.641080600000	0.00
403	Kpa	0.248641080600	0.00
404	mmHg	1.865077000000	0.00
405	In Hg	0.07342822834646	0.00
406	PSI	0.036094567768	0.00
407	kgf/cm2	0.002535630000	0.00
408	mBar	2.48641011188	0.00
501	degF - BASE	1.00	0.00
502	degC	0.555555556	-17.77777778
503	degK	0.555555556	255.3722222
504	degR	1.00	459.67
601	LBM - BASE	1.0000000000	0.00
602	kg	0.45359237000	0.00
701	MMBTU - BASE	1.0000000000	0.00
702	GJ	1.05505585262	0.00
703	BTU	1000000.0000000000	0.00
704	KJ	1055055.8526210000	0.00
801	GAL - BASE	1.000000000000	0.00
802	BBL	42.000000000000	0.00
803	M3	264.172052637296	0.00
804	LIT	0.264172052358	0.00
805	CF	7.480519480271	0.00
806	ACF	7.480519480271	0.00
807	ACM	264.172052637296	0.00
901	Volts	1.0000000000	0.00
902	Millivolts	1000.00000000000	0.00
1001	LBM/CU FT	1.0000000000	0.00
1002	KG/M3	16.01846433740	0.00
1201	inches	1.0000000000	0.00
1202	ft	0.0833333333	0.00
1203	yard	0.0277777778	0.00
1204	mile	0.0000157828	0.00
1205	mm	25.40000000000	0.00
1206	cm	2.5400000000	0.00
1208	m	0.0254000000	0.00
1209	km	0.00002540000	0.00
1301	Hz	1.0000000000	0.00
1302	kHz	0.0010000000	0.00
1303	MHz	0.0000010000	0.00

Value	Units	Scale	Offset
1401	ohms	1.0000000000	0.00
1402	kiloohms	0.0010000000	0.00
1403	megaohms	0.0000010000	0.00
1501	mA	1.0000000000	0.00
1502	A	0.0010000000	0.00
1601	cP	1.0000000000	0.00
1602	lbm/ft.sec	1488.1159420290	0.00

Enron Log Data

The Scanner 2100 provides Enron Modbus compliant downloads. For detailed instructions on downloading interval, daily and event data, refer to *Specifications and Requirements for an Electronic Flow Measurement Remote Terminal Unit for Enron Corp.* If an Enron host is not available or is too cumbersome or inefficient for the host system, there are other methods that are available to retrieve the log data from the instrument. Contact Cameron technical support for details.

The following registers are used for interval, daily and event log registers. Interval and daily records contain 16 user-configurable values. For details on the archive configuration, see Section 3 of the ModWorX Pro Software User Manual. All of the Enron registers have an access type of Read Only (RO).

Enron Registers

Register	Description	Data Type
32	Enron Modbus Event Log Register	Refer to Enron Event Record Format
700	Enron Modbus Interval Log	Refer to Enron Interval/Daily Record Format
701	Enron Modbus Daily Log	Refer to Enron Interval/Daily Record Format
7000	Interval Pointer [1 to 2304] standard, [1 to 6392] with expansion board (WIRED ONLY)	FP32
7001	Daily Pointer [1 to 768]	FP32
7002	Event Counter [1 to 1152]	FP32

Enron Interval/Daily Record Format

The interval and daily record contents are user-configurable. The following table shows the default values. For more information, see Section 3 of the ModWorX Pro Software User Manual.

Parameter	Data Type
Date (MMDDYY)	FP32
Time (HH:MM:SS)	FP32
FR1 Previous Volume (base units)	FP32
FR1 Previous Mass (base units)	FP32
FR1 Previous Energy (base units)	FP32
Differential Pressure Previous Average (InH2O)	FP32
Static Pressure Previous Average (PSIA default, can be PSIG)	FP32
Process Temperature Previous Average (DegF)	FP32
FR1 Previous Run Time (seconds of flow)	FP32
Turbine 1 Previous Volume (base units)	FP32
Turbine 1 Previous Run Time (seconds of flow)	FP32
<Parameter 12> through <Parameter 16>	FP32

Enron Event Record Format

Parameter	Data Type
Status	U16
Address	U16
Time (HH:MM:SS)	FP32
Date (MMDDYY)	FP32
As-Found	FP32
As-Left	FP32

The status parameter in the event record can be decoded with the following table.

Alarm Decoding

Description	Bit
<Unassigned>	0 to 8
User Change/Event	9
Low Low Alarm	10
Low Alarm	11
Hi Alarm	12
Hi Hi Alarm	13
<Unassigned>	14
Alarm Set/Reset (1=Set, 0=Reset)	15

Log Capacity

Log Type	Capacity
Interval Logs	2304 (Std) 6392 (w/ Expansion Board, WIRED ONLY)
Daily Logs	768
Event Logs	1152

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