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MICRO-FLO

INSTRUCTION MANUAL



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1.0 INTRODUCTION

Congratulations on purchasing the Micro-Flo electronic flow meter. The Micro-Flo flowmeter is designed to display flow rate and flow total on a six digit LCD display. The meter can measure bi-directional flows in either vertical or horizontal mounting orientation. Six flow ranges and four optional pipe and tubing connections are available. Pre-programmed calibration K-factors can be selected for the corresponding flow range or a custom field calibration can be performed for higher accuracy at a specific flow rate. The meter is factory programmed for the correct K-factor of the body size included with the meter.

2.0 FEATURES

- **Four connection options available:**

1/8" F/NPT, 1/4" F/NPT, 1/4" OD x .170 ID Tubing & 3/8" OD x 1/4" ID Tubing sizes.

- **Six body size/flow range options available:**

30 to 300 ml/min, 100 to 1000 ml/min, 200 to 2000 ml/min,
300 to 3000 ml/min, 500 to 5000 ml/min, 700 to 7000 ml/min.

- **5 model display variations:**

FA = Analog Output. Rate & Total. Panel Mounted Display

FP = Rate & Total. Panel Mounted Display

FR = Flow rate and Totalizing. Remote panel mounting

FS = Rate & Total. Sensor Mounted Display

FV = No Display, Sensor Only. 5 VDC current sinking output

- **6 digit LCD, up to 4 decimal positions.**

- **Displays both rate of flow and total accumulated flow.**

- **Open collector alarm setpoint.**

- **User selectable or custom programmable K-factor.**

Flow units: Gallons, Liters, Ounces, milliliters

Time units: Minutes, Hours, Days

- **Volumetric field calibration programming system.**

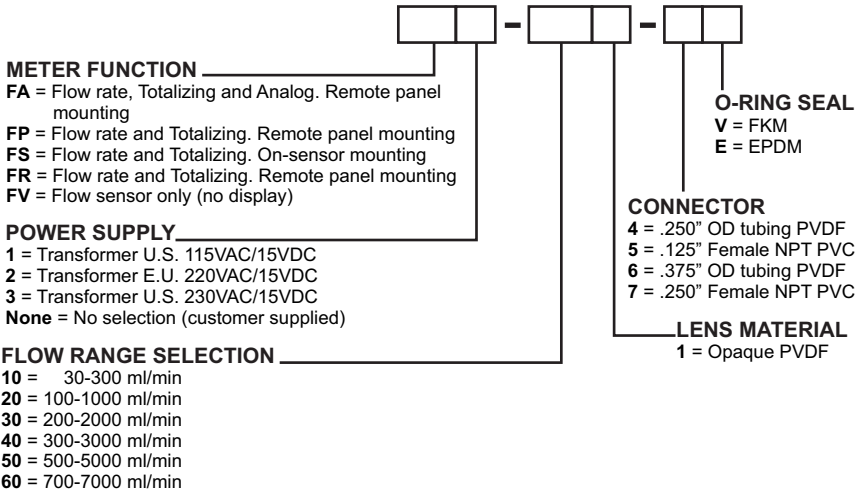
- **Non-volatile programming and accumulated flow memory.**

- **Total reset function can be disabled.**

- **Opaque PVDF chemical resistant lens.**

- **Weather resistant Valox PBT enclosure. NEMA 4X**

3.0 MODEL NUMBER MATRIX



4.0 SPECIFICATIONS

Max. Working Pressure

PVC lens.....130 psig (9 bar) @ 70° F (21° C)
 PVDF lens.....150 psig (10 bar) @ 70° F (21° C)

Max. Fluid Temperature

PVC lens.....130° F (54° C) @ 0 PSI
 PVDF lens.....200° F (93° C) @ 0 PSI

Full scale accuracy.....+/- 6%

Input Power requirement.....9 - 28 VDC (31mA @ 15Vdc)

Sensor only output cable.....3-wire shielded cable, 6ft

Pulse output signal.....Digital square wave (2-wire) 25ft max.
 Voltage high = 5Vdc,
 Voltage low < .25Vdc
 50% duty cycle

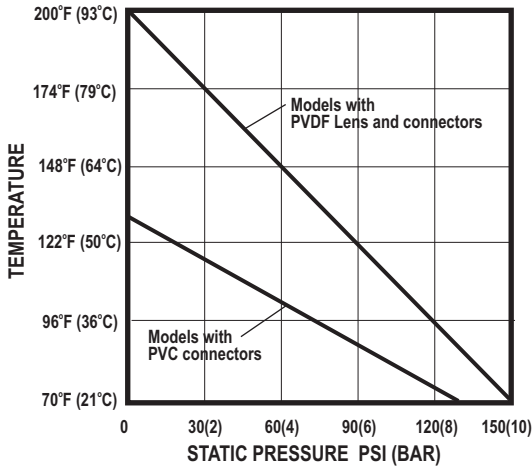
Output frequency range.....4 to 500Hz

Alarm output signal.....NPN Open collector. Active low above
 programmable rate set point.
 30Vdc maximum, 50mA max load.
 Active low < .25Vdc
 2K ohm pull up resistor required.

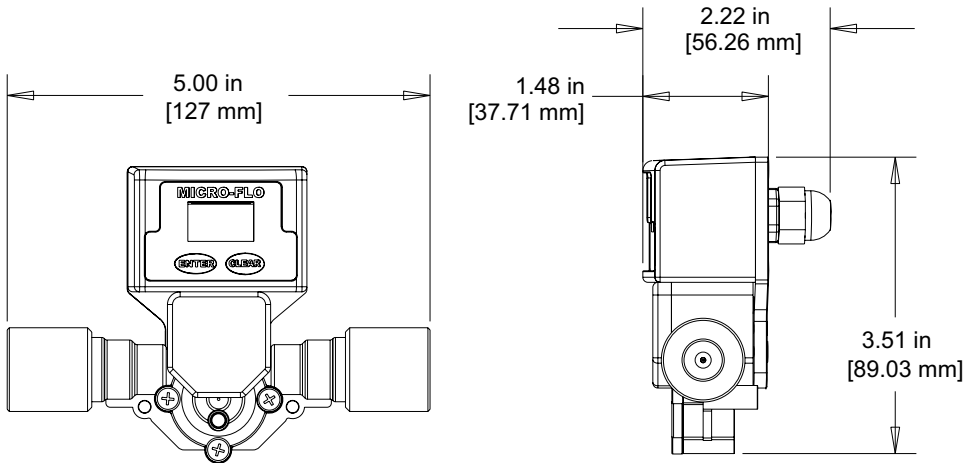
Enclosure.....NEMA type 4X, (IP56)

Approximate shipping wt.....1 lb. (.45 kg)

4.1 TEMPERATURE AND PRESSURE LIMITS



4.2 DIMENSIONS

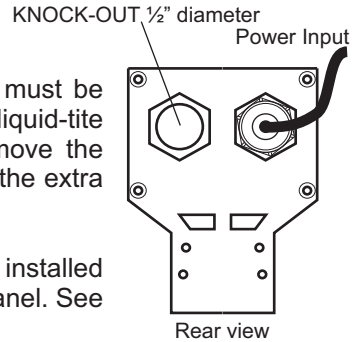


5.0 INSTALLATION

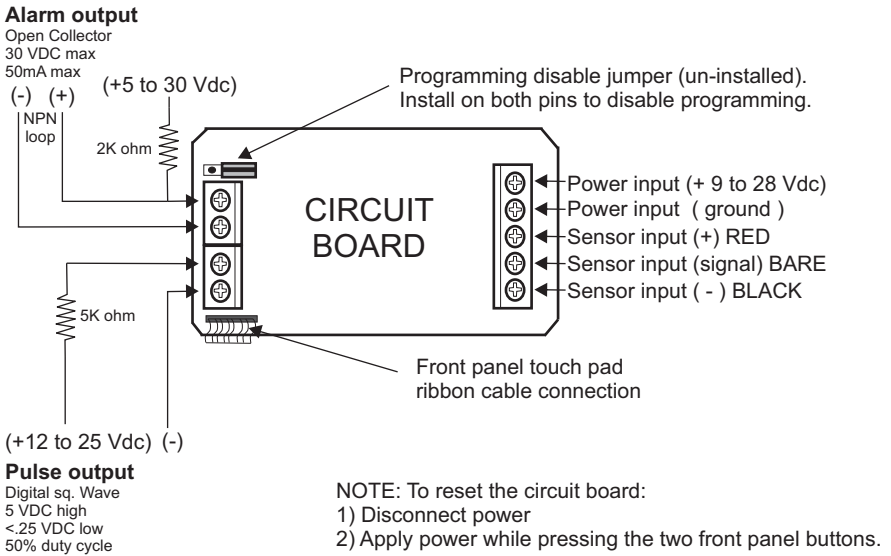
5.1 WIRING CONNECTIONS

On sensor mounted units, the output signal wires must be installed through the back panel using a second liquid-tite connector (included). To install the connector, remove the circular knock-out. Trim the edge if required. Install the extra liquid-tite connector.

On panel or wall mounted units, wiring may be installed through the enclosure bottom or through the back panel. See below.



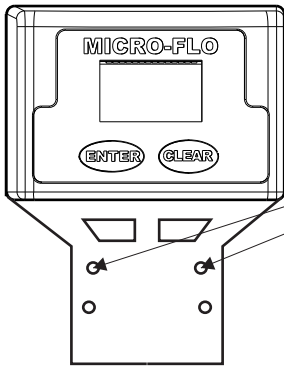
5.2 CIRCUIT BOARD CONNECTIONS



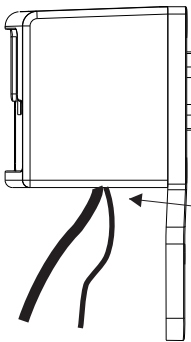
5.3 FLOW VERIFICATION OUTPUT SIGNAL

When connected to external equipment such as a PLC, data logger, or Blue-White metering pump, the pulse output signal can be used as a flow verification signal. When used with Blue-White metering pumps, connect the positive (+) terminal on the Micro-Flow circuit board to the pump's yellow signal input wire and the negative (-) terminal to the black input wire.

5.4 PANEL OR WALL MOUNTING



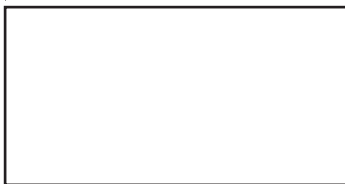
Panel or wall mounting screw locations



Through panel wiring for water resistant applications

Wiring through enclosure bottom for dry applications

1.75 in
[45 mm]



1.00 in
[25 mm]

Recommended panel or wall mounting cut-out for wire connection opening

6.0 OPERATION

6.1 THEORY OF OPERATION

The Micro-Flo flowmeter is designed to measure the flow rate and accumulate the total volume of a fluid. The unit contains a paddle wheel that has six (6) through holes to allow infrared light to pass through, a light-detecting circuit and a LCD-display electronic circuit.

As fluid passes through the meter body, the paddle wheel spins. Each time the wheel rotates a DC square wave is output from the sensor. There are six (6) complete DC cycles induced for every revolution of the paddle wheel. The frequency of this signal is proportional to the velocity of the fluid in the conduit. The generated signal is then sent into the electronic circuit to be processed.

The meter is factory programmed for the correct K-factor of the body size included with the meter.

The Micro-flo flowmeter includes the following features:

- Displays either the flow rate or the accumulated total flow.
- Provides a pulse output signal that is proportional to the flow rate.
- Provides an open collector alarm output signal. Active low at flow rates above the user programmed value.
- Provides user selectable, factory preset calibration k-factors.
- Provides a field calibration procedure for more precise measurement.
- Front panel programming can be disabled by a circuit board jumper pin.

6.2 CONTROL PANEL

ENTER BUTTON (right arrow)

- **Press and release** - Toggle between Rate, Total, and Calibrate screens in the run mode. Select program screens in the program mode.
- **Press and hold 2 seconds** - Enter and exit program mode. (Automatic exit program mode after 30 seconds of no inputs).

CLEAR/CAL (up arrow)

- **Press and release** - Clear total in the run mode. Scroll through and Select options in the program mode.



6.3 FLOW STREAM REQUIREMENTS

- The Micro-flo flowmeter can measure fluid flow in either direction.
- The meter must be mounted so that the paddle axle is in a horizontal position - up to 10° off the horizontal is acceptable.
- The fluid must be capable of passing infra-red light.
- The fluid must be free of debris. A 150 micron filter is recommended - especially when using the smallest body size (S1), which has a 0.031" through hole.

6.4 RUN MODE DISPLAY

Body size/range

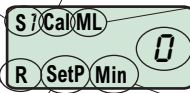
- 0 = Field calibrate
- 1 = 30-300 ml/min
- 2 = 100-1000 ml/min
- 3 = 200-2000 ml/min
- 4 = 300-3000 ml/min
- 5 = 500-5000 ml/min
- 6 = 700-7000 ml/min

Field Calibration indicator

- Cal (steady) = active
- Cal (flashing) = calibrating
- none = factory cal. active

Flow units indicator

- ML = Milliliters
- OZ = Ounces
- GAL = Gallons
- LIT = Liters



Function indicator

- R = Flow rate indicated
- T = Flow total indicated

Alarm indicator

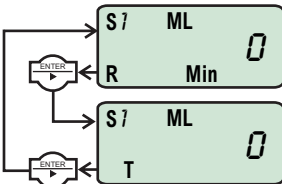
- SetP (steady) = active
- SetP (flashing) = alarm
- none = not programmed

Display Value

Rate time base indicator

- Min = Rate per minute
- Hr = Rate per hour
- Day = Rate per day

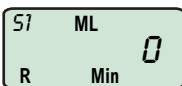
6.5 RUN MODE OPERATION



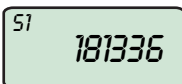
FLOW RATE DISPLAY - Indicates rate of flow, S1 = body size/range #1, ML = units displayed in milliliters, MIN = time units in minutes, R = flow rate displayed.

FLOW TOTAL DISPLAY - Indicates accumulated total flow, S1 = body size/range #1, ML = units displayed in milliliters, T = total accumulated flow displayed.

6.6 VIEWING THE K-FACTOR (PULSES PER UNIT)



While in the run mode, Press and hold ENTER then press and hold CLEAR to display the K-factor.



Release ENTER and CLEAR to return to run mode.

6.7 K-FACTORS (pulses per fluid volume)

Body Size	Flow Range (ml/min)	Pulses per Gallon	Pulses per Liter
1	30-300	181,336	47,909
2	100-1000	81,509	21,535
3	200-2000	42,051	13,752
4	300-3000	25,153	6,646
5	500-5000	15,737	4,157
6	700-7000	9,375	2,477

Body Size	K-Factor	Flow Range (ml/min)	Rate 1	Rate 2	Total 1	Total 2
1	181336	30-300	12.520	XXXX.X	.2082	XXXX.X
2	81509	100-1000	27.862	XXXX.X	.4644	XXXX.X
3	42051	200-2000	5.400	XXXXX	.0900	XXXXX
4	25153	300-3000	9.028	XXXXX	.1500	XXXXX
5	15737	500-5000	14.4307	XXXXX	.2403	XXXXX
6	9375	700-7000	24.224	XXXXX	.4035	XXXXX

Useful formulas

$60 / K = \text{rate scale factor}$

$\text{rate scale factor} \times \text{Hz} = \text{flow rate in volume per minute}$

$1 / K = \text{total scale factor}$

$\text{total scale factor} \times n \text{ pulses} = \text{total volume}$

7.0 PROGRAMMING

The Micro-Flo flowmeter uses a K-factor to calculate the flow rate and total. The K-factor is defined as the number of pulses generated by the paddle per volume of fluid flow. **Each of the six different body sizes have different operating flow ranges and different K-factors. The meter is factory programmed for the correct K-factor of the body size included with the meter.**

The meter's rate and total displays can be independently programmed to display units in milliliters (ML), ounces (OZ), gallons (GAL), or liters (LIT). Rate and total can be displayed in different units of measure. The factory programming is in milliliters (ML).

The meter's rate display can be independently programmed to display time base units in minutes (Min), Hours (Hr), or Days (Day). The factory programming is in minutes (Min).

For greater accuracy at a specific flow rate, the meter can be field calibrated. This procedure will automatically over-ride the factory K-factor with the number of pulses accumulated during the calibration procedure. The factory default settings can be re-selected at any time.

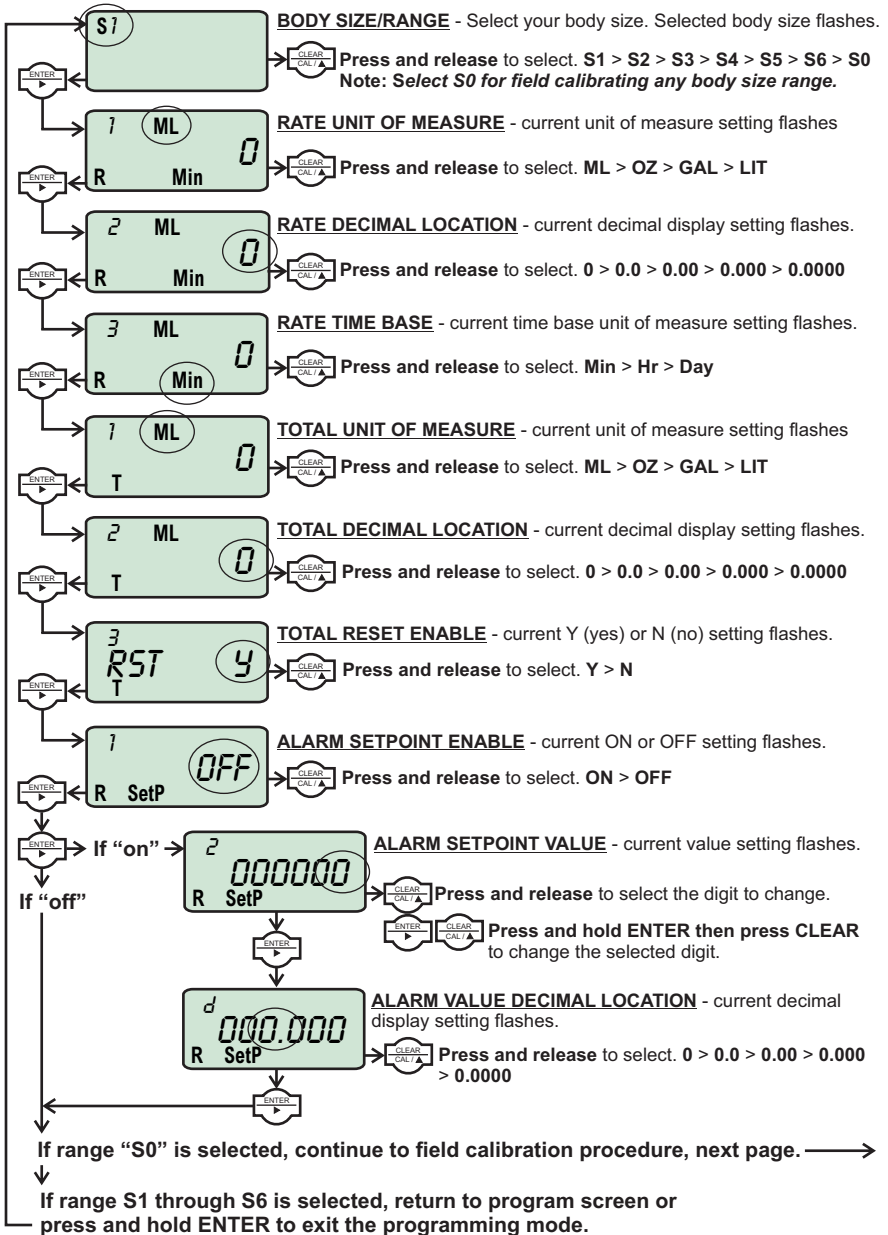
7.1 FIELD CALIBRATION

Any body size/range can be field calibrated. Calibration will take into account your specific application's fluid properties, such as viscosity and flow rate, and increase the accuracy of the meter in your application.

The Body Size/Range must be set for "S0" to enable the calibration mode. Follow the programming instructions on pages 10 & 11 to reset the Body Size/Range and perform the calibration procedure.

7.2 PROGRAMMING FOR BODY SIZE/RANGE S1 - S6

Press and Hold ENTER to initiate the programming mode.



7.3 FIELD CALIBRATION SIZE/RANGE SETTING S0

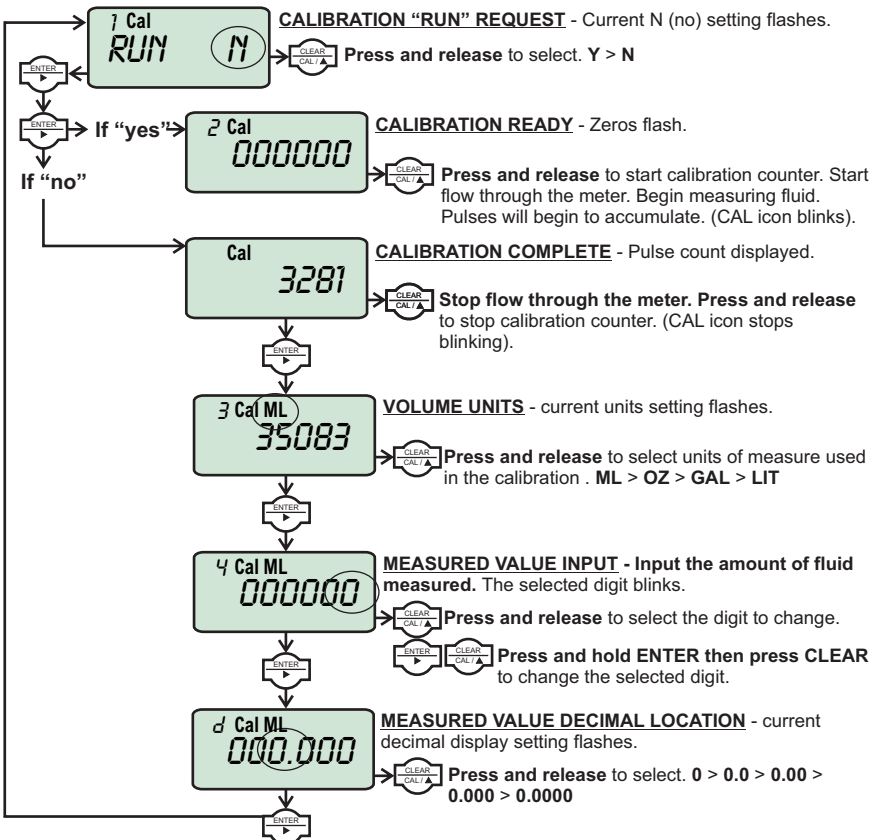
Continuation of programming sequence when range "S0" is selected.

The meter should be installed as intended in the application.

The amount of fluid that flows through the meter during the calibration procedure must be measured at the end of the calibration procedure.

Allow the meter to operate normally, in the intended application, for a period of time. A test time of at least one minute is recommended. Note - the maximum number of pulses possible is 52,000. Pulses will accumulate in the display. After the test time period, Stop the flow through the meter. The pulse counter will stop.

Determine the amount of fluid that passed through the meter using a graduated cylinder, scale, or other method. The measured amount must be entered in calibration screen #4 "MEASURED VALUE INPUT."



8.0 FVS

The Micro Flow FVS can be connected directly to many Blue-White injector pumps (see table below). The sensor will verify that chemical injection has actually occurred.

The pumps sophisticated electronics continuously monitor the sensor. If chemical should fail to inject, the pump will stop and an alarm relay will close - allowing for remote alarm indication and/or initiation of a back-up injector pump.

Recommended sensor mounting locations differ from diaphragm pump to peristaltic pump.

Diaphragm pump installation; the sensor should be mounted on the discharge (outlet) side of the pumphead. The sensor can be mounted directly on the pumphead or anywhere along the tubing on the discharge side of the pump.

Peristaltic pump installation; the sensor should be mounted on the suction (inlet) side of the pumphead.

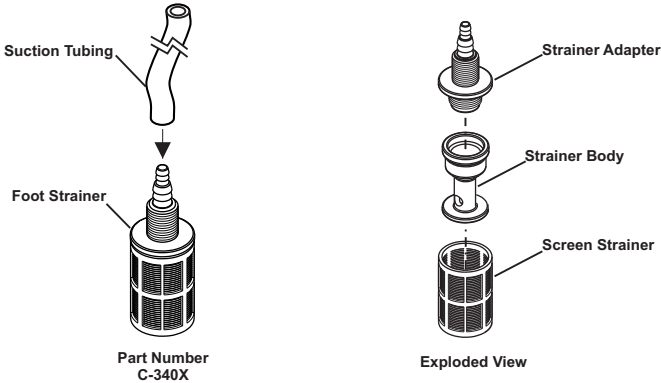
Blue-White FVS compatible metering pumps:

Pump Series	Pump Type	Pump Description	Pump Shut-Down Time*	FVS Installation Location
A-100NV	Peristaltic	Variable speed	User programmable (up to 256 seconds)	Suction side of pump head
A-100NA	Peristaltic	Fixed speed timer controlled	6 seconds	Suction side of pump head
A-100NF	Peristaltic	Fixed speed timer controlled	6 seconds	Suction side of pump head
C-1100V	Diaphragm	Variable speed	User programmable (up to 256 seconds)	Discharge side of pump head
C-1100A	Diaphragm	Fixed speed timer controlled	6 seconds	Discharge side of pump head
C-1100F	Diaphragm	Fixed speed timer controlled	6 seconds	Discharge side of pump head
C-1500NK	Diaphragm	Fixed speed timer controlled	6 seconds	Discharge side of pump head

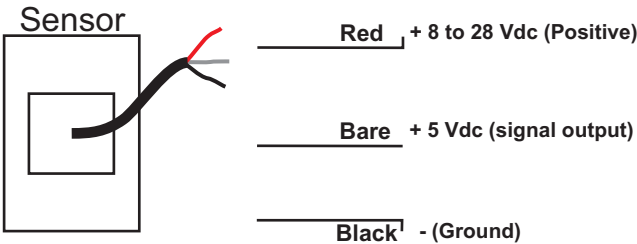
* Pump Shut-Down Time = If chemical should fail to inject in the amount of time specified, the pump will automatically shut-down, also triggering an alarm relay.

8.1 FVS ACCESSORIES

Your flow verification sensor package includes a Foot Strainer (see diagram below). This strainer will prevent any small particles from entering and clogging the Micro Body. Diaphragm pumps will require a strainer and a check valve. The part number for the strainer that includes a check valve is C-340A. Blue-White peristaltic pumps do not require a check valve.



8.2 FVS WIRING DIAGRAM



Sensor connections:

Input voltage (vdc) 8 to 28 vdc

Output voltage (v) "high state" 4.80 v dc min (5 vdc normal)

Output voltage (v) "low state" 0.2v dc max



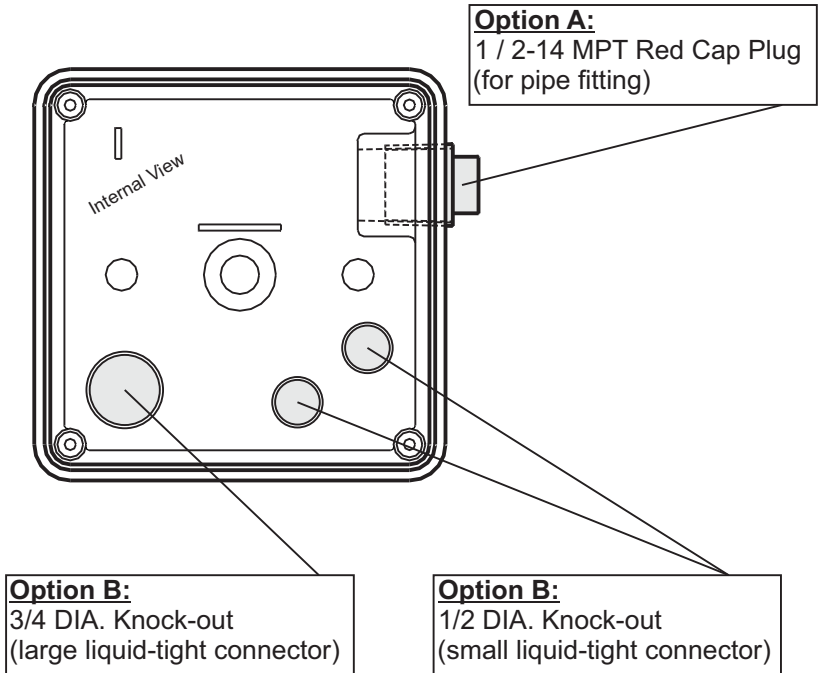
(True digital Square-wave output)

9.0 FA FLOW ANALOG**9.1 ENCLOSURE KNOCK-OUT INSTRUCTIONS****Option A: Conduit Connection**

1. Remove the red cap plug.
2. Install your pipe fitting (1/2 - 14 NPT male end).

Option B: Liquid-Tight Connections

1. Remove knock-out(s) using a screwdriver.
2. Trim edge(s) with a knife and remove sharp edges.
3. Install the provided liquid-tight connector(s).

**Notes:**

For the large liquid-tight connector (3/4" Knock-out), the acceptable cable diameter is between .200 - .394 in (5.1 - 10.0 mm).

For the small liquid-tight connector (1/2" Knock-out), the acceptable cable diameter is between .118 - .255 in (3.0 - 6.5 mm).

9.2 MODEL RT CIRCUIT BOARD WIRING

CAUTION: DISCONNECT POWER SOURCE BEFORE SERVICING.

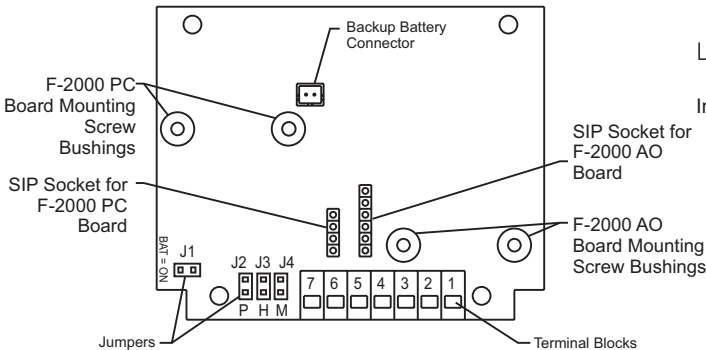
Jumper Configuration

Jumpers		Function
J1 Installed		Battery Input (4 - 1.5 VDC, AA Cells)
J1 Left Open		Plug-In Transformer (115 VAC / 15 VDC, 220 VAC / 15 VDC, 230 VAC / 15 VDC)
J2 Installed		Front Panel Programming is Disabled
J2 Left Open		Front Panel Programming is Enabled (factory default)
J3 Installed and J4 Left Open		Hall Effect Sensor Input
J3 Left Open and J4 Installed		AC Coil Sensor Input / Micro-Flow Sensor Input

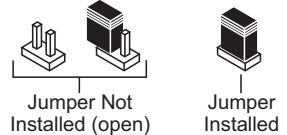
Terminal Configuration

	Terminal	Function
Supply Power Input	6	Positive (+) power input (red wire from battery pack, or black with stripe wire from 15 VDC plug-in transformer)
	5	Ground (-) power input (black wire from battery pack or 15 VDC plug-in transformer)
AC Coil Sensor Input	2	Ground (-) input (black wire from coil sensor body)
	3	Pulse input (yellow or red wire from coil sensor body)
Hall Effect Sensor Input	1	Positive (+) input (red wire from hall effect sensor)
	2	Ground (-) input (black wire from hall effect sensor)
	3	Pulse input (bare wire from hall effect sensor)
Open Connector Pulse Output (from sensor)	7	(Max voltage: 24VDC, Max load: 15mA, 2k ohm pull-up recommended.)
	4	NPN negative (-) signal output

F-2000 RT Board





Jumper Positions



9.3 MODEL AO CIRCUIT BOARD WIRING

CAUTION: DISCONNECT POWER SOURCE BEFORE SERVICING.

Jumper Configuration

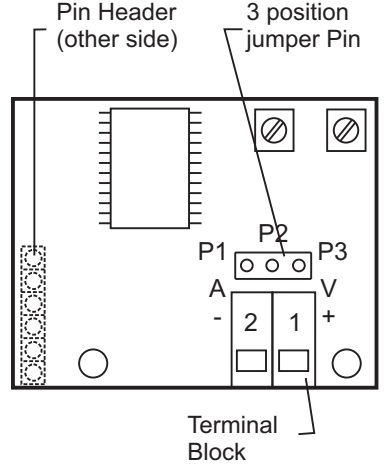
Output	Jumper Settings	
4-20 Milliamp	Connect P1 & P2 (leave P3 open) (factory default), Max Load = 250 Ohms	P1  P3
0-10 Volts DC	Connect P2 & P3 (leave P1 open), Max Load = 500 Ohms	P1  P3

Terminal Configuration

Terminal Number	Terminal Block Connections
1	Positive (+) Analog Output Signal
2	Negative (-) Analog Output Signal

Output Type: Linear, Non-Isolated, powered loop.

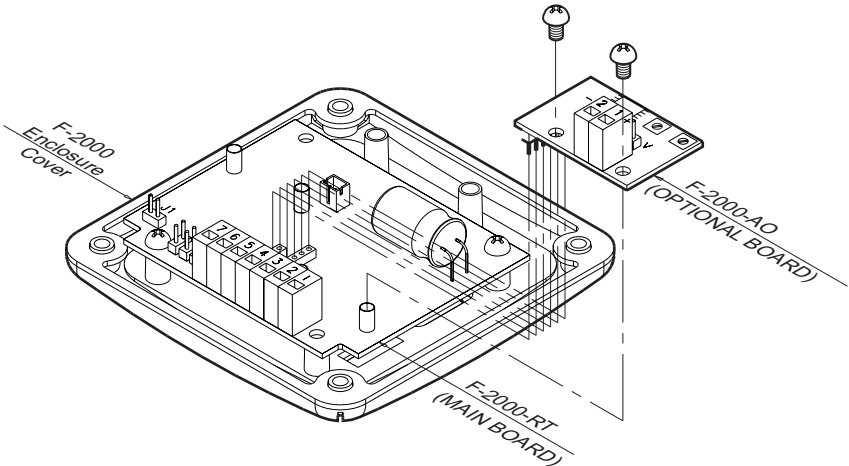
Loop resistance: 250 ohm maximum for 4-20mA output
500 ohm maximum for 0-10 V DC



9.3.2 Optional Circuit Board Installation

CAUTION: DISCONNECT POWER SOURCE BEFORE SERVICING.

1. Carefully align optional board's Pin Header with the Pin Header socket located on the main circuit board.
2. Press firmly into place.
3. Secure the board



9.4 HOW TO OPERATE THE MODEL AO

9.4.1 What Was The MODEL AO Designed To Do?

- Output a 4-20mA or 0-10VDC signal which is proportional to the flow.

9.4.2 What Features Are Available?

- Front panel programmable zero and span.
- 20-4mA and 10-0VDC inverted logic capabilities.
- Front programming can be disabled for security.
- 4-20mA or 10VDC output signal (factory default) selected via jumper pin located on the circuit board.

9.4.3 How Do I Program The MODEL AO?






Note: The F-2000 must be powered by AC Adapter

Note: The output signal can be inverted. Either the low or the high output signal may be assigned to the lower or upper flow rate value in the range.

Programming Screen	Programming Screen Function
MA 1	Input the desired flow rate which corresponds to an output signal of 4mA or 0VDC. This value may be either the high or the low point in the range.
MA 2	Input the desired flow rate which corresponds to an output signal of 20mA or 10VDC. This is the opposite range point from the MA 1 setting (above).






Step 1 MA 1 Flow Rate at Low Output Signal (4mA or 0VDC).

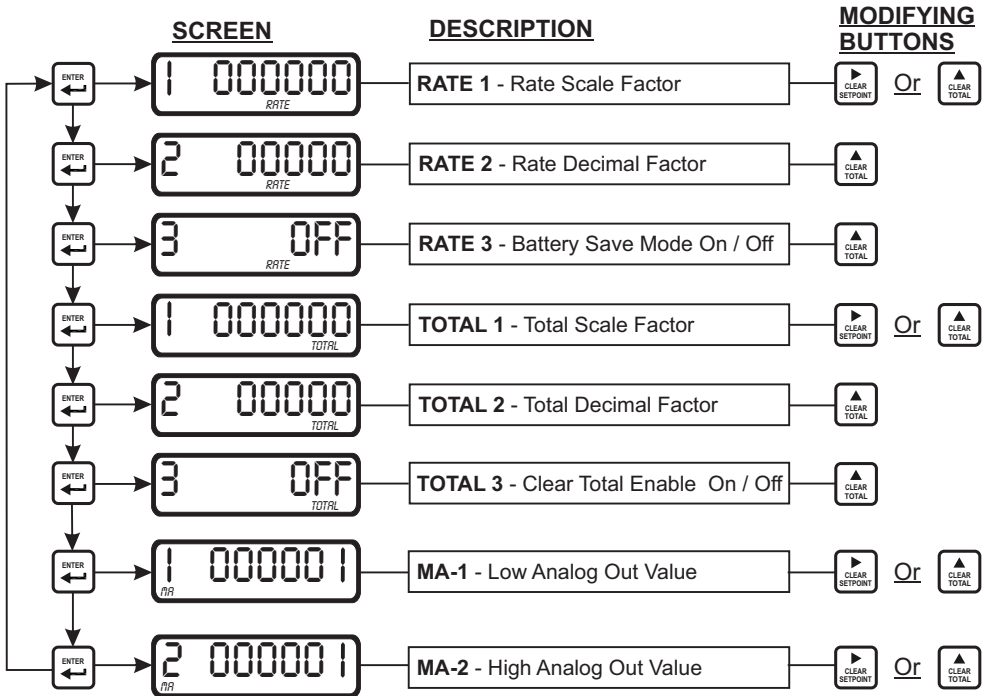
- Press  for at least 1.25 seconds to activate programming mode.
- Press  to toggle until you reach the MA screen.
- Press  to select the digit to be changed. The selected digit will blink.
- Press  to change the selected digit.
- Press  .



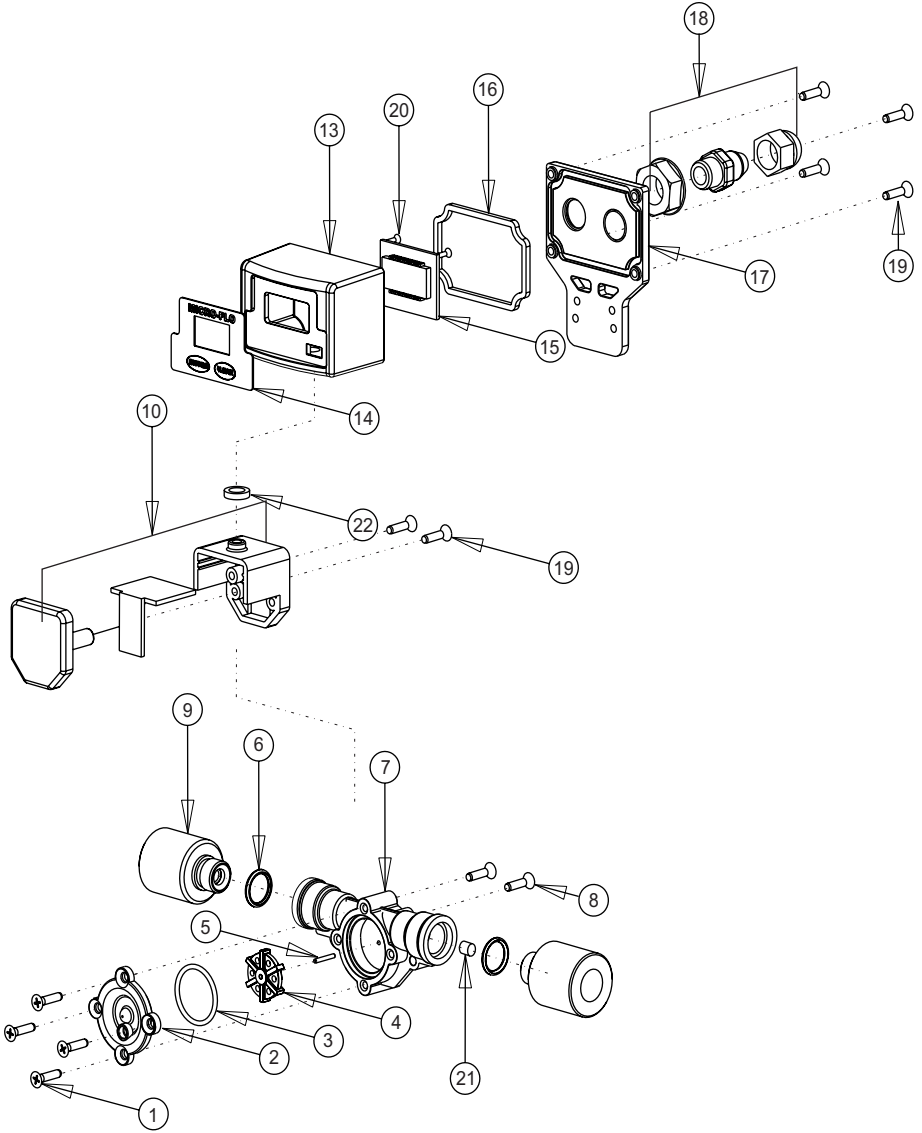
Step 2 MA 2, Flow Rate at High output Signal (20mA or 10VDC).

- Press  to select the digit to be changed.
- Press  to change the selected digit.
- Press  .

9.5 Programming Menu Flow Chart



10.0 REPLACEMENT PARTS



PARTS LIST

Key	Part No.	Description	Qty.
1	90011-190	Screw 6-32x.50 Phil Flt SS	4
2	90002-228	Lens Cap Opaque PVDF	1
3	90003-143	O-Ring FKM	1
	90003-146	O-Ring EP	
4	90002-229	Paddle PVDF	1
5	90007-592	Axle PVDF	1
6	90003-012	O-Ring FKM	2
	90003-011	O-Ring EP	
7	76001-705	Body S1 PVDF (30-300ml/min)	1
	76001-301	Body S2 PVDF(100-1000ml/min)	
	76001-302	Body S3 PVDF (200-2000ml/min)	
	76001-706	Body S4 PVDF (300-3000ml/min)	
	76001-304	Body S5 PVDF (500-5000ml/min)	
	76001-305	Body S6 PVDF (700-7000ml/min)	
8	90011-178	Screw #4x.50 Phil Blk	2
9	76000-137	Adapter .250" F/NPT PVC	2
	76000-456	Adapter .125" F/NPT PVC	
	90002-038	Adapter .375" OD Tubing Connection, PVDF	
	90002-042	Adapter .250" OD Tubing Connection, PVDF	
	76001-360	Adapter .500" ID Hose Barb, PVC	
	76001-359	Adapter .500 F/NPT, PVC	
	76001-358	Adapter .500 M/NPT, PVC	
10	71010-182	Sensor	1
13	90002-242	Enclosure, Valox	1
14	90012-254	LCD display	1
15	90010-260	Circuit board	1
16	90006-604	Gasket, rear enclosure	1
17	90002-243	Cover, enclosure rear	
18	90008-199	Liquid Tight Connector Set	1
19	90011-075	Screw #4x.62 Phil SS Blk	6
20	90011-177	Screw #2x.25 L Phil St	2
21	76001-299	Tubing connector seal	1
22	90006-605	Gasket, sensor mount seal	1

BLUE-WHITE INDUSTRIES LIMITED WARRANTY

FLOWMETERS are warranted to be free of defects in material and workmanship for up to 12 months from the date of factory shipment. Warranty coverage is limited to repair or replacement of the defective flowmeter only. Blue-White Industries does not assume responsibility for any other damage that may occur.

This warranty does not cover damage to the flowmeter that results from misuse or alterations, nor damage that occurs as a result of: meter misalignment, improper installation, over tightening, use of non- recommended chemicals, use of non-recommended adhesives or pipe dopes, excessive heat or pressure, or allowing the meter to support the weight of related piping. Flowmeters are tested and calibrated with water only. Although meters may be suitable for other chemicals, Blue-White cannot guarantee their suitability.

Flowmeters are repaired at the factory only. Call or write the factory to receive a Return Authorization Number, carefully pack the flowmeter to be returned, including a brief description of the problem. Note the RA number on the outside of the carton.

Prepay all shipping costs. The factory does not accept COD Shipments. Damage that occurs during shipping is the responsibility of the sender.

***We are not satisfied
until you are!***



Users of electrical and electronic equipment (EEE) with the WEEE marking per Annex IV of the WEEE Directive must not dispose of end of life EEE as unsorted municipal waste, but use the collection framework available to them for the return, recycle, recovery of WEEE and minimize any potential effects of EEE on the environment and human health due to the presence of hazardous substances. The WEEE marking applies only to countries within the European Union (EU) and Norway. Appliances are labeled in accordance with European Directive 2002/96/EC.

Contact your local waste recovery agency for a *Designated Collection Facility* in your area.

**ISO 9001:2015
CERTIFIED**



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USA**

80000-406

REV.8 03052021

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