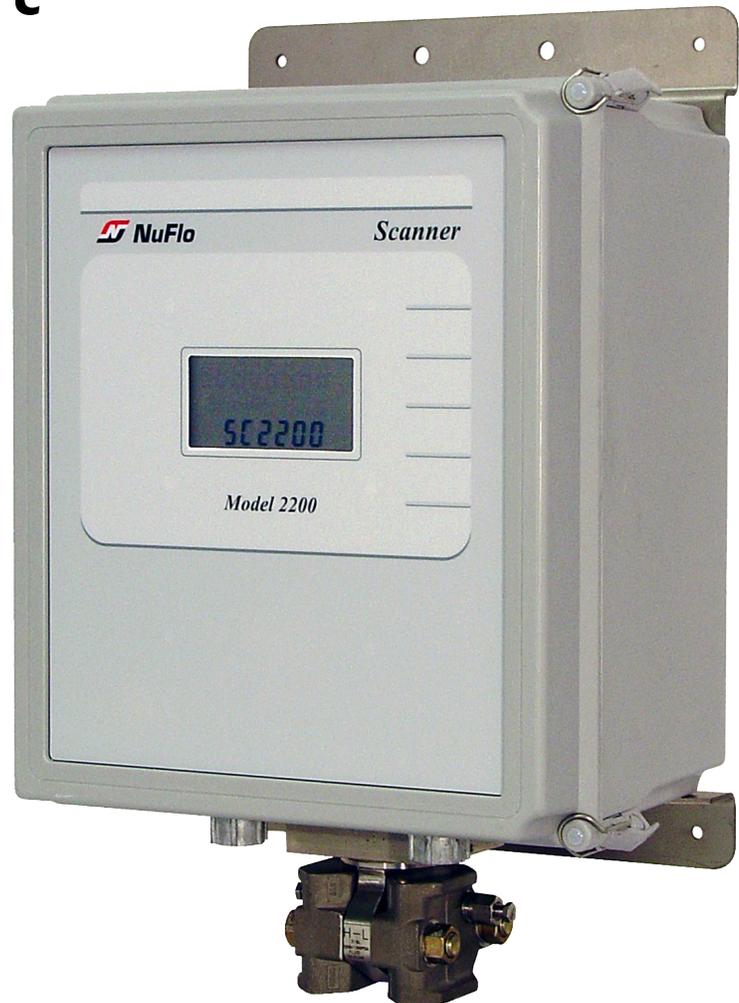# Scanner® 2200 EFM
QuickStart

A Quick Reference on Mounting, Wiring, and Configuring the Scanner 2200 EFM

For complete instructions, see the Scanner 2200 User Manual (Part No. 9A-30165030) and the ModWorX™ Pro Software User Manual (Part No. 9A-30165025).

Installing the Scanner 2200 EFM

Mounting Instructions

To install the NuFlo Scanner 2200 EFM, perform the following steps:

1. Mount the Scanner to a flat, vertical surface using the brackets, or bolt to a 2-in. pipe using the pole-mount hardware provided.
2. Install process tubing between the orifice run and the manifold, making sure that the upstream pressure tap is connected to the high-pressure manifold port and the downstream pressure tap is connected to the low-pressure manifold port. Slope all piping at least 1-inch per linear foot to avoid trapping liquid.
3. Use a suitable compound or tape on all threaded process connections.
4. Position all shutoff and bypass valves so they are accessible from the front of the instrument.
5. Check the manifold for leaks.

Important—Due to the weight of the instrument and the potential for vibration in pipeline installations, direct mounting the Scanner 2200 to a manifold is not recommended. A remote mount is recommended for instrument stability.

Wiring the Scanner 2200

Field wiring enters the Scanner 2200 EFM through the conduit hubs in the bottom of the enclosure and connects to terminal blocks on the circuit assembly, and the DC power supply/charger or the solar charge controller.

Thirteen terminal blocks are arranged along the bottom and side edges of the circuit assembly, as shown at right.
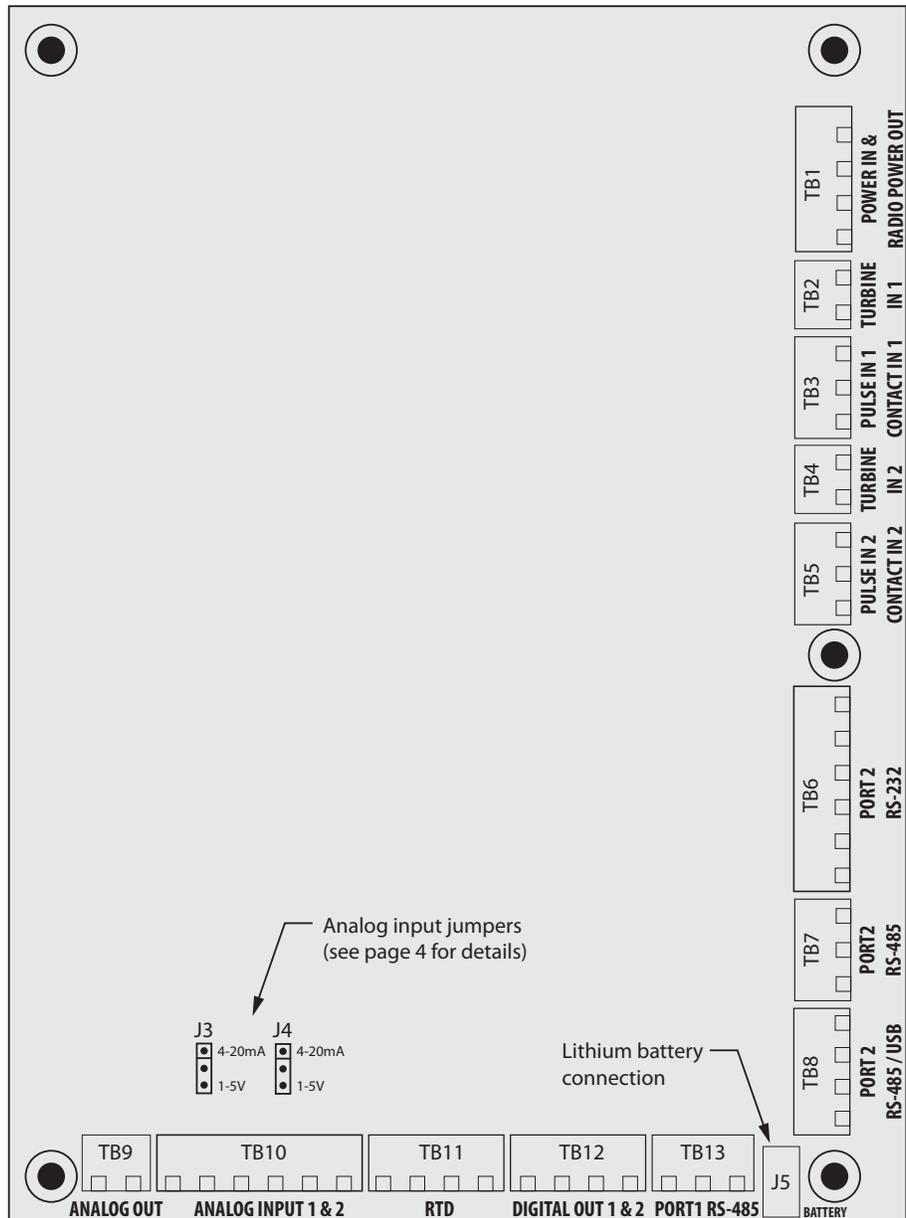
The numbers printed on the charge controller and DC power supply indicate the order in which connections should be made.
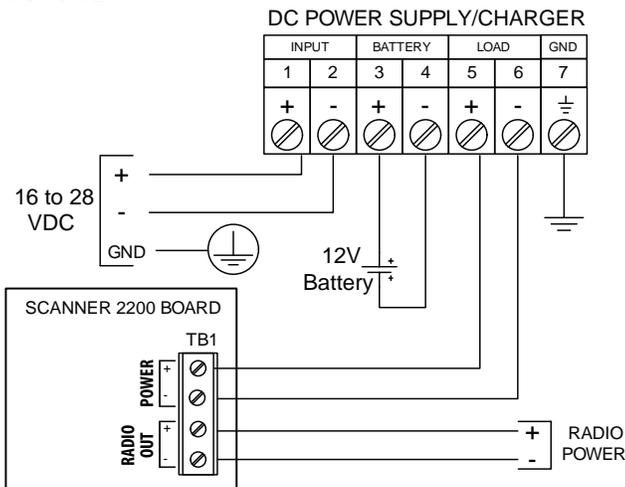
Power Connections

The Scanner 2200 EFM can be powered externally with a 16 to 28 VDC power supply or a 12-VDC solar panel using an integral charge controller and a lead acid battery. The Scanner 2200 supports batteries rated up to 33 amp-hours.

When the Scanner is powered externally, the internal lithium battery pack (two "D" batteries in series) provides backup power and should not be disconnected from the J5 connector.
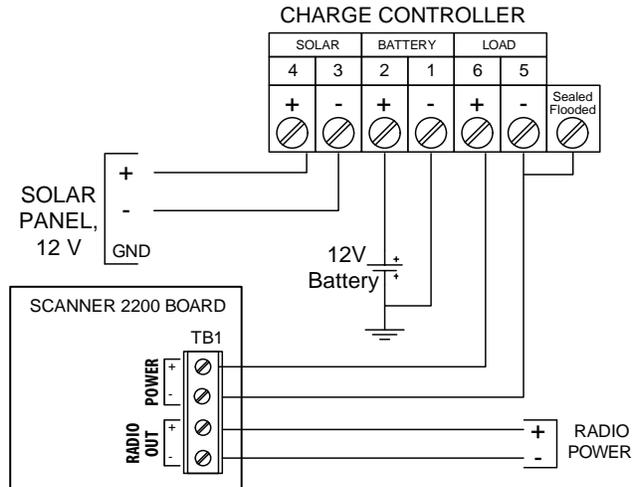
Wiring diagrams for DC power and solar power are provided below. For other power options, see the Scanner 2200 EFM User Manual.
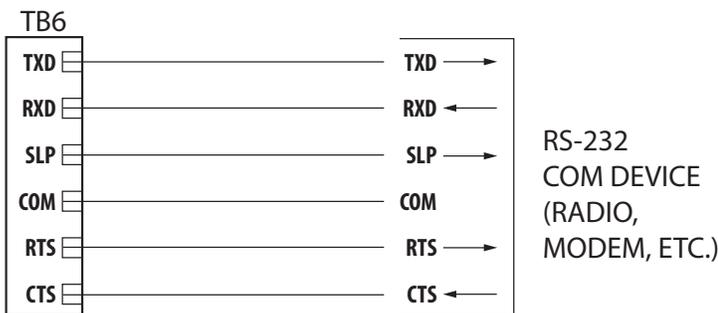

Analog input jumpers
(see page 4 for details)

Lithium battery connection

DC POWER

DC POWER SUPPLY/CHARGER

INPUT		BATTERY		LOAD		GND
1	2	3	4	5	6	7
+	-	+	-	+	-	

16 to 28 VDC

GND

12V Battery

SCANNER 2200 BOARD
TB1
POWER
RADIO OUT

RADIO POWER

SOLAR POWER

CHARGE CONTROLLER

SOLAR		BATTERY		LOAD	
4	3	2	1	6	5
+	-	+	-	+	-

Sealed Flooded

SOLAR PANEL, 12 V

GND

12V Battery

SCANNER 2200 BOARD
TB1
POWER
RADIO OUT

RADIO POWER

COM PORT 1 (RS-485)

TB13

COM	COM
A	A
B	B

RS-485
COM DEVICE
(RADIO, ETC.)

COM PORT 2

TB8

USB ACTIVE	USB ACTIVE
B	B
A	A
COM	COM

EXTERNAL
USB PORT

TB7

B	B
A	A
COM	COM

RS-485
COM DEVICE
(RADIO, ETC.)

TB6

TXD	TXD →
RXD	RXD ←
SLP	SLP →
COM	COM
RTS	RTS →
CTS	CTS ←

RS-232
COM DEVICE
(RADIO,
MODEM, ETC.)

Safety Requirements

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 have a wire range of 22 to 14 AWG and 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.

WARNING—To prevent ignition of hazardous atmospheres, do not remove the cover while circuits are alive. Under normal conditions, the Scanner 2200 EFM poses no hazard when opened in a safe area.

Communications Connections

The Scanner 2200 supports three types of COM connections: RS-485, RS-232, and USB.

Communications Port 1 provides a dedicated RS-485 connection that can be used simultaneously with Communications Port 2.

Communications Port 2 is factory wired to support an external USB connector, but it can also support RS-485 and RS-232 inputs. Any of three terminals can be used to connect a device to Port 2:
TB6—RS-232 communications
TB7—RS-485 communications
TB8—USB communications

While multiple devices can be wired to Port 2 simultaneously, the Scanner 2200 communicates with only one device at a time. When multiple devices are connected, USB communication (TB8) has priority over RS-232 (TB6), which has priority over RS-485 (TB7).

Example:
A radio is connected to TB6 and a user connects a laptop to the external USB connector (TB8) to download data. When the Scanner 2200 detects the USB connection, communications with the radio (TB6) are temporarily suspended. When the USB cable is disconnected from the external USB connector, radio communications via TB6 resume.

The sleep pin on TB6 is an open drain transistor output that is intended for use with radios that incorporate a hardware line for power management.
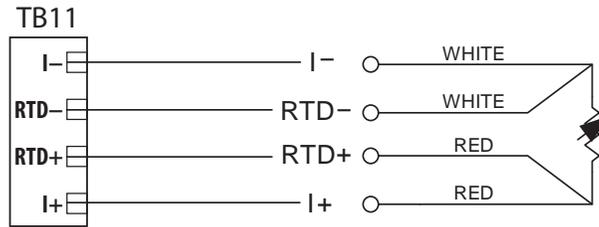
For information on radio control capabilities, see the Radio Power Output wiring diagram on page 5 and Configure Radio Communications on page 10.

Inputs

Temperature Input (TB11)

A 4-wire, 100-ohm platinum 0.00385 OHM/OHM°C RTD is recommended for performing orifice gas and compensated liquid calculations or gas turbine calculations, though a 2- or 3-wire RTD may prove functional. See the Scanner 2200 EFM User Manual for 2-wire and 3-wire diagrams.
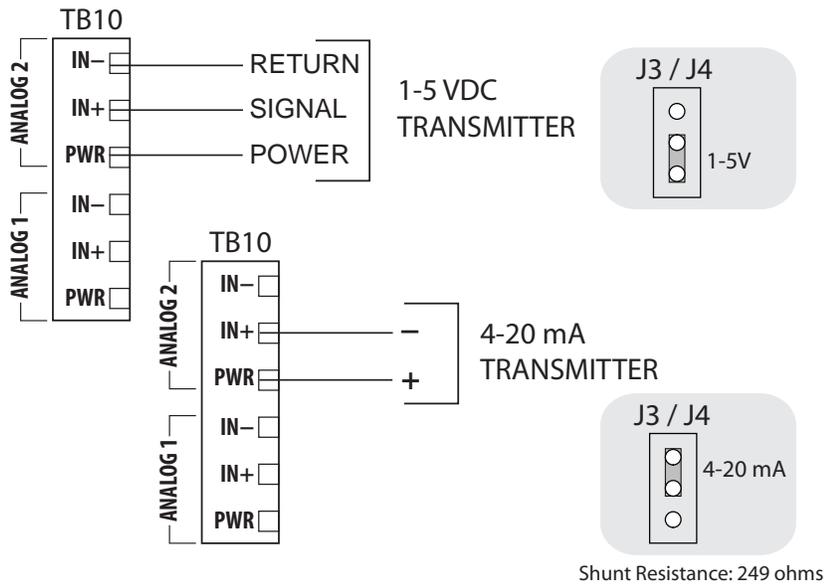
Analog Input (TB10)

The Scanner 2200 EFM provides two analog inputs that can be configured for a 1-5 V, 0-5 V or 4-20 mA signal. They can receive readings from a static pressure, differential pressure, or temperature sensor for any type of calculations, and they can be used to log measurements from any device with a 1-5 V, 0-5 V or 4-20 mA output.

The Scanner can be used to power a transmitter only when the Scanner is externally powered. The output voltage equals the input voltage less 0.25 VDC, and is limited to 20 mA.

The position of a jumper on the board determines whether the input circuit is configured for a 1-5V signal or a 4-20 mA signal. No resistors are required. Jumper J3 determines the signal type for analog input 1. Jumper J4 determines the signal type for analog input 2.
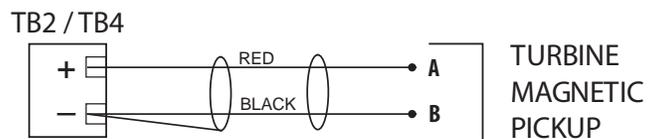
Turbine Inputs (TB2/TB4)

The Scanner 2200 EFM provides two turbine inputs that accept a turbine flowmeter input signal generated by a magnetic pickup. The Scanner 2200 can be configured to use this signal to calculate and display instantaneous flow rates and accumulated totals.

A differential pressure flow run and two turbine runs can be monitored and logged simultaneously.
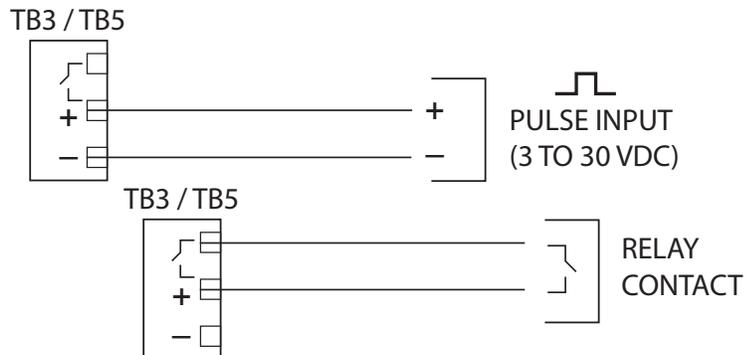
Pulse Input (TB3/TB5)

Two pulse inputs provide optically isolated inputs for high-amplitude pulse (frequency) signals, which includes signals from a turbine meter equipped with a preamplifier or signals from a PD meter (via contact closure).
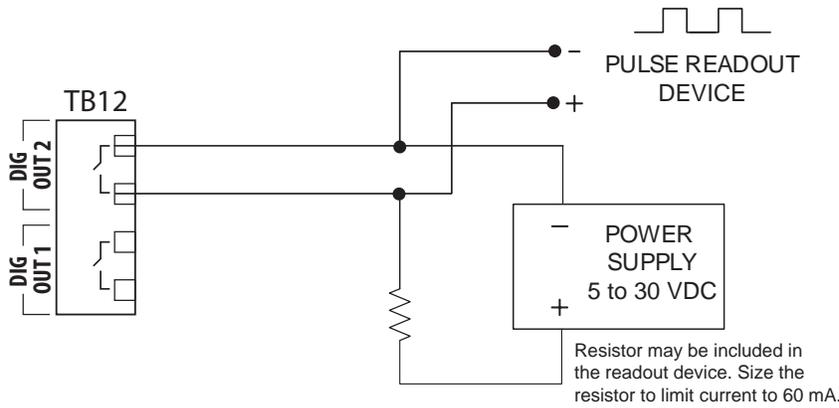
TEMPERATURE INPUT (shown with 4-wire interface)

ANALOG INPUT (1-5V or 4-20 mA TRANSMITTER)

Shunt Resistance: 249 ohms

TURBINE INPUT (TB2 AND TB4)

PULSE INPUT / RELAY CONTACT

DIGITAL OUTPUT

TB12

PULSE READOUT DEVICE

POWER SUPPLY 5 to 30 VDC

Resistor may be included in the readout device. Size the resistor to limit current to 60 mA.

RADIO POWER OUTPUT

TB1

RADIO POWER

ANALOG OUTPUT

TB9

ANALOG READOUT (Resistor may be included.)

POWER SUPPLY 8-30 VDC
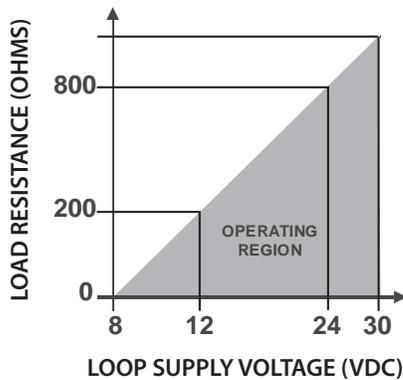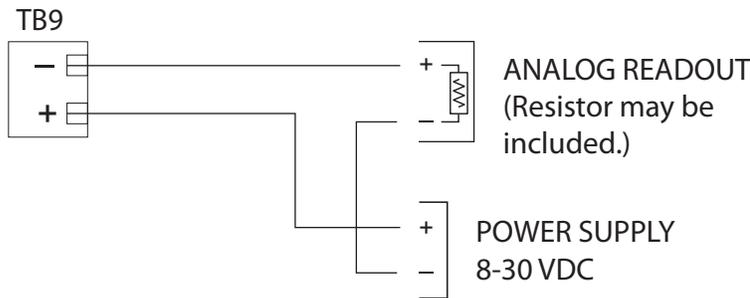
$$R_L \ MAX = \frac{(V \ loop - 8V)}{20 \ mA}$$

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

$$R_L \ MAX = 800 \ ohms$$

LOAD RESISTANCE (OHMS)

800

200

0

OPERATING REGION

8   12   24   30

LOOP SUPPLY VOLTAGE (VDC)

Pulse Input (TB3/TB5) cont'd

The Scanner 2200 can calculate flow from no more than two frequency inputs at a time, so if a turbine input is used, only one other frequency input may be received simultaneously. Each of the two frequency inputs can be a turbine input, a pulse input, or a contact input.

Outputs

Digital Output (TB12)

The Scanner 2200 supports two solid-state digital outputs that are configurable as either a pulse output or an alarm output. Because the circuit is isolated, it can be used in conjunction with any other feature on the Scanner 2200. The maximum rating of the digital output circuit is 60 mA at 30 VDC. Maximum frequency is 50 Hz. For reduced power consumption, turn the digital output feature off when it is not in use.

Radio Power Output (TB1)

When the Scanner 2200 is used to power a radio, a user can conserve power by controlling the power output to the radio. To enable this control, the radio power must be wired to TB1 and the radio power settings must be configured in ModWorX Pro software. The maximum voltage rating of the TB1 circuit is 30V. The maximum current rating is 1A. See Configure Radio Communications on page 10 to configure radio power settings.

Analog Output (TB9)

The 4-20 mA linear current output can be configured with 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 an analog readout device to be located in the remote location.

The graph at left 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.

Navigating the ModWorX™ Pro Interface

Main Display Screen

○ Dedicated button for quick and easy downloads
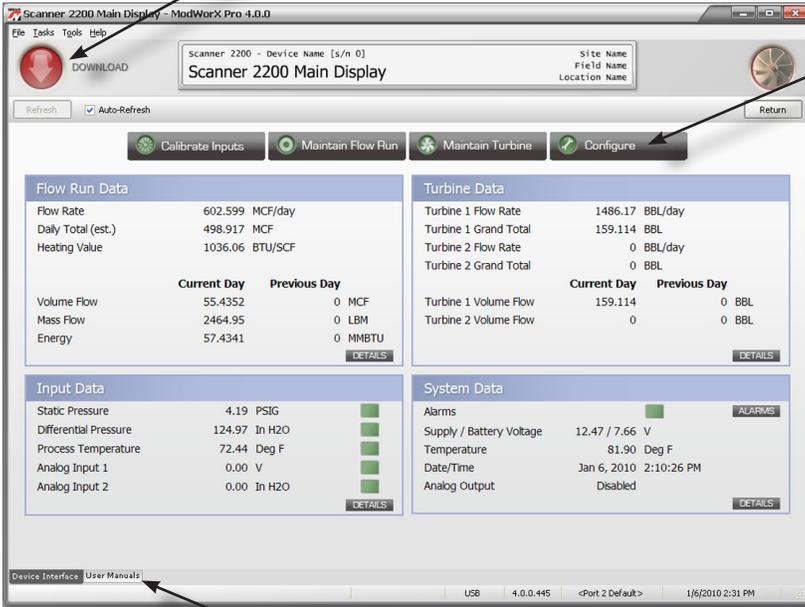
Four task-based menus simplify navigation

Documentation for quick reference

The ModWorX Pro installation CD provided with the instrument loads the ModWorX Pro interface software for configuring and operating the Scanner 2200.

The Main Display screen (at left) is the control center for the Scanner 2200 and provides quick and easy access to the most commonly performed tasks. From this screen, the user can:
- view real-time totals and flow rates, input data, and system information
- download data
- access configuration, calibration, and flow run/turbine maintenance menus
- get quick answers to task-specific questions with links to user documents

Calibrate Inputs:
Differential Pressure
Static Pressure
Process Temperature
Analog Input 1
Analog Input 2

Calibrate, Verify and Set Zero Offset selections available for each parameter.

Maintain Flow Run:
Change Orifice Plate
Change Cone
Change Gas Composition
Change Liquid Properties
Change Steam Properties
Change Flow Coefficients
Change Avg. Pitot Tube

Maintain Turbine:
Change Turbine
 Flowmeter
Change K-Factors

Configure:
System Parameters
Device ID
Date and Time
Communications
Security
Display
Archive
Alarm
Modbus Registers
Flow Run Setup
Turbine Setup
Inputs
Differential Pressure
Static Pressure
Process Temperature
Analog Inputs 1 & 2
Outputs
Digital
Analog

Controls for all commonly performed tasks are conveniently grouped under four menus near the top of the Main screen. Menus are named for the functions they support: Calibrate Inputs, Maintain Flow Run, Maintain Turbine, or Configure.

Calibrate Inputs Menu

From the Calibrate Inputs menu, a user can calibrate differential pressure, static pressure, process temperature, and analog inputs. The user can load a factory calibration, load a previous calibration, or enter new calibration points.

1 *Select the task you want to perform. Then select the parameter you want to calibrate.*

2 *Click Acquire Point to enter a new calibration point and enter the applied calibration value at the prompt. Or click Load Calibration From... to load the data from a factory calibration or previous calibration.*

Click on Change Task to select a new parameter or a new calibration task.

ModWorX Pro

Change Calibration Task

Calibration Task
- Calibrate (Multi-point)
- Set Zero Offset
- Verify

Input Parameter
- Differential Pressure
- Static Pressure
- Process Temperature
- Analog Input 1
- Analog Input 2

Calibrate Differential Pressure - ModWorX Pro 4.0.0

File Tasks Tools Help

DOWNLOAD

Scanner 2200 - Device Name [s/n 0]
Calibrate Differential Pressure

Site Name
Field Name
Location Name

Save Changes   Exit Maintenance Mode

Calibrate Inputs

Change Task | **Input Parameter**   Differential Pressure
             | **Calibration Task**   Calibration

New Calibration

Calibration Working Units   In H2O

	Applied	Measured	Change (% of FS)
1	0.000	0.017	0.01
2	25.000	25.006	0.00
3	50.000	50.020	0.01
4	75.000	75.011	0.01

Acquire Point
Recalibrate Point
Clear Point
Clear All Points
Load Calibration From...

Current Calibration
Operator: None, Calibrated On:

Applied	Measured

Factory Calibration

Note

Note

USB   4.0.0.445   <Port 2 Default>   1/6/2010 11:29 AM

ModWorX Pro

Acquire Differential Pressure - (100.000 In H2O)

Live Value   100.012   In H2O   Measured Value   95.898   In H2O

Stability   Hide Trend <<

Spread: 23.135 In H2O (Tolerance: 0.200 In H2O)   Samples: 19

Force Lock On   OK   Cancel

3 *The measured value can be viewed with or without a trend graph. Repeat Step 2 to enter additional calibration points.*

4 *Click Save Changes to save the New Calibration values to memory.*

5 *Click Exit Maintenance Mode to resume live data readings.*

Maintenance Mode

When a user enters a menu in which parameter changes affect volume calculations, the Scanner 2200 is placed in "Maintenance Mode." This locks the input sensor readings at their current values. When the user exits "Maintenance Mode," the inputs are unlocked.

ModWorX Pro

Exit Maintenance Mode

he device will

ModWorX Pro

Enter Maintenance Mode

All sensor inputs will be locked at present values and will remain locked until the user exits maintenance mode.

Continue?

Yes   No

No

Maintain Flow Run Menu

From the Maintain Flow Run menu, a user can change an orifice plate size, cone meter or averaging pitot tube parameters, cone meter factors, steam properties, or gas composition.

Tasks will vary with the flow calculation method used.

Click Change Task to select a new maintenance task.

1 *Select the task you want to perform.*

2 *Enter new parameters in the fields provided.*
Or click on Copy From Current to load current parameters.

3 *Click Save Changes to save the new parameters to memory.*

4 *Click Exit Maintenance Mode to resume live data readings.*

Maintain Turbine Menu

From the Maintain Turbine menu, a user can change the K-factor or select a different turbine meter.

The user can enter a linear K-factor or a multi-point calibration factor (1 to 12 points allowed).

Click Change Task to select a new turbine meter or a new maintenance task.

1 *Select the task you want to perform.*

2 *Select a new meter or enter a new K-factor using the fields provided.*

3 *Click Save Changes to save the new selections to memory.*

4 *Click Exit Maintenance Mode to resume live data readings.*

Configure Menu

From the Configuration menu (right), a user can access every setting required to perform the initial setup for the Scanner 2200.

1 Set the instrument date and time.

2 Establish archive settings
- parameters to be logged
- contract hour
- interval period for saving logs

3 Configure flow run parameters (as shown below).
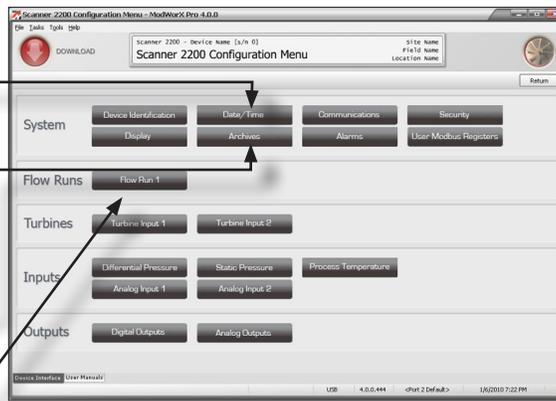
4 Set the calculation period.
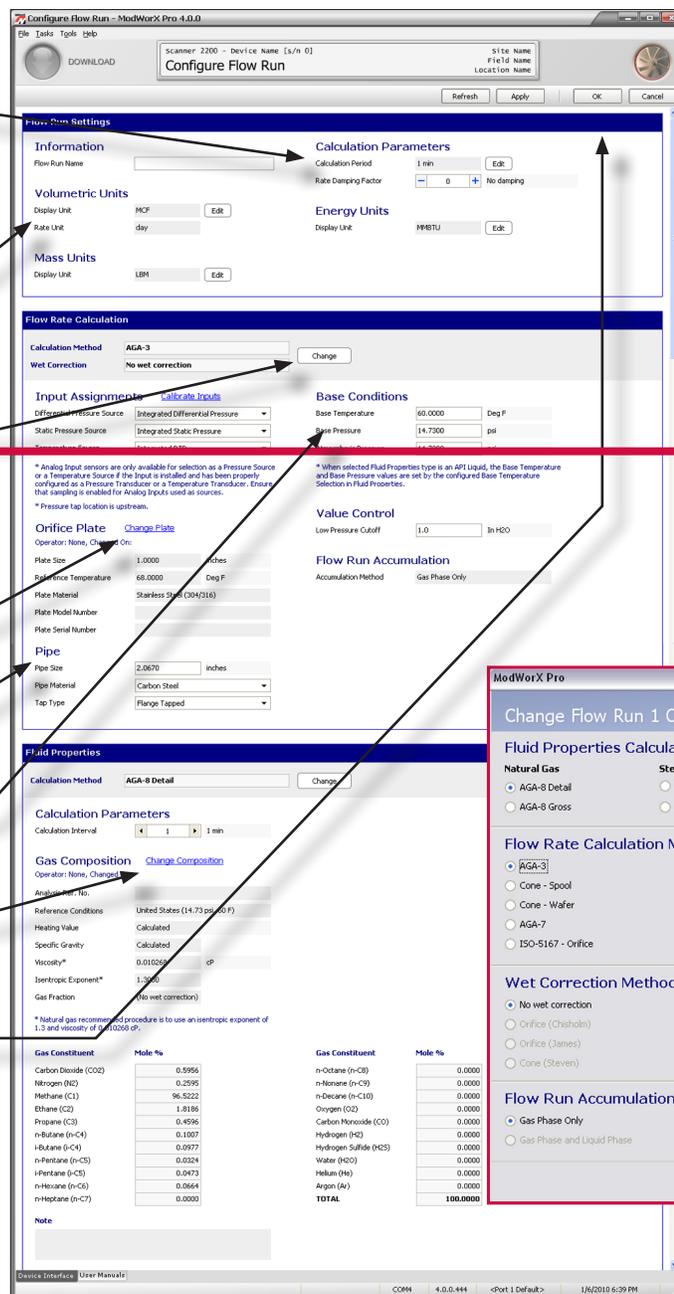
5 Set the units of measurement used for volume and rate.

6 Click "Change" to select the flow calculation method and fluid property calculation method to be used.

7 Click "Change Plate" to specify plate parameters.

8 Specify pipe parameters.

9 Enter base conditions specific to the location.

10 Click "Change Composition" to specify the gas composition. (Percentages must total 100%.)

11 Click OK to save the new selections to memory.

The Configure Flow Run 1 screen below shows configuration settings for an AGA-3 gas run. Required parameters will vary, depending on the flow calculation method selected (step 6).
For information on configuring a steam flow run, see the ModWorX™ Pro User Manual.

If a liquid turbine input will be used in addition to a compensated gas run, click on Turbine Input 1 for configuration options.
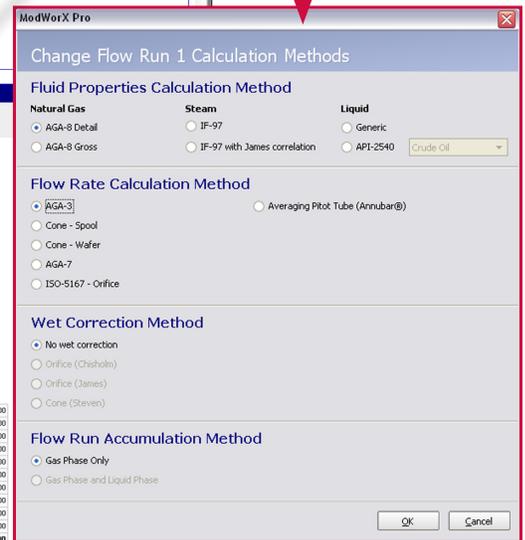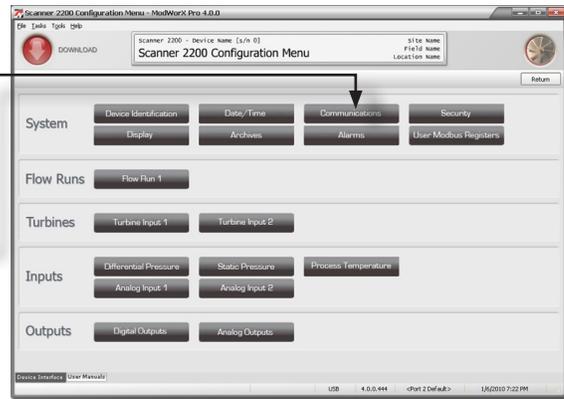
Configure Radio Communications

When the Scanner 2200 is connected to a communications device such as a radio, power consumption can be minimized by configuring radio settings.

To control power to the communications device, the device must be wired to the Power Out terminal block (TB1) of the Scanner 2200 .

If a radio has a hardware line for power management, it can be wired to the sleep output on TB6 to control sleep functions. ModWorX Pro is used to configure the sleep functions (see Step 4 below).

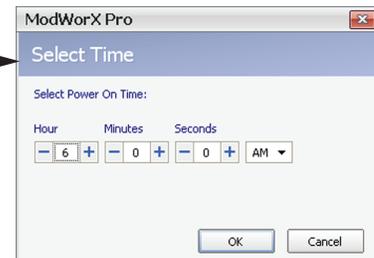**1** From the Configuration Menu, click on the Communications tab.
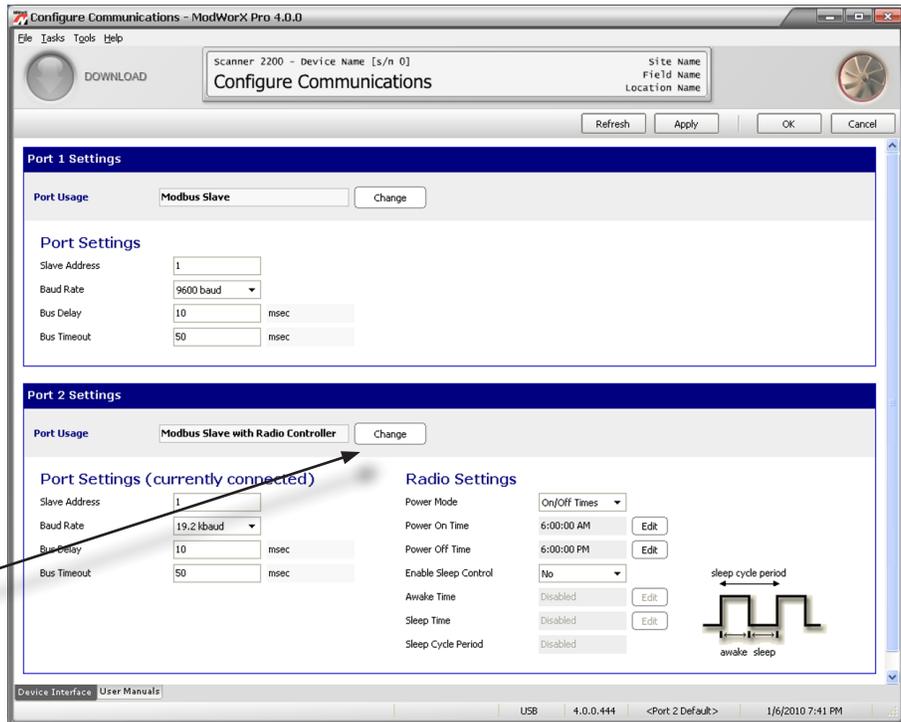
2 In the Port 2 Settings section, change the Port Usage field to Modbus Slave with Radio Controller.

3 In the Radio Settings section, configure the power mode as "always on" for continuous power, or "on/off times" to select the time of day for turning the radio off and on. If "on/off times" is used, enter "power on" and "power off" times by clicking the Edit buttons.

4 To enable sleep control, select "Yes" in the Enable Sleep Control field. Specify an "awake" time period and a "sleep" time period by clicking the Edit buttons.

The sleep cycle period will be automatically displayed in a read-only field.

Download Screens

To download data, simply press the Download button and select the range and type of files to be downloaded. Daily and interval logs can be viewed or printed as a table or a trend graph.
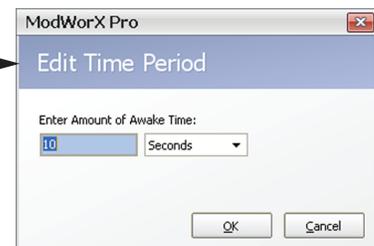
1 *Click on the red Download button to download log data.*

2 *Select the range of data, the type of logs, and any additional settings to be included in the report. Then click Download Now.*

Each log type and setting type is displayed under a separate tab.

3 *Downloaded data will appear in a table as shown. Click one of these buttons to:*
- *export data*
- *print the tabular data*
- *view and/or print a trend graph*

Export formats:
.cfx (Flow-Cal®)
.ANA, .VOL, and .EVT (PGAS®)
.pdf, .xls, .rtf, .csv, and .html

4 *The trend view offers two methods of navigation:*

(1) Use the scroll bar to move the trend line left or right. The data point that intersects this vertical record index (white dotted) line marks the record being read; the values of all parameters in the record appear in the table at left. Values in the table update automatically as the intersecting data point changes.

(2) Move the mouse to guide the cursor along the trend line. The cursor will snap to the nearest data point. The corresponding parameter, date and time stamp, and parameter value will appear in a pop-up box on the screen.

View all downloaded data (gray box shows range of data displayed in bottom graph).
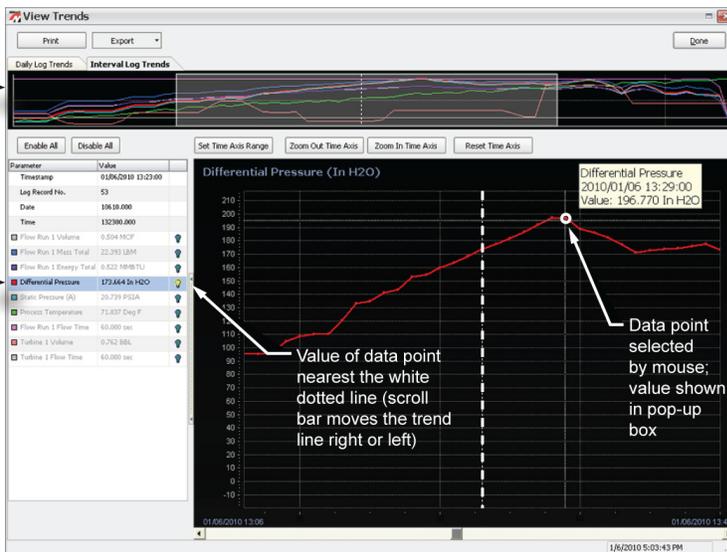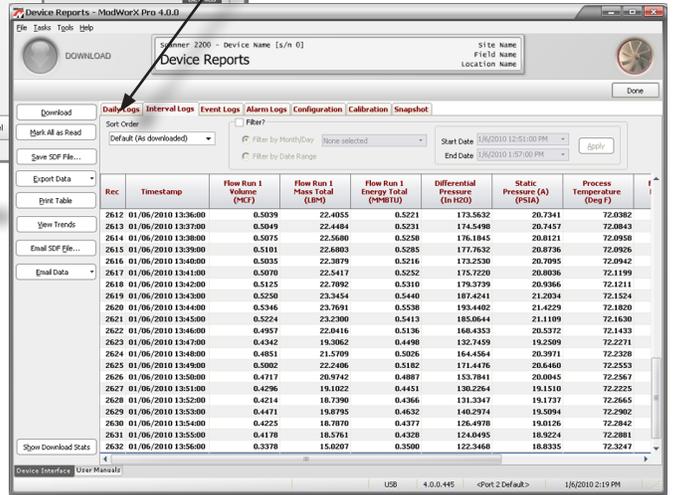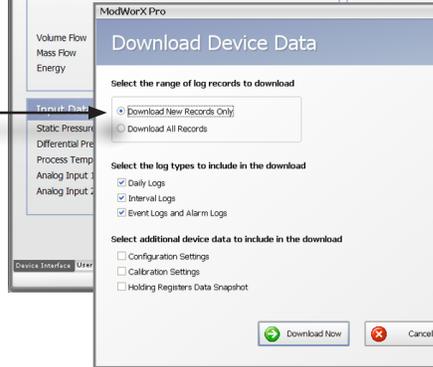
Select the parameter you want to view.

Value of data point nearest the white dotted line (scroll bar moves the trend line right or left)

Data point selected by mouse; value shown in pop-up box

Accessing User Documents

Electronic user documents including a hardware manual, software manual, this quick start guide, and other support documentation are embedded in the ModWorX Pro software. With the click of a button, they will open inside the ModWorX Pro viewing window for quick reference.

User documents can be accessed two ways:
- *Click the User Manuals tab at the bottom of the screen.*
- *Click the Help menu at the top of the screen and select User Manuals.*

Select your Scanner product to open a list of links to user documents supporting that product.

To return to the Select Your Product screen to select a different document, click the Home button.

To restore the view of ModWorX Pro controls, click the Device Interface tab at the bottom of the screen.

1 *Click Help > User Manuals*

or click User Manuals tab

2 *Select your product.*

3 *Click on the link for the desired document.*

4 *Click the Device Interface tab to restore view of ModWorX Pro controls.*