WARRANTY

All products manufactured by **MIC** will be free of defects in material and workmanship for a period of one year from shipment. If found to be defective by us, we will repair or replace the nonconforming goods at our option or return the purchase price. Notice of a defective product must be given to **MIC** immediately upon discovery of the defect. **MIC** will not be liable for special or consequential damages in any claim, suit or proceedings arising under this warranty, nor will **MIC** accept any liability for claims for labor, loss of profit, repairs or other expenses incidental to replacement. The product warranty expressed above is our only warranty and may not be verbally changed or modified by any representative of **MIC**. The offer to repair or replace the nonconforming goods within warranty does not cover defects caused by shipping damages, damages caused by improper use or installation, or by the buyer's attempts to use products beyond their mechanical, thermal, chemical, or electrical capacity. This warranty does not cover damage by ultraviolet rays (sun) or exposure to elevated temperatures.

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Midwest Instruments & Controls

Remote Display Programmable Paddle Wheel Flow Meter with Totalizers

Instruction and Installation Manual

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1. Introduction

This manual contains specifications along with installation and operating instructions for your digital flow meter. Please read this manual carefully; hopefully, it will answer your questions and allow you to get the most from this meter.

2. Description

This digital meter is a paddle wheel type, microprocessor-based instrument. The compact, efficient design operates with negligible head loss. The display is water resistant, the flow sensor is waterproof. These attributes allow it to be installed where no external power source is available. If installed outdoors, the meter display must be shielded from direct sunlight to prevent damage to the display and overheating. Calibration of the meter is accomplished by selecting the pipe size and schedule then choosing the units.

3. Theory of Operation

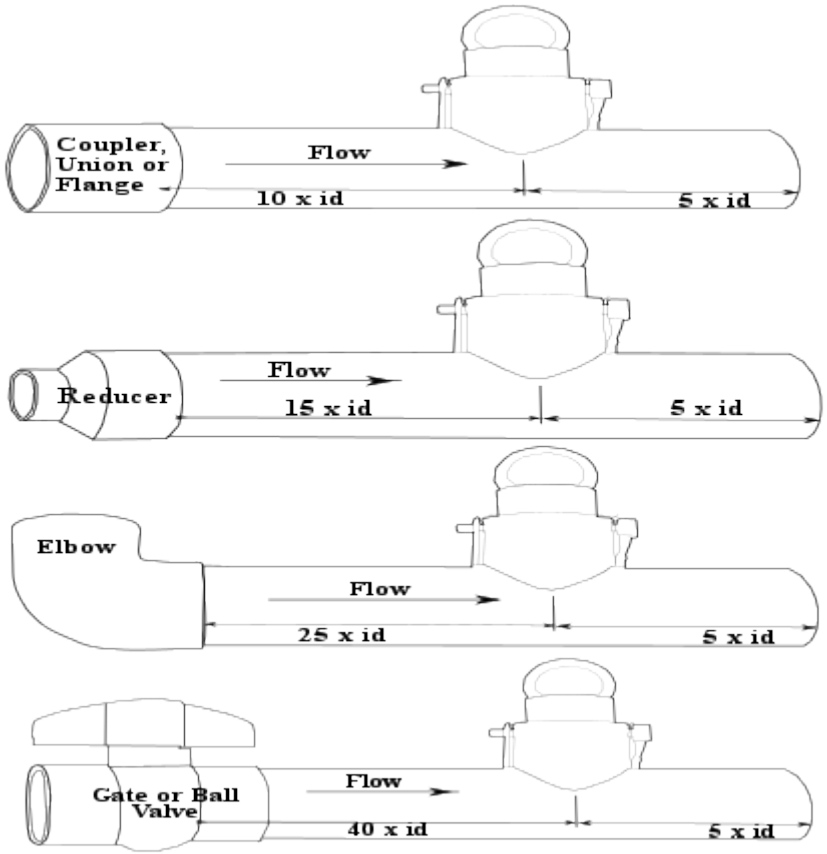
When the flow meter is properly installed, the paddle spins at a rate linearly proportional to the velocity of the flow. A magnet, contained within the paddle, actuates a switch every time the paddle revolves. By measuring the time it takes the paddle to revolve, the velocity is determined, and, from this, the flow rate can be calculated. A stable reading is obtained by averaging many revolutions of the paddle.

4. Installation

This display will not withstand direct sunlight exposure and sunlight damage (degradation of the display and plastic case) will not be covered under the warranty.

This section explains the procedure for properly installing the flow sensor to obtain accurate readings and to assure a trouble free operating life.

Paddle wheel flow meters will only produce accurate results when the pipe is full, and the meter is properly installed.

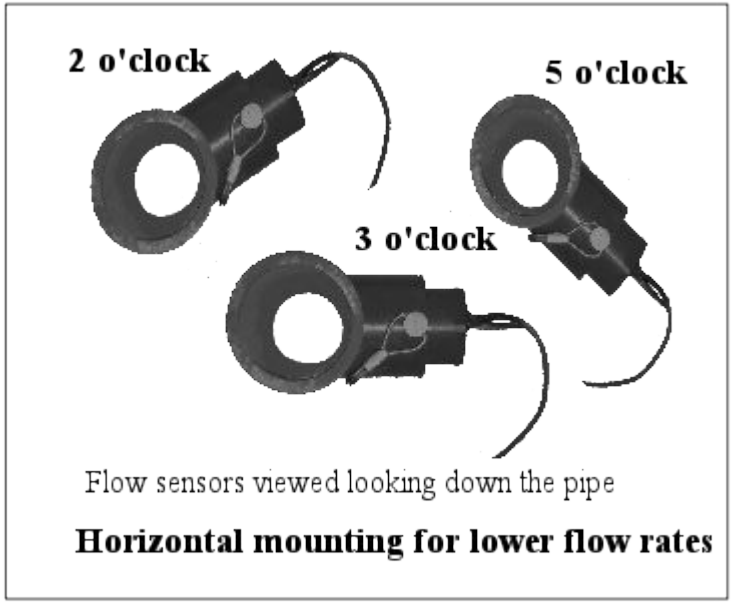


General:

The flow sensor must be installed in a straight length of pipe with at least 10 pipe diameters upstream of the meter. A minimum of 5 pipe diameters is required downstream.

In testing this and other paddle-wheel flow meters, it was found that accurate readings were only obtainable when the meter was installed in a section of pipe that was straight; no sagging or drooping. With the flow meter mounted in a sagging pipe, results were affected by as much as 5%. Secondly, on 3" and larger pipes, 25 pipe diameters were needed when the flow meter was down stream of a 90° elbow. If a major flow obstruction such as a partially closed butterfly valve or a pump is upstream of the flow meter, 40 pipe diameters may be required to assure uniform flow.

Horizontal Installations: See figure below for preferred positions when horizontally mounting the sensor. If the sensor



is mounted on the top, air bubbles may become entrapped around the paddle and produce inaccurate results when the flows are low. Mounting the sensor on the bottom of the pipe may entrap sediment that will eventually effect the operation of the paddle wheel. However, if no suspended particles are present, a bottom-mounted position is preferred. If the flow rate is always in the upper half of the recommended flow range, mounting on the top or the bottom is preferred. When flow rates are high and the sensor is mounted on the side, the paddle will slowly wear into the gray leg.

Vertical Installations: If possible, mount the flow sensor in a pipe with an upward flow. Upward flows will assure that the pipe remains full of liquid; however, downward flows can be measured if the pipe is slightly pressurized to assure that the pipe remains full.

Installation of the Pipe Mounted Flow Meter

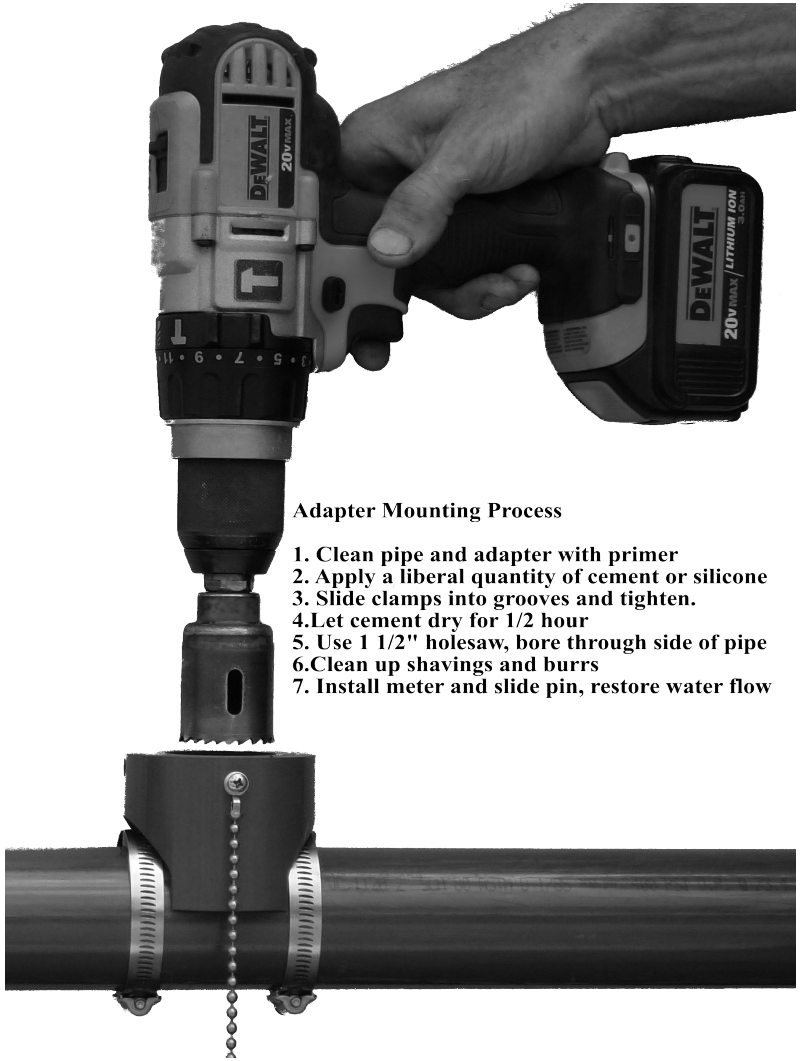
After determining a suitable location, a section of pipe will need to be removed from the existing system equal to the length of the pipe adapter plus the length of the coupling fittings. Be sure the mounting location and position will allow the flow sensor to be removed for cleaning and maintenance.

Install the pipe section using traditional PVC plumbing procedures.

Align the holes for the stainless steel pin, then using a rocking motion, press the meter into the adapter, and install the pin.

Installation of the Insertion Flow Meter on PVC Pipe

Be sure the mounting location will allow the sensor to be removed for cleaning and maintenance.



Adapter Mounting Process

1. Clean pipe and adapter with primer
2. Apply a liberal quantity of cement or silicone
3. Slide clamps into grooves and tighten.
4.Let cement dry for 1/2 hour
5. Use 1 1/2" holesaw, bore through side of pipe
6.Clean up shavings and burrs
7. Install meter and slide pin, restore water flow

1. 1. Install the hose clamps and slide them off to the side.

2. Clean the curved part of the adapter and the pipe using PVC primer and let dry to tacky.

3. Apply PVC cement to the pipe and the adapter.

4. Mount the adapter to the pipe.

5. Slide the clamps into the adapter grooves and tighten them enough to pull the adapter tight to the pipe.

Note: Over tightening will distort the pipe.

6. Wipe off any excess cement, and let it dry for 1/2 hour.

7 Using a 1 ½" hole saw and the adapter as a guide, bore a hole through the pipe. De burr and clean up shavings.

8 Align the holes for the stainless steel pin, then press the sensor into the adapter, and install the pin.

9 Mount the display.

Note: The display is not waterproof, if mounting outdoors it must be protected from the elements. Moisture and sunlight damage will not be covered under warranty.

The meter is now mounted and ready for operation.

Installation of the Insertion Flow Meter on Metal Pipes and other non-PVC pipes:

Mount the sensor in a location that will allow it to be removed for cleaning and maintenance.

1. Refer to the previous figure, install the hose clamps and slide them off to the side.

2. Using medium grit sandpaper, clean the pipe.

3. Clean the curved part of the adapter and the pipe using an acetone soaked rag.

4. Apply a layer of RTV silicon to the pipe & adapter.

5. Mount the adapter to the pipe.

6. Slide the clamps into the adapter grooves and tighten them to pull the adapter to the pipe.

7 Wipe off the excess silicone and let the assembly cure for 3 hours.

8 Using a 1 ½" hole saw and the adapter as a guide, bore a hole through the pipe. Clean up the shavings.

9 Align the holes for the stainless steel pin and press the sensor into the adapter then install the pin.

10 Mount the display.

The meter is now mounted and ready for operation.

5. Reading the Display

The left corner of the flow rate display contains two icons resembling paddle wheels. These icons will appear and alternately flash when the paddle wheel is rotating. If the flow rate is too low and/or the paddle is stuck, the paddle icons will disappear. In this case the flow rate will have to be increased, the pipe diameter reduced or the paddle wheel freed. The resettable totalizer can be reset using the middle "**Reset"** button, whereas the totalizer is not resettable. Pressing the **"Size"** button will display the currently programmed size and schedule of the pipe followed by the **units** and finally the **percent adjus**t factor. Refer to the calibration section if any of the information is incorrect.

To be able to store totalized data for a long periods, the larger sized meters will have the totalizer registers stored with a multiplier. The multiplier, either x 10 or x 100, will be displayed every 6 seconds. Example, a 4" meter will have the totalizer registering in gallons x 10. Every 6 seconds "by 10" will be displayed. To get get the correct readings both totalizers must be multiplied by 10. The 4", 6" and 8" meters use a x100 multiplier for the liter units.

6. Care & Maintenance

The serviceable parts that may need replacing are the paddle wheel, pin, and o-ring and batteries. The life of these parts is dependent on the flow rate and the fluid. If the display becomes erratic or readings seem lower than normal, inspect the paddle wheel and pin.

7. Replacing the Battery

The meter operates for about 1 ½ years to 3 years depending on flow rate and length of the sensor cable. Symptoms of low batteries include faint display and unresponsive meter. Two AAA standard alkaline batteries are housed in the display unit. To change the batteries a #1 Phillips screwdriver is required. Remove the four screws on the backside of the meter and separate the enclosure. Replace the batteries, reposition the gasket and reassemble. Do not over tighten the screws, they are only anchored in plastic. Check the meter size and schedule, if meter needs reprogramming refer to the section on programming.

8. Checking & Replacing the Paddle and Pin

The paddle wheel should turn freely. If not, check for foreign material lodged between the paddle and housing. If the unit is operated in water with fine suspended sand, it is possible for a grain of sand to become lodged between the paddle and the pin. If this occurs, the pin will have to be removed, and the paddle cleaned. To remove the paddle pin, use a drill bit slightly smaller than 3/32". Hold the bit in a vise or pair of pliers, and push the paddle pin out. Do not grab the pin with the pliers, this will mar the pin surface.

9. Specifications

Operating pressure/temperature corresponds to standard schedule 40 & 80 PVC pipe with **maximum pressure not to exceed 200 PSI.**

Wetted Materials:	PVC Stainless Steel Paddle Pin Buna N or Viton O-Ring

Ambient Operating Temperature:	20° to 130° F
Maximum % Solids:	1% of Fluid Volume
Linearity:	±1.5% Full Scale
Repeatability:	±1% Full Scale
Battery Life	Greater than 2 Years

Pipe Size vs. Flow Range

Pipe Size		id.(inches)	Flow Range (GPM)
	1/2”		0.6 - 15
	3/4”		1.5 - 30
	1”		5 - 55
1 1/2”	sch40	1.61”	10-125
	sch80	1.50	
2”	sch40	2.07	15 - 200
	sch80	1.94	
3”	sch40	3.07	40 - 450
	sch80	2.90	
4”	sch40	4.03	60 - 800
	sch80	3.83	
6”	sch40	6.07	120 - 1800
	sch80	5.76	
8”	sch40	7.98	250 – 3200
	sch80	7.63	

10. Troubleshooting

Most problems with the flow meter can be traced to either an improper installation or solids becoming entrapped in the paddle. If the paddle clogs, the paddle wheel icons in the upper left hand corner of the display will not be visible. Most times, cleaning can be accomplished by washing the paddle under running water. If not, refer to Section 8 for removal and cleaning.

Common Problems

- Inadequate lengths of pipe before or after meter
- Bubbles or silt trapped around the paddle
- Pipe not full of water
- Flow rate too low

11. Calibration

The calibration procedure matches the meter with the pipe. The process is broken down into three parts: selecting a factory preset; choosing the units and possibly changing the calibration factor.

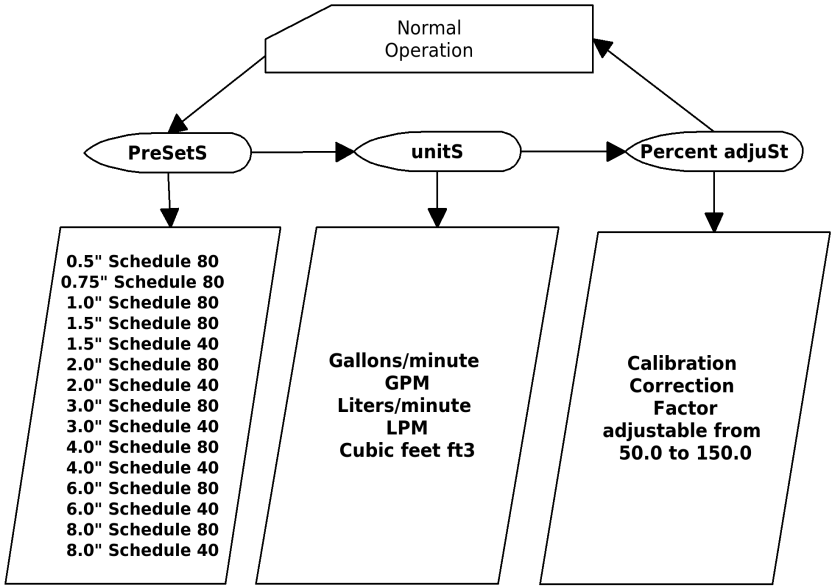
Programming Procedure

(Refer to the flow chart)

PreSetS:

Using the three buttons on the face of the meter and the flow chart as a guide, the meter is programmed as follows. The programming mode is accessed by depressing and holding the menu ► button for ten seconds until “**PreSetS**” is displayed. Release the button and press the ▼ key. A list of factory

presets will be displayed. Using the ▲ and ▼ keys, select the size and schedule of the pipe. After selecting the size and schedule, press the menu ► key to confirm. If the pipe size or type of pipe is not listed, the meter will have to be calibrated using a pipe size that has a similar inside diameter and then adjusted using the "**percent adjust**" procedure outlined in the Appendix, example 2.



Calibration Flowchart

UnitS:

The word "**UnitS"** should now be displayed. Using the ▲ and ▼ keys, other units can be selected if needed. The three options are gallons/min, cubic feet/min and liters/min. After selecting, press the menu ► key to confirm.

PerCent AdJUSt:

This register contains the value used to "fine tune" the accuracy of the meter or reprogram the meter to accommodate a pipe size or pipe schedule that is not in the **"PreSetS"** list. The adjustment is accomplished by multiplying the flow rate, resettable totalizer and totalizer with the value stored in the **"percent adjust**" register. The flow rate and both totalizers can be increased or decreased by up to 50%. The factory preset of 100.0 can be changed from 50.0 up to 150.0. The examples in the appendix outline the calculation and adjustment of this register.

The meter should now be displaying **"PerCent AdJUSt:".** If this register needs to be changed, press the ▼ key. The register can be modified using the ▲ and ▼ keys. Press and hold either button to advance the count quickly. Once the register has been adjusted, press the **menu** ► button to accept the changes and return to the normal monitoring mode.

. Appendix

Calibration Examples

Improving the accuracy of the meter.

Variations in fluid viscosity and the numerous mounting configurations cause slight inaccuracies. By modifying the **"percent adjust**" register, these inaccuracies can be greatly reduced.

The procedure is as follows.

- Place a tank of known volume at the outlet.
- Using a stopwatch, determine the time it takes to fill the tank.
- Divide the volume of water (in gallons) by the time (in minutes), this will result in the actual flow rate.
- Divide the actual flow rate by the current reading, this will result in a multiplier.
- Next, using the procedure outlined in Section 11 and the flow chart, access the "**percent adjust**" register.

- Using the ▲ and ▼ buttons, change the **"percent adjust"** register to reflect the new value. To increment or decrement the register rapidly, depress and hold either button. Press the menu ► key to confirm the change and return to normal metering mode.

Example, a 1" meter is mounted in a location that does not allow the recommended straight run of pipe. This common problem usually affects the accuracy of the meter but not the linearity. By recalibrating the meter it is possible to reduce this error.

The meter is indicating 33.4 GPM. The flow is diverted into a 100-gallon tank that takes 175 seconds to fill.

$$actual\ flow\ rate = \frac{(volume\ of\ Tank)}{\left(seconds \Big/ 60\right)}$$

$$actual\ flow\ rate = \frac{100}{\left(175 \Big/ 60\right)}$$

$$actual\ flow\ rate = 34.3\ gpm$$

Next, calculate the multiplier (multiply by 100 to convert to percentage).

$$percent\ adjust = \frac{actual\ flow\ rate}{present\ meter\ reading}\ x100$$

$$percent\ adjust = \frac{34.3}{33.4} x100$$

$$percent\ adjust = 102.7$$

Modify the **"percent adjust"** register to 102.7 and press the menu ► key, this places the meter back in service.

Example 2

This procedure is used to calibrate the meter for a pipe that is not listed as a factory preset.

- Measure or look up the inside diameter (id) of the pipe.
- Referring to Section 9, Specifications, find a pipe size with a similar id.
- **Program the meter using the closest factory preset value.**

Next, calculate the **"percent adjust"** factor by dividing the two squared numbers and multiplying by 100 to convert to a percentage.

$$percent\ adjust = \frac{(new\ \ pipe\ id)^2}{(closest\ \ pipe\ \ id)^2} x\ 100$$

Note: The cross sectional area of a pipe increases as the square of the diameter.

- Using the procedure outlined in Section 11 and the flow chart, access the "**percent adjust**" register
- Using the ▲ and ▼ buttons, adjust the value to match the value calculated above. To increment the register rapidly, depress and hold either button.
- Once adjusted, press the menu ► key to confirm the changes.

Example, a fish processing plant wants to monitor water usage. The supply line feeding the facility is 2" type L copper pipe. Using a data sheet, the id of the type L pipe is found to be 1.96", referring to Section 9, Specifications, the nearest pipe id is 2" schedule 80 with an id of 1.94". Program the meter for the 2" schedule 80 pipe, this will load the parameters that will then be modified to match the 2" type L pipe.

Calculate the **"percent adjust"** multiplier

$$percent\ adjust = \frac{(new\ \ pipe\ id)^2}{(closest\ \ pipe\ \ id)^2} x\ 100$$

$$percent\ adjust = \frac{(1.96)^2}{(1.94)^2} x\ 100$$

$$percent\ adjust = 102.1$$

Modify the **"percent adjust"** register to 102.1 using the ▲ and ▼ buttons. Press the menu ► key to confirm the changes, this also places the meter back in service.

Example 3

This procedure is used to calibrate the meter to display the flow rate and totalizers in units other than *gallons/minute.*

A farmer wants to use the meter to adjust a valve that will restrict the flow in a 2" schedule 40 pipe to 300 *liters/minute*. Using the flowchart and the Calibration section of this manual, proceed to the "**UnitS**" section as follows.

- Press and hold the menu ► key for 10 seconds. **"PreSetS**" should displayed.
- Press the ▼ button and select *2.0 schedule 40.*
- Press the menu ► key, **"UnitS"** should be displayed.
- Press the ▼ key and select *liters* from the options, press the menu ► key.
- **"Percent AdJust"** will be displayed, press the menu ► key to confirm the changes, this also places the meter back in service.

Unit options: "gallons/min", "liters/min" and "cubic feet/min".