



Badger Meter

Industrial Flow Computer

Model FC-5000 Flow Monitor



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SCOPE OF THIS MANUAL

This manual describes how to install and program two configurations of the FC-5000 Flow Monitor—the single pulse input (P0) version and the dual pulse input (P2) version. The electronic version of this manual and related wiring interchange application briefs are available on our website at www.badgermeter.com.

IMPORTANT

Read this manual carefully before attempting any installation or operation. Keep the manual in an accessible location for future reference.

UNPACKING AND INSPECTION

Upon opening the shipping container, visually inspect the product and applicable accessories for any physical damage such as scratches, loose or broken parts, or any other sign of damage that may have occurred during shipment.

NOTE: If damage is found, request an inspection by the carrier's agent within 48 hours of delivery and file a claim with the carrier. A claim for equipment damage in transit is the sole responsibility of the purchaser.

SAFETY CONSIDERATIONS

Terminology and Symbols



Indicates a hazardous situation, which, if not avoided, is estimated to be capable of causing death or serious personal injury.



Indicates a hazardous situation, which, if not avoided, could result in severe personal injury or death.



Indicates a hazardous situation, which, if not avoided, is estimated to be capable of causing minor or moderate personal injury or damage to property.



Please consult the user manual in all cases where this symbol is used in order to find out the nature of potential hazards, and any actions which have to be taken to avoid them.



This symbol signifies that the FC-5000 flow computer may be powered by a DC power supply. Acceptable DC input voltage range is: 10...40V DC.



This symbol signifies that the FC-5000 flow computer may be powered by a AC power supply. Acceptable AC input voltage range is: 9...28V AC RMS (50...60 Hz).

NOTE: Operating temperature is 32...130° F (0...55° C) with a maximum humidity of 85% non condensing. Always select a mounting location with proper ventilation and environmental protection.

- Maximum operating altitude: 2000 meters (6561 feet)
- Pollution Degree 2: Only non-conductive pollution occurs except that occasionally a temporary conductivity caused by condensation is to be expected
- Over-Voltage Rating: CAT II

Safety Instructions

⚠ WARNING

- **LIFE SUPPORT APPLICATIONS: THE FC-5000 IS NOT DESIGNED FOR USE IN LIFE SUPPORT APPLIANCES, DEVICES, OR SYSTEMS WHERE MALFUNCTION OF THE PRODUCT CAN REASONABLY BE EXPECTED TO RESULT IN A PERSONAL INJURY. CUSTOMERS USING OR SELLING THESE PRODUCTS FOR USE IN SUCH APPLICATIONS DO SO AT THEIR OWN RISK AND AGREE TO FULLY INDEMNIFY THE MANUFACTURER AND SUPPLIER FOR ANY DAMAGES RESULTING FROM SUCH IMPROPER USE OR SALE.**
- **ELECTROSTATIC DISCHARGE INFLECTS IRREPARABLE DAMAGE TO ELECTRONICS! BEFORE INSTALLING OR OPENING THE UNIT, INSTALLERS MUST DISCHARGE THEMSELVES BY TOUCHING A WELL-GROUNDED OBJECT.**
- **THIS UNIT MUST BE INSTALLED IN ACCORDANCE WITH THE EMC (ELECTROMAGNETIC COMPATIBILITY) GUIDELINES.**

Safety Rules and Precautionary Measures

The manufacturer accepts no responsibility whatsoever if the following safety rules and precaution instructions and the procedures as described in this manual are not followed.

- Modifications of the flow computer implemented without preceding written consent from the manufacturer will result in the immediate termination of product liability and warranty period.
- Installation, use, maintenance, and servicing of this equipment must be carried out by authorized technicians.
- Check the mains voltage and information on the manufacturer's nameplate before installing the unit.
- Check all connections, settings and technical specifications of the various peripheral devices with the flow computer supplied.
- Never open the enclosure.
- Never touch the electronic components (ESD sensitivity).
- Never expose the system to heavier conditions than allowed according to the casing classification (see manufacturer's nameplate).
- If the operator detects errors or dangers, or disagrees with the safety precautions taken, then inform the owner or the principal responsible.
- Adhere to the local labor and safety laws and regulations.

DESCRIPTION

The Badger Meter® FC-5000 is a microprocessor-driven flow computer designed for flow monitoring. The FC-5000 flow computer is compatible with the complete line of Badger Meter industrial flow meters, creating a solution to totalize and indicate fluid flows.

Functions and Features

This product is designed with a focus on:

- Large display for easy viewing
- Ease-of-use with softkeys and a full numeric keypad
- Ruggedness for its application with a robust enclosure, keypad and proper mechanical relays
- Info/sensor data—view raw and calculated flow data, as well as relay and digital I/O status
- User-friendly installation with quality plug-and-play terminals
- 100-point linearization
- A wide range of outputs and functions for a broad fulfillment in many applications
- User-programmable relay triggers for Flow and Total alarms—High, Low, High/Low

Additionally, the dual pulse input (Sensor Inputs option P2) version features:

- Single button toggling between flow meter channels
- Temperature compensaion
- Roshko/Strouhal algorithms

Flow Meter Input(s)

Depending on the configuration, one (P0) or two (P2) sensor inputs are available. A passive or active pulse signal output can be connected to the FC-5000 flow computer. The input circuit supports low and high frequency (0.5 Hz to 3.5 kHz) flow meters. A power supply is available to power the sensor with 12V DC.

Control Inputs

The FC-5000 flow monitor control inputs allow the following functions:

- Unlatch Relays
- Reset Totalizers
- Unlatch Relays and Reset Totalizers
- Inhibit Functions (Sensor Inputs option P2)

Relay Control Outputs

The FC-5000 flow computer has two Form C relay outputs. All control functions are always available by dedicated relay outputs. Unneeded outputs may be left unconnected.

Relays are used for High Alarm, Low Alarm, High/Low Alarm and Totalizer.

- TB3 and TB4 can be powered directly from mains circuits rated up to 240V.
- TB3 and TB4 must be powered through circuits that are insulated from mains by at least basic insulation.
- Sources of power connected to TB3 and TB4 need to be limited to 240V AC and fused at 5A (NC) and 5A (NO) or less.
- Other than TB3 and TB4, this equipment is suitable for connection to external circuits that are insulated from mains by at least double insulation (SELV), including the power supply to the unit connected to TB1.

Power Supply

The power supply used must be isolated from mains by double or reinforced insulation (for instance, SELV power supply).

The FC-5000 flow computer operates on 10...40V DC or 9...28V AC supplied by any suitable source that also meets the requirement listed above. Badger Meter has a power supply cable/cord available for the FC-5000 Flow Monitor. Order PN 68334-001 (includes wall mount power supply and adapters) or PN 68334-002 power module that allows discrete power wiring.

The selected power supply must be capable of supplying a minimum of 8 Watts.

Configuring the Unit

The FC-5000 flow computer is designed for many types of applications. See *"Setting Up a Flow Meter"* on page 28 for instructions on configuring your FC-5000 flow computer to your specific requirements.

The *Advanced Setup* menu includes features such as K-factors and selection of the control outputs. All information is stored in EEPROM memory and will not be lost in the event of power failure.

Display Information

The FC-5000 flow computer has a large transfective LCD with a bright LED backlight that displays symbols and digits for measuring units, status information and keyword messages. See *"Changing Display Properties"* on page 26.

INSTALLING THE FLOW COMPUTER

CAUTION MOUNTING, ELECTRICAL INSTALLATION, STARTUP AND MAINTENANCE OF THIS INSTRUMENT MAY ONLY BE CARRIED OUT BY TRAINED PERSONNEL AUTHORIZED BY THE OPERATOR OF THE FACILITY. PERSONNEL MUST READ AND UNDERSTAND THIS OPERATING MANUAL BEFORE CARRYING OUT ITS INSTRUCTIONS.

CAUTION THE FC-5000 FLOW COMPUTER MAY ONLY BE OPERATED BY PERSONNEL WHO ARE AUTHORIZED AND TRAINED BY THE OPERATOR OF THE FACILITY. OBSERVE ALL INSTRUCTIONS IN THIS MANUAL.

CAUTION OBEY ALL SAFETY PRECAUTIONS MENTIONED IN "SAFETY CONSIDERATIONS" ON PAGE 5.

Mounting Options

The FC-5000 flow computer can be mounted on a wall or shelf, or in an instrumentation panel. Wall-mount units are shipped in a NEMA 4X enclosure, ready to mount.

Panel-Mount Installations

NOTE: Mounting clips can accommodate a maximum panel thickness of 1.5 in. (38.1 mm).

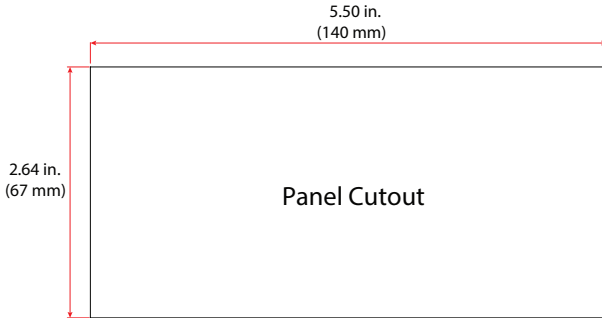


Figure 1: Panel cutout

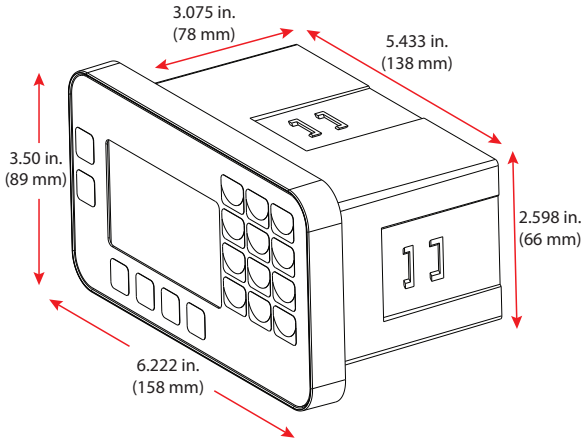


Figure 2: Mounting dimensions

The basic unit is equipped for panel mount. To install:

1. Measure and cut a mounting hole to the dimensions shown in *Figure 1*.
2. Verify that the gasket is secure inside the mounting bezel.
3. Insert the unit through the control panel cutout.
4. Secure the unit to the panel with the mounting clips.

Wall-Mount Installations

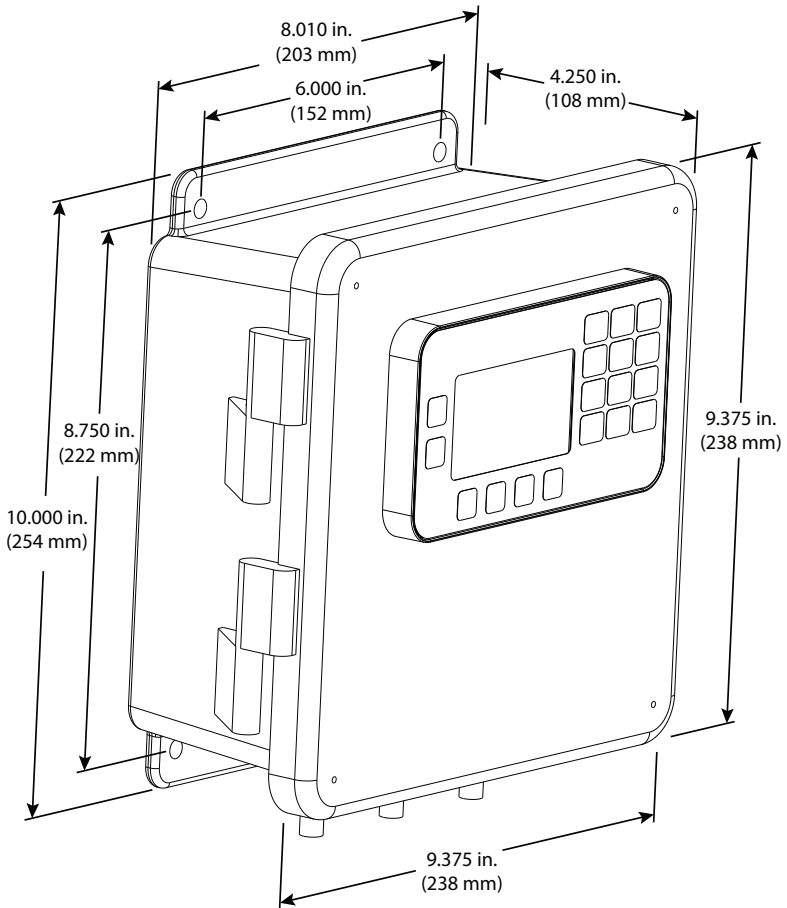


Figure 3: FC-5000 flow computer in an enclosure

To install the FC-5000 flow computer on a wall, secure the enclosure to the wall with four customer-supplied mounting screws.

WIRING THE FLOW COMPUTER

At installation, be sure to comply with the following requirements:

- Disconnect power to the unit before attempting any connection or service to the unit.
- Avoid using machine power service for AC power. When possible, use a dedicated circuit or a lighting circuit.
- Observe all local electrical codes.
- The unit must be wired with wires and/or cables with a minimum temperature rating of 167° F (75° C).

⚠ CAUTION *TO PREVENT ACCIDENTS, DO NOT APPLY POWER UNTIL ALL OTHER CONNECTIONS HAVE BEEN COMPLETED.*

Terminal Connectors

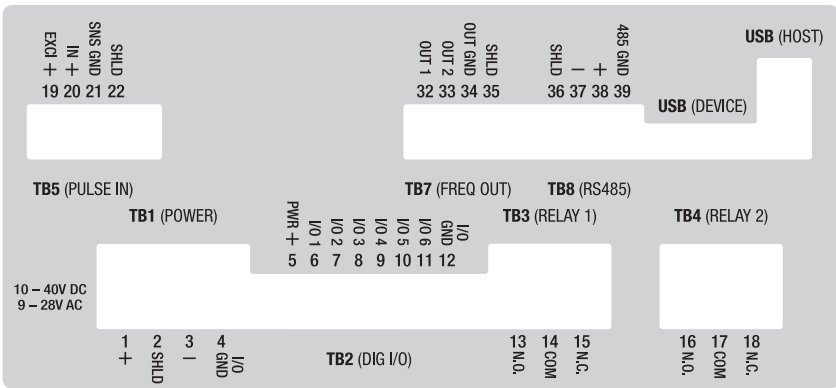


Figure 4: Terminal connectors, single pulse input (P0)

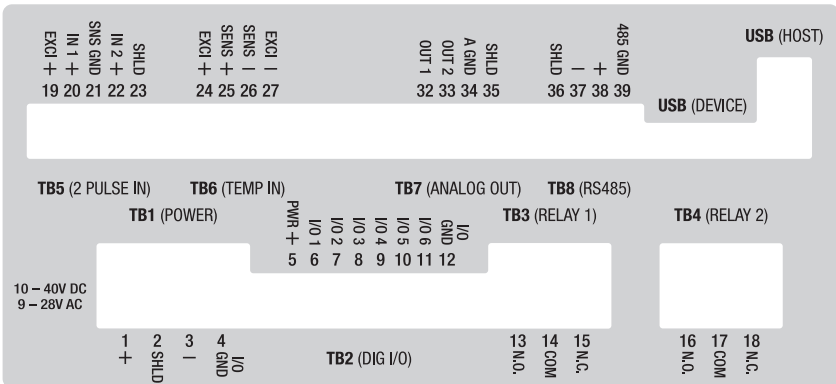


Figure 5: Terminal connectors, dual pulse input (P2), analog output

The plug-in connectors on the rear panel of the FC-5000 flow computer are:

- Power
- USB (HOST) port (external memory flash drive)
- USB (DEVICE) port
- Pulse input (one for Sensor Inputs option P0, two for Sensor Inputs option P2)
- Two frequency/pulse outputs (Output option F)
- Two analog outputs (Output option A)
- RS485 communication
- Six programmable digital I/O channels
- Two Form C relay outputs
- Temperature (Sensor Inputs option P2)

⚠ CAUTION

THE FC-5000 IS MICROPROCESSOR CONTROLLED. IT IS VERY IMPORTANT THAT THE POWER SUPPLY BE FREE OF ELECTRICAL NOISE. AVOID USING POWER LINES THAT FEED HEAVY LOAD ELECTRICAL DEVICES SUCH AS PUMPS AND MOTORS.

Power Input Connector

The FC-5000 flow computer's power input is internally fused and protected from common line noise by a filtering network.

TB1 - Power Input Terminal

Connector Pin	Function	Reference Pin
1	Voltage IN (+)	1
2	Shield (Chassis GND)	2
3	Voltage IN (-)	3
4	Ground	4



Flow Sensor Input (Pulse Input)

The FC-5000 flow computer is designed to accept pulses from open collector transistors or dry contact closure transmitters.

Before making any connections:

- Always use shielded wire to protect the signal line from external noise (ground shield to terminal #3).
- Make sure the signal lines are not bundled with or touching power lines.

Frequency	0.5 Hz to 3.5 kHz
Voltage	Low: -0.3...1.85V DC High: 2.5...25V DC
Impedance	Pullup to 12V DC
VDC Current	± 50 mA short circuit current
Response	100 μs min pulse (high speed) 3.5 ms min pulse (low speed)

NOTE: In the tables below, **RF Pin** refers to RF type pickups/amplifiers.

TB5 - Single Channel Pulse Input Terminal

Connector Pin	Function	Reference Pin	RF Pin
1	Excitation (+12V output)	19	A
2	Sensor Input	20	C
3	Sensor Common (GND)	21	B
4	Shield	22	—



TB5 - Dual Channel Pulse Input Terminal

Connector Pin	Function	Reference Pin	RF Pin
1	Excitation (+12V output)	19	A
2	Sensor Input CH1	20	C
3	Sensor Common (GND)	21	B
4	Sensor Input CH2	22	C
5	Shield (Earth GND)	23	-

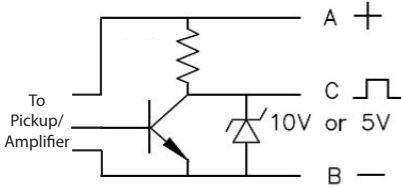


Powering Radio Frequency (RF) Type Pickups

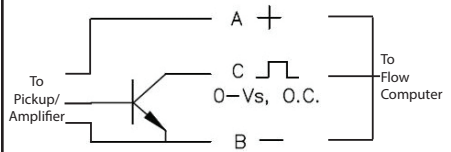
Radio Frequency (RF) type pickups require a power source to generate a radio frequency field. Similar to magnetic pickups, as fluid velocity provides rotational energy on the flow meter rotor, the field generated is disturbed, producing output pulses that are proportional to flow rate.

NOTE: Maximum current draw from the Excitation pin cannot exceed 200 mA. RF style pickups will require a signal conditioning amplifier.

0...5V, 0...10V Configuration



Source Voltage Configuration



Temperature Input

TB6 - Single Temperature Input Terminal

Connector Pin	Function	Reference Pin
1	CH1 Excitation (+)	24
2	CH1 Sensor Input	25
3	CH1 Excitation (-)	26
4	CH1 Sensor Input (-)	27



Output Connector

The FC-5000 flow computer is designed to output a pulse signal for use in feedback on certain applications. The scaled pulse output is configurable and is tied to the rate or total volume.

TB7 - Dual Channel Output Terminal

Connector Pin	Function	Reference Pin
1	Output CH1	32
2	Output CH2	33
3	Ground	34
4	Shield	35



RS485 Communication Connector

The FC-5000 flow computer is available to communicate over RS485.

TB8 - RS485 Comm Port Terminal

Connector Pin	Function	Reference Pin
1	Shield	36
2	Negative Terminal (-)	37
3	Positive Terminal (+)	38
4	Ground	39

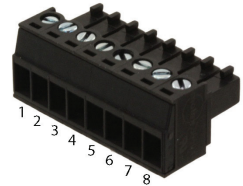


Digital I/O Connector

The FC-5000 flow computer has six independent channels available for digital input. The channels accept TTL voltage signals in the 0...5V DC range. Input range for a logic low signal is 0...1V, logic high from 4...5V.

TB2 - Digital Input/Output Terminal

Connector Pin	Function	Reference Pin
1	Power +	5
2	I/O Channel 1	6
3	I/O Channel 2	7
4	I/O Channel 3	8
5	I/O Channel 4	9
6	I/O Channel 5	10
7	I/O Channel 6	11
8	Ground (-)	12



Relay Output Connectors

The FC-5000 flow computer has two Form C relay output terminals.

TB3 & TB4 - Relay Output Terminal

Connector Pin	Function	Reference Pin
1	Normally Open (+)	13, 16
2	Common	14, 17
3	Normally Closed	15, 18



Mechanical Form C Relay(s) Specifications

Load	Resistive
Rated Carry Current	5 A (NO) / 5 A (NC)
Max Switching Voltage	250V AC, 30V DC
Min permissible Load	10 mA at 5V DC
Coil Rating	5...24V DC
Life Expectancy	5,000,000 operations

OPERATOR INTERFACE

Control Panel Display

The *Home* screen display shows flow rates and totals, either separately or simultaneously. Status and alarm messages or alarm icons appear on the display when appropriate.

To toggle views on the *Home* screen, press the **UP/DOWN** keys to switch from or to:

- FLOW RATE CH1 (*Figure 6*)
- FLOW TOTAL CH1 (*Figure 6*)
- FLOW RATE CH1 + FLOW TOTAL CH1 (Dual Display) (*Figure 7*)

The Sensor Inputs option P2 also allows for a second flow sensor, indicated by rate/total CH2. To toggle between CH1 and CH2, press the **F3** key.

- FLOW RATE CH2
- FLOW TOTAL CH2
- FLOW RATE CH2 + FLOW TOTAL CH2 (Dual Display)

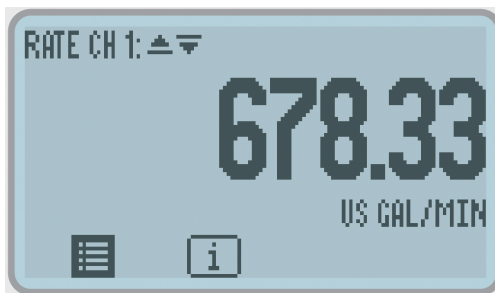


Figure 6: Single display



Figure 7: Dual display

Keypad and Soft Keys

The keypad and soft keys are for programming, editing and changing views.

Scrolling

The screens can display 4 lines at a time. Some menus have more than 4 items to display. To see the off-screen items, press the **UP/DOWN** keys to scroll through the entire list.

CAUTION

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Control Panel Keys

NOTE: Always press  (ENTER) to save a new value.







	<p>The numbered keys are used to enter or change parameter values.</p>
	<p>In editing mode, the BACKSPACE key deletes the character to the left of the cursor. While navigating, the BACKSPACE key moves to a previous menu selection.</p>
	<p>Depending on the current screen, the ENTER key:</p> <ul style="list-style-type: none"> • Saves the current value and ends the editing session • Advances deeper into the menu structure • Toggles enumerations
	<p>The UP and DOWN keys have various functions:</p> <ul style="list-style-type: none"> • Toggles the display to view flow rate, total, or flow + total
	<ul style="list-style-type: none"> • While editing, the UP/DOWN keys advance the cursor to the right or left, respectively • In the menu structure, the UP/DOWN keys scroll through the menus and parameters
	<p>The F1-F4 function keys are soft keys that change function to whichever icon is present above them. See "Icon Functionality" on page 19</p>

Table 1: Control panel keys

Icon Functionality

Depending on the task being performed and the configuration of the flow monitor, one or more of the following icons may appear on the screen. To activate an icon, press the **Function** key (F1, F2, F3 or F4) directly under the icon.





















Icon	Function
	Display the <i>Home</i> screen or cancel an edit (if you activate it without saving first)
	Display the menu structure
	Create a custom label (name) for unit of measure
	Return to <i>Setup</i> menu
	Cycle through alpha characters
	Enter a decimal point
	Cycle through special characters
	Reveal raw and calculated info/sensor data for the flow computer
	Enter frequency-in-hertz calibration data
	Enter K-factor in multi-point calibration table
	Clear the selected value or cancel edit (press twice, consecutively)
	Enter conversion factor for custom unit of measure
	Change selected value to positive (+) or negative (-)
	Enter viscosity value
	Enter frequency-over-viscosity value on multi-point calibration table
	Enter density value
	Set totalizer rollover point
	Appears on <i>Home</i> screen if relay is triggered; informational only
	Toggle flow sensor channels
	Enter temperature value

Table 2: Icon functionality

Numeric Editing

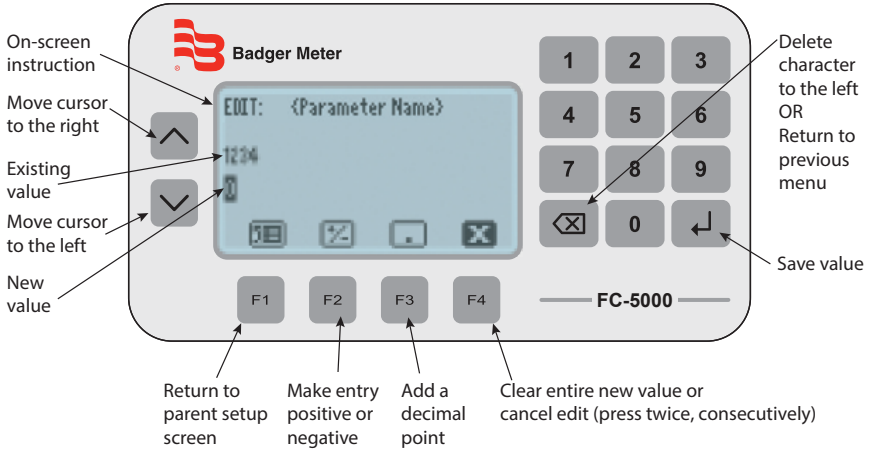


Figure 8: Numeric editing

Alpha-Numeric Editing

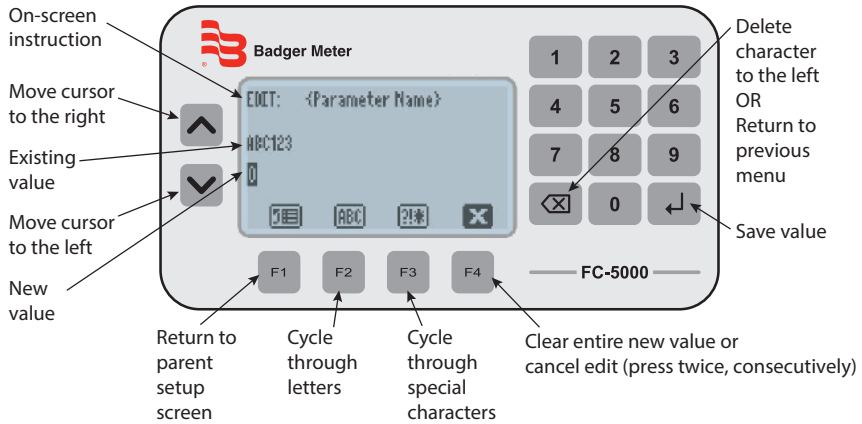


Figure 9: Alpha-numeric editing

Selection/Enumeration Editing

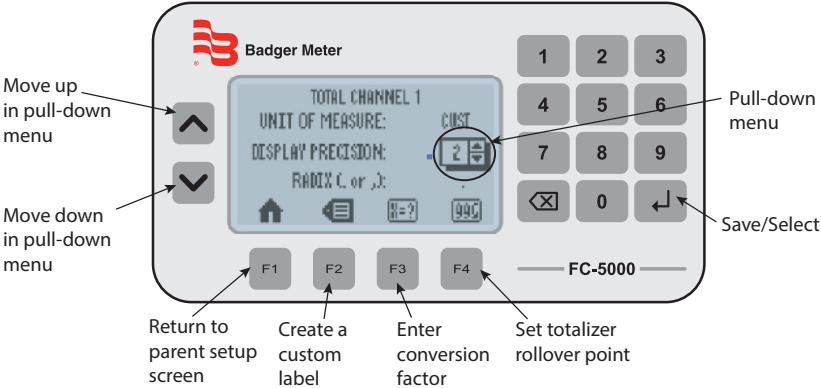


Figure 10: Selection editing

Confirmation Screen

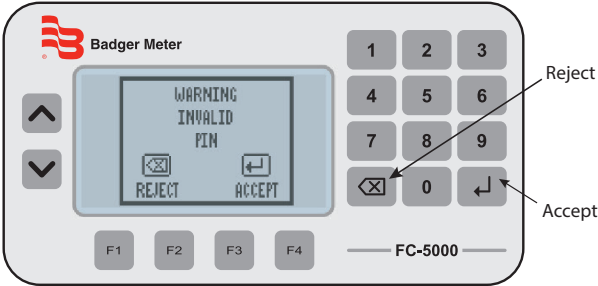
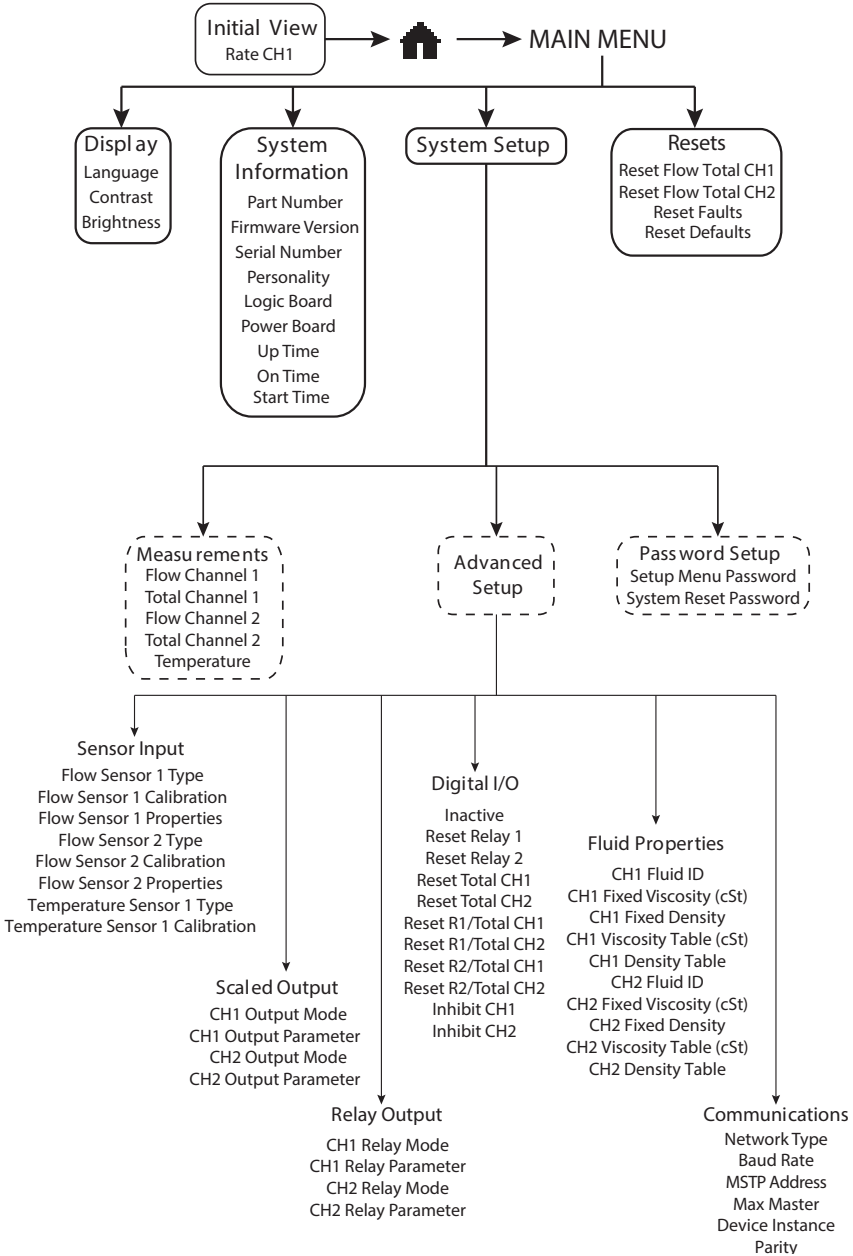


Figure 11: Confirmation screens

MENU STRUCTURE

The available menu items depend on the flow monitor configuration. Each menu item is explained in detail in the following pages.



SYSTEM INFORMATION

The *System Information* menu contains build information specific to the configuration of the unit.

To view your system information, navigate to *System Information* from the *Main* menu.

Item	Description
P/N	Configured model number
FW VERSION	Loaded firmware version
SERIAL NO	Serial number
PERSONALITY	For factory/diagnostic purposes only
LOGIC BRD	For factory/diagnostic purposes only
POWER BRD	For factory/diagnostic purposes only
UPTIME	Time, in seconds, since unit's last power-on session start
ONTIME	Total lifetime power-on, in seconds
STARTTIME	Ontime at start of power-on session

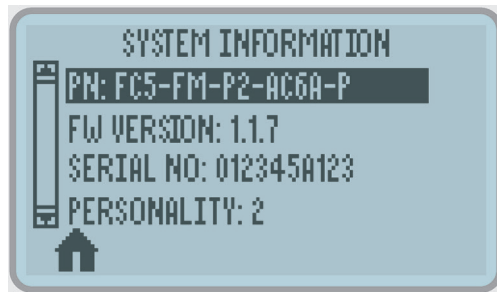


Figure 12: System information screen

INFO/SENSOR DATA

The FC-5000 flow monitor features a quick method to view measured data traveling to, and from, the device. You can use the data for informational purposes or for troubleshooting. The type of data displayed can include raw input frequency, relay status or calculated data, such as flow rate.

Item	Description
CH1 FREQ	CH1 sensor input frequency
CH1 COUNT	CH1 total pulse count
CH1 RATE	Calculated rate of CH1
CH1 TOT	Calculated total of CH1
CH2 FREQ	CH2 sensor input frequency
CH2 COUNT	CH2 total pulse count
CH2 RATE	Calculated rate of CH2
CH2 TOT	Calculated total of CH2
CH1 TEMP	Displays the temperature of the connected sensor. Displays "NO SENSOR" if no sensor is connected.
RELAY 1	ON/OFF status of relay 1
RELAY 2	ON/OFF status of relay 1
D-I/O 1	ON/OFF status of digital I/O port 1
D-I/O 2	ON/OFF status of digital I/O port 2
D-I/O 3	ON/OFF status of digital I/O port 3
D-I/O 4	ON/OFF status of digital I/O port 4
D-I/O 5	ON/OFF status of digital I/O port 5
D-I/O 6	ON/OFF status of digital I/O port 6

To view this information, press **F2** (info/sensor data) from the home screen.

To return to the home screen, press **BACKSPACE** or **F1** (home).

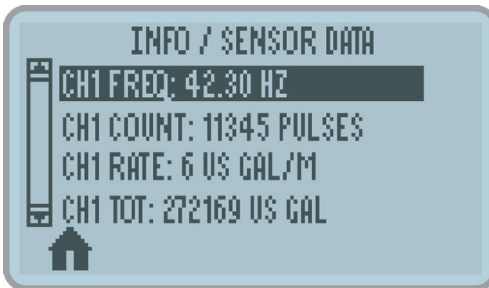


Figure 13: Info/sensor data screen

PROGRAMMING

This section explains each of the menus and the menu options. See “*Icon Functionality*” on page 19 for an explanation of the various on-screen icons.

Setting a Password

FC-5000 units are shipped without password protection. Passwords can be optionally configured for *System Setup* and *Reset* functions. To set a password:

1. Navigate to *SYSTEM SETUP > PASSWORD SETUP*.
2. Highlight **SETUP MENU PASSWORD** or **SYSTEM RESET PASSWORD** and press **ENTER**.

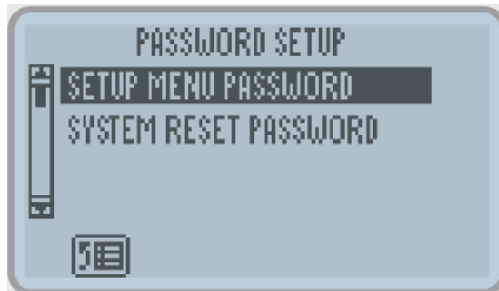


Figure 14: Set password screen

3. Enter a numeric password from 4 to 8 digits and press **ENTER**.
4. On the confirmation screen, press **ENTER** again to accept the password.

NOTE: An asterisk (*) appears next to the option for which a password is set.

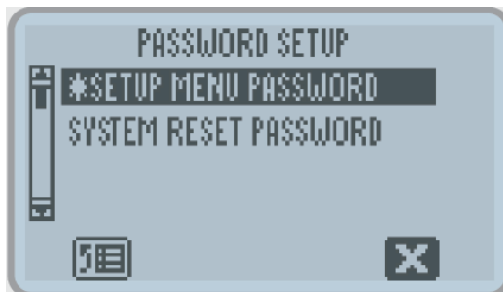


Figure 15: An asterisk indicates a set password

Deleting a Password

1. Navigate to *SYSTEM SETUP > PASSWORD SETUP*.
2. Highlight the type of password you want to delete (**SETUP MENU PASSWORD** or **SYSTEM RESET PASSWORD**) and press **F4** (clear).
3. On the confirmation screen, press **ENTER** to confirm removal of the password.

Changing Display Properties

To change the display properties for *Language*, *Contrast* or *Brightness*.

1. From the *Main* menu, highlight **DISPLAY** and press **ENTER**.
2. Press the **UP/DOWN** keys to scroll to the drop-down menu for **LANGUAGE**, **CONTRAST** or **BRIGHTNESS** and press **ENTER**.
3. Scroll through the available options, then press **ENTER** to select one.



Figure 16: Display configuration screen

Setting Measurement Options

The *MEASUREMENTS* menu configures:

- Units
- Display precision (1...4)
- Radix (comma or decimal point)

Units

The *Units* parameter determines the engineering unit and/or time interval for calculated measurements.

1. Navigate to *SYSTEM SETUP > MEASUREMENTS*.
2. Highlight **FLOW CHANNEL 1**, **FLOW CHANNEL 2**, **TOTAL CHANNEL 1**, **TOTAL CHANNEL 2** or **TEMPERATURE** and press **ENTER**.
The drop-down menu for *UNIT OF MEASURE* displays the available units of measure for the selected parameter.
3. Press **ENTER** to activate the drop-down menu.
4. Press the **UP/DOWN** keys to scroll to the unit and press **ENTER**. For rate measurement, all options are available in time intervals of seconds (S), minutes (M), hours (H) and days (D).

For any of the *Flow* parameters (*Rate* or *Total*), the available units are:

Unit	Description	Unit	Description
US GAL	US Gallon	M ³	Cubic Meters
I GAL	Imperial Gallon	ACFT	Acre Feet
US MGAL	US Million Gallons	OBBL	Oil Barrels [42 US Gallons]
I MGAL	Imperial Million Gallons	LBBL	Liquid Barrels [31.5 US Gallons]
L	Liters	US OZ	US Ounces
ML	Million Liters	I OZ	Imperial Ounces
FT ³	Cubic Feet	CUST	Custom

The TEMPERATURE units are °F, °C, °K (Kelvin), and °R (Rankine).

Changing Custom Units for Rate or Total Measurement

1. Highlight **CUST** and press **ENTER**.
The display populates with additional icons that need to be modified for custom units.
2. Press **F2** (custom label). Use the soft keys in conjunction with the numeric keypad and **UP/DOWN** keys to create a custom label, then press **ENTER**. See *Table 1 on page 18* and *Table 2 on page 19* for button functionality.
3. On the confirmation screen, press **ENTER** to confirm the new custom unit. The new label displays in the selection list.
4. Press **F3** (conversion) to assign a conversion factor for this custom unit. The number entered will be a factor of gallons-per-minute (flow) or gallons (total).
5. Press **ENTER** to save the change.
6. On the confirmation screen, press **ENTER** to confirm the change.

NOTE: As a conversion factor example, if you enter 2, the custom unit is equivalent to 2 gallons per minute. If you enter 0.5, the custom unit is equivalent to 1/2 gallon per minute.

Display Precision

The *Display Precision* parameter determines the resolution of a value indicated by the number of digits after the decimal place.

1. Highlight the drop-down menu for **DISPLAY PRECISION** and press **ENTER**.
2. Press the **UP/DOWN** keys to highlight a display precision from 1...4 and press **ENTER**.

Radix

The *Radix* parameter determines if a period or comma is used to represent a decimal place.

1. Highlight the drop-down menu for **RADIX** and press **ENTER**.
2. Press the **UP/DOWN** keys to highlight either the decimal point (.) or the comma (,) and press **ENTER**.

Setting Up a Flow Meter

To set up a flow meter, first select a sensor type, then edit the parameters available for that sensor type.

Flow Sensor Type

See "Flow Sensor Types" on page 45 for more details on flow type selection for Badger Meter products.

1. Navigate to *SYSTEM SETUP* > *ADVANCED SETUP* > *SENSOR INPUT*.
2. Highlight **FLOW SENSOR 1 TYPE** or **FLOW SENSOR 2 TYPE** and press **ENTER**.
3. Press the **UP/DOWN** keys to highlight a flow sensor type and press **ENTER**.
The flow sensor types are (table continues on next page):

Option	Description
No Sensor/ Disabled	No sensor is connected to the input terminal
Sine K-Factor	<ul style="list-style-type: none"> • Frequency input channel <ul style="list-style-type: none"> ◊ Examples: Mag pick-offs, Low level signals (~100 mV) • Single K-Factor entry
Pulse K-Factor	<ul style="list-style-type: none"> • Pulse input channel <ul style="list-style-type: none"> ◊ Any pulse producing sensor ◊ Examples: TTL, RF carriers w/ amplifier • Single K-Factor entry • Active sensor: No pullup resistor
Pulse K-Factor Pullup	<ul style="list-style-type: none"> • Pulse input channel <ul style="list-style-type: none"> ◊ Any pulse producing sensor ◊ Examples: TTL, RF carriers w/ amplifier • Single K-Factor entry <ul style="list-style-type: none"> ◊ Pulses per unit of volume • Passive sensor: Pullup resistor to 12V for excitation
Pulse DIC	<ul style="list-style-type: none"> • Unique to the Data Industrial (DIC) product line • Pulse input channel <ul style="list-style-type: none"> ◊ Any pulse producing sensor ◊ Examples: TTL, RF carriers w/ amplifier • K & Offset values entered <ul style="list-style-type: none"> ◊ K = unit of volume per pulse • Active sensor: No pullup resistor
Pulse Debounce K-Factor	<ul style="list-style-type: none"> • Unique to products with raw reed switches • Pulse input channel <ul style="list-style-type: none"> ◊ Any pulse producing sensor coupled with a reed switch ◊ Examples: Industrial Oval Gear • Single K-Factor entry <ul style="list-style-type: none"> ◊ Pulses per unit of volume • Passive sensor: Pullup resistor to 12V for excitation
Sine UVC Fixed v	<ul style="list-style-type: none"> • Viscosity is manually programmed for a given process temperature • Frequency input channel <ul style="list-style-type: none"> ◊ Examples: Mag pick-offs, Low level signals (~100 mV) • Multi-point linearization

Option	Description
Pulse UVC Fixed v	<ul style="list-style-type: none"> • Viscosity is manually programmed for a given process temperature • Pulse input channel <ul style="list-style-type: none"> ◊ Any pulse producing sensor ◊ Examples: TTL, RF carriers w/ amplifier • Multi-point linearization • Active sensor: No pullup resistor
Sine UVC	<ul style="list-style-type: none"> • Temperature input required • Viscosity is automatically calculated for a given process temperature measurement • Frequency input channel <ul style="list-style-type: none"> ◊ Examples: Mag pick-offs, Low level signals (~100 mV) • Multi-point linearization
Pulse UVC	<ul style="list-style-type: none"> • Temperature input required • Viscosity is automatically calculated for a given process temperature measurement • Pulse input channel <ul style="list-style-type: none"> ◊ Any pulse producing sensor ◊ Examples: TTL, RF carriers w/ amplifier • Multi-point linearization • Active sensor: No pullup resistor
Sine UVC RS	<ul style="list-style-type: none"> • Temperature input required • Viscosity is automatically calculated for a given process temperature measurement • Roshko/Strouhal calculation accommodates changes to meter bore based on process temperature measurement • Frequency input channel <ul style="list-style-type: none"> ◊ Examples: Mag pick-offs, Low level signals (~100 mV) • Multi-point linearization
Pulse UVC RS	<ul style="list-style-type: none"> • Temperature input required • Viscosity is automatically calculated for a given process temperature measurement • Roshko/Strouhal calculation accommodates changes to meter bore based on process temperature measurement • Pulse input channel <ul style="list-style-type: none"> ◊ Any pulse producing sensor ◊ Examples: TTL, RF carriers w/ amplifier • Multi-point linearization • Active sensor: No pullup resistor
Sine Multi-Point Cal	<ul style="list-style-type: none"> • Frequency input channel <ul style="list-style-type: none"> ◊ Examples: Mag pick-offs, Low level signals (~100 mV) • Multi-point linearization
Pulse Multi-Point Cal	<ul style="list-style-type: none"> • Pulse input channel <ul style="list-style-type: none"> ◊ Any pulse producing sensor ◊ Examples: TTL, RF carriers w/ amplifier • Multi-point linearization • Active sensor: No pullup resistor

Flow Sensor Calibration

The flow sensor calibration parameters vary with the flow sensor *type* selected.

1. Navigate to *SYSTEM SETUP > ADVANCED SETUP > SENSOR INPUT*.
2. Highlight **FLOW SENSOR 1 CAL** or **FLOW SENSOR 2 CAL** and press **ENTER**.
3. Select and edit each option, as necessary. The options include:

Option	Description
K-factor	A singular K-factor entry point. Used when sine/pulse <i>K-Factor</i> is used for flow sensor 1 type
Offset	Used to apply an offset to sensor input calibration
Low Flow Cutoff	The point at which the display reads zero. Represented in configured unit of measure
Multi-Point Table	A multi-point calibration table used when any sine/pulse UVC type is selected for flow sensor type

100 Point Linearization

The FC-5000 flow monitor can be set up to linearize the output from an eligible flow meter. The calibration data for a particular flow meter are included when the meter, calibration and FC-5000 unit are ordered from the factory. The calibration data are represented by either:

- Curve-fitted FREQUENCY/VISCOSITY (f/v) vs K-FACTOR (KFct) or
- FREQUENCY (f: Hz) vs K-FACTOR (KFct),

To manipulate or enter the linearization parameters:

1. See “*Flow Sensor Type*” on page 28 for an explanation of these flow sensor input types:

<i>Sine UVC Fixed v</i>	<i>Pulse UVC Fixed v</i>
<i>Sine UVC</i>	<i>Pulse UVC</i>
<i>Sine UVC RS</i>	<i>Pulse UVC RS</i>
<i>Sine Multi-Point Cal</i>	<i>Pulse Multi-Point Cal</i>
2. Navigate to *SYSTEM SETUP > ADVANCED SETUP > SENSOR INPUT > FLOW SENSOR 1 CAL*.
3. Highlight **MULTI-POINT TABLE** and press **ENTER**.
4. For each calibration point, press **F2** (which represents either *f/v* or *frequency*) to enter or edit the corresponding value or press **F3** (kFct) to enter or edit the *K-factor* value.
5. On the numeric entry screens, enter the value and press **ENTER** to save the value, then return to the previous screen.

NOTE: Each entry, 1...100, represents each calibration data point. Any number of points can be entered, up to 100. Leave the fields at 0.000 if no data exists.

Flow Sensor Properties

1. Navigate to *SYSTEM SETUP > ADVANCED SETUP > SENSOR INPUT*.
2. Highlight **FLOW SENSOR 1 PROP** or **FLOW SENSOR 2 PROP** and press **ENTER**.
3. Select and edit each option, as necessary.
The flow sensor properties are:

Option	Description
CH1 or CH2 Bore Dia	Bore diameter of connected flow meter
CH1 or CH2 Dia. Unit	Unit of measure (in. or mm) associated with bore diameter
CH1 or CH2 Material	Construction material of the connected flow meter. <ul style="list-style-type: none"> • Aluminum • Brass • SS 302/3 • SS 304 • SS 316 • Cast iron
CH1 or CH2 Sens	Descriptive, user-defined text string for the sensor
CH1 or CH2 Temp Ref	Reference calibration temperature; used in Roshko/Strouhal algorithms
CH1 or CH2 Smoothing	Smoothing coefficient. As the number increases, averaging becomes greater. As the number decreases, it approaches the raw reading

Setting Up a Temperature Sensor

Temperature Sensor Type

1. Navigate to *SYSTEM SETUP > ADVANCED SETUP > SENSOR INPUT*.
2. Highlight **TEMPERATURE SENSOR 1 TYPE** and press **ENTER**.
3. Press the **UP/DOWN** keys to highlight a temperature sensor type and press **ENTER**.

The temperature sensor types are:

Item	Description
No Sensor/Disabled	No temperature sensor is connected to the input terminal
RTD DI Type	Data Industrial RTD configuration
RTD PT 100 0385	100 Ohm platinum RTD using 0.0385 TCR (temperature coefficient of resistance)
RTD PT 1000 0385	1000 Ohm platinum RTD using 0.0385 TCR
RTD PT 100 0375	100 Ohm platinum RTD using 0.0375 TCR
RTD PT 2 Point	2-point calibration PT RTD
Thermistor DI Type	Data Industrial thermistor configuration
Thermistor Custom	Allows custom calibration for a thermistor

Temperature Sensor Calibration

1. Navigate to *SYSTEM SETUP > ADVANCED SETUP > SENSOR INPUT*.
2. Highlight **TEMPERATURE SENSOR 1 CALIBRATION** and press **ENTER**.
3. Press the **UP/DOWN** keys to highlight a temperature sensor calibration option and press **ENTER**.

The temperature sensor calibration options are:

Item	Description
R0	Resistance (Ω) at 0° C / Resistance (Ω) at T0
Alpha	Callendar-Van Dusen constant
Beta	
Delta	
T0	Temperature at T0 (°C)
R1	Resistance (Ω) at temperature T1
T1	Temperature at T1 (°C)
Offset	Temperature calibration offset
A	Steinhart-Hart coefficient
B	
C	

Setting Up Outputs

The calibration options for each sensor type are:

Sensor Type	Calibration Options
No Sensor/Disabled	—
RTD DI Type	Resistance (Ω) at 0° C (Alpha, Beta, Delta) Callendar-Van Dusen constants
RTD PT 100 0385	
RTD PT 1000 0385	
RTD PT 100 0375	
RTD P2 Point	R0, T0, R1, T1
Thermistor DI Type	Offset (A, B, C) Steinhart-Hart coefficients
Thermistor Custom	

Scaled Output

The scaled output sends a frequency (pulse) or analog output for any eligible measured value in the FC-5000 flow computer. To set up scaled output, first select an output mode, then edit the parameters available for that output mode. The parameters available depend on the selected mode.

The *Scaled Output* options are:

Option	Description
CH1 Output Mode	Selects the behavior of Output Channel 1
CH1 Output Parameter	Defines output characteristics of Output Channel 1
CH2 Output Mode	Selects the behavior of Output Channel 2
CH2 Output Parameter	Defines output characteristics of Output Channel 2

1. Navigate to *SYSTEM SETUP > ADVANCED SETUP > SCALED OUTPUT > CH1 OUPUT MODE* or *CH2 OUTPUT MODE*.

The *Output Mode* options are:

Option	Description
Output Off	Sends no output from the flow computer through the output channel
Pulse Output (Total)	Sends pulse(s)-per-total unit of measure
Pulse Output (Rate)	Sends pulse(s)-per-rate unit of measure
0...5V analog	Transmits data with 0...5V analog signal
0...10V analog	Transmits data with 0...10V analog signal
4...20 mA analog	Transmits data with 4...20V analog signal

2. Highlight an output mode and press **ENTER**.
3. Press **BACKSPACE** to return to the *Scaled Output* menu.
4. Highlight **CH1 OUTPUT PARAMETER** or **CH2 OUTPUT PARAMETER** and press **ENTER**. The options vary, depending on the mode:

Option	Description
Output Source	Parameter assignment of the output (such as flow, total or temperature)
Pulse Factor	Pulses output per unit of measure
Pulse Full Scale	Maximum flow value of configured flow meter (in units of measure)
Pulse Low Scale	Minimum flow value of configured flow meter (in units of measure)
Pulse Max Frequency	Maximum frequency output value
Analog Full Scale	Sets measurement value associated with 5V, 10V or 20 mA
Analog Low Scale	Sets measurement value associated with 0V or 4 mA

5. Highlight **OUTPUT SOURCE** and press **ENTER**. One or more options are available, depending on the flow computer model.
6. Highlight an output source and press **ENTER**.
7. Press **BACKSPACE** to return to the *CH1 Output Parameter* or *CH2 Output Parameter* menu.
8. To edit the remaining parameters:
 - a. Highlight the parameter (*Pulse Factor, Pulse Full Scale, Pulse Low Scale, Pulse Max Frequency, Analog Full Scale* or *Analog Low Scale*) and press **ENTER**.
 - b. Use the soft keys and numeric keypad to enter a value and press **ENTER** to save the value.
9. On the confirmation screen, press **ENTER** to confirm the change.

Relay Output Configuration

The relay output can be configured:

- To control On/Off functions of devices such as lights, buzzers, pumps and fans.
- As a totalizing point.
- As a manual control for remote switches and buttons.

To set up the relay output, first select a relay mode, then edit the parameters available for that relay mode.

1. Navigate to *SYSTEM SETUP > ADVANCED SETUP > RELAY OUTPUT > CH1 RELAY MODE* or *CH2 RELAY MODE*.

The relay mode options are:

Option	Description
Disable Relay	No output
Totalizer	Totalizer output
High Alarm	On/Off function tripped at high point
Low Alarm	On/Off function tripped at low point
High/Low Alarm	On/Off function tripped beyond a range limit
Manual	On/Off function of manual operation

2. Highlight a relay mode and press **ENTER**.
3. Press **BACKSPACE** to return to the *Relay Output* menu.
4. Highlight **CH1 OUTPUT PARAMETER** or **CH2 OUTPUT PARAMETER** and press **ENTER**. The parameters vary, depending on the mode you selected. The parameters are:

Parameter	Description
Output Source	Parameter assignment of the output (like flow or total)
Scaling Factor	Transmits programmed number of pulses per unit of measure
Units	Desired unit of measure for the output
Min On-Time	Time, in milliseconds, that the relay will remain in active state
Latching	Leaves relay in triggered state until it is manually cleared (See " <i>Clearing a Latched Relay</i> " on page 36)
Set High	Set the high value for the relay trigger
Set Low	Set the low value for the relay trigger
Set Delay	Time in milliseconds (ms) that it will elapse before the relay triggers if trigger condition is met
Release Delay	Time, in milliseconds (ms) that the relay will remain triggered after trigger condition is remedied
Override	ONLY ACTIVE IN MANUAL MODE: Bypasses any programmed triggers to trigger relay. Will remain triggered until deactivated

5. Highlight **OUTPUT SOURCE** and press **ENTER**. One or more options are available, depending on the flow computer model.
6. Highlight an output source and press **ENTER**.
7. Press **BACKSPACE** to return to the *CH1 Relay Parameter* or *CH2 Relay Parameter* menu.

8. To edit the remaining parameters:
 - a. Highlight the parameter and press **ENTER**.
 - b. Use the soft keys and numeric keypad to enter a value and press **ENTER** to save the value.
9. On the confirmation screen, press **ENTER** to confirm the change.

Clearing a Latched Relay

To clear a relay that is configured to latch following a trigger:

1. From the *Home* screen, press **F1** (menu) to display the *Main* menu.
2. Highlight **UNLATCH R1** or **UNLATCH R2** and press **ENTER**.

Resetting Totals

To reset *CH1 Flow Totals*, *CH2 Flow Totals*, *Faults* or *Defaults*:

1. From the *Main* menu, highlight **RESETS** and press **ENTER**.

NOTE: If a passcode was configured, enter the passcode and press **ENTER**.

2. Select the parameter to reset and press **ENTER**.
3. On the confirmation screen, press **ENTER** to confirm the change.

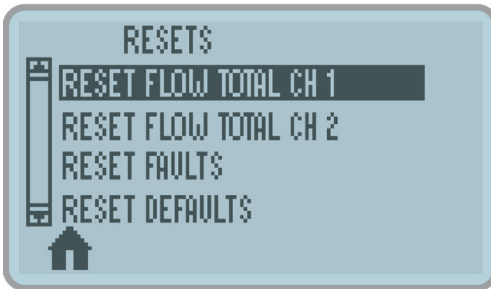


Figure 17: Reset totals screen

Digital I/O

The *Digital I/O* channel can be used for remote control of some functions of the FC-5000 flow computer.

All six of the channels are input-only and can be configured for any combination of the following.

Function	Description
Inactive	No Function
Reset Relay 1	Resets latch on Relay 1
Reset Relay 2	Resets latch on Relay 2
Reset Total CH1	Resets <i>Total CH1</i>
Reset Total CH2	Resets <i>Total CH2</i>
Reset Relay 1 / Total CH1	Resets latch on Relay 1 and resets <i>Total CH1</i>
Reset Relay 2 / Total CH1	Resets latch on Relay 2 and resets <i>Total CH1</i>
Reset Relay 1 / Total CH2	Resets latch on Relay 1 and resets <i>Total CH2</i>
Reset Relay 2 / Total CH2	Resets latch on Relay 2 and resets <i>Total CH2</i>
Inhibit CH1	Disables flow/total on CH1
Inhibit CH2	Disables flow/total on CH2

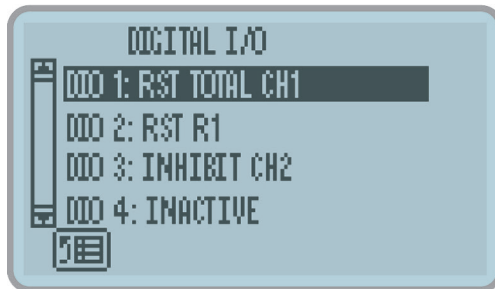


Figure 18: Digital I/O screen

1. Navigate to *SYSTEM SETUP > ADVANCED SETUP > DIGITAL I/O*.
2. Highlight one of the six input channels and press **ENTER**. Each time you press **ENTER**, the channel toggles through the available configurations.
3. Press **ENTER** repeatedly until the configuration you want appears.
4. Press **BACKSPACE** to return to the previous menu.

To disable any channel, simply toggle the digital I/O channel to *INACTIVE*.

Fluid Properties

From the *Fluid Properties* menu, you can set these parameters:

Parameter	Description
CH1 Fluid ID	Custom text entry for the fluid name
CH1 Fixed Viscosity (cSt)	Numeric entry for fixed fluid viscosity, in centistokes
CH1 Fixed Density	Numeric entry for fixed fluid density
CH1 Viscosity Table (cSt)	Temperature-compensated fluid viscosity table
CH1 Density Table	Temperature-compensated fluid density table
CH2 Fluid ID	Custom text entry for the fluid name
CH2 Fixed Viscosity (cSt)	Numeric entry for fixed fluid viscosity, in centistokes
CH2 Fixed Density	Numeric entry for fixed fluid density
CH2 Viscosity Table (cSt)	Temperature-compensated fluid viscosity table
CH2 Density Table	Temperature-compensated fluid density table

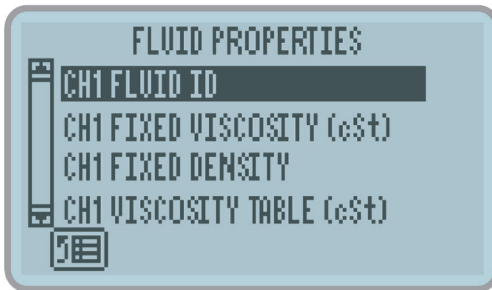


Figure 19: Fluid properties screen

1. Navigate to *SYSTEM SETUP* > *ADVANCED SETUP* > *FLUID PROPERTIES*.
2. Highlight a parameter and press **ENTER**.
3. Use the soft keys and numeric keypad to enter a value and press **ENTER** to save the value.
4. On the confirmation screen, press **ENTER** to confirm the change.

Communications

From the *Communications* menu, you can set these parameters:

Parameter	Options
Network Type	Inactive, Modbus RTU or Modbus ASCII
Baud Rate	1200, 2400, 4800, 9600, 14400, 19200, 28800, 38400, 57600 or 115200
Parity	No Parity, Odd Parity or Even Parity
Stop Bit	No Stop Bit, One Stop Bit or Two Stop Bit
Slave Address	[Edit screen]
Device Name	[Edit screen]

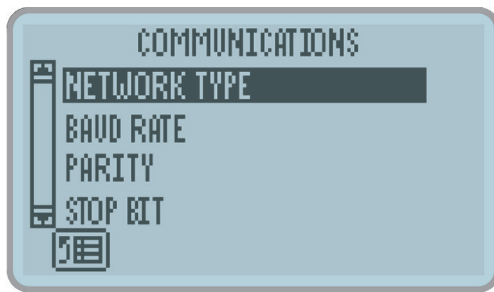


Figure 20: Communications screen

1. Navigate to *SYSTEM SETUP > ADVANCED SETUP > COMMUNICATIONS*.
2. Highlight a parameter and press **ENTER**.
3. Highlight an option and press **ENTER**.
4. Press **BACKSPACE** to return to the previous menu.

TROUBLESHOOTING

This section lists common problems that you may encounter with the flow computer, the possible causes and the recommended remedies. Most problems are due to improper wiring and/or programming procedures. The problem may also be in the flow meter, valve, pump or other piece of equipment.

Be sure that all other equipment is functioning properly. The FC-5000 flow computer is extensively tested at the factory before shipment. However, the unit may get damaged during transit or installation. If after all possible remedies have been tried and the problem persists, contact your local representative or Badger Meter.

Problem	Possible Causes	Remedies
Unit is powered but the display does not light up.	Incorrect power wiring.	Re-check power wiring.
Transmitter is connected but the FC-5000 does not count.	<ol style="list-style-type: none"> 1. Incorrect transmitter wiring or broken wire. 2. Transmitter is defective. 3. No sensory type selected. 4. Wrong scale factor. 5. Low frequency input must be on terminal #7. 6. Meter is defective, rotor not turning. 	<ol style="list-style-type: none"> 1. Check wiring diagrams. 2. Replace parts or entire unit. 3. Select a sensor type. See "Flow Sensor Type" on page 28. 4. Check scale factor calculation: For example, if programmed 0.001 instead of 0.100, unit will wait for 100 pulses before decrementing one count. 5. Verify connection. 6. Disassemble meter, check rotor, replace if defective.
Valve does not close at setpoints.	<ol style="list-style-type: none"> 1. Relay output is not properly connected. 2. Relay is defective. 3. Valve components are defective. 	<ol style="list-style-type: none"> 1. Reconnect relay wiring. 2. Contact factory for replacement. 3. Check and replace valve components.
Counter accumulates too many counts.	<ol style="list-style-type: none"> 1. Wrong scale factor. 2. Electrical noise causing extra pulses. 3. Excessive vibration. 	<ol style="list-style-type: none"> 1. Check scale factor calculation. 2. Check wiring. Make sure power lines are not touching or close to pulse signal line. Always use shielded cable. 3. Dampen vibration.
Some of the keys on the control panel are not operational.	<ol style="list-style-type: none"> 1. Broken switch behind control panel. 2. Function not available on this model. 3. Problem with internal components. 	<ol style="list-style-type: none"> 1. Replace the flow computer or return for repair. 2. See "Operator Interface" on page 17. 3. Return the flow computer to the factory.
DISPLAY OVERRUN error	There are more than 8 digits in the display.	<ol style="list-style-type: none"> 1. Check that the unit of measure you entered will not result in a readout greater than 8 digits. 2. Check the display precision and reduce it, if possible.

Table 3: Troubleshooting

⚠ CAUTION **THERE ARE NO FIELD-REPLACEABLE PARTS INSIDE. OPENING THE UNIT WILL VOID ALL WARRANTIES.**

NOTE: Before returning the unit to the factory call your local representative or the factory to obtain a "Return Material Approval".

Carefully repack the flow computer in the original carton (or other suitable container) and ship to:

ATTN: Customer Service Department "FC-5000 FOR REPAIR"

Badger Meter Inc.

4545 W. Brown Deer Road

P.O. Box 245036

Milwaukee, WI 53224-9536

SPECIFICATIONS

Power Supply	Input range 10...40V DC and 9...28V AC RMS
	AC input voltage frequency range 50...60 Hz
	Maximum 8 Watts power consumption
	Isolated from power ground
	Over-voltage, transient and reverse polarity protected
Flow Meter Input	1 or 2 independent channels
	Configurable as square wave 0...30V pulse with 2.5 V threshold
	Configurable as sine wave, zero-centered with 200 mV amplitude and 45 mV threshold
	0...10 kHz frequency input range
	Configurable debounce
	Isolated from power ground
Frequency Outputs (Output Option F)	Over-voltage, transient and reverse polarity protected
	Output is multiplexed on the process out pins
	Resolution 0.01 Hz
	Uncertainty $\pm 0.01\%$ RDG
	2 independent channels
	Isolated from power ground
	TTL, 1...4000 Hz, square wave
Analog Outputs (Output Option A)	Over-voltage, transient and reverse polarity protected
	Output is multiplexed on the process out pins
	16-bit resolution (0...10V and 4...20 mA), 15-bit resolution (0...5V)
	200 ms, 90-10% step response
	Uncertainty $\pm 0.1\%$ of RDG
	0...5V, 0...10V or 4...20 mA
	Isolated from power ground
	2 independent channels
Field Configurable Digital I/O (Optional)	Over-voltage, transient and reverse polarity protected
	0...30 Volts as input
	De-bounce
	0...5V, TTL, 200 ms 90...10% step response, driving $< 0.1 \mu\text{F}$
	Isolated from power ground
	6 independent channels
Relay Outputs	Over-voltage, transient and reverse polarity protected
	4-wire interface/half duplex
	2 Form C mechanical
RS-485 Communications	Isolated coil drivers
	Over-voltage/ESD Protection
	Isolated from power ground
USB Communications	USB host interface (A connector)
	USB device interface (mini B connector)
	Over-voltage/ESD/transient protected
Display/User interface	Membrane keypad / domed tactile response
	128 x 64 pixel backlit graphical display
	Protected from EMI/RFI
	Keypad interface is protected from ESD

Flow Calculation	± 0.01% uncertainty	
	Adjustable FIR/IIR filtering	
Pollution Degree	2	
Altitude Restriction	Up to 2000 m (6561 ft)	
Over-Voltage Rating	Category II	
Operator Functions	Unlatch Relays, Reset Totalizer, Unlatch Relays and Reset Totalizer, Inhibit Flow Channels	
	Flow Rate, Total, Flow Rate and Total	
Flow Total or Flow Rate	Digits	8 digits
	Units	US Gallons (US GAL), Imperial Gallons (I GAL), Mega US Gallons (US MGAL), Mega Imperial Gallons (I MGAL), Liters (L), Mega Liters (ML), Cubic Meters (M ³), Cubic Feet (FT ³), Acre Feet (ACFT), Oil Barrels (OBBL), Liquid Barrels (LBBL), US Ounces (US OZ), Imperial Ounces (I OZ), Custom (user-specified)
	Decimals	0...4
Flow Rate Only	Time unit	second (S), minute (M), hour (H), day (D)
	Digits	8 digits
Temperature	Units	°F (Fahrenheit), °C (Celsius), °R (Rankine) or °K (Kelvin)
	Decimals	0...4

Table 4: Specifications

PART NUMBER MATRIX

	<div style="display: flex; justify-content: space-around; align-items: center;"> <div style="border: 1px solid black; padding: 2px;">FCS</div> <div style="font-size: 20px;">-</div> <div style="border: 1px solid black; padding: 2px;">FM</div> <div style="font-size: 20px;">-</div> <div style="border: 1px solid black; width: 20px; height: 15px;"></div> <div style="font-size: 20px;">-</div> <div style="border: 1px solid black; width: 20px; height: 15px;"></div> <div style="border: 1px solid black; width: 20px; height: 15px;"></div> <div style="border: 1px solid black; width: 20px; height: 15px;"></div> <div style="border: 1px solid black; width: 20px; height: 15px;"></div> </div>
PERSONALITY	
Flow Monitor	FM
SENSOR INPUTS	
One Pulse Only	P0
Two Pulse / One Temp	P2
SCALED OUTPUT	
Two Analog Outputs <i>Available with SENSOR INPUTS option "P2" Only</i>	A
Two Frequency Outputs <i>Available with SENSOR INPUTS option "P0" Only</i>	F
RELAY OUTPUT	
Two Form "C" Relays	C
DIGITAL OUTPUT	
Six Programmable Inputs/Outputs	6
COMMUNICATIONS	
EIA-485 Modbus and USB	A
MOUNTING METHOD	
Panel Mount	P
Wall Mount (includes NEMA 4X rated box)	W

MODBUS INTERFACE

Modbus Function Code Support

The FC-5000 flow monitor supports access through all four of the Modbus data types. Both single and multiple write-access commands are supported for register and coil data types. For multiple register writes, the command must initiate on a valid parameter address and end on last register of a valid parameter address. Multiple register writes that start in the middle of a multiple register parameter or do not end on the last register of a multiple register parameter are not supported. The table below lists the supported function codes.

Description	Function Code	Subcode
Read Coils	01	—
Read Discrete Inputs	02	—
Read Holding Registers	03	—
Read Input Registers	04	—
Write Single Coil	05	—
Write Single Register	06	—
Diagnostic – Return Query Data	08	00
Write Multiple Coils	15	—
Write Multiple Registers	16	—
Report Slave ID	17	—

Table 5: Supported modbus function codes

Modbus Register Map

Register Name	Register Address	Coil Addr.	Data Type	Read/Write	Access Type
Flow Rate CH1	0x0000	—	Float	Read Only	Register
Flow Total CH1	0x0002	—	Float	Read Only	Register
Flow Total Precision CH1	0x0004	—	Double	Read Only	Register
Flow Rate CH2	0x0008	—	Float	Read Only	Register
Flow Total CH2	0x000A	—	Float	Read Only	Register
Flow Total Precision CH2	0x000C	—	Double	Read Only	Register
Flow Rate Quad	0x0010	—	Float	Read Only	Register
Flow Total Quad	0x0012	—	Float	Read Only	Register
Flow Total Precision Quad	0x0014	—	Double	Read Only	Register

Table 6: Modbus register map

FLOW SENSOR TYPES

The table below lists the Badger Meter products suitable for use with the FC-5000 Flow Monitor.

Meter Technology	Product Line	Output Type	Flow Sensor Input
Impeller	Impeller	Square Wave Frequency	PULSE DIC
Oval Gear	Oval Gear	Reed Switch Pulse	PULSE DEBOUNCE K-FACTOR
Positive Displacement	OP	Unscaled Pulse	PULSE DEBOUNCE K-FACTOR
		Scaled Pulse	PULSE DEBOUNCE K-FACTOR
	Recordall	Unscaled Pulse	PULSE DEBOUNCE K-FACTOR
		Scaled Pulse	PULSE DEBOUNCE K-FACTOR
Turbine	Blancett	MAG Pickup	SINE K-FACTOR, SINE MULTI-POINT CAL
		MAG Pickup w/ K-Factor Scaler	PULSE K-FACTOR, PULSE MULTI-POINT CAL
	Cox	RF Pickup w/ Signal Conditioner	PULSE UVC FIXED v
		NOTE: Requires temperature sensor	SINE UVC, PULSE UVC, SINE UVC RS, PULSE UVC RS
		MAG Pickup	SINE UVC FIXED v
		NOTE: Requires temperature sensor	SINE UVC, PULSE UVC, SINE UVC RS, PULSE UVC RS
		MAG Pickup w/ Signal Conditioner	PULSE UVC FIXED v
		NOTE: Requires temperature sensor	SINE UVC, PULSE UVC, SINE UVC RS, PULSE UVC RS
	Turbo	Unscaled Pulse	PULSE DEBOUNCE K-FACTOR
		Scaled Pulse	PULSE DEBOUNCE K-FACTOR
	Flo-tech	MAG Pickup	SINE K-FACTOR, SINE MULTI-POINT CAL
		MAG Pickup w/ K-Factor Scaler	PULSE K-FACTOR, PULSE MULTI-POINT CAL
	Vision	Frequency	PULSE K-FACTOR PULLUP

STANDARDS AND CERTIFICATIONS

Safety

Agency Approval/Standards

- CE Marked for Low Voltage Directive and RoHS
- CSA Marked per Class C225286 and C225206, Process Control Equipment
- CSA C22.2 No. 61010-1-12, General requirements
- CAN/CSA-C22.2 No. 61010-1-12 Safety requirements for electrical equipment for measurement, control and laboratory use. Part 1: General requirements—Tri-national standard with UL 61010-1 and ANSI/ISA-61010-1 (82.02.01)

EMI/EMC Compliance

Conducted and Radiated Emissions per CISPR11:2009 / EN55011.	Class A, Group 1
IEC 61000-4-2:2008 Electro-static Discharge	2/4 kV - Contact Discharge, 2/4/8 kV Air Discharge Performance Criteria B
IEC 61000-4-3:2006 Radiated RF Immunity	Test levels: 80...1000 MHz & 1400...2000 MHz Performance Criteria A
IEC 61000-4-4:2004 EFT Immunity (Signal and Power lines)	Tested per specification to Performance Criteria B
IEC 61000-4-5:2005 Surge Protection	Tested per specification to Performance Criteria B
IEC 61000-4-6:2008 Conducted RF Immunity (Signal and Power lines)	Test Levels: 0.15...80 MHz Level 3, Performance Criteria A
IEC 61000-4-11:2004 Voltage Dips, Interruptions, and Dropouts	Tested per specification to Performance Criteria B & C

Enclosure Protection

- IEC/CSA/UL 60529-1: Degrees of protection provided by enclosures (IP65), when installed with all four mounting clips in a similarly rated enclosure, which includes the optional wall mount enclosure.
- Additional Protection (optional): NEMA 4X (wall mount enclosure only).

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