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## ▶ Flow Rate Transmitter Installation, Operating & Maintenance Manual

# Technical Specifications

## Measuring Accuracy

±2.0% of full scale

## Repeatability

±1% of full scale

## Flow Measuring Range

0.1-150 GPM (0.5-550 LPM)

2-1300 SCFM (1-600 SLPS)

## Standard Calibration Fluids

Oil monitors: DTE 25® @ 110°F (43°C), 0.873 sg

Water monitors: tap water @ 70°F (21°C), 1.0 sg

Air monitors: air @ 70°F (21°C), 1.0 sg and 100 PSIG (6.8 Bar)

## Maximum Operating Pressure

### Liquids

Aluminum and brass monitors:

3500 PSIG (240 Bar)

Stainless steel: 6000 PSIG (410 Bar)

### Air

Aluminum and brass: 600 PSIG (40 Bar)

Stainless steel: 1000 PSIG (69 Bar)

## Maximum Operating Temperature

Media: 185°F (85°C)

Ambient: 185°F (85°C)

## Filtration Requirements

74 micron filter or 200 mesh screen minimum

## Viscosity

Standard viscosities up to 110 cSt. For viscosities between 110 to 430 cSt contact factory.

*DTE 25 is a registered trademark of Exxon Mobil.*

# Electronic Transmitter Performance

## Power Requirements

12-24 VDC

## Load Driving capacity

4-20mA: Load resistance is dependent on power supply voltage.

Use the following equation to calculate maximum load resistance:  
Max Loop Load ( $\Omega$ ) = 50 (Power supply volts - 12).

0-5 VDC: Minimum load resistance 1000

1-5 VDC\*: Consult factory

Square Wave Pulse: Minimum load resistance 1000  $\Omega$

## Transmission Distance

4-20mA and 1-5 VDC (regulated) are limited only by wire resistance and power supply voltage.

<200 feet recommended for 0-5 VDC and square wave pulse.

## Over-Current Protection

Self limiting at 35mA

## Resolution

10-bit (0.1%)

## Response Time

<100 milliseconds

*\*The 1-5Vdc output requires an external 249 ohm resistor (not included with transmitter) to be wired at the receiving device.*

## Enclosure Materials of Construction (non-wetted components)

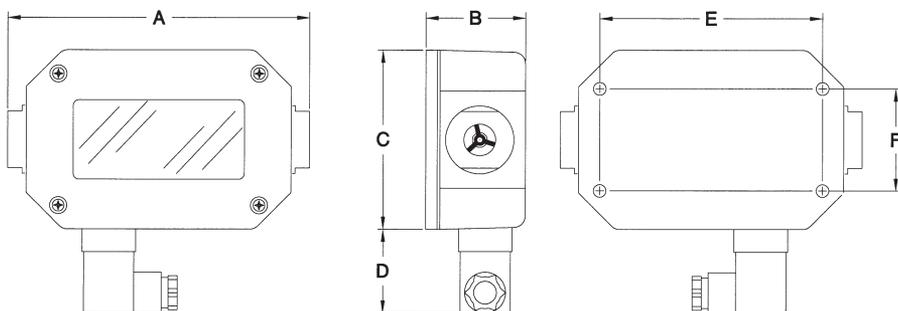
Enclosure & Cover	Painted Aluminum
Seals	Buna-N®
Window	Pyrex®
Din Connector	Polyamide

Buna-N is a registered trademark of Chemische Werke Huls. Pyrex® is a registered trademark of Corning Incorporated.

## Flow Meter Materials of Construction (wetted components)

Casing & End Ports	Anodized Aluminum	Brass	Stainless Steel
Seals	Buna-N (STD), EPR, FKM or Kalrez®	Buna-N (STD), EPR, FKM or Kalrez®	FKM with PTFE backup (STD), Buna-N, EPR or Kalrez®
Transfer Magnet	PTFE coated Alnico	PTFE coated Alnico	PTFE coated Alnico
All other internal parts	Stainless Steel	Stainless Steel	Stainless Steel

Kalrez is a registered trademark of DuPont Incorporated.



## Mechanical - Size Code

DIM	Series 3	Series 4	Series 5	Series 5 (2" port only)
A	6-9/16" (167mm)	7-5/32" (182mm)	10-1/8" (258mm)	12-5/8" (322mm)
B	2-3/16" (56mm)	2-15/16" (75mm)	3-13/16" (97mm)	3-13/16" (97mm)
C	4" (101mm)	4-1/2" (114mm)	5-5/16" (135 mm)	5-5/16" (135mm)
D	1-7/8" (47mm)	1-7/8" (47mm)	1-7/8" (47mm)	1-7/8" (47mm)
E	4-7/8" (128mm)	5" (127mm)	6-3/4" (172mm)	6-3/4" (172mm)
F	2-1/4" (57mm)	2-7/8" (73mm)	3-3/4" (95mm)	3-3/4" (95mm)

# Introduction

This manual is a service guide produced by the manufacturer and provides specific procedures and/or illustrations for disassembly, assembly, inspection, cleaning, and filtration. When followed properly, these procedures will keep your flow meter in top operating condition.

It is important for operators and maintenance personnel to be safety conscious when operating or repairing equipment. Developing a thorough knowledge of the precautionary areas and following safe operating procedures can prevent equipment damage and/or personal injury. Before making any repair, read all of the repair procedures to learn the correct method and all precautions.

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## Basic Application Information

The flow meter can be installed directly in the fluid line without flow straighteners or special piping. The meter is used to measure the flow rate of most liquids which do not contain particles greater than 74 micron.

1. Internal components are sealed inside a painted aluminum enclosure which permit use in areas where the meter may be sprayed or washed with soap and water.
2. Mount the meter in the most convenient location to allow easy access for reading and maintenance.
3. The meter should NOT be mounted near hot pipes or equipment that can increase the ambient temperature above the meter rating. The meter should be mounted at least one foot (.3 meter) from large electric motors, or the internal magnet may weaken or become demagnetized.

## Warning and Precautionary Areas

1. The standard meters are designed to operate in systems that flow in only one direction: the direction of the arrow on the flow scale. Attempting operation in the reverse direction may cause damage to the meter or other system components. (See page 7 for reverse flow information)
2. To retain accuracy and repeatability many internal moving parts are precision machined and require filtration of at least 74 micron or a 200 mesh screen.
3. All liquid meters are tested and calibrated at our test facility using a light hydraulic oil (DTE-25) or water. The units are well drained, but some oil residue may still remain within the meters. Please check the compatibility with your fluid. The meter may have to be cleaned before use. (See “Cleaning & Inspection” section)
4. When installing aluminum or brass meters onto steel pipe caution should be taken not to over tighten the pipe connections. The thread in the meter end fittings may strip if over tightened.
5. It is not recommended to install meters to unsupported piping.
6. Operating Pressure: Meters should not be used above the maximum rated operating pressure.
7. Pressure and flow surges may disengage the outer magnet follower from the transfer magnet. If this occurs, a shock suppressor should be used to eliminate malfunction.
8. Thread seal tape: Caution should be used when using Thread seal tape on pipe thread joints. Leave the first thread of pipe thread exposed from end of pipe when applying tape.
9. These meters, as well as many other meters, use an internal transfer magnet in the design. Because of this magnet, be aware of the following:
  - a) Do not install near highly magnetic devices
  - b) If metal particles are moving through the system, a magnetic filter may be required.

**WARNING: Never hit a flow meter or empty fluid with full fluid flow. This fluid shock or hammering effect on the internals of the flow meter can permanently damage the internal components.**

# Installation

## Basic Installation Instructions

The meters are mounted in-line and are direct reading. The meters can be mounted in a vertical or horizontal position as long as the fluid is flowing in the direction of the arrow on the scale. No straight pipe is required before or after the meter.

When installing a meter, apply “Thread seal Tape” or “Liquid Thread Sealant” on pipe threads. If tape is used, be sure to leave the first pipe thread on end of pipe exposed. Position filter in front of meter and in a location that allows easy access for routine maintenance. Refer to “Warnings and Precautionary Areas” for additional information.

### INSTALLATION DOS AND DON'T

To obtain satisfactory operation from a flow meter, the following points should be considered:

#### DO:

- Install a pressure gauge near the inlet of the meter
- Place throttling valves at the outlet of the meter
- Use pipe sealer on the connections
- Install a union on one side of the meter for easy removal for maintenance and calibration
- Install solenoid valves at meter outlet (as far downstream as possible)
- Mount either vertically or horizontally

#### DO NOT:

- Use in systems where reverse flow is possible unless using RF option
- Place meter in non-aligned piping
- Over-flow the meter by more than 50% of maximum reading
- Operate at pressures and temperatures greater than specified
- Install restrictions between pressure gauges and the meter inlet
- Install solenoid valves at the meter inlet

## Fluid Flow in Reverse Direction

The standard meter should not see flow in the reverse direction (opposite direction to the arrow printed on the flow rate scale). Prolonged flow in the reverse direction will cause damage to the standard meter's internal mechanism that could result in inaccurate readings or premature failure of the meter. If the standard meter will be installed in a system where reverse flow is possible, Lake recommends that a check valve be installed in parallel with the meter in order to facilitate reverse flow around the meter. Check valves are readily available through fluid component distributors.

Alternatively, flow meters designed to allow reverse flow may be specified. These meters do not measure in reverse flow for that Bi-Directional meters are available. These meters are designated by a "-RF" suffix attached to the end of the standard 8-digit model code.

Reverse flow meters will allow flows in the reverse direction of up to the maximum flow rate printed on the flow rate scale without any damage to the monitor's internals.

## Operation

### Operating Principles: Mechanical

We have developed a line of unique flow meters which combine the simplicity of a sharp-edged orifice disk and a variable area flow meter. See Illustration 1 "Flow Meter Cross Section".

The meters are tubular, with all internal wetted parts sealed within the body casing. Running through the center of the body casing is a tapered center shaft which is centered in the bore by pilot disks at each end. Encircling the shaft is a sharp-edged, floating orifice disk, transfer magnet and return spring. The disk and transfer magnet are held in the "no flow" position by the biased return spring.

As the flow moves through the meter it creates a pressure differential across the floating orifice disk, forcing the disk and transfer magnet against the return spring. As flow increases, the pressure differential across the disk increases, forcing the disk and transfer magnet to move along the tapered center shaft. As flow decreases, the biased return spring forces the disk and transfer magnet down the tapered center shaft, returning to the "no flow" position.

In metal casing meters the movement of the floating orifice disk and transfer

magnet cannot be seen because they are sealed inside the body casing. Therefore, a magnet follower is positioned around the outside of the body casing and is magnetically coupled to the internal transfer magnet. As the flow rate increases, the internal magnet moves along the tapered center shaft (inside the body casing) and the magnet follower moves along the outside of the body casing (under the scale).

## Reading the Meter

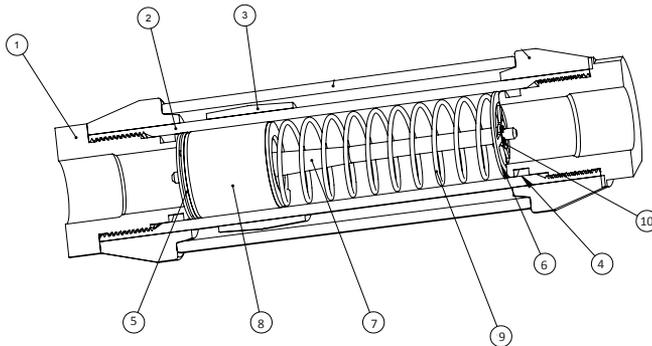
Notice the black reference line which runs 360° around the white magnetic follower. This reference line moves under the scale in direct relation to the movement of the internal orifice disk. When fluid is flowing, the flow rate through the meter is read by lining up the black reference line with the closest rate line on the external flow scale.

## Specific Gravity or Density Effect

Standard meters are calibrated for either WATER with a specific gravity of 1.0 , OIL with a specific gravity of .873 or AIR at specific gravity 1.0. The floating disk meter is affected by fluid density as are most other similar type meters. Lake's

### Illustration 1

#### Flow Meter (Cross Section)



- |                                     |                         |
|-------------------------------------|-------------------------|
| 1. End Porting                      | 7. Tapered Center Shaft |
| 2. Body Casing                      | 8. Transfer Magnet      |
| 3. Magnet Follower                  | 9. Return Spring        |
| 4. Seal Assembly                    | 10. Retainer Ring       |
| 5. Pilot Disk                       |                         |
| 6. Flowing Sharp-Edged Orifice Disk |                         |

meters have less of this effect because of the sharpness of the floating orifice disks being used.

The indicated flow reading will read high for heavier fluids and low for lighter fluids. A corrective factor can be applied to the standard scale or a special scale can be added at a slight additional costs. When measuring fluids with other specific gravities, the basic equations below can be used to develop corrected readings.

- For AIR Meters use:**  $\sqrt{1.0/\text{Specific Gravity}} \times \text{scale reading}$
- For WATER Meters use:**  $\sqrt{1.0/\text{Specific Gravity}} \times \text{scale reading}$
- For OIL Meters use:**  $\sqrt{.873/\text{Specific Gravity}} \times \text{scale reading}$

Figure 1.

**DENSITY CORRECTION FACTORS**

SCFM (indicated) x (CF) = SCFM (Actual)     $CF = (F_1) \times (F_2) \times (F_3)$

Note: all correction factors need not be used.

**Table 1. ( $f_1$ ) PRESSURE CORRECTION FACTORS (inlet pressure)**

psig	25	50	75	100	125	150	175	200
$f_1$	.56	.75	.88	1.0	1.11	1.2	1.29	1.37

$$f_1 = \sqrt{\frac{14.7 + \text{psig}}{114.7}}$$

**Table 2. ( $f_2$ ) TEMPERATURE CORRECTION FACTORS**

°F	10°	30°	50°	70°	90°	110°	130°	150°
$f_2$	1.08	1.04	1.02	1.0	.98	.96	.95	.93

$$f_2 = \sqrt{\frac{530}{460 + ^\circ\text{F}}}$$

**Table 3. ( $f_3$ ) SPECIFIC GRAVITY CORRECTION FACTOR**

$$f_3 = \sqrt{\frac{1}{\text{Sp. Gr.}}}$$

$f_1$  = correction factor for other than 100 PSI inlet.  
 $f_2$  = correction factor for other than 70°F.  
 $f_3$  = correction factor for other than air at 1.0 Sp. Gr.

## Viscosity Effect

The meters incorporate a unique floating, sharp-edged orifice disk. The floating, sharp-edged orifice disk offers greater operating stability and accuracy over a wide range of viscosities up to 500 SUS and for applications above 500 SUS contact factory.

# Pneumatic Meter uses & Operating Theory

Our rugged, high-pressure, pneumatic meters are designed for permanent installation in compressed gas systems. These products provide a low cost means to measure compressor volumetric outputs, pneumatic tool consumptions and other industrial gas flow rates.

The meters operate using the variable annular orifice method with compression spring return –the identical method used in our field proven liquid flow rate meters. The product's follower, where the measurement is indicated, is magnetically coupled through a high pressure casing to the meter's internal orifice assembly.

## **Benefits of these design features are:**

- High operating pressure
- Linear displacement of the follower with respect to flow rate
- Measuring accuracy  $\pm 2.5\%$  of full scale in the center third of the measuring range,  $\pm 4\%$  in upper and lower thirds
- Operation in any mounting orientation

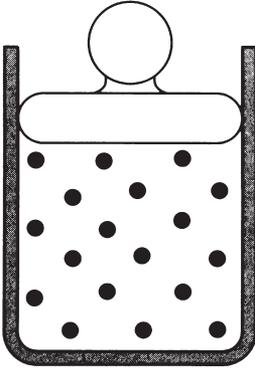
## **Lake meters are offered in three standard materials of construction:**

- Aluminum for standard monitoring applications to 600 PSIG
- Brass for media/material compatibility to 600 PSIG
- Stainless steel for compatibility and operation to 1000 PSIG
- Measuring ranges cover 2–12 SCFM through 150–1300 SCFM

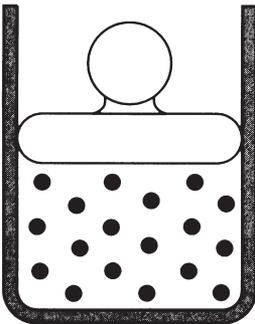
Twenty-four port sizes from 1/4" through 2" in NPTF, SAE and BSPP can be ordered to meet specific plumbing requirements. Lake's pneumatic meters are also available in alarm and basic meter configurations for electronic monitoring applications.

## Illustration 2

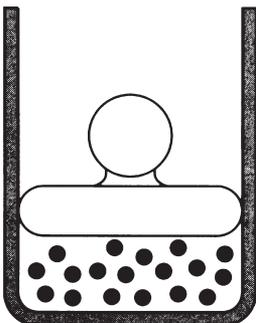
14.7 PSIA (0 PSIG)



29.4 PSIA (14.7 PSIG)



58.8 PSIA (44.1 PSIG)



### Standard Cubic Feet

Lake's meter are calibrated to measure the flow of compressible media (gases) in SCFM - standard cubic feet per minute. A "standard" cubic foot is defined as a cubic foot of dry air at standard atmospheric conditions: 70°F and 14.7 PSIA (0 PSIG) measured at sea level.

When a standard cubic foot of air is compressed, its actual volume will decrease proportionally as absolute pressure increases. For example, a standard cubic foot of air's actual volume will decrease by 50% and density will increase by 100% as the air is compressed from atmospheric pressure 14.7 PSIA (0 PSIG) to 29.4 PSIA (14.7 PSIG). **See Illustration 2.**

There are three factors that affect the Flow Meter Calibration: specific gravity, pressure and temperature. Lake meters are calibrated for air (specific gravity of 1.0) at 70°F and 100 PSIG. Most low pressure rotameters are calibrated at 0 PSIG and require corrections for use at any other pressure.

Lake products are designed for pneumatic systems where pressures between 90 -110 PSIG are used. In these common applications, a Lake monitor with a standard calibration can be read directly without applying corrections.

## Correction Factors

If a flow meter is installed in a system where conditions differ from the standard listed on page 9 (Figure 1.) correction factors will need to be applied to retain the design accuracy of the meter. The appropriate correction factor equations are detailed on page 9. To assure the best monitoring accuracy, pressure and temperature measurements should be taken directly at the meter's inlet port.

## Special Scales

Special calibrations can be performed by Lake Monitors to correct for the following system characteristics:

- System temperature
- Media specific gravity
- Various measuring units (i.e. LPM, LPS, m3/hr, etc.)
- Any combination of the above

*Consult Lake's factory or your distributor for details and prices.*

## Selecting the Proper Meter

To order a pneumatic flow meter the following information is required:

- Pipe size and port style
- Media (air, nitrogen, argon etc.) – for material compatibility and specific gravity considerations
- Flow range required
- Nominal System pressure
- System temperature

## Operation

### Operation Principle: Electronics

The Flow Transmitters are typically used to transmit a signal proportional to flow rate to a process control computer, a PLC, a recorder, or a panel-mount display. The Flow Transmitters are used as the primary input device to record flow rates through hydraulic, water and pneumatic systems.

The universal output transmitter circuit employed by the Lake Flow Transmitter is capable of producing output signals of 4–20 mA, 0–5 VDC, and 0–2000 Hz square wave pulse. A 1–5 VDC signal may be obtained by connecting a 249  $\Omega$  resistor to the 4–20 mA loop.

## Overview

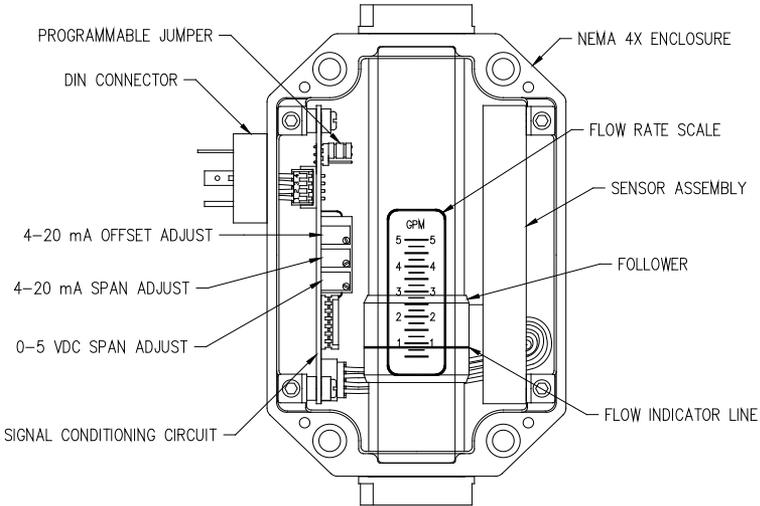
**Illustration 3** shows a Flow Transmitter with the cover removed. The follower moves in unison with an orifice plate inside of the unit's pressure vessel via a magnetic coupling in order to indicate flow rate. As the follower moves with changes in flow rate, the flow rate is determined by relating the position of the flow indicator line to the increments on the flow rate scale.

The sensor array located in the sensor assembly sends a signal relative to the position of the follower to the signal conditioning circuit. The signal conditioning circuit converts the signal from the sensor array into three different signals. These signals are all directly proportional to the reading that is determined by relating the position of the flow indicator line to the flow rate scale.

The user may choose between reading a 0–2000 Hz square wave pulse, a 0–5 VDC analog signal, or a two-wire 4–20 mA analog signal by connecting to the appropriate pins on the 4-pin Hirschmann® DIN connector and by placing the programmable jumper in the appropriate position for the desired output.

An analog 1–5 VDC output may also be obtained by configuring the unit for the two-wire 4–20 mA output and then connecting a 249 ohm resistor to the current loop. The exact output pins and jumper positions that correspond to each output are discussed later in this manual.

### Illustration 3



## 4-20 mA Output Connections

### Input Voltage

The supply voltage must be between 12 and 35 VDC. The maximum resistance that may be placed within the current loop is given by the following formula:

$$R_{\max} = 50(V_s - 12)$$

Where:  $R_{\max}$  = the maximum resistance that may be placed in the current loop ( $\Omega$ )

$V_s$  = the value of the supply voltage (VDC)

Illustration 4

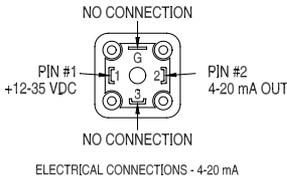
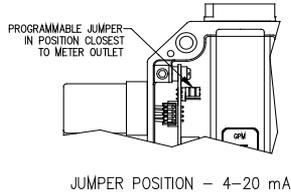


Illustration 5



## 4-20 mA Output Connections

### Wiring Instructions (Refer to Illustrations 4 and 5 above):

1. Move the jumper on the signal conditioning board into the position closest to the meter's outlet, as shown in Illustration 5.
2. Connect the positive DC power source (+12 to +35 VDC) to terminal #1 on the DIN connector
3. Connect terminal #2 of the DIN connector to the positive current input on the receiving device.
4. If the power source does not originate from the receiving device, the negative side of the power supply must be connected to the signal ground of the receiving device.
5. If the transmitter is operating properly, the green LED on the signal conditioning board will illuminate dimly at zero flow and will increase in intensity as flow increases.

Illustration 6

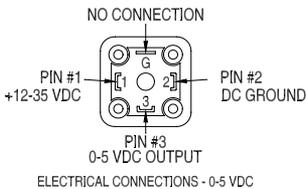
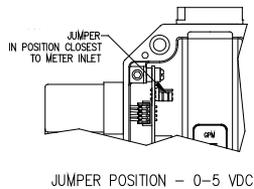


Illustration 7



## 0-5 VDC Output Connections

### Wiring Instructions (Refer to Illustrations 6 and 7 above):

1. Move the jumper on the circuit board into the position closest to the meter's inlet, as shown in Illustration 7.
2. Connect the positive voltage source (+12 to +35 VDC) to terminal #1 of the DIN connector.
3. Connect terminal #2 of the DIN connector to the negative side of the DC voltage source.
4. Connect terminal #3 of the DIN connector to the 0-5 VDC input of the receiving device.
5. If the power source does not originate at the receiving device, a wire will need to be connected between the negative side of the voltage source and the signal ground of the receiving device.
6. If the transmitter is operating correctly, the green LED on the circuit board will illuminate brightly when power is applied to the unit.

*NOTE: The input impedance (resistance) of the receiving device must not be lower than 1000  $\Omega$  or non-linearities may result. Lower impedance will not damage the transmitter.*

Illustration 8

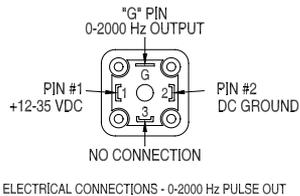
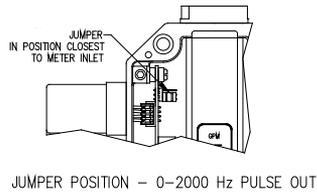


Illustration 9



## 0-2000 Hz Pulse Output Connections

### Wiring Instructions (Refer to Illustrations 8 and 9 above):

1. Move the jumper on the circuit board into the position closest to the meter's inlet, as shown in Illustration 9.
2. Connect the positive voltage source (+12 to +35 VDC) to terminal #1 of the DIN connector.
3. Connect terminal #2 of the DIN connector to the negative side of the DC voltage source.

4. Connect the “G” terminal of the DIN connector to the pulse input of the receiving device.
5. If the power source does not originate at the receiving device, a wire will need to be connected between the negative side of the voltage source and the signal ground of the receiving device.
6. If the transmitter is operating properly, the green LED on the circuit board will illuminate brightly when power is applied to the unit.

*NOTE: The input impedance (resistance) of the receiving device must not be lower than 1000  $\Omega$  or non-linearities may result. Lower impedance will not damage the transmitter.*

## Connectors

Standard flow sensors are prewired with 4-wire Hirschmann-type DIN connectors which consist of a female section as shown in **Illustration 10** and a male section as shown in **Illustration 11**. In order to make the user connections, the screw terminals located inside of the female section must be accessed.

To open the female section, first remove the screw and then lift the connector portion out of the casing by inserting the head of a screwdriver into the slot marked for that purpose.

**Illustration 12** shows the disassembled female section. The screw terminal connections can be seen on the piece located at the far right side of the illustration. Alternate connectors are available on a custom basis.

Illustration 10



Illustration 11



Illustration 12

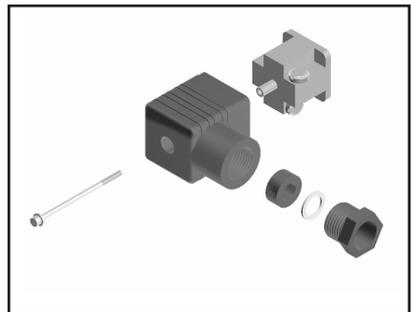
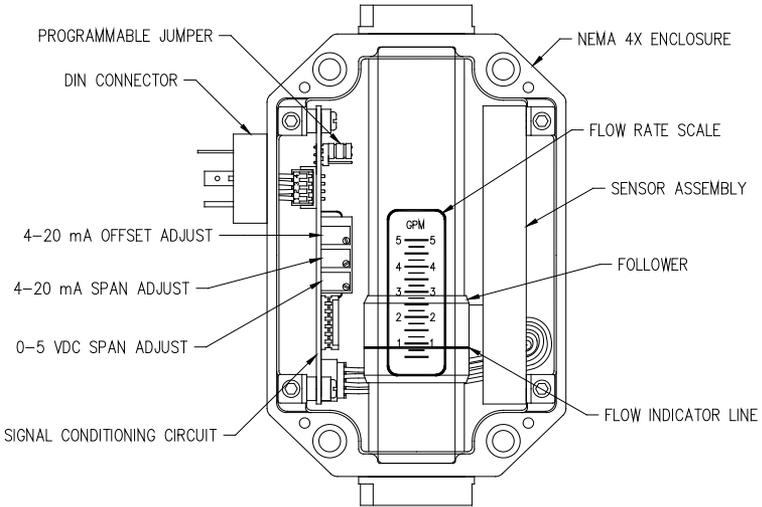


Illustration 13





# Troubleshooting & Maintenance

<b>TROUBLESHOOTING CHART</b>	
<b>Symptom</b>	<b>Solution</b>
<b>The green LED does not illuminate when power is applied.</b>	<p>Re-check the wiring diagram for the signal output that is being used and verify that the wiring is correct.</p> <p>Verify that the DC supply that is being used is capable of producing at least 12 VDC.</p> <p>Make sure that the cable that is soldered to the DIN connector inside of the sensor enclosure is plugged into the connector opposite to the programmable jumper.</p>
<b>The readings obtained from the electronic output do not agree with the readings shown on the printed flow rate scale.</b>	<p>Make sure that the programmable jumper is in the correct position for the signal output that is being used and verify that the wiring is correct.</p>
<b>The green LED illuminates, but no readings are obtained from the sensor's electronic output.</b>	<p>Re-check the wiring diagram for the signal output that is being used and verify that the wiring is correct.</p> <p>Make sure that the cable from the sensor assembly is plugged into the connection on the signal conditioning board located near the sensor inlet.</p>
<b>When the flow rate in the systems changes, the follower and electronic output do not respond.</b>	<p>Remove the flow sensor from the hydraulic systems and inspect the internals to see if anything has caused them to become jammed. Make sure that the 200 mesh, 74 micron filtration required of the flow sensor is being observed.</p>

# Troubleshooting & Maintenance

## TROUBLESHOOTING CHART

**Malfunction: Magnet follower sticks in mid-scale and will not return to the “no flow” position.**

**Possible Cause:**

**Horizontal/Vertical Mount**

Particulate, thread seal tape, rust or other foreign matter is holding the internal parts from returning.

**Horizontal/Vertical Mount**

A surge or shock in the fluid flow moved the internal magnet faster than the external follower could follow, thus separating the follower from the magnet.

**Corrective Action:**

Disassemble and inspect meter for contamination. Install proper filtration or problem may reoccur.

Remove cover and manually slide follower until it re-couples with internal magnet.

**Malfunction: Meter scale reading is off an equal amount at all points and the magnet follower still moves freely.**

**Possible Cause:**

Reading the scale using the top or bottom edge of the magnet follower.

**Corrective Action:**

Be sure to read the scale using the black reference line which runs around the magnet follower.

**Possible Cause:**

Fluid being monitored may not be compatible with standard meter scale.

**Corrective Action:**

Standard meters are calibrated for .873 SP. Gr oil at 110°F (43°C) , water 1.0 sg at 70°F (21°C) and air at 1.0 sg 70°F (21°C), and 100 PSIG (6.8 bar). Check your fluid data for variance or call the factory for assistance.

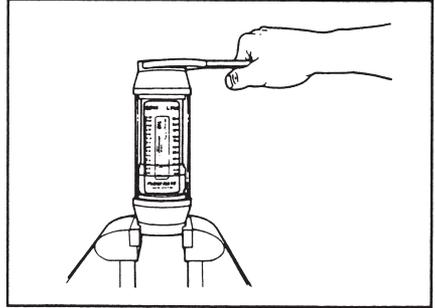
## Disassembly

**IMPORTANT:** It is not necessary to remove window tube or window seals to clean the meter. Note also how the meter disassembles for ease of reassembly.

**WARNING:** Shut down system before removing meter from flow line.

1. Use a clean dry cloth to remove all foreign material from exterior of meter, especially around threaded ends.
2. Remove meter from the flow line.
3. With the arrow on the scale pointing upward, mount the meter in a vice. See **Illustration 3**. Use the flats of the inlet end porting when securing the meter in the vice.

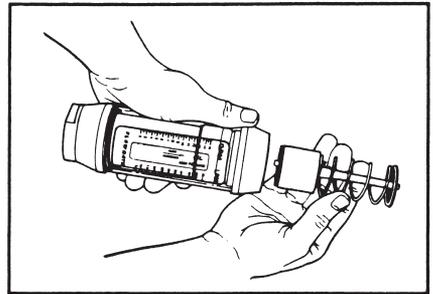
Illustration 3



**IMPORTANT:** DO NOT wrench or tighten vice on window tube.

4. Install a wrench across the flats of the outlet end porting and turn counterclockwise to loosen assembly. Do not remove end porting at this time.
5. Remove meter from vice. Hold the meter so the end port that is loose, is on top. Remove loose end porting.

Illustration 4



## Cleaning & Inspection

*Note: If the inner cartridge is damaged or contaminated beyond repair, the complete meter can be sent to the manufacturer for evaluation. The manufacturer will repair or replace parts as needed.*

1. Inspect inner cartridge and body casing for contamination. If the inner cartridge did not slide out freely, it may be a sign of contamination. Locate and eliminate the source of contamination before reconnecting meter to the system or the same problem will reoccur. It may be necessary to install finer filtration or a magnetic filter in the system.
2. Soak inner cartridge assembly in a suitable cleaning solvent. Naptha or Stoddard is recommended.
3. Remove parts from solvent. Use an air hose and/or scrub with a light brush to remove any remaining contaminants. Remove any magnetized particles from transfer magnet.
4. Inspect inner cartridge for scored or worn parts.
5. Remove any contaminants from inside body casing.
6. Clean and inspect seal assemblies (O-rings and seals) for nicks or cuts. Replace as needed.

Properly filtered meters will provide years of trouble-free service. If the meter is not properly filtered, it may be damaged and malfunction. Meter damage caused by excessive contamination is not covered under warranty.

## Contamination and Filtration

### Recommended Filtration

The manufacturer recommends system filtration of at least 74 micron filter or a 200 mesh screen. It has been found that if inadequate filtration has caused meter failure, it will normally fail in the open position. Some systems may require a magnetic filter.

**IMPORTANT:** Meter damage caused by excessive contamination is not covered under warranty.

### Contamination Sources

#### Fresh Fluid

When fresh fluid is stored in holding tanks, it may be contaminated with scale or metal flakes from inside the tank. To prevent this type of contamination, be sure to filter fresh fluid before adding to the system.

#### New Machinery Contamination

When building new machines, a certain amount of built-in contamination is unavoidable. Typical built-in contamination consists of dust, dirt, chips, fiber, sand, flushing solutions, moisture, weld splatters and pipe sealants. Flushing the system before operation can reduce contamination, but cannot eliminate it totally. Unless the system is flushed at a high velocity, some contamination will not be dislodged until the system is in operation. System contamination can cause fluid component malfunction.

#### Environmental Contamination

When performing routine maintenance, the system's fluid is commonly exposed to environmental contamination. Exercise caution during routine maintenance to prevent this type of contamination. Be sure to change breather filter and systems air filter regularly.

#### Self-Generation Contamination

Self-generated contamination is a product of wear, cavitation, fluid breakdown and corrosion. Systems that are carefully flushed, maintained, and have fresh fluid added, mainly have self-generated contamination. In this case, proper filtration can prevent fluid component malfunction.



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