



FLO-CORP.com

STEAMFLO MFSF™

Industrial Steam Flow Meter

OPERATING INSTRUCTIONS



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Introduction

Please read carefully! No liability can be accepted for damage caused by improper use or installation of the MEMFlo SteamFlo MFSF Flow Meter.

SupraFlo MFSF SteamFlo Flow Meters are simple, accurate, meters for use in industrial steam applications. These meters measure flow to one percent accuracy. The wide flow range and small pressure drop makes this meter an excellent energy monitor. SupraFlo SteamFlo Flow Meters use an internal magnet to carry an external indicator in a non-wetted enclosure and are supplied with MFT™ 2-Wire Transmitters for digital flow rate and total indication. Additionally, these meters can be supplied with a high temperature indicator option for service up to 500°F.

Safety Precautions

If you are unsure of the suitability of a MFSF Flow Meter for your installation, please consult your FLO-CORP representative for further information.

NOTE: REMOVE ALL PACKING INSERTS BEFORE OPERATING FLOW METER.

Authorized Personnel

All operations described in this operating instructions manual must be carried out only by trained specialist personnel authorized by the plant operator. During work on and with the device the required personal protection equipment must always be worn.

Warning about misuse

Inappropriate or incorrect use of the instrument can give rise to application-specific hazards , e.g. vessel over fill or damage to system components through incorrect mounting or adjustment.

General Safety Instructions

The user must take note of the safety instructions in this operating instructions manual , the country specific installation standards as well as all prevailing safety regulations and accident prevention rules. The instrument must only be operated in a technically flawless and reliable condition . The operator is responsible for trouble-free operation of the instrument. During the entire duration of use, the user is obliged to determine the compliance of the required occupational safety measures with the current valid rules and regulations and also take note of new regulations.

Disclaimer

The information contained in this document is subject to change without notice. FLO-CORP makes no representations or warranties with respect to the contents hereof and specifically disclaims any implied warranties of merchantability or fitness for a particular purpose.



SPECIFICATIONS

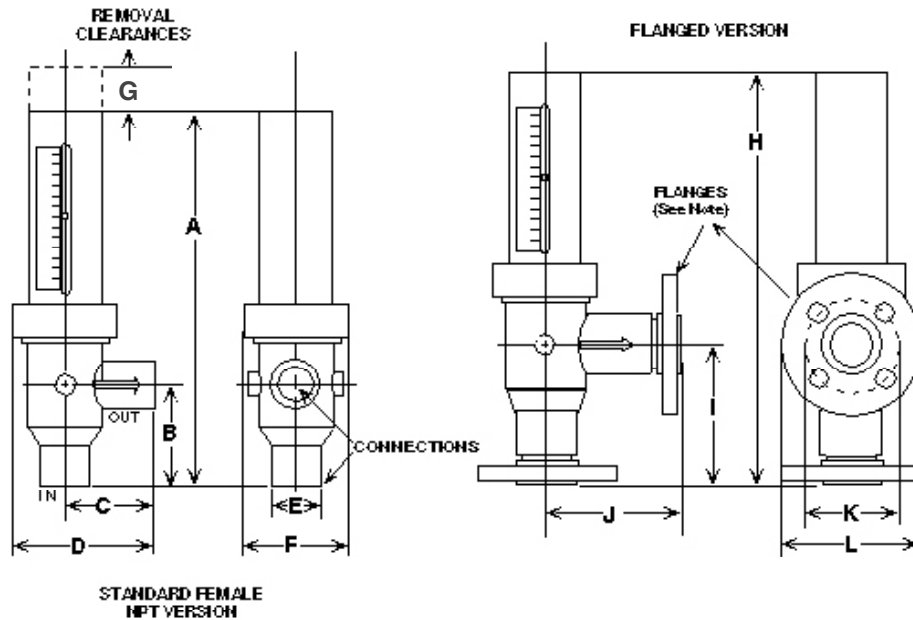
Accuracy	± 1% of 100% flow rate
Repeatability	1/2" to 2": +/- 1/4% of indicated flow rate 2" to 4": +/- 1/2% of indicated flow rate
Rangeability	30 to 1 average
Materials	T-316 stainless steel (1/2" to 2" Small Body), NI Plated Steel with all stainless internals (2" to 4" Large Body) Geothermal EPR O-Ring, and Teflon-coated Alnico magnet. All stainless construction is optional for large body.
Pressure Rating	Up to 600 psig (41.37 BAR)
Temperature Rating	Up to 600°F (315°C) [Pressure ratings decrease at higher temperatures]
Environmental	Humidity: 0-90% non-condensing
Power Requirements	0-5 VDC Output 10-30 VDC @ 0.75 max. 0-10 VDC Output 12-30 VDC @ 0.75 max. 4-20 mA Output loop-powered, 30 VDC max.
Power Consumption	25 mA max.

Analog Outputs	0-5 VDC and 0-10 VDC into 10,000 Ohms min. 4-20 mA into 1000 Ohms max.
Circuit Protection	Reverse polarity and current limiting
Transmission Distance	0-20 mA limited by cable resistance 0-5 VDC 1000 feet (330m) max. 0-10 VDC 1000 feet (300m) max.
Isolation of Transmitter	Inherently isolated from the piping system
Display Operating Modes	Fixed or Toggle
Display	Rate & Total = 8 digit 0.70" high numeric and 8 digit 0.35" high alpha for units and menu.
Temperature Drift	500 ppm/°C (Max)
Resolution	1:4000
Enclosure Rating	Standard - NEMA 4 (IP67) Option - NEMA 7
Transient Over-Voltages	Category 3, in accordance with IEC 64

Note: Please Consult Factory for Special Requirements

DIMENSIONS

Small Body



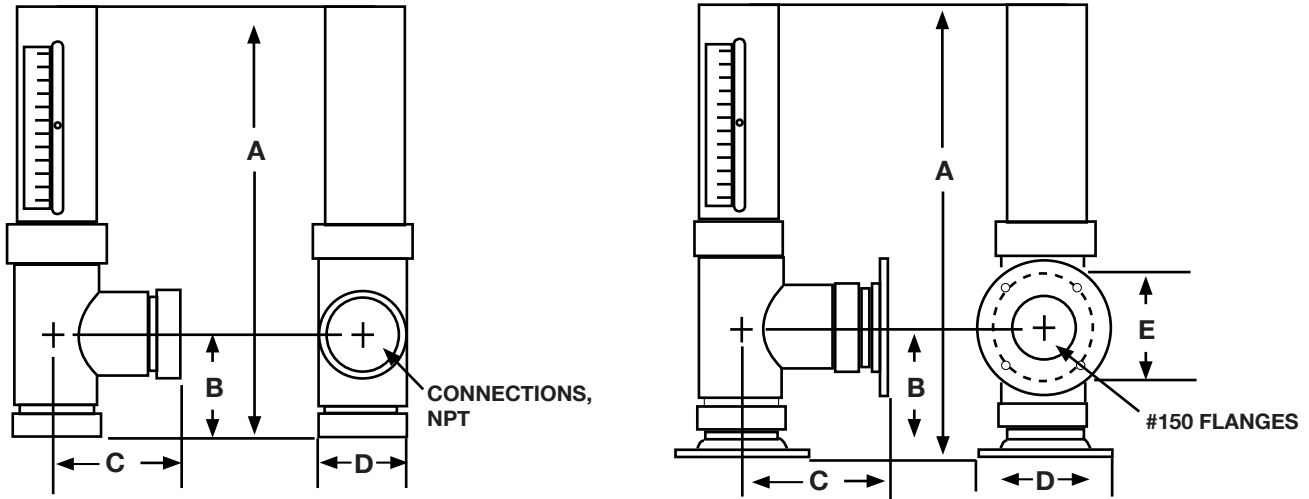
BODY MATERIAL	A	B	C	D	E	F	G	Female NPT
All Stainless	10.76	2.81	2.68	4.03	1.50	2.75	3.00	Up to 3/4"
All Stainless	15.64	4.53	3.71	5.70	2.48	4.01	5.00	Up to 2"

BODY MATERIAL	H	I	J	K	L	150lb Flange
All Stainless	11.64	5.92	3.56	2.75	3.88	Up to 3/4"
All Stainless	17.03	5.92	4.96	3.88	5.00	Up to 2"

Note: All dimensions are in inches, with a tolerance of ±0.03" on threaded models, ±0.20" on flanged units.



Large Body

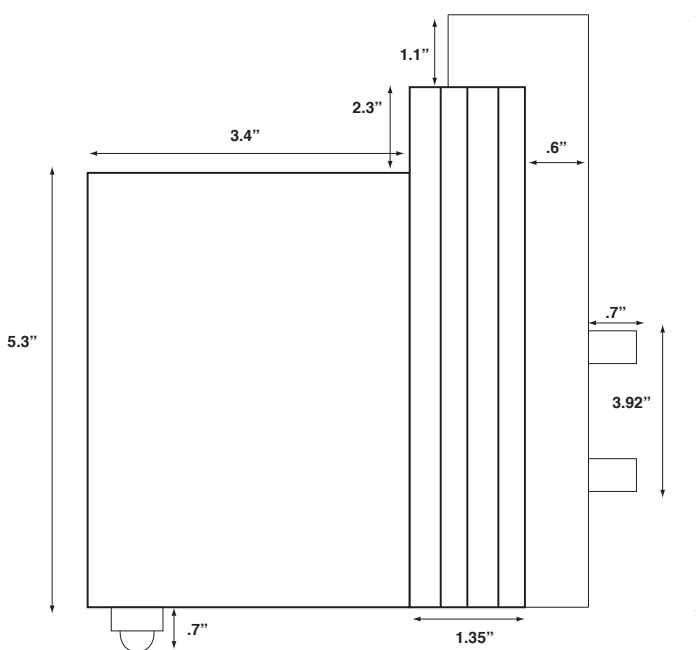


BODY & SIGHT TUBE DESCRIPTION	A	B	C	D	E	Female NPT
Stainless	20.23	6.38	5.38	3.63	NA	2"
Stainless	20.85	6.38	5.38	3.36	NA	2 1/2"
Stainless (150 GPM/1750 SCFM)	22.35	7.50	6.00	4.25	NA	3"
Stainless (200 GPM/2300 SCFM)	25.35	7.88	6.38	4.50	NA	
Stainless	26.85	8.63	7.13	5.56	NA	4"

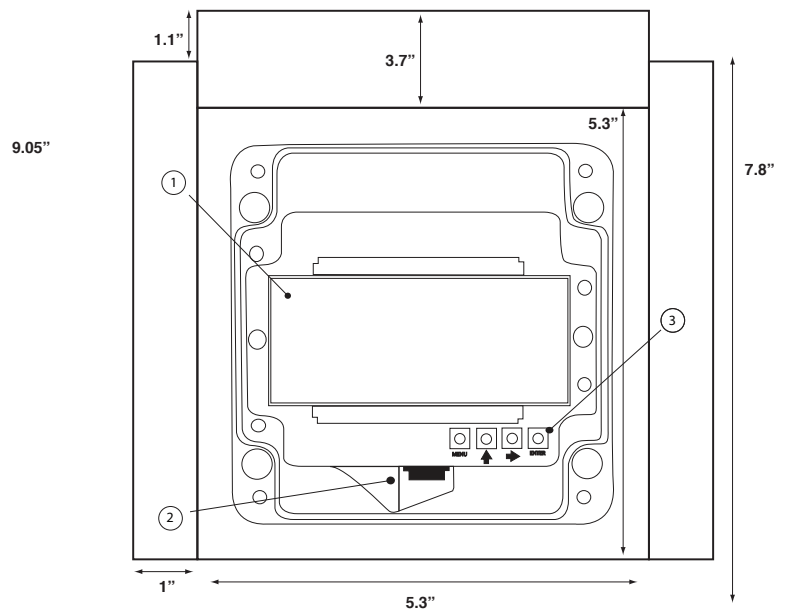
BODY & SIGHT TUBE DESCRIPTION	A	B	C	D	E	150lb Flange
Stainless	20.73	6.28	6.88	6.00	4.75	2"
Stainless	21.35	6.88	6.88	7.00	5.50	2 1/2"
Stainless (150 GPM/1750 SCFM)	22.60	7.75	7.75	7.50	6.00	3"
Stainless (200 GPM/2300 SCFM)	25.60	8.13	8.13	7.50	6.00	
Stainless	28.10	9.88	9.88	9.00	7.50	4"

Note: All dimensions are in inches, $\pm 0.05"$. Subject to change without prior notice.

MFT DIMENSIONS



SIDE VIEW



FRONT VIEW

- 1) LC DISPLAY
- 2) RIBBON CABLE
- 3) ADJUSTMENT KEYS

Installation and Setup

RECOMMENDED PIPING: FLO-CORP's flow meters generally have no special straight run or other piping requirements. Restrictive valves, reducer bushings, elbows, and other devices that might cause contraction of the media stream should not be mounted at inlet. A slight effect on meter accuracy may occur at high flow velocities if inlet piping guidelines are violated.

Inlet piping should be the same size as the meter connection. When installing a different pipe size, use standard pipe adapters and come into the meter inlet with a nipple eight diameters long of the same size for greatest accuracy. Control valves should be mounted on the outlet side of the meter. The use of a three valve manifold around the meter is suggested as it allows uninterrupted process flow while the meter is being cleaned.

PREPARATION: FLO-CORP's flow meters are ready to install as-is, although the MFT display may need to be reoriented so the the screen is visible after installation.

PLUMBING-IN: While the flow meters should be vertical, exact plumbness is not necessary. A general rule is that if the meter appears plumb, it is close enough (even if off by 10°, the predictable reading error is usually less than 1%). Pipe should be cut to proper lengths to avoid stress on the meter used. Avoid over-tightening of the flange bolts.

SIGHT TUBE ROTATION: On standard MFAM All Metal Flow Meters, the magnet slides out of the carrier at the top of the float assembly. The screw holding the carrier to the float may be loosened to allow rotating the carrier toward the desired scale location. Re-tighten the screw (thread sealant is recommended), replace magnet, and reassemble the meter (see "Assembly"). Verify that the ball indicator has been "captured" by the magnet. If not, rotate the sight tube (DO NOT twist on the edges of the plastic raceway assembly) until the ball is "grabbed" by the float magnet.



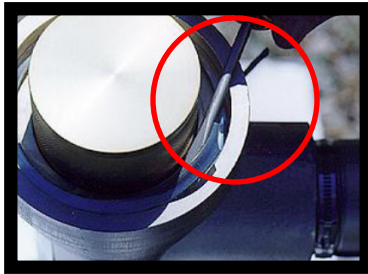
Disassembly

It is not necessary to remove the SteamFlo Flow Meter from the pipeline for cleaning or replacing parts. The body remains plumbed into the pipe, allowing easy service and even installation of different sensing elements to accommodate new flow rates. Figure 1 shows some of the major components. Step by step disassembly and reassembly instructions and photos are included below.

CAUTION: BE SURE PRESSURE IS FULLY VENTED AND STEAM COMPLETELY DRAINED BEFORE DISASSEMBLING THE FLOWMETER. DISCONNECT POWER TO ELECTRONIC ACCESSORIES. WEAR SAFETY GLASSES AND PROTECTIVE CLOTHING IF THERE IS A CHANCE OF EXPOSURE TO HAZARDOUS MEDIA!

1) Remove the raceway cover by removing the stainless screw at the top, and lift it up and off the meter. Remove the black phenolic raceway, being careful not to displace the ball indicator. Remove the ball indicator by hand.

2) Using a screwdriver, carefully pry the notched end of the spiral retaining ring out of the body groove. Move the screwdriver blade under the ring — the action is very much like putting a key on a key ring. Continue until the entire spiral ring has been removed from the groove (please see photo below).



3) Using hands only, pull the sight tube straight up out of the body with a slight twisting motion, lifting it clear of the body and snorkel. The inner flange ring will lift off with the sight tube.

4) Remove the float assembly by lifting it up and away from the snorkel. The core tube assembly may then be lifted out. If stuck, CAREFULLY pry up at the top of the slot with a brass rod, taking care not to damage the body or core tube. The spider ring and O-Ring will come out with the core tube. If the core tube is stuck, try removing the metal spider ring first (please see the photo below).

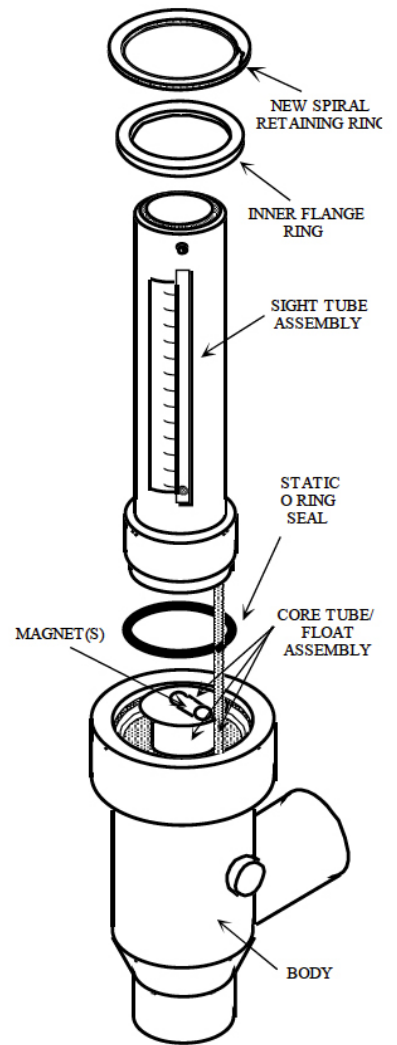


Fig. 1: Partially exploded drawing of the MEMFlo SteamFlo Flow Meter

Reading Flow

Read flow directly from the scale as the number nearest the center of the ball indicator or on the display of the MFT Transmitter.

Maintenance

Occasional cleaning of the sight tube and internal sensing elements to assure float visibility and continued accuracy is the only maintenance necessary for MEMFlo flow meters. Frequency will depend on the application – in most cases, an annual cleaning is adequate. It is not necessary to remove the MEMFlo flow meter from the pipeline for cleaning or replacing parts. The body remains plumbed into the pipe, allowing easy service and even installation of different sensing elements to accommodate new flow rates or fluids.

Inspection and Cleaning

Inspect parts for nicks, scratches, chips, wear and contaminant build-up. The edges of the core tube slot, ID of the core tube, and OD of the piston (largest section at the float assembly bottom) are precision machined. Damage to these areas can destroy the meter's accuracy. Also, inspect the O-Ring, the bottom section of the sight tube and the inside of the upper body section. Damage to these areas may result in leaking. Clean, rinse, and dry all parts carefully, including the O-Ring, preferably with a mild detergent, water, and a soft cloth or soft tube brush. If solvents are used, make sure they are compatible with meter parts.

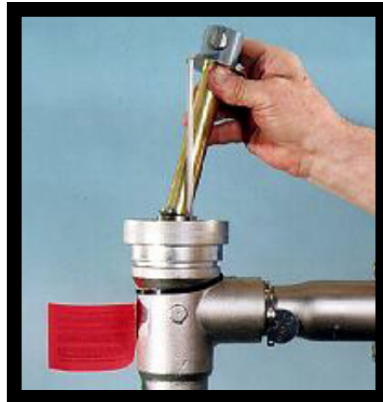
Assembly Instructions

In general, replace all parts in reverse order of disassembly.

- 1) Place the slotted meter tube into the body, aligning the “key” at the bottom of the tube with the keyslot in the bottom of the body.
- 2) Place the spider over the meter tube with the “notched” leg over the snorkel tube or guide rod. Slide the spider down to the meters tube's shoulder.
- 3) Place the meter float in the meter tube, aligning the notch in the indicator disk with the snorkel.
- 4) Seat the O-Ring on the sight tube, lubricating it with a small amount of service-compatible silicone grease or petroleum jelly to facilitate replacement.

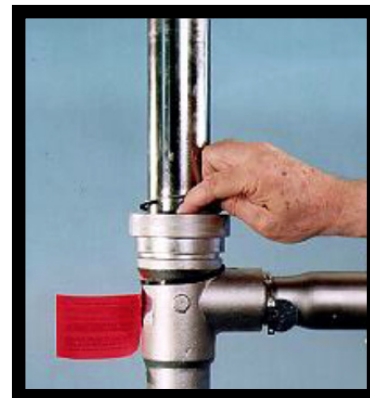


5) Using hands only, press the sight tube firmly down into the meter body with a twisting motion. Be careful not to rock the sight tube side to side and bend the snorkel tube/guide inward where it might interfere with float movement. Rotate sight tube as necessary for scale visibility and/or alignment of the raceway screw.



6) Slide the inner flange ring over the sight tube. When properly seated, the top of the flange ring should be flush with the bottom edge of the snap ring groove.

7) Separate the coils of the spiral retaining ring, and insert one end into the body groove. Wind the ring into the groove, making sure the ring is properly seated. Then replace the ball indicator (the tip of a screwdriver can be used to help locate the magnet, and replace the raceway and raceway cover).



If reassembled correctly, the center of the ball indicator should line up with the scale “zero” (either dotted black or scribed line). If it does not, disassemble the meter completely and carefully reassemble it, making sure the slotted meter tube is completely seated in the body. If new flow internals are used, the scale may have to be remounted on the sight tube. Depending on the model type, this can be done either by loosening the mounting screw, or reattaching the scale with double sided adhesive (new flow internals are shipped with a new scale).

Replacement Parts

Because MEMFlo flow meters are custom meters, it is best to stock several complete units as spares to assure availability of replacement parts. Under proper care, there should be no need to stock additional replacement components. If the service or environment is quite harsh, or frequent meter disassembly dictated, spare O-Rings and sight tubes should be considered.

Otherwise, parts only need to be replaced if damaged. Any visible damage to the entire surface of the O-Ring or sight tube (particularly from the bottom edge) indicates need for replacement. To insure accuracy, the inside surface of the meter core tube, the slot edges, and the OD of the float piston should be free of nicks, chips, with no visible erosion of any surfaces. If abrasive particles are suspended in the metered media, it may be desirable to keep replacement core tube/float assemblies on hand.

FLO-CORP can inspect any suspect parts or recheck calibration. Parts returned should include information regarding the flow application, suspected problem, and who to contact for an authorization on corrective measures. Again, unless the meter is misused, or service is extremely hard, there should be no need for factory recalibration.

To order parts, include the model and serial numbers of the units involved along with a description of the part ordered. If converting the meter to a new application, in addition to the model and serial numbers, SEND FLO-CORP COMPLETE APPLICATION DATA INCLUDING FLUID, MAXIMUM FLOW RATE, MAXIMUM AND OPERATING PRESSURES AND TEMPERATURES AND ANY OTHER APPLICATION PARTICULARS OR FLUID CHARACTERISTIC. This information is essential for FLO-CORP to provide proper items and verify that the new application is within the operating limits of the flow meter.

The only storage or handling requirements for MEMFlo flow meters or parts is to keep them in a reasonably clean location away from excessive heat (over 120°F), chemical or solvent fumes and vapors not compatible with the materials of construction.

Calibration Traceability

Each MEMFlo flow meter is individually calibrated on test facilities designed and operated according to applicable ASME, ISA, and NIST standards and practices. Individual measuring components of these facilities are certified traceable to NIST, and tandem meter arrangements are employed to continually verify flow data. FLO-CORP's calibrations meet both static and dynamic traceability criteria. For an additional charge, calibrations for $\pm 1\%$ full scale accuracy can be certified per MIL-STD-45662.

Flow Rate Selection

It is common practice to select a flow meter placing normal flow at about 75% of full scale. However, the unique "over-read" feature of MEMFlo flow meters allows sizing meters to normal flows in the 85% — 100% range. This provides more precise flow measurement, as meter accuracy is generally a percentage of the 100% scale rating.

MEMFlo Sizing Calculators

Please visit our website for Sizing Calculators

<http://www.flowlineoptions.com/tech/calculators/sizing-calculator/>

MEMFlo Online Calculator Sets are offered for either meter capacity selection, or for correcting an existing MEMFlo Flow Meter for a different fluid and/or operating conditions.



Temperature Limits

Temperature Limits of Standard MEMFlo Materials

MATERIALS	TEMPERATURE LIMITS
BUNA N	250°F
NEOPRENE	300°F
VITON	475°F
T316 STAINLESS	600°F
CPVC	210°F
EPR (STD.)	250°F
SILICONE	450°F
GEOHERMAL EPR (WATER/STEAM ONLY)	600°F
POLYSULFONE	300°F
KALREZ	575°F
TEFLON	500°F

Float Specific Gravities / Densities

MATERIAL	SPECIFIC GRAVITY OF METER FLOAT	DENSITY OF THE METER FLOAT
Stainless Steel	8.05	501.1

Specific Gravity or Density

Density, viscosity, and temperature (which affects both density and viscosity) are the key variables affecting accuracy. Pressure effects are negligible, except for safety considerations, since in MEMFlo meter ranges, liquids are generally incompressible. The specific gravity or density of the metered liquid must be known to correctly size the flow meter. This is necessary since the flow indication is proportional to the square root of liquid density. Conversion formulas are provided in this specification.

Viscosity Considerations

Each MEMFlo flow meter for liquid service has a so-called "Viscosity Immunity Ceiling" (V.I.C.). In most cases, as long as the viscosity of the metered liquid is less than the V.I.C. of the particular flowmeter, accuracy will not be influenced by changes in viscosity. When the viscosity is greater the V.I.C., accuracy is influenced significantly, and the flow meter must be calibrated for the particular fluid. In general, the higher the capacity of the flow meter, the greater (higher V.I.C.) the range of immunity to viscosity variations.

However, the effects of viscosity on a given flow meter are not always predictable. Two apparently similar liquids with comparable densities and viscosities may affect meter calibrations quite differently.



Table 1: Flow Meter Capacities, lb/HR Saturated Steam @ 100 PSIG, 338°F

CAPACITY DESIGNATOR	FLOW RANGE (lb/HR Steam)	CONNECTION SIZE	FLOW RANGE SCFM Conversion	ΔP, INCHES H2O	
00	0 - 30	04 (1/2")	0 - 10	2.5	
01	0 - 60		0 - 20	3.3	
02	0 - 100		0 - 35	4.0	
03	0 - 150		0 - 50	4.5	
04	0 - 250		06 (3/4")	0 - 85	18.0
05	0 - 370		0 - 125	22.0	
06	0 - 500		08 (1")	0 - 160	45.0
07	0 - 770	0 - 260	93.0		
08	0 - 75	12 (1½")	0 - 25	1.4	
09	0 - 125		0 - 40	1.4	
10	0 - 300		0 - 100	7.6	
11	0 - 525		0 - 175	7.6	
12	0 - 750		0 - 250	7.5	
13	0 - 930		0 - 310	12.0	
14	0 - 1500		0 - 510	40.0	
15	0 - 2000	16 (2")	0 - 750	28.5	
16	0 - 2500		0 - 840	32.5	
17	0 - 3000	20 (2½")	0 - 1006	40.0	
18	0 - 3000	24 (3")	0 - 1006	40.0	
19	0 - 3500		0 - 1173	31.5	
20	0 - 4000		0 - 1341	45.5	
21	0 - 4000		0 - 1341	45.5	
22	0 - 4500	32 (4")	0 - 1509	29.5	
23	0 - 5000		0 - 1679	32.0	
24	0 - 6000		0 - 2012	65.0	
25	0 - 6500		0 - 2179	92.5	



Table 2: Operating Limits, SteamFlo Flow Meter

BODY SIZE & DESCRIPTION	MAXIMUM NON-SHOCK WORKING PRESSURE, PSIG @ °F								CONNECTION SIZE
	0°F	70°F	300°F	350°F	400°F	450°F	500°F	600°F	
All Stainless	1000	1000	1000	990	970	950	930	900	Up to 3/4"
All Stainless	800	800	800	790	780	770	760	750	Up to 2"

Table 3: Operating Limits, (pipe sizes 2" to 4")

BODY SIZE & DESCRIPTION	MAXIMUM NON-SHOCK WORKING PRESSURE, PSIG @ °F							CONNECTION SIZE
	To 100°F	150°F	200°F	250°F	300°F	350°F	400°F	
All Stainless	400	400	400	400	400	375	350	2" to 4"

N.R. = NOT RECOMMENDED

* OPERATING LIMITS GIVEN ARE BASED ON WATER OR AIR. FOR MORE SEVERE SERVICE, CORROSIVES, AND OTHER MEDIA AND/OR ENVIRONMENTAL FACTORS, AN ADDITIONAL CORRECTION FACTOR DOWN-RATING THESE LIMITS MAY BE REQUIRED. LIMITS ARE BASED ON TESTING AND PRACTICAL EXPERIENCE. POSSIBLE EXTREME APPLICATION CONDITIONS CANNOT BE FORESEEN. THUS, DATA IS OFFERED ONLY AS A GUIDE. IT IN NO WAY CONSTITUTES A SPECIFIC RECOMMENDATION OR WARRANTY EXPRESSED OR IMPLIED.

Troubleshooting

SYMPTOM	USUAL CAUSE	SUGGESTED REMEDY
FLOAT HANG-UP	Usually caused by particles, sludge, etc. (including failure to remove the plastic tubing used to block meter float during shipment) inside the core tube and/or sight tube holding float. A bent float shaft or guide rod (usually caused by careless disassembly or violent surges) may also be causing float to stick.	Remedies include tapping the meter gently to temporarily dislodge the float, but if the problem reoccurs, meter should be disassembled and cleaned, and/or float shaft or guide rod straightened. If hang-up caused by sludge or pipe scale, clean lines and install a filter or other form of cleaner in supply line.
FLOAT BOUNCE	Caused by pumping/compressor surges or other pulsation sources, loose valve disks or similar mechanical components, extreme violation of inlet piping recommendations, or for gas applications, harmonics commonly found in systems with low pressure, low density gas.	Modification of piping, such as addition of a desurger, receiver, accumulator, vibration eliminators, loops, hoses, etc. between the source and meter should remedy the problem. Severe vibration may ultimately damage the meter, and should be avoided. If "bounce" seems to be from some other source, or shocks such as "water hammer" (a potentially dangerous condition), discontinue using the meter and contact FLO-CORP.
APPARENT FALSE READING, GAS METERS	Gas density not according to calibration data(different pressure, temperature, gas, etc), high water vapor content, saturated gas going into vapor or condensation phases, partially clogged core tube slot or foreign matter interfering with float movement, and/or violation of piping recommendations at high flow velocities.	Remedies include checking meter pressure (FLO-CORP can install a pressure gauge on the meter) & temperature, determining actual gas mixture density & correcting with appropriate formulae in this bulletin. Modifying inlet piping, relocating meter to point of higher temperature and/or lower pressure to eliminate vapor or condensation phase effects, and/or cleaning the meter (install filter or other form of cleaner if dirt repetitive problem) may also be required. If accuracy still questioned, return core tube/float assembly to FLO-CORP for calibration check.

<p>APPARENT FALSE READINGS, LIQUID METERS</p>	<p>Liquid density not according to calibration data (different temperature or new liquid mixture), excessive dissolved or suspended solids or gases, partial clogging of core tube slot or foreign matter interfering with float movement, or viscosity levels above the meter's immunity index (V.I.C.).</p> <p>NOTE: If the MEMFlo meter is suspected of giving false readings, and none of the causes mentioned is found, please advise MEMFlo as to the method used in determining the suspected flow "error." Each MEMFlo flow meter is individually calibrated by traceable methods, and carefully inspected. There may be some error in checking the MEMFlo meter against another standard.</p>	<p>By determining the actual density (due to changes in mixture, temperature, etc.), the correction formula may be applied. If dissolved gases are in the liquid, some elimination means should be provided on the supply side (also recheck all piping, as improper seals at connection points are common sources of air in the liquid.) If the metered liquid is near the boiling point producing partial "flash gas" at the meter, relocate the meter to point of lower temperature and/or higher pressure, or cool lines and/or increase system pressure. Note: It is potentially dangerous to meter near the "flash point" of any fluid, and this practice should be avoided. Consult FLO-CORP for recommendations. The previous recommendations regarding cleaning the meter and/or filtration will also solve problems due to dirt. If metering liquids with high viscosities, consult FLO-CORP (may require special calibration). If none of these causes seem to be present, return meter core tube/float assembly to FLO-CORP along with the application data.</p>
<p>APPARENT METER READING MIGRATION (reading changes but flow appears constant)</p>	<p>Frequently caused by use of soft disc type valves, which may need to be replaced with a valve more suited to flow control. Can also be indicative of changing fluid conditions (density, viscosity, etc.) Problems with other elements of the flow system, including leaks, clogged filters, pump/compressor wear, etc. may first appear as a change in meter reading-one of the functions of a flow meter.</p>	<p>Verifying the proper fluid conditions are known and applying correction formulae as needed will remedy problems associated with changing fluids. Cleaning, servicing, and replacement and/or repair of other system components may be required.</p>
<p>LEAKAGE</p>	<p>If at the junction of the body and sight tube, it is indicative of either (a) damaged O-Ring (most common); (b) damaged sight tube; or (c) damage to the gland section of the body. It may also be caused by improper reassembly of the flowmeter in the field.</p> <p>If there is leakage at the pipe connections to the meter, it is probably caused from over-tightening pipes on a prior installation (or the initial installation, particularly with PVC or CPVC flow meters).</p>	<p>Replace any damaged parts immediately, using the proper assembly procedures indicated in this instruction and the assembly detail drawings.</p> <p>Remove the body and inspect for damage--if none is visible, check pipe threads, reapply proper thread lubricant/sealant, and reinstall. If leak persists, replace meter body.</p>

All MEMFlo flow meters are hydrostatically pressure tested before they are shipped. FLO-CORP encourages you to contact your FLO-CORP representative or the factory with any questions regarding the proper installation and operation of our flow meters.

MEMFlo MFT™ Two-Wire Flow Transmitter Operating Instructions

MFT Installation and Setup

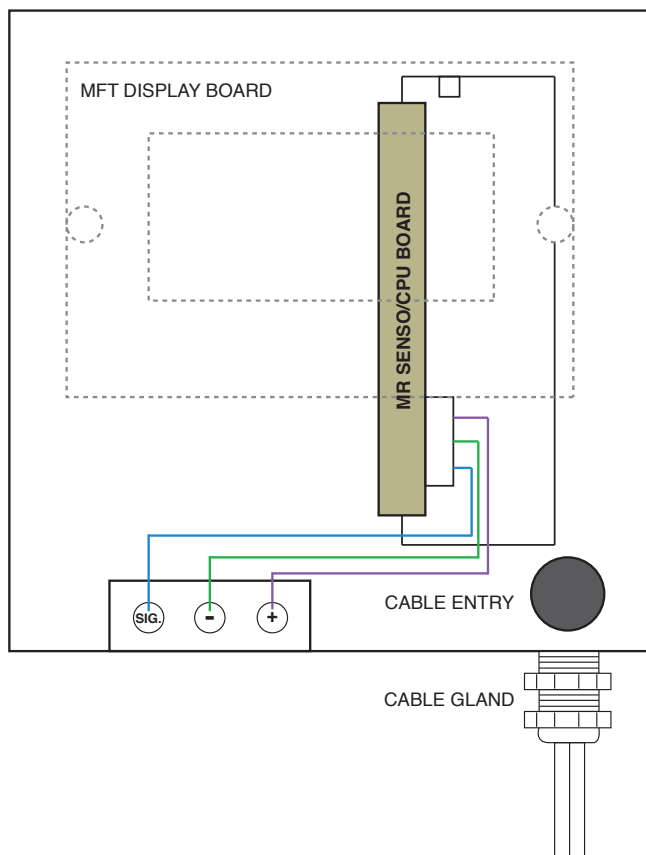
1. After the MEMFlo Flow Meter has been installed, place the MFT transmitter on the meter's sight tube.
2. Disconnect electrical power from the target system before making or changing any transmitter connections.
3. Use 0.5A fast acting fuse if non-current limited power sources are utilized.
4. Terminate cable shield connection at either DC ground or Earth ground.
5. Install unit in desired location. Use Allen wrench to fasten lock rings, which will hold the unit in place.

Note: The MFT can be configured via PC using MR Link Software - See page 23

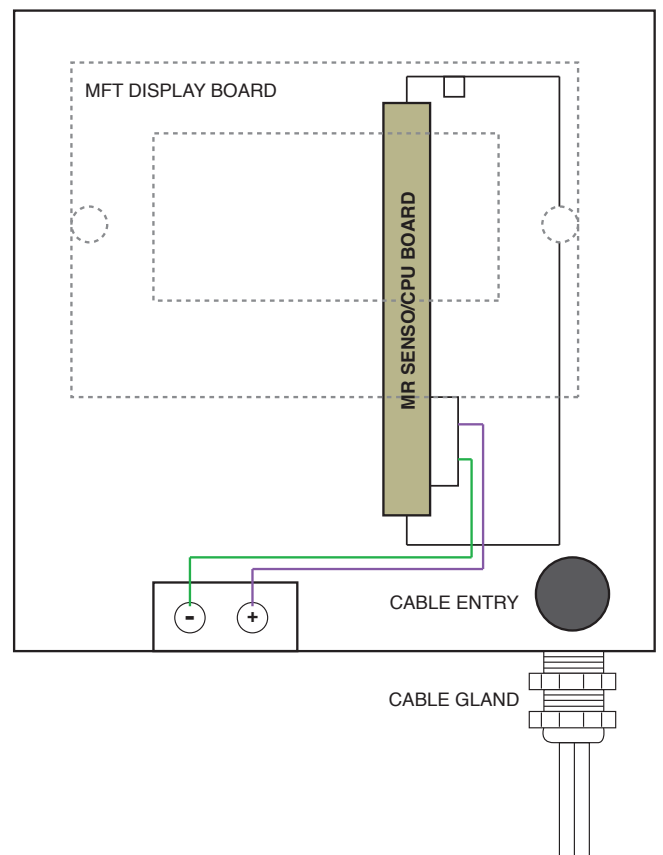
Wiring Diagrams

FLO-CORP assumes no responsibility for users incorrectly wiring their device. Please refer to the wiring diagrams for correct wiring of this device.

**05/10 VDC 3-WIRE DC
POWERED TRANSMITTER**



**4-20mA TWO-WIRE LOOP
POWERED TRANSMITTER**



MFT Operation

The monitor has two modes of operation: Run Mode and Program Mode. Normal operation will be in the Run Mode. To access the Program Mode, press the Menu button until DISPLAY appears - PROGRAM will be displayed on the left.

Normal Operation (Run Mode)

During normal operation, the unit will display RUN and the flow rate, total flow, or toggle back and forth between the two as defined by the Display configuration.

Controls in Run Mode:	
MENU	Used to enter Program Mode
UP ARROW (↑)	No function
RIGHT ARROW (→)	No function
ENTER	Used to manually save the current total in the MFT's flash memory. To save the current total manually press Enter until TOTALSVD (Total Saved) starts to flash. The TOTALSVD will stop flashing and the unit will return to Run Mode when complete.

Programming Operation (Program Mode)

During programming mode, the unit will display PROGRAM and one of several configuration menus.

Controls in Program Mode:	
MENU	Used to exit Program Mode
UP ARROW (↑)	Used to navigate through selections the Program Mode. For numeric setup, this button increments numeric values.
RIGHT ARROW (→)	Used to navigate through selections the Program Mode. For numeric setup, this button moves the active digit to the right.
ENTER	Used to enter menus, change configurations and save programming information.

Note: If any input value exceeds the units capabilities the LIMIT indicator will begin flashing, indicating an invalid entry. Press Enter once to return to the entry screen and re-enter the correct value.

IMPORTANT: This unit comes pre-calibrated from the factory. For questions, please contact factory.



Programming and Calibration

It is necessary to remove the MFT transmitter cover to access the programming keys. Use a Phillips screwdriver to remove the 4 screws that hold the cover in place. When programming is complete, reinstall the cover. To properly seat the built-in cover gasket, tighten the cover screws clockwise in a crisscross pattern as shown below.

Configuration

The MFT can be configured to display Rate, Total, or both Rate and Total. To configure these settings follow the instruction set below:

1. Press: Menu
MFT will read: DISPLAY
2. Press: Enter
MFT will read: RATE
3. Press: Right (→) to scroll between Rate, Total, Both (Both Rate and Total to display), or Test.
4. Once desired setting is indicated Press: Enter
5. Press: Menu again to exit Program Mode and enter Run Mode.

Totalizer Reset

To reset the totalizer on the MFT follow the instruction set below:

1. Press: Menu and Enter Simultaneously
MFT will flash: TOTALRST (Totalizer Reset)
2. The totalizer is now reset

Note: At the conclusion of the reset procedure the display will return to Run Mode.

Configuration of Rate Units of Measure

The MFT can be configured to display most common rate units (See Table 1). To configure these settings follow the instruction set below:

1. Press: Menu
MFT will read: DISPLAY
2. Press: Right (→)
MFT will read: RATE UNT (Rate Unit)
3. Press: Enter
MFT will read: GALLONS
4. Press: Right (→) to scroll through the available units.
5. Once desired setting is indicated Press: Enter
6. Press: Menu again to exit Program Mode and enter Run Mode.

Configuration of Rate Interval

The MFT can be configured for specific intervals based on time. To configure these settings follow the instruction set below:

1. Press: Menu
MFT will read: DISPLAY
2. Press: Right (→)
MFT will read: RATE UNT (Rate Unit)
3. Press: Right (→)
MFT will read: RATE INT (Rate Interval)
4. Press: Enter
MFT will read: MINS (Minutes)
5. Press: Right (→) to scroll through the available rate (time) intervals.
6. Once desired setting is indicated Press: Enter
7. Press: Menu again to exit Program Mode and enter Run Mode.

Configuration of Total Units of Measure

If the total flow is being displayed, the units for the total must first be chosen. The MFT can be configured for many common totalization units (See Table 1). To configure these settings follow the instruction set below:

1. Press: Menu
MFT will read: DISPLAY
2. Press: Right (→)
MFT will read: RATE UNT (Rate Unit)
3. Press: Right (→)
MFT will read: RATE INT (Rate Interval)
4. Press: Right (→)
MFT will read: TOTL UNT (Total Unit)
5. Press: Enter
MFT will read: GALLONS
6. Press: Right (→) to scroll through the available units.
7. Once desired setting is indicated Press: Enter
8. Press: Menu again to exit Program Mode and enter Run Mode.

TABLE 1	
Display View	Units of Measure
GALLONS	Gallons
LITERS	Liters
MGAL	Mega Gallons
CUBIC FT	Cubic Feet
CUBIC ME	Cubic Meters
MEGLTRS	Mega Liters
ACRE FT	Acre-Foot
OIL BARR	Oil Barrel
LIQ BARR	Liquid Barrel
LBS	Pounds
KGS	Kilograms



Configuration of Totalizer Exponential Factor (Multiplier)

The MFT has the ability to accumulate the flow total in multiples of ten (See Table 2). This feature allows the unit to accumulate totals that exceed the 8-digit display capacity. To implement a multiplier follow the instruction set below:

1. Press: Menu
MFT will read: DISPLAY
2. Press: Right (→)
MFT will read: RATE UNT (Rate Unit)
3. Press: Right (→)
MFT will read: RATE INT (Rate Interval)
4. Press: Right (→)
MFT will read: TOTL UNT (Total Unit)
5. Press: Right (→)
MFT will read: TOTL EXP (Totalizer Exponential)
6. Press: Enter
MFT will read: E0 (1 Unit)
7. Press: Right (→) to scroll through the available units.
8. Once desired setting is indicated Press: Enter
9. Press: Menu again to exit Program Mode and enter Run Mode.

TABLE 2	
Display View	Exponential Unit
E-2	0.01
E-1	0.1
E0	1
E1	10
E2	100
E3	1,000
E4	10,000
E5	100,000
E6	1,000,000

Configuration of Maximum Flow

To set the maximum flow follow the instruction set below:

1. Press: Menu
MFT will read: DISPLAY
2. Press: Right (→)
MFT will read: RATE UNT (Rate Unit)
3. Press: Right (→)
MFT will read: RATE INT (Rate Interval)
4. Press: Right (→)
MFT will read: TOTL UNT (Total Unit)
5. Press: Right (→)
MFT will read: TOTL EXP (Totalizer Exponential)
6. Press: Right (→)
MFT will read: FULLFLOW (Full Flow)
7. Press: Enter
MFT will read: FULLFLOW plus a series of numbers (ie. 000000.0)
8. To select a number Press: Right (→)
Number selected will flash
9. Press: Up (^) to increase number value (0-9)
10. Once desired maximum flow is displayed Press: Enter
11. Press: Menu again to exit Program Mode and enter Run Mode.

Configuration of Zero Capture

The zero position of the meter must be set when installing the meter - New units are factory set. To capture the zero calibration position follow the instruction set below:

1. Press: Menu
MFT will read: DISPLAY
2. Press: Right (→)
MFT will read: RATE UNT (Rate Unit)
3. Press: Right (→)
MFT will read: RATE INT (Rate Interval)
4. Press: Right (→)
MFT will read: TOTL UNT (Total Unit)
5. Press: Right (→)
MFT will read: TOTL EXP (Totalizer Exponential)
6. Press: Right (→)
MFT will read: FULLFLOW (Full Flow)
7. Press: Right (→)
MFT will read: ZERO CAPTURE
8. Press: Enter
MFT will read: NO
9. Press: Right (→) to select YES
10. Press: Enter
11. Press: Menu again to exit Program Mode and enter Run Mode.

Configuration of Specific Gravity

Specific Gravity is used to compensate for the specific gravity of the liquid or gas being measured with the meter. To set the specific gravity correction factor follow the instruction set below:

1. Press: Menu
MFT will read: DISPLAY
2. Press: Up (^)
MFT will read: RES DEFLT (Restore Defaults)
3. Press: Up (^)
MFT will read: PASSWORD
4. Press: Up (^)
MFT will read: OUT MODE (Output Mode)
5. Press: Up (^)
MFT will read: DAMPING
6. Press: Up (^)
MFT will read: SP GRAV (Specific Gravity)
7. Press: Enter
MFT will read: SP GRAV plus a series of numbers (ie. 00001.000)
8. To select a number Press: Right (→)
Number selected will flash
9. Press: Up (^) to increase number value (0-9)
10. Once desired maximum flow is displayed Press: Enter
11. Press: Menu again to exit Program Mode and enter Run Mode.



Configuration of Damping

The damping factor is increased to enhance the stability of the flow readings. Damping values are decreased to allow the flow meter to read faster to changing values of flow. The parameter can range from 0 to 99; factory default is 0. To set the damping factor follow the instruction set below:

1. Press: Menu
MFT will read: DISPLAY
2. Press: Up (^)
MFT will read: RES DEFLT (Restore Defaults)
3. Press: Up (^)
MFT will read: PASSWORD
4. Press: Up (^)
MFT will read: OUT MODE (Output Mode)
5. Press: Up (^)
MFT will read: DAMPING
6. Press: Enter
MFT will read: DAMPING plus a set of numbers (ie. 00)
7. To select a number Press: Right (→)
Number selected will flash
8. Press: Up (^) to increase number value (0-9)
9. Once desired maximum flow is displayed Press: Enter
10. Press: Menu again to exit Program Mode and enter Run Mode.

Configuration of Output Mode

To The MFT offers three analog output modes: 4-20 mA, 0-5 VDC, or 0-10 VDC. The output mode selected is determined by the type of peripheral device connected to the MFT. To set the output mode follow the instruction set below:

1. Press: Menu
MFT will read: DISPLAY
2. Press: Up (^)
MFT will read: RES DEFLT (Restore Defaults)
3. Press: Up (^)
MFT will read: PASSWORD
4. Press: Up (^)
MFT will read: OUT MODE (Output Mode)
5. Press: Enter
MFT will read: 4-20 MA
6. Right (→) to scroll through the available output modes.
7. Once desired setting is indicated Press: Enter
8. Press: Menu again to exit Program Mode and enter Run Mode.



Configuration of Password

Password protection prevents unauthorized users from changing programming information. Initially the password is set to all zeros. To set a password follow the instruction set below:

1. Press: Menu
MFT will read: DISPLAY
2. Press: Up (^)
MFT will read: RES DEFLT (Restore Defaults)
3. Press: Up (^)
MFT will read: PASSWORD
4. Press: Enter
MFT will read: PASSWORD plus a set of numbers (ie. 0000)
5. To select a number Press: Right (→)
Number selected will flash
6. Press: Up (^) to increase number value (0-9)
7. Once desired password is displayed Press: Enter
8. Press: Menu again to exit Program Mode and enter Run Mode.

Restore Defaults

This feature allows you to restore factory calibration data. To restore factory calibration data follow the instruction set below:

1. Press: Menu
MFT will read: DISPLAY
2. Press: Up (^)
MFT will read: RES DEFLT (Restore Defaults)
3. Press: Enter
MFT will read: NO
4. Press: Right (→) to select YES
5. Press: Enter
6. Press: Menu again to exit Program Mode and enter Run Mode.

Troubleshooting

No LCD Display

- For 4-20mA operation, check for current flow in the loop.
- Check polarity of the current loop connections for proper orientation.
- For 0-5V or 0-10V operation, check for proper voltage being supplied to the unit.
- Check for polarity of the supply voltage.

No Rate or Total Display

- Check flow meter for debris. Float assembly should move up and down freely.
- Check setup programming of flow meter.

Unstable Flow Reading

- This usually indicates pushing or oscillation in the actual flow. To provide a more stable display reading increase the DAMPING parameter, which will increase the filtering.



MR LINK™ SOFTWARE INSTRUCTIONS

ATTENTION: FLO-CORP is in no way responsible for configuring the end users network. Please consult with your IT department if you are experiencing problems.

Introduction

MR Link™ is an easy-to-use configuration utility for MFT Two-Wire Flow Transmitters. MR Link allows users to view and configure all device settings through a single programming screen. In addition to simple programming, MR Link unlocks additional user-configurable settings. These unlocked areas include: Scale Factor, Meter Type, Viscosity/Units, Operating Pressure/Units, Operating Temperature/Units, Min/Max Analog Output, Calibration of Analog Output.

Note: This unit comes pre-calibrated from the factory. However, the unit may be adjusted by the user to meet specific system requirements.

Installation & Setup

Software Installation

1. In your internet browser go to <http://www.flowlineoptions.com/tech/software> and click on the link to download MFT™ MR Link Software and follow the onscreen installation instructions.

USB Serial Converter Driver Installation

1. Insert the driver CD into your CD-ROM before plugging the hardware into the PC
Note: If you have inserted the hardware first and the Found New Hardware Wizard launched, click cancel to exit.
2. After inserting the CD, the USB Driver Installation wizard should launch automatically. If not, navigate to the CD-ROM drive and run setup.exe. To find your CD-ROM drive, double click "Computer" or "My Computer" on your desktop, then double click on your CD-ROM drive (usually D:).
3. When the USB Driver Installation Wizard appears, follow the wizard to complete the installation.
4. When the USB Driver Installation Wizard is done installing the driver, using the included USB cable plug the USB hardware into an available USB port on the PC.

Setting up your MFT

Note: MFT must be operating in Run Mode and connected to your PC using the USB serial Converter Drive during MR Link configuration.

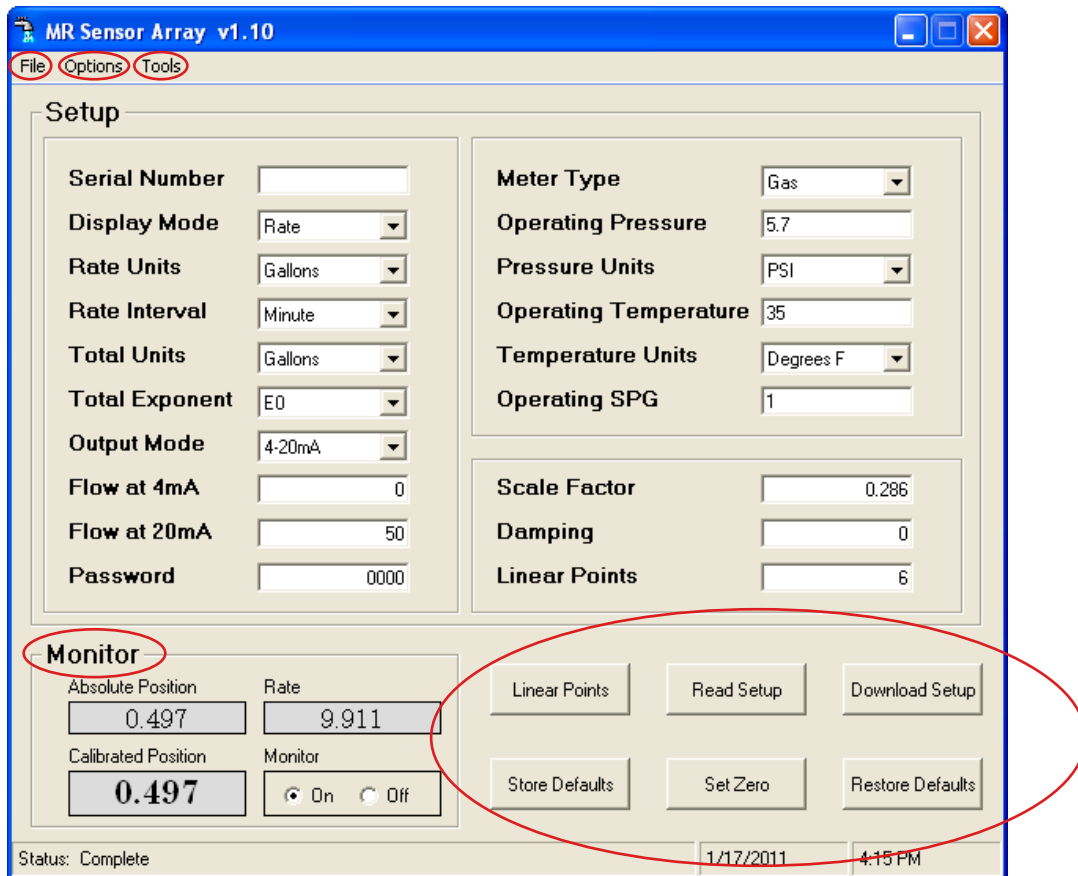
1. To open the software program, go to your PC desktop and Click: MR Link Icon
2. Input the correct Serial Port location for your device
Go to Options > Serial Port > Select a Com Port (Typically Com 3)
3. Next, Click: Read Setup
 - If serial port is found, software will automatically advance and new settings will appear in fields.
 - If serial port is not detected, select a different serial port from the menu and Click: Read Setup*Note: This step must be repeated until correct serial port is found.*
4. To view display readings, locate the area labeled Monitor and Click: On



Software Configuration

MR Link is easy to use and offers simple programming functions:

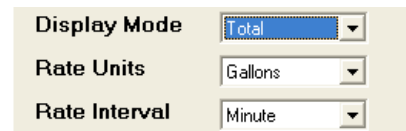
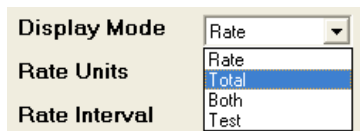
1. File: Used to Open Data File, Save Data File, Clear All Data, or Exit the program
 2. Options: Used to select appropriate Serial Port (Com 1-12) and Cal Point (6-8)
 3. Tools: Used to Calibrate, Comm Debug, or Display Sensor Readings
 4. Setup: Used to configure various input settings (i.e. Display Mode, Scale Factor, etc.)
 5. Monitor: Displays measurement output of the device
 6. Control Buttons: Used to Store/Restore Defaults, Download/Read Setup, Set Zero, or set Linear Points
- Note: During the initial setup, all fields shown within the programming screen will reflect the current device settings (See Figure 1).



Setup

To update the device configuration, simply enter the desired settings into the appropriate fields

- 1) Select appropriate field
- 2) Click on desired units
- 3) Selection complete



Monitor

The Monitor section provides data that is used to in simple calculations (i.e. Scale Factor, Linear Points).

1. Absolute Position: Displays Linear Position
2. Calibrated Position: Displays Linear Position
3. Rate: Used to monitor the actual display output
4. Monitor (On/Off): Used to disable the monitoring features



Control Buttons

The control buttons are used to perform simple programming functions.

- Linear Points: Used to perform calibration testing on device (See Important Calculations)
- Read Setup: Used to update fields with current device settings
- Download Setup: Used to save configuration updates to device
- Store Defaults: DO NOT TOUCH - This function erases factory settings
- Set Zero: Used to Set Zero of the process application
- Restore Defaults: Used to restore the default settings of the device

Important Calculations

All fields shown on the main menu are easily programmed using either the drop-down or manual entry. However, there are some areas (i.e. Scale Factor) that require additional calculation to ensure proper configuration.

Scale Factor

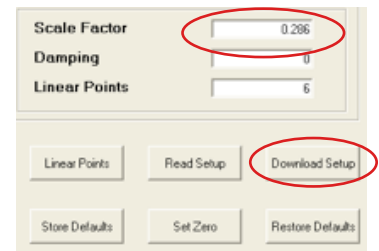
The scale factor is used to program the measurement range on device

1. Set the Scale Factor to 1.0000
2. Increase process to maximum flow
3. Once maximum flow is achieved, use the formula below to calculate the Scale Factor:

$$\text{Maximum Flow} \div \text{Displayed Rate} = \text{Scale Factor}$$

(Example: $50 \div 174.8 = 0.28604119$)

- Update the Scale Factor field with the calculation output (i.e. 0.286)
- To save changes to device, Click Download Setup
- To ensure accuracy, it is important to run a test



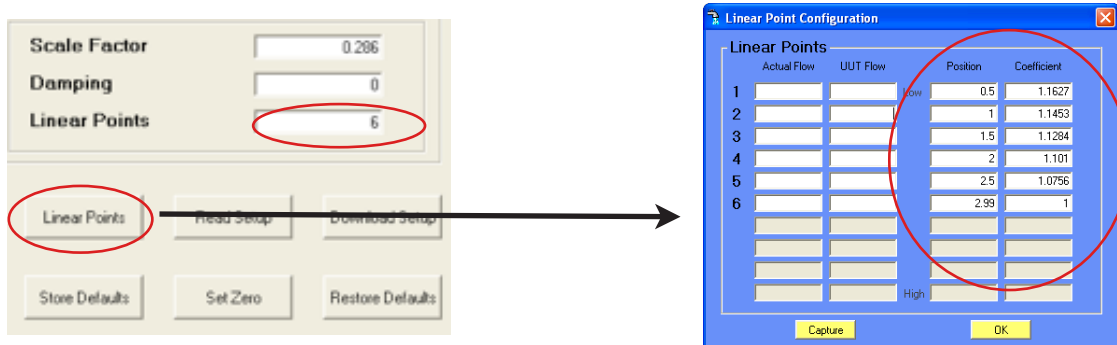
Troubleshooting

If maximum flow is correct, but you are experiencing an inaccurate reading at the other flow range - Linearization is required.

Linear Points

Linear points are used to preform calibration testing on the device. To configure the Linear Points (10 total possible) follow the instruction set below:

1. Enter the number of points into the Linear Points text box
2. Once the number of points is entered, Click the Linear Points button to open the configuration menu
3. Enter the positions at which you want to record, along with the coefficients in the fields provided (Formula provided, see Calculating Coefficients)



Important: Flow rate must be known for accurate calibration.

Calculating Coefficients

The chart below may be used to record data that will be used to determine the coefficient for each position. Use the formula below to calculate the Coefficient:

Position	Displayed Rate	Absolute Position	Coefficient
Example: 0.5	29	25.7	1.12840467

Rate ÷ Absolute Position = Coefficient
(Example: 29 ÷ 25.7 = 1.12840467)

Note: Coefficient must be between 0.5 and 1.5

Restore Defaults

Linear points are used to preform calibration testing on the device. To configure the Linear Points (10 total possible) follow the instruction set below:

1. Click: Restore Defaults
2. Click: Read Setup
MFT default settings have been restored.

For technical assistance, please contact FLO-CORP toll-free at (877) 356-5463.

Ordering Information

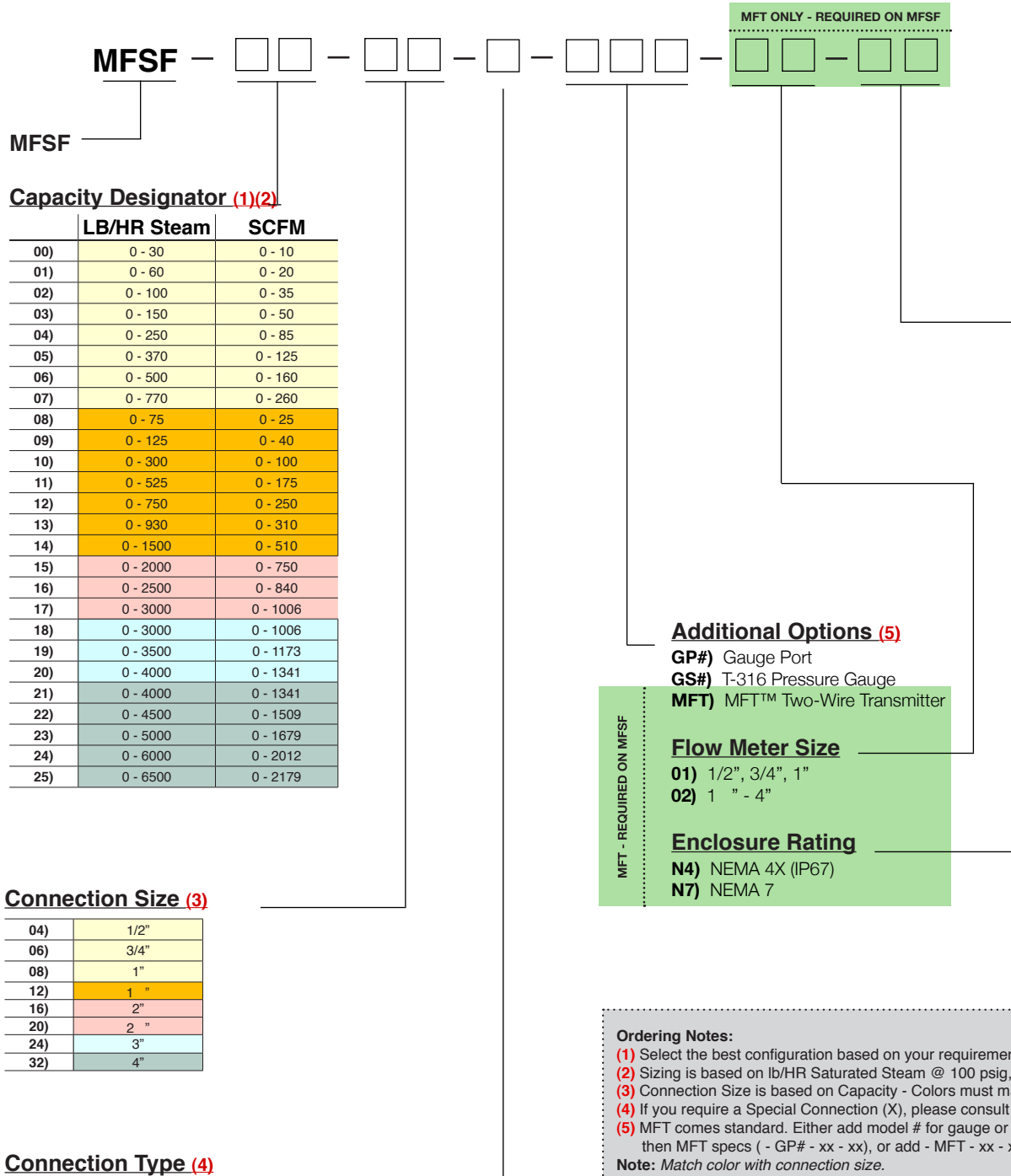
FLO-CORP MODEL NUMBER BUILDER

For Assistance Call **877.356.5463**

Use the diagram below, working from left to right to construct your FLO-CORP Model Number.
Simply match the category number to the corresponding box number.

Example: MFSF-15-16-T-MFT-02-N4

MEMFlo MFSF SteamFlo Flow Meter with 0-750 SCFM, 2" Connection Size, Female NPT Threaded Connection Type with NEMA 4X MFT Two-Wire Transmitter.



Return Policy

FLO-CORP warrants this product against defects in material or workmanship for the specified period under "Specifications" from the date of shipment from the factory. FLO-CORP liability under this limited warranty shall not exceed the purchase value, repair, or replacement of the defective unit.

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Warranty Policy

FLO-CORP (Flow Line Options) warrants to the original purchaser of its products that such products will be free from defects in material and workmanship

under normal use and service for a period which is of eighteen months from the date of purchase. This warranty covers only those components of the products which are non-moving and not subject to normal wear. Moreover, products which are modified or altered. FLO-CORP obligation under this warranty is solely and exclusively limited to the repair or replacement, at FLO-CORP decision, of the products (or components thereof) which Flow Line Options' examination proves to its satisfaction to be defective. FLO-CORP SHALL HAVE NO OBLIGATION FOR CONSEQUENTIAL DAMAGES TO PERSONAL OR REAL PROPERTY, OR FOR INJURY TO ANY PERSON. This warranty does not apply to products which have been subject to electrical or chemical damage due to improper use, accident, negligence, abuse or misuse. Abuse shall be assumed when indicated by electrical damage to relays, reed switches or other components. The warranty does not apply to products which are damaged during shipment back to Flow Line Options' factory or designated service center or are returned without the original casing on the products. Moreover, this warranty becomes immediately null and void if anyone other than service personnel authorized by FLO-CORP attempts to repair the defective products. Products which are thought to be defective must be shipped prepaid and insured to Flow Line Options' factory or a designated service center (the identity and address of which will be provided upon request) within 30 days of the discovery of the defect. Such defective products must be accompanied by proof of the date of purchase. FLO-CORP further reserves the right to unilaterally waive this warranty and to dispose of any product returned to FLO-CORP where: a. There is evidence of a potentially hazardous material present with product. b. The product has remained unclaimed at FLO-CORP for longer than 30 days after dutifully requesting disposition of the product. THERE ARE NO WARRANTIES WHICH EXTEND BEYOND THE DESCRIPTION ON THE FACE OF THIS WARRANTY. This warranty and the obligations and liabilities of FLO-CORP under it are exclusive and instead of, and the original purchaser hereby waives, all other remedies, warranties, guarantees or liabilities, express or implied. EXCLUDED FROM THIS WARRANTY IS THE IMPLIED WARRANTY OF FITNESS OF THE PRODUCTS FOR A PARTICULAR PURPOSE OR USE AND THE IMPLIED WARRANTY OF MERCHANT ABILITY OF THE PRODUCTS. This warranty may not be extended, altered or varied except by a written instrument signed by a duly-authorized officer of FLO-CORP

