Impeller
Data Industrial®

Industrial Flow Monitor

Series 3000

Badger Meter

DSY-UM-01667-EN-05 (April 2017)

User Manual

CONTENTS

INTRODUCTION

The Badger Meter® Data Industrial® Series 3000 flow monitor is an economical, full featured, digital flow monitor.

The two-line × 16-character alphanumeric display can be configured by the user to display flow rate and flow total. The panel meter has a NEMA 4X rated front panel and conforms to DIN Standard dimensions, 96 mm × 96 mm, for meter sizes and panel cutouts. An optional NEMA 4 wall mount is also available.

The Series 3000 flow monitor accepts pulse, sine wave or linear analog input signals. Like all Data Industrial flow monitors, the Series 3000 flow monitor may be field calibrated by the user. For Data Industrial sensors "K" and "offset" numbers are entered, while other pulse or frequency output sensors may use a K-factor only. Analog inputs are fully programmable for slope and intercept.

SAFETY INFORMATION

The installation of the flow monitor must comply with all applicable federal, state, and local rules, regulations, and codes.

Failure to read and follow these instructions can lead to misapplication or misuse of the flow monitor, resulting in personal injury and damage to equipment.

UNPACKING & 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.

PROGRAMMING THE SERIES 3000 FLOW MONITOR

Programming is menu driven. All data is entered using the LCD/keypad interface. A password gate is included to prevent unauthorized access to programming parameters. Programming flexibility is extended to units of measure. In addition to several factory units of measure, the Series 3000 flow monitor software permits the custom units for rate and total to be created by the installer.

The Series 3000 flow monitor provides one Form C solid-state relay, and one solid-state switch output. Both are fully programmable as either pulse/volume, or setpoint control. For pulse output, the installer can program both the resolution and the pulse width. Setpoint control is extremely versatile with fully independent set and release points, each with its own time delay.

Options

- Analog output
- Analog input
- Single flow channel input
- One control relay output
- One programmable pulse output
- Low voltage AC/DC supply
- USB
- RS485 w\BACnet™ or Modbus® protocols
- Wall mounting

INSTALLATION

Mechanical

The Series 3000 flow monitor can be either panel mounted or wall mounted.

Location

In any mounting arrangement the primary concern is easy viewing and convenient operation of the keypad. The unit generates very little heat, so no consideration need be given to cooling or ventilation. However, prolonged direct sunlight can damage the front panel so some level of shading is recommended, especially if installed in a tropical climate.

Panel Mount Installation

The Series 3000 panel mount flow monitor is designed for through-panel mounting, which allows access to the back of the unit. The flow monitor is secured to the panel by two draw brackets shown in *Figure 1*. See *Figure 2* for flow monitor and panel cutout dimensions.

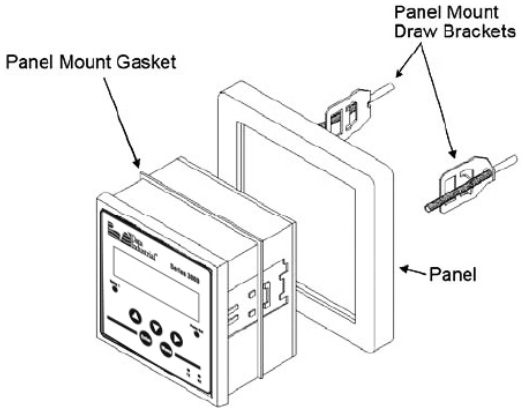


Figure 1: Panel mounting

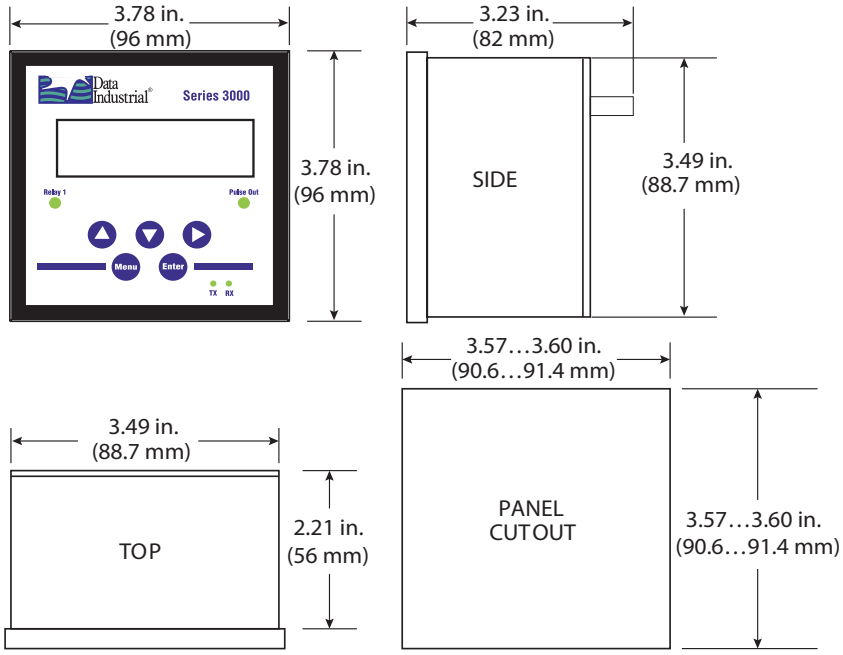


Figure 2: Physical dimensions and panel cutout

Wall Mount Installation

The Series 3000 wall mount flow monitor is designed to mount onto a wall with four bolts or screws. The mounting hole pattern and box dimensions for the Series 3000 NEMA4 wall mount are shown in *Figure 3*.

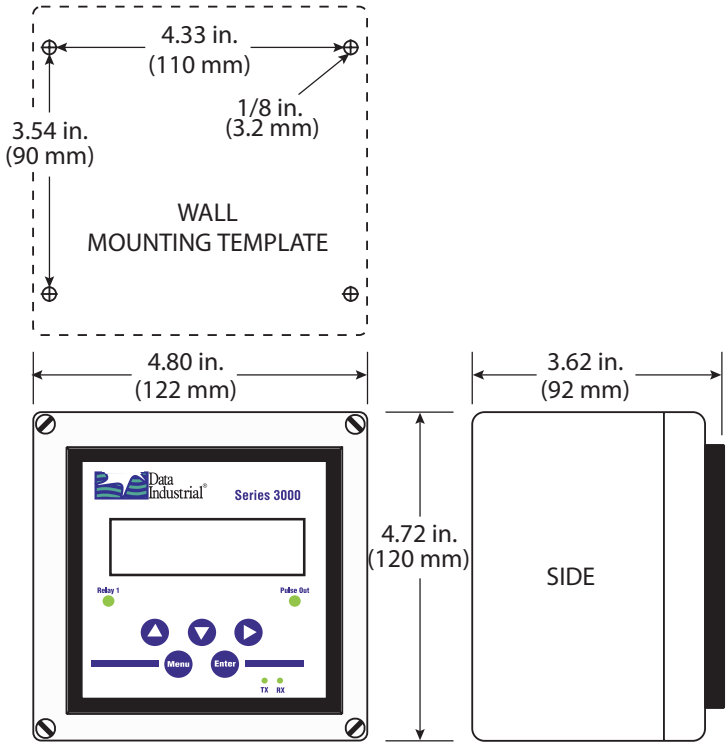


Figure 3: Wall mount and dimensions

Electrical Installation

Power Supply Wiring

The Series 3000 flow monitor requires 12…24V DC/AC to operate. See *"Specifications" on page 24* for DC current draw and AC Volt-Amp requirements.

Always use a fused circuit. Connect the positive of the power supply to the flow monitor terminal marked (ACL/DC+), and connect the negative of the power supply to the flow monitor terminal marked (ACC/DC-).

If a Badger Meter Data Industrial plugin power supply (Model A-1028) is being used, connect the black-white wire to the terminal marked (ACL/DC+) and the black wire to the terminal marked (ACC/DC-).

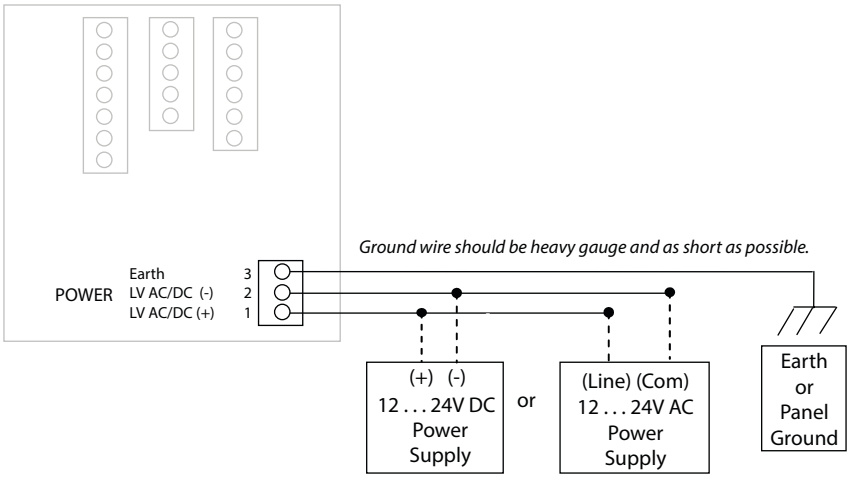


Figure 4: Power supply wiring

Flow Sensor Wiring

The Series 3000 flow sensor inputs are extremely versatile, designed to accept either two-wire or three-wire pulse inputs (Data Industrial 200 Series, 4000 Series) or Analog inputs. Although different rear panel terminals are used, all parameters are set with the LCD/keypad interface. There are no internal or external jumpers, switches or potentiometers to move or adjust.

The following pulse input types are accommodated:

- **Pulse DI**: Used for all Badger Meter Data Industrial Flow Sensors. Provides an internal pullup resistor and uses and Offset values for calibration.
- **Pulse K-Factor**: Accepts non zero-crossing inputs but provides no internal pullup, classical K (pulses/gallon) values for calibration.
- **Pullup K-Factor**: Provides an internal pullup resistor and uses classical K (pulses/gallon) values for calibration.

NOTE: All the above pulse input types wire the same as shown in *Figure 5 on page 7*. See *"Programming Flowchart—Software Version 1.2.29" on page 13* for required input configuration.

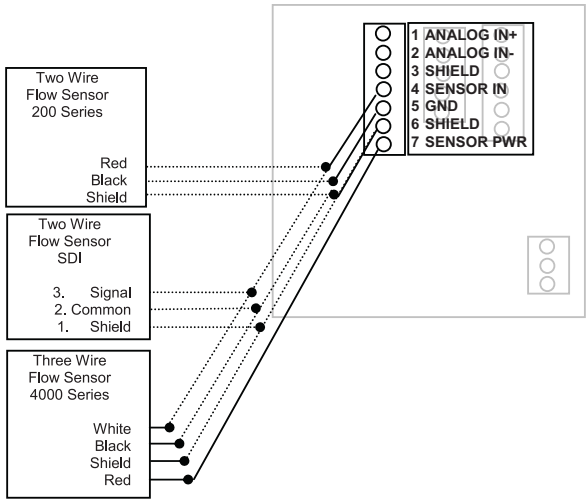


Figure 5: Data industrial flow sensor wiring examples (two- and three-wire pulse types)

Analog Input

As an alternative to the pulse inputs, the Series 3000 flow monitor can accept an Analog input. The input is non-isolated, but can accept 0…1V DC, 0…5V DC, 0…10V DC, 0…20 mA and 4…20 mA with both factory-defined and custom units of measure.

Low impedance 100 Ohm input for current inputs optimizes performance and flexibility or loop power supplies. Both the low-end and high-end scaling are independent and field configured by the installer.

NOTE: See *"Programming Flowchart—Software Version 1.2.29" on page 13* for required input configuration.

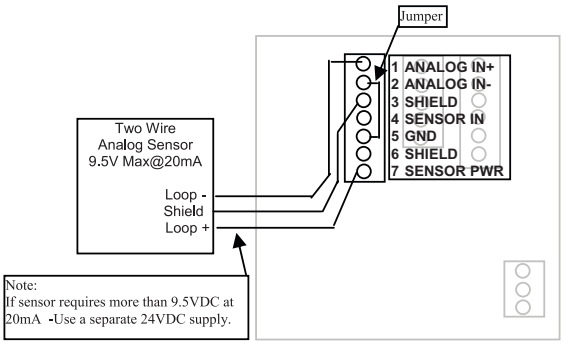


Figure 6: 4…20 mA analog loop powered wiring

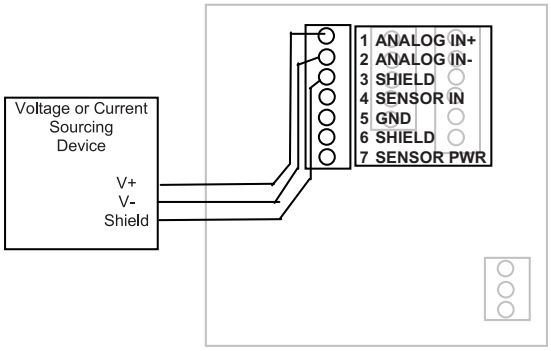


Figure 7: Voltage or current sourcing analog inputs

Solid-State Switch and Form C Output Wiring

The Series 3000 flow monitor has one Normally Open (N.O.) solid-state switch, and one solid-state form "C" relay. See *"Specifications" on page 24* for maximum voltage and current ratings for each type output.

These outputs are completely independent, electrically isolated, and can be programmed as either Pulse or Set Point outputs.

When the "Totalizer" function is selected, the unit of measure and resolution are independent from the displayed units and can be programmed where one pulse occurs once every 0000000.1 to 999999999. of units selected, with any pulse width from 0001 to 9999 mS.

When the "Alarm" is selected as the unit of measure and the resolution is independent from the displayed units, it allows the unit to be programmed as either a high or low rate Set Point. Since the Set Point, Release Point and their associated time delays are fully independent, this output can be either a classical high rate or low rate alarm, depending on the settings selected. When design planning, keep in mind that although both of these outputs can be programmed as alarm points only, the relay provides both N.O. and N.C. contacts. The switch is a simple N.O. contact.

Examples:

High Flow Set Point

The Set Point must be a value greater than the Release Point**.**

The relay output will have continuity between its N.C. terminal and "COM" until the flow has exceeded the Set Point (**"SETPT")** for a continuous period of time exceeding the Set Point Delay (**"SDLY")**, at which time the N.C. connection will open and the N.O. contact will have continuity to the "COM" terminal. When the flow has dropped below the Release Point (**"RELP")** for a continuous period of time exceeding the Release Point Delay (**"RDLY"),** the relay states will return to their original states. If the latch has been set to "ON", the relay will not release until manually reset once the Set Point and Set Delay have been satisfied.

Low Flow Set Point

The Set Point must be a value less than the Release Point.

The relay output will have continuity between its N.C. terminal and "COM" until the flow has dropped below the Set Point ("**SETPT**") for a continuous period of time exceeding the Set Point Delay(**"SDLY"),** at which time the N.C. connection will open and the N.O. contact will have continuity to the "COM" terminal. When the flow has again risen above the Release Point ("**RELP**") for a continuous period of time exceeding the Release Point Delay (**"RDLY"),** the relay states will return to their original states. If the latch has been set to "ON", the relay will not release until manually reset once the Set Point and Set Delay have been satisfied.

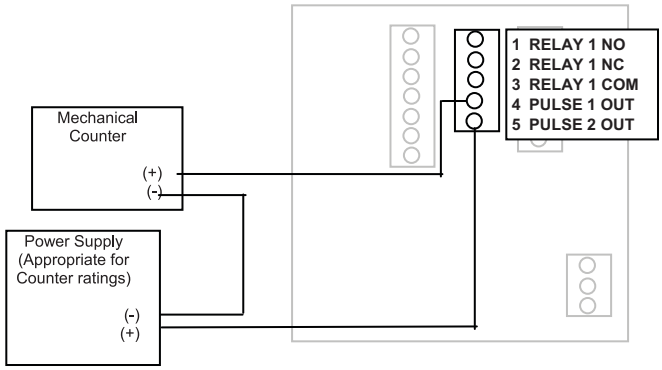


Figure 8: Relay and switch wiring examples

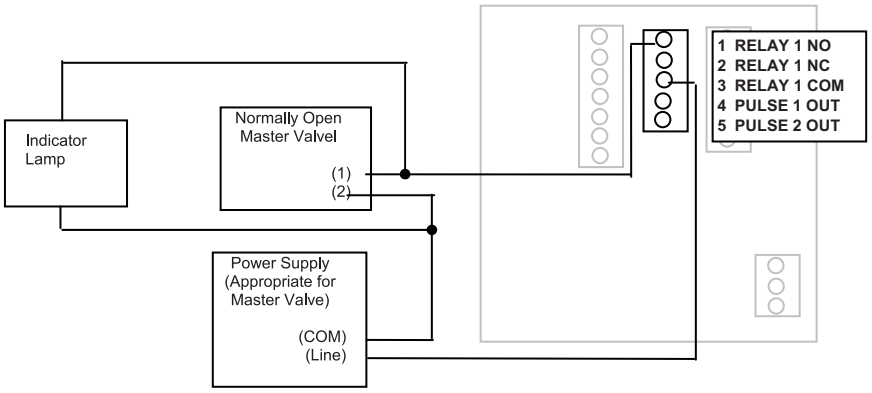


Figure 9: Relay and switch wiring examples (continued)
High Flow Shutdown and Normally Open Master Valve with Indication

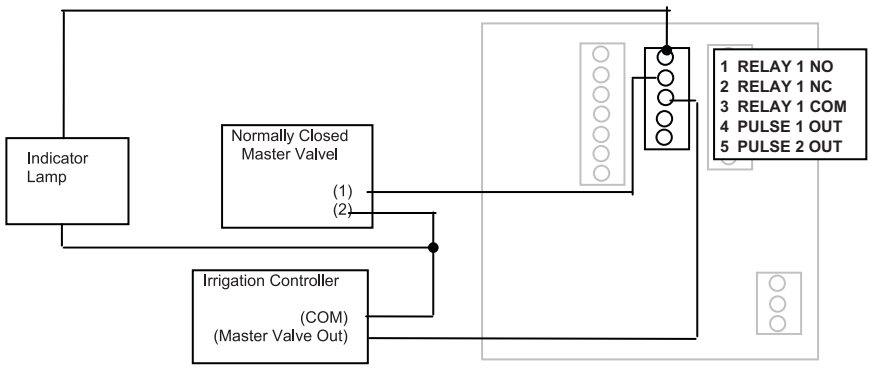


Figure 10: Relay and switch wiring examples (continued)
High Flow Shutdown and Irrigation Clock Normally Closed Master Valve with Indication Program as High Flow with Latch

OUTPUT OPTION CARD

If the Series 3000 flow monitor was ordered with the Output Option card, it will have these additional outputs:

- **Analog Output** (0…20 mA; or 4…20 mA), which can be converted externally to 0…5V DC, 1…5V DC with a 250 Ohm resistor, or 0…10V DC or 2…10V DC with a 500 Ohm resistor. A 15V DC power supply is provided to permit current sinking or sourcing. The Series 3000 flow monitor has special software that permits the analog output.
- **USB** for direct access to a computer using a standard mini-USB cable.
- **RS485** for fully addressable Modbus or BACnet communication.

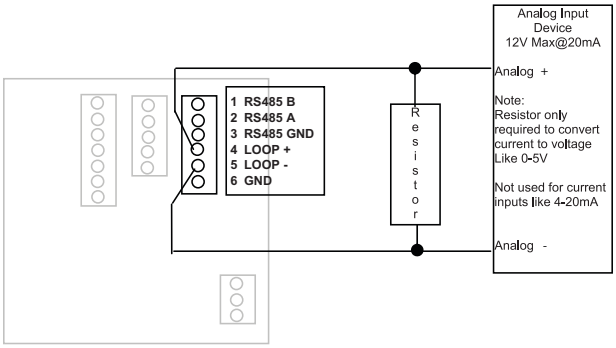


Figure 11: Current sourcing analog output

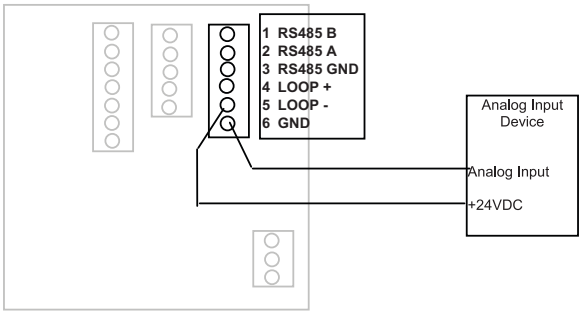


Figure 12: Current sinking analog output

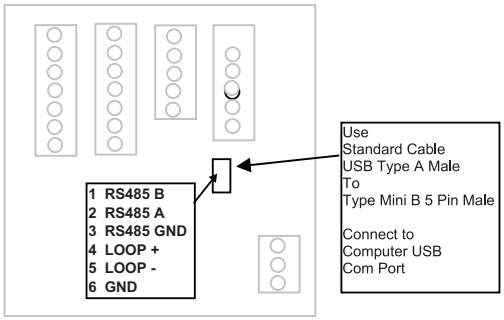


Figure 13: Analog output wiring

USB Port

To communicate using the USB port requires Windows® HyperTerminal or other similar communications software. This port is part of the Analog Output Option card. See *"Communication" on page 19* for instructions on how to use this port.

DISPLAY AND KEYPAD

The Series 3000 flow monitor has a two line by 16-character display with two modes of operation and 5 keys on the front panel for programming.

Menu	1-Switch to main menu 2-Backward/Previous menu	**Up Arrow**	1-Select Menu option 2-Increase numerical value
Enter	1-Save value 2-Forward/Next menu	**Down Arrow**	1-Select Menu option 2-Decrease numerical value
		Right Arrow	1-Select Menu option 2-Move cursor to the right

When the Series 3000 flow monitor is first powered up, it runs through internal self checks while displaying "**Badger Meter DIC Initializing."** At the end of this cycle its normal mode display will appear.

In the normal mode, if still using the factory defaults, flow rate will be displayed on the top line, and flow total displayed on the bottom. Both lines can be custom-defined in the field as desired. In the normal mode the **Enter** key has no function.

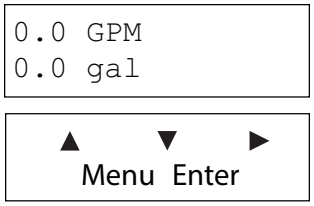


Figure 14: Normal mode display

The other mode is the program mode, used to configure the unit. Press **Menu** to enter and exit this mode. See *"Programming Flowchart—Software Version 1.2.29" on page 13*.

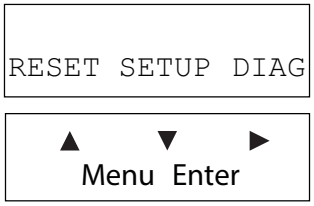


Figure 15: Program mode display

PROGRAMMING

With the normal mode display showing, press **Menu** to enter the programming mode. In this mode, the three arrow keys (▲▼▶) are used on the *selection* screens to select the option displayed above the key, and on the o*ption list* screens to scroll up or down a list of choices, like a pull-down menu. Most screens presenting choices show three choices, one for each arrow key. When the number of choices exceeds three, a small arrow (→) appears on the upper right side of the display indicating there are more choices on that level. Press **Enter** to toggle to the next set of choices. Once the selection has been made, press **Enter** to complete the selection. Press **Menu** again to return to the normal mode display.

Selection Screens

Most selection screens show three choices, one for each arrow (▲▼▶) key. When the number of choices exceeds three, a small arrow (→) appears on the upper right side of the display indicating there are more choices on that level. Press **Enter** to view the next set of choices.

For example, pressing **Menu** from the normal mode screen shows the *RESET SETUP DIAG* screen. Pressing the ▲key brings up the reset screens. The ▼key brings up the setup screens and the ▶key brings up the diagnostic screens. If the▼key is pressed, the screen would appear as follows.

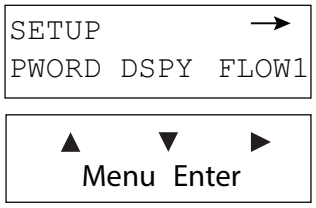


Figure 16: Selection screen

Option List Screens

Units of measure is an example of an options list screen.

Pressing the ▲ key scrolls up the list while the ▼key scrolls down through the list. In this case starting with GPM; gal/s; gal/hr;…LPM;….ending in a selection of custom units.

Pressing **Enter** completes the selection. Pressing **Menu** leaves the selection unchanged. The ▶ key has no function on this type of screen.

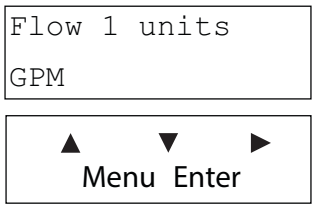


Figure 17: Option list screen

Data Screens

Some screens are data entry screens. For example, Set Points or Custom Units screens.

When a data entry screen is first displayed, the current value will be displayed. The cursor will be flashing the most left hand digit. Pressing the ▲ key will increase the value. The ▼key will reduce it. If the cursor is flashing the decimal point, pressing the▲key will move the decimal point to the right, pressing the ▼key will move the decimal to the left.

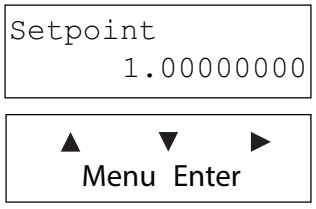
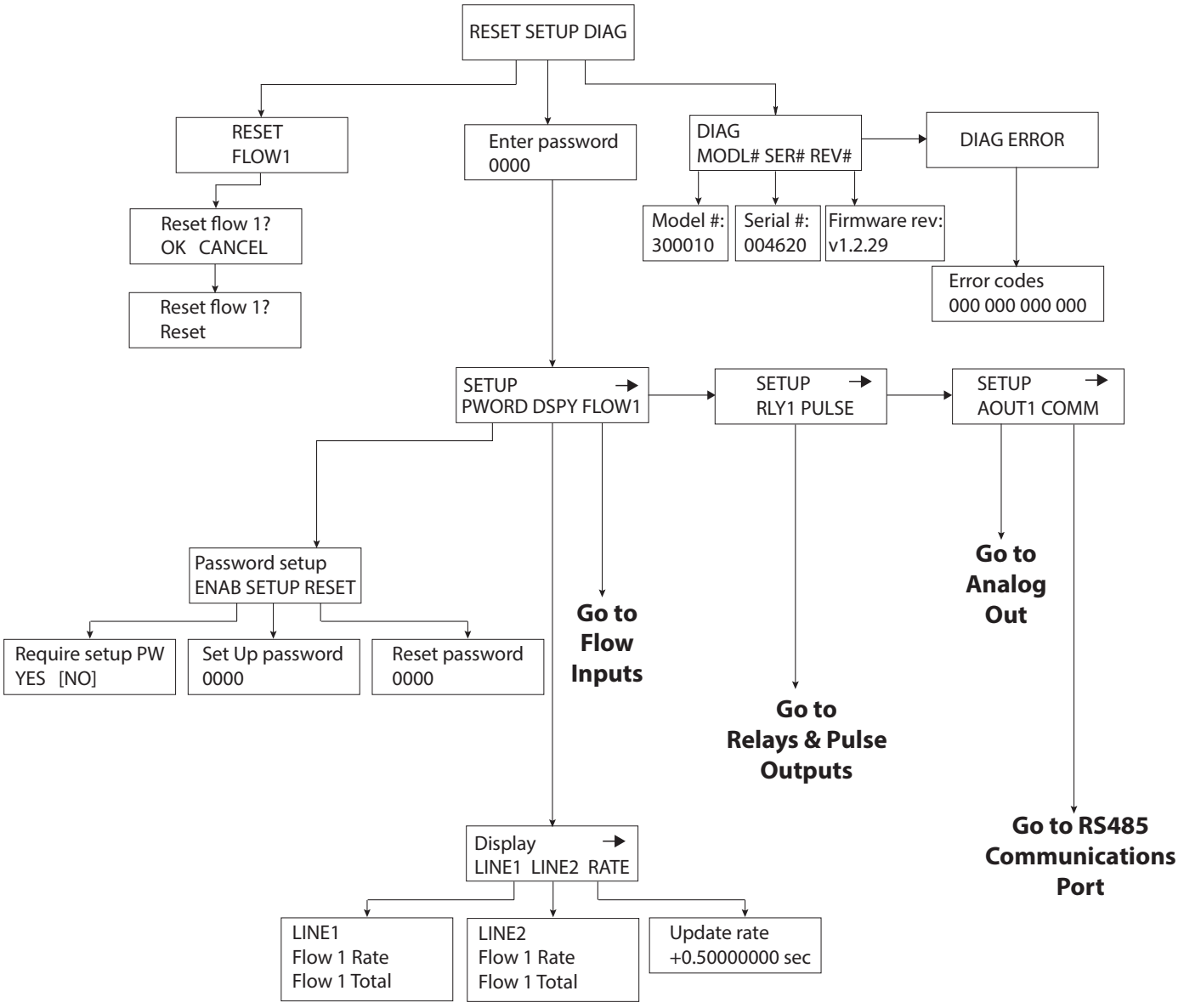
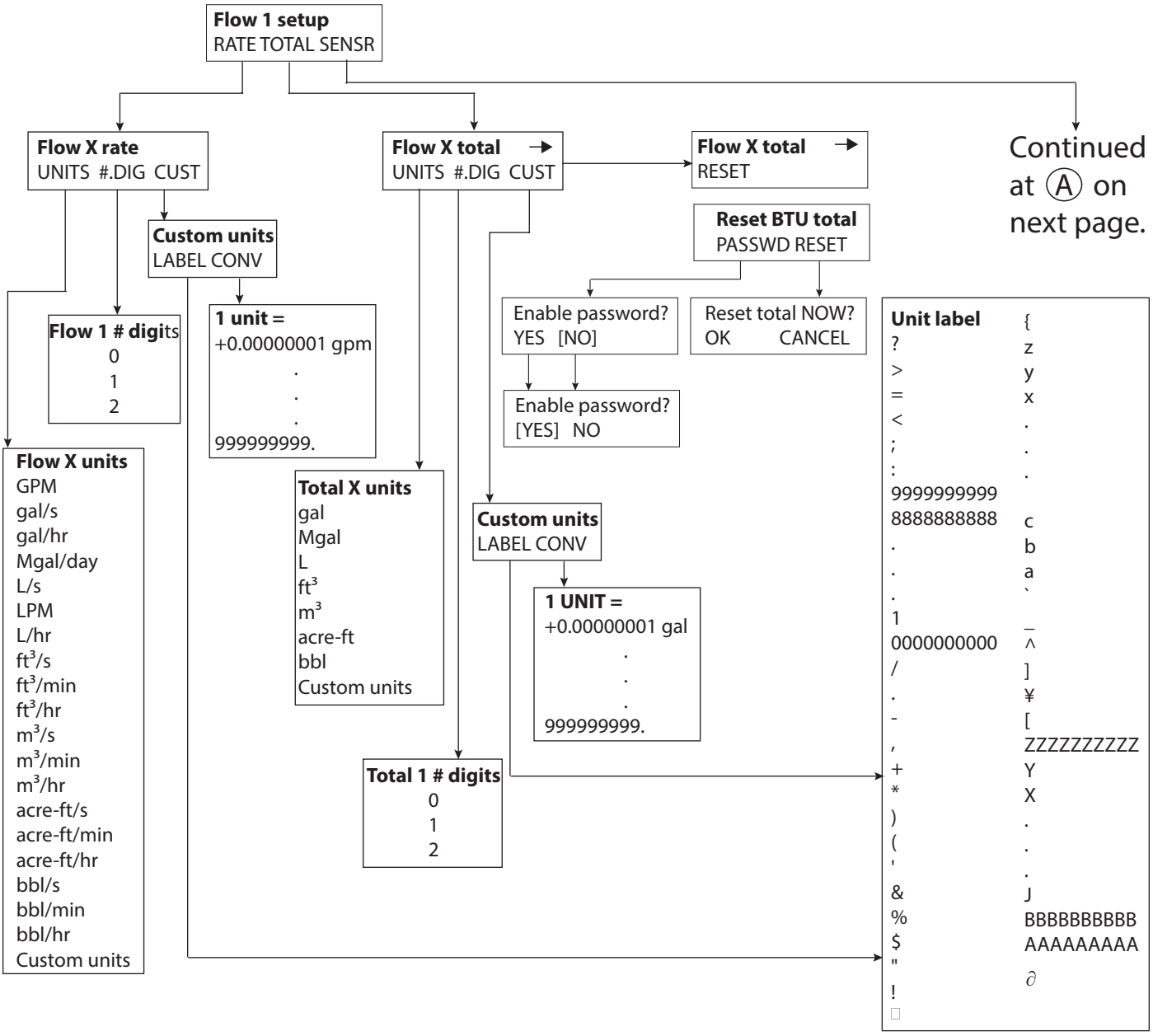


Figure 18: Data screen

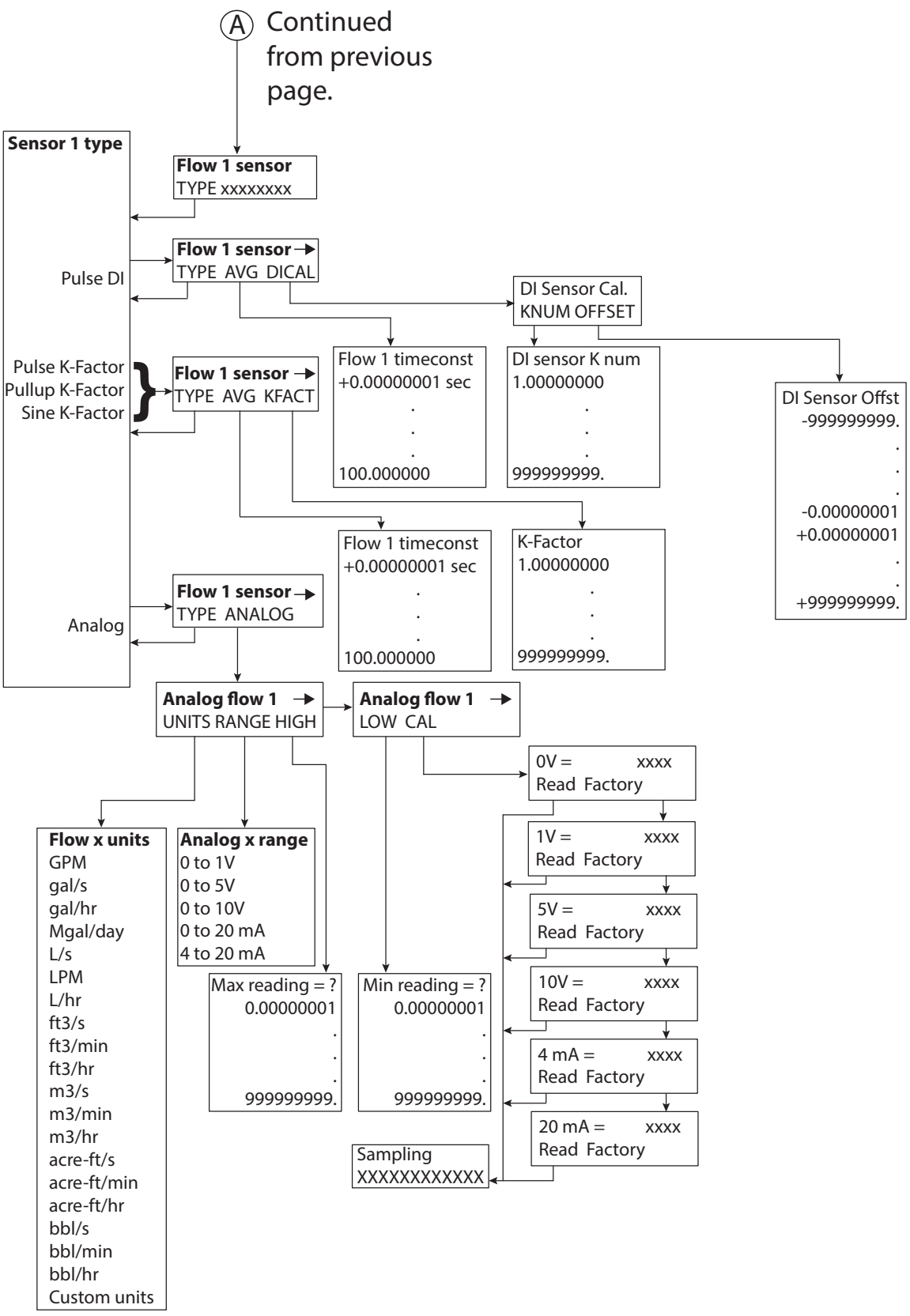
Programming Flowchart—Software Version 1.2.29



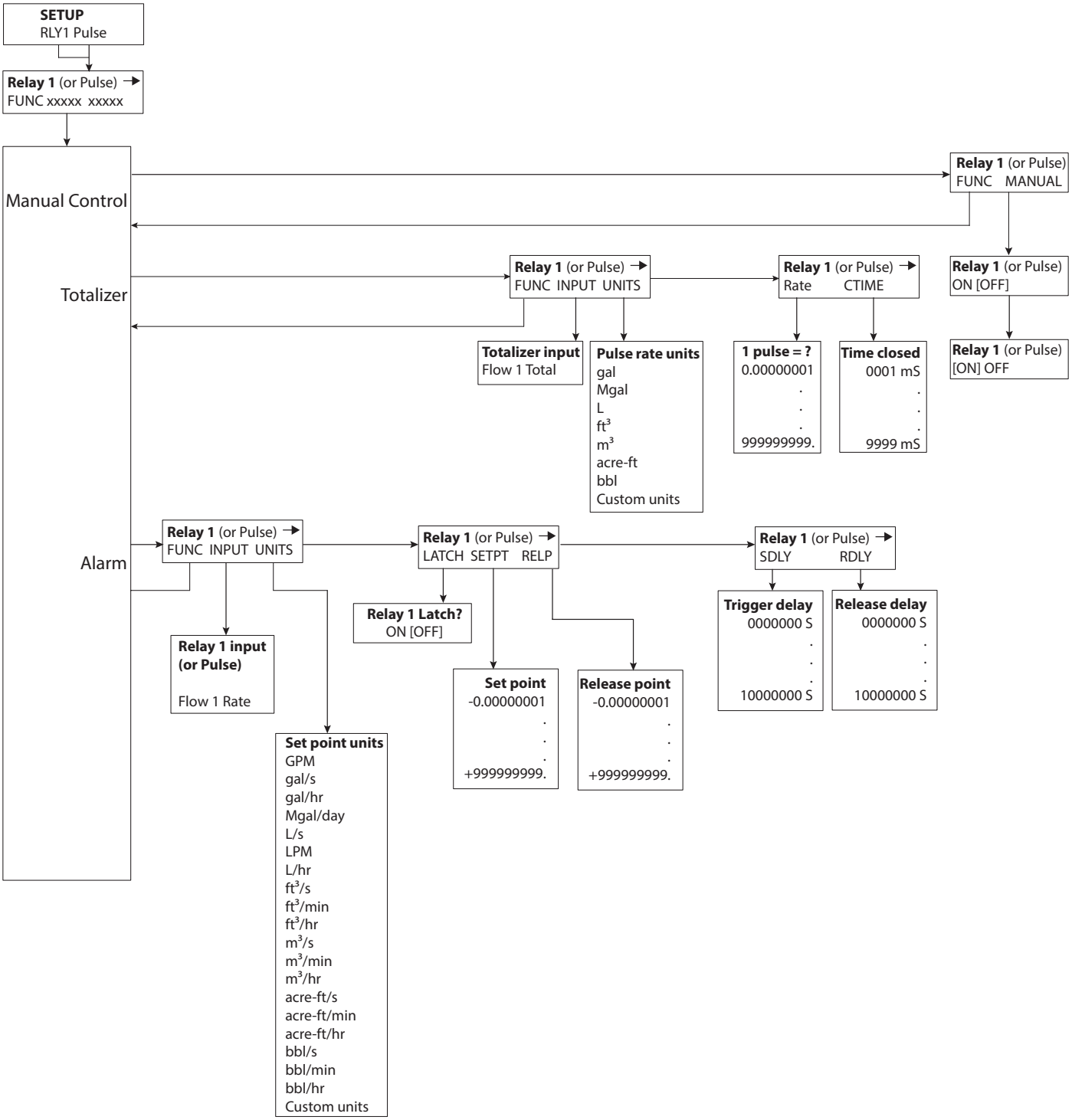
Flow Inputs Flowchart



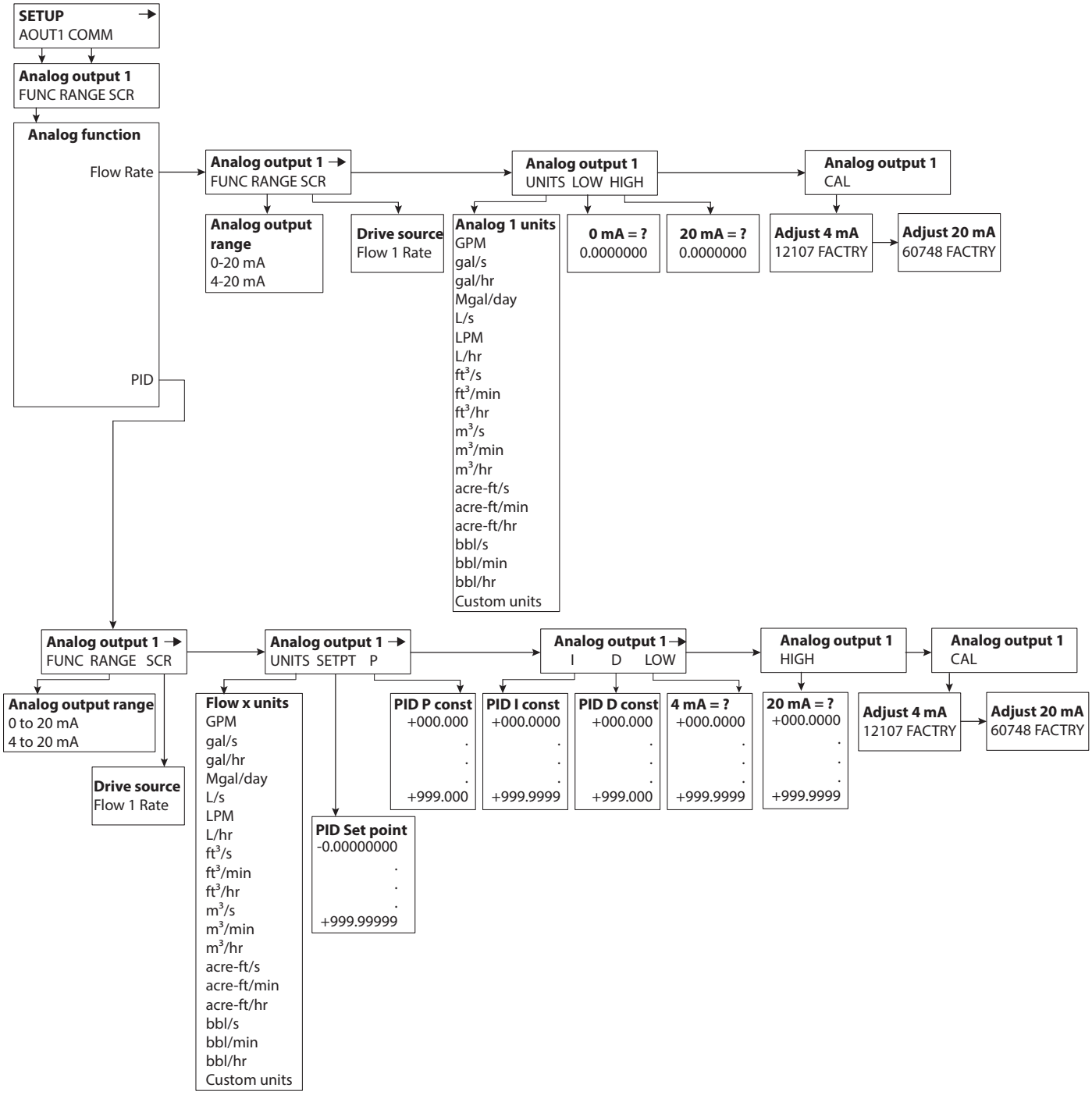
Flow Inputs Flowchart (continued)



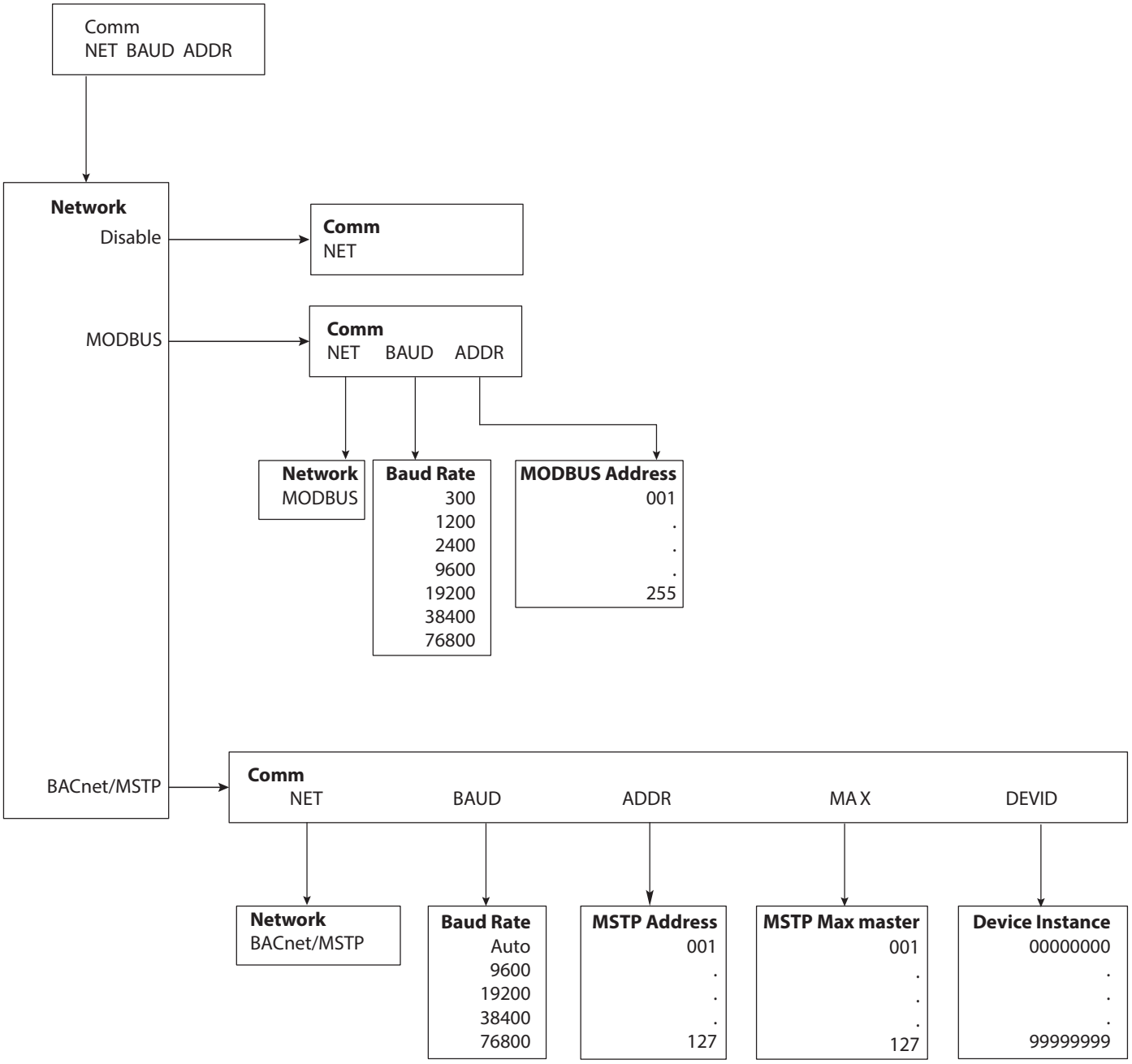
Relays & Pulse Outputs Flowchart (Manual, Set-Point Rate and Pulse/Volume)



Analog Output Flowchart



RS485 Communication Port Flowchart



Communication

RS485 COM Port Configuration

The RS485 is very simple to configure.

1. Select the communications type: Modbus or BACnet.
2. Choose the BAUD Rate: Auto, 300, 1200, 2400, 9600, 19200, 38400, or 76800 to match the rest of the devices on the network. The factory default of 9600 is recommended for most systems. The lower the baud rates have greater stability, and greater tolerance of wiring and other hardware issues.
3. Configure the Modbus or BACnet are described in there respective sections.

Modbus

Network: RS485
Baud Rate: Selectable
Protocol: RTU or ASCII
Addresses: 001 to 248
Slave only
Read Input Registers 30001- 39999 (Function "04")
Data Type: IEEE 754 Float (ABCD – CDAB)
Each variable is stored in two Modbus registers; lowest byte in the first and highest in the second.
Only the variable value is transmitted.
The associated units of measure must be manually configured in the receiving Modbus device.
Flow 1 Rate (Input Register 30002 + 30003)

Flow 1 Total (Input Register 30006 + 30007)

Modbus uses the following:
Data Bits = 8

Stop Bits = 1

Parity = None

BACnet

The Series 3000 can be configured to communicate on a BACnet RS485 MSTP (Master Slave Token Passing) system. Configuration is via the front panel keypad.

The following settings are required

- Baud Rate: [9600; 19200; 38400; or 76800]. The recommended factory default is 9600.
- MSTP Address: [0…127]. Each device must have a unique address.
- MSTP MAX master: [0…127]. This range must be greater than the highest address on the network.
- Device Instance: [00000000…99999999]. This is a unique identifier for each device in the system.

Object Name	I/O (Write/Read)	Object Type	Object ID	Units
BACnet Address	I/O	Analog Value	AV1	
BACnet BaudRate	I/O	Multi-State	MSV1	See Note 1
Flow 1 Rate	O	Analog Input	AI1	Same as Displayed
Flow 1 Total	O	Analog Input	AI3	Same as Displayed

Note 1: 0 = Auto, 1 = 9600, 2 = 19200, 3 = 38400, 4 = 76800
Note 2: Units of measure are selected by installer from a list of pre-programmed units, or as custom units created by the installer. BACnet will transmit in the same units as displayed on the flow meter's front panel LCD.

USB Communication

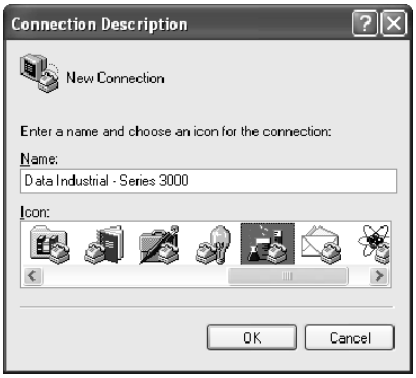
If the Series 3000 flow monitor is ordered with an analog output option card, a five-pin USB connector is also included. As much as possible the commands mimic the use of the front panel controls.

To use this feature the following are required.

- PC with USB ports and Windows HyperTerminal or other communications software
- FTDI Virtual COM port drivers http://www.ftdichip.com/FTDrivers.htm
- USB 2.0 A to Mini-B 5-pin cable

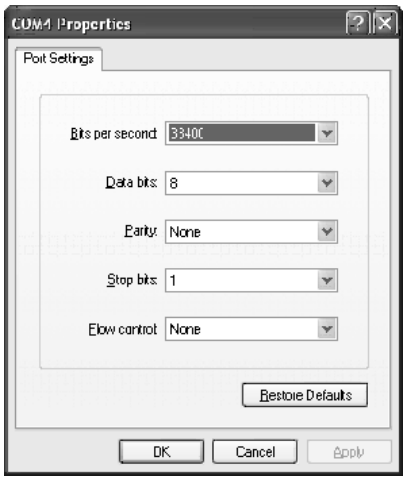
To communicate using HyperTerminal, use the following procedure.

1. Make sure that the Series 3000 flow monitor has a Mini-B five-pin connector on the back panel. (The Series 3000 flow monitor must have an analog output option card installed and will be marked Series # 3000-1x.)
2. Be sure the appropriate FTDI Virtual COM port drivers are installed on you computer.
3. Plug the USB 2.0 A end of the cable into an available USB port on your computer. Plug the Mini-B five-pin end into the back of the Series 3000 flow monitor.



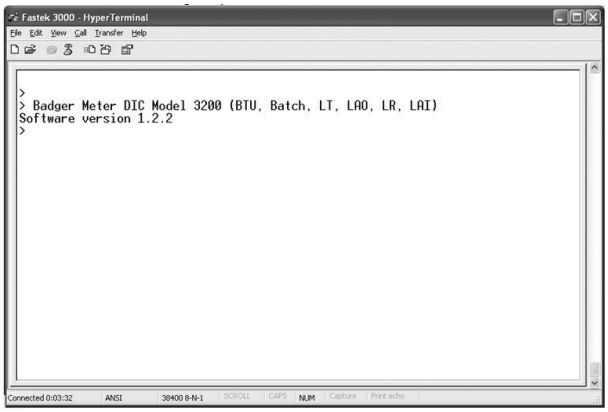
4. Run HyperTerminal (from the Windows Start Menu) and create a new connection, with a name and icon.

5. Configure this port with 38400 baud, 8 data bits, 1 stop bit, no parity and no flow control.



6. When connected, a ">" symbol will appear in the upper left corner of the main HyperTerminal display screen. Press **Enter**. Both the Rx and Tx LEDs on the front of the Series 3000 flow monitor flash once, and the "Badger Meter DIC … Software Version…" text message appears.

The Series 3000 flow monitor is now communicating, ready to take commands from the list below.



USB Command List

In the list below, brackets indicate an argument, specifying its type and value range. For instance, [0-18] stands for any number between 0 and 18 (inclusive).

Example*:*
"display line1 = 1" sets Line 1 of the display to display #1, which happens to be the totalizer for flow channel 1.

Diagnostics

id – show model number & software version

echo [on/off] – turn on/off interactive command line:

with echo off, this interface is more amenable to scripting; it still accepts the same commands.

Any command entered without an " = " sign and variable will display the current setting.

Example: Typing "display line1" returns "0" which is the variable for Flow Rate.

read flow [1-2] – read the current flow on channel 1 or 2 in GPM.

read flow [1-2] total – read the current total flow on channel 1 or 2 in gallons.

Display Configuration

display line1 = [0-1] – set line 1 of the display

display line2 = [0-1] – set line 2 of the display

0: flow 1 rate

1: flow 1 total

display urate = [0.1-10] – set the update rate of the display, in seconds

Input Channel Configuration

flow [1-2] sensor type = [0-4] – flow sensor type:

0: PulseDI,

1: PulseKFactor,

2: PullupKFactor

3: Analog

flow [1-2] sensor dical k = [x] – DI-type flow sensor k

flow [1-2] sensor dical off = [x] – DI-type flow sensor offset

flow [1-2] sensor kfact = [x] – K factor for non-DI sensors

flow [1-2] sensor analog units = [0-19] – flow units for analog input

flow [1-2] sensor analog range = [0-4] – current range for analog input

flow [1-2] sensor analog high = [x] – flow rate @max current

flow [1-2] sensor analog low = [x] – flow rate @min current

flow [1-2] sensor avg = [0-100] – averaging "time constant," in seconds:

flow [1-2] rate units = [0-19] – flow (channel) rate units to display.

0: GPM

1: gal/s

2: gal/hr

3: Mgal/day

4: L/s

5: LPM

6: L/hr

7: ft3/s

8: ft3/min
9: ft3/hr
10: m3/s
11: m3/min
12: m3/hr
13: acreft/s
14: acreft/min
15: acreft/hr
16: bbl/s
17: bbl/min
18: bbl/hr
19: Custom

flow [1-2] rate ndigits = [2-10] – number of decimal places to show for flow rate
flow [1-2] rate custom label = [string] – set the label for custom units
flow [1-2] rate custom conv = [0-100] – conversion factor for custom units
flow [1-2] total units = [0-7] – set the totalizer units to display

0: gal
1: Mgal
2: L
3: ft3
4: m3
5: acreft
6: bbl
7: Custom

SPECIFICATIONS

Voltage	12…24V DC / AC (Limit: 8…35V DC) (Limit: 8…28V AC)			DC current draw (~280 mA) AC power rating (~5V A)	
Display	16 character by two line alphanumeric dot matrix 7.95 mm high backlit LCD				
Operating Temperature	–20…70° C				
Storage Temperature	–30…80° C				
Dimensions	**Panel mount:** 3.78 in. W × 3.78 in. H × 3.23 in. D (96 mm × 96 mm × 63 mm)		**Wall mount:** 4.80 in. W × 4.72 in. H × 3.63 in. D (120 mm × 120 mm × 92 mm)		
Weight	**Panel mount:** 12 oz				
Pulse and Relays	Both pulse and relay are fully functional as either totalizing or setpoint outputs				
Pulse Electrical	Solid-state Form A	1 Amp @ 35V DC/ 30V AC	**Closed:** 0.5 Ω @ 1 AMP	**Open:** $>10^8$ Ω	
Relay Electrical	Mechanical Form C	**Resistive load:** 5Amp @ 120V AC/30V DC	**Inductive load:** 1Amp @ 120V AC/30V DC		
Pulse/Unit Volume (Totalizer)	**Driving source:** Flow total; Btu total	**Units:** Any predefined or custom unit	**Rate:** Pulse per 1.0000000…99999999 units	**Contact time:** 1…9999 mS	**Max Pulse Rate:** 1 Pulse/2 Sec
Setpoint (Alarm)	**Driving source:** flow rate; Btu rate; temperature 1; temperature 2, delta T		**Units:** Any predefined or custom unit	**Setpoint:** Pulse per 1.0000000…99999999 units	
	Delay to set: 1…9999 Seconds		**Release point:** 1.0000000…999999999	**Delay to release:** 1…9999 seconds	
Optional Analog Output	**Driving source:** Flow rate; PID control		**Range:** 4…20 mA; 0…20 mA (isolated current sinking or sourcing)	**Sinking:** 30V DC @ 0 mA maximum; 3V @ 20 mA minimum **Sourcing:** 600 W maximum load	
USB Communication	Provides complete access to all programming and operation features **Requirements:** USB 2.0 A to Mini-B 5-Pin Cable (Example: SYSONIC model UAM56 GWT/B)				
RS-485 Communication	Supports Modbus and BACnet/MSTP				
Accessories	Wall mount kit				

ORDERING MATRIX

Example:	3000	-	x	x
Series				
Flow Monitor	3000			
Portable Battery Operated Kit	3020			
Option - Analog Output, RS485 (BACnet / Modbus), and USB				
No Option			0	
Analog Output, RS485 with BACnet and Modbus, and USB			1	
Option - Mounting				
Panel Mount				0
Wall Mount				1

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