

# Installation & Operation

## PADDLE WHEEL TURBINE FLOW METERS





## Introduction

This manual is a service guide produced by the manufacturer. The manual provides specific procedures and/or illustrations for installation, inspection, cleaning and filtration of all KW Series flow meters. When properly followed, these procedures will keep your paddle wheel flow meter operating dependably for many years.

It is important for operators and maintenance personnel to be safety conscience 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.

## Description of Operation

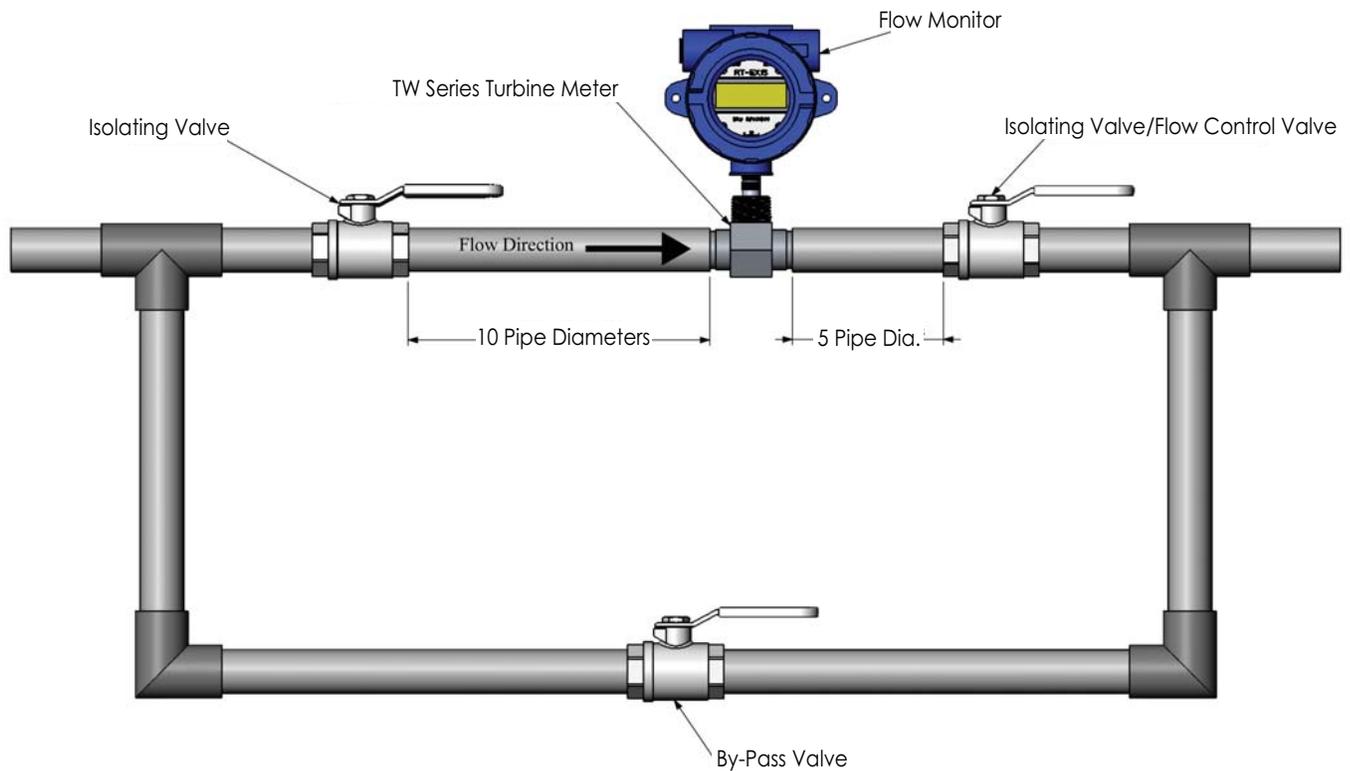
The SABRE Flow paddle wheel flow meters integrate rugged tangential turbine technology with a precision electronic output signal hermetically encapsulated within the body of the meter. The flow transmitter is ideal for measuring flow rates in cooling circuits, HVAC systems and batching operations.

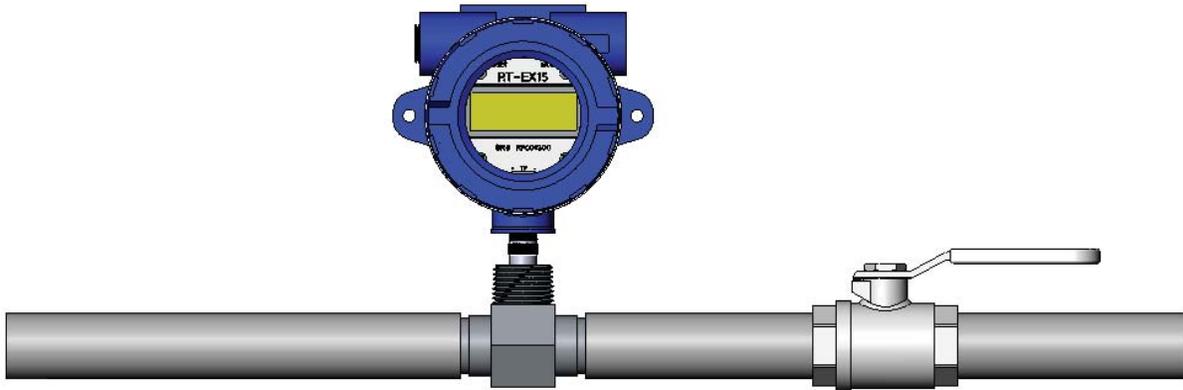
Additional features are:

- Simple in-the-field serviceability of its moving components.
- The integral 4-20mA circuit design eliminates the need for separate signal conditioning modules.
- Units come factory calibrated to your system requirements.
- The low impedance 4-20mA circuit can transmit a "clean" signal over low-cost wire for several thousand feet without degradation.
- Accurately measures flow in both directions.

## Installation - Mechanical

1. The KW flow meter has NPT (National Pipe Thread) plumbing connections. Lake Monitors recommends that a paste type pipe sealant be used on these threads. [Teflon tape sealant can be used as long as it is applied in such a way that it will not enter the flow stream. Pieces of Teflon tape can wrap around the turbine and impede its rotation.]
2. The recommended mounting orientation would be any plane that will place the axis of the turbine horizontal with respect to the ground. The unit will operate satisfactorily with its axis at angles other than horizontal, but side loading of the bearing surfaces will lead to premature wear of the rotating parts.





3. For optimum flow meter performance a minimum length of upstream and downstream piping is required. It is recommended that a minimum length equal to **10 pipe diameters** of straight pipe be installed directly on the upstream side of the flow meter and **5 pipe diameters** on the downstream side of the flow meter. This helps to eliminate turbulence in the fluid. Having shorter pipe lengths, other system components and elbows too close to the flow meter may adversely affect the accuracy and repeatability of the flow meter. Piping should be the same size as the meter bore or port size.

Do not locate the flow meter or the connection cable close to electric motors, transformers, sparking devices, high voltage lines or place connecting cable in a conduit with wire supplying power for such devices. These devices can induce false signals in the flow meter coil or cable, causing the meter to read inaccurately.

4. It is recommended that the meter be installed in such a position that the round access cover can be removed for cleaning and turbine servicing. It is also recommended that a union be placed near the sensor to allow easy removal.

## Installation - Electronic (4-20mA Only)

The KW circuit is a two-wire loop-powered design that transmits a 4-20mA signal that is proportional to flow rate. The noise-immune current transmission from the sensor can be routed with low cost two conductor twisted-pair cable. The circuit operates on 12-35 Vdc and requires a source capable of supplying at least 24mA of current. The circuit has built in polarity protection and over-current limiting to protect both the transmitter and what the transmitter is connected to.

1. Connect the red wire (pin 1 for units with the electronic disconnect option) from the transmitter sensor to the positive 12-35 Vdc power supply output.
2. Connect the black wire (pin 2 for units with the electronic disconnect option) from the transmitter to the positive side of the loop load (resistor, chart recorder, data acquisition board, meter, etc.). This connection may be labeled "4-20mA Input" or "4-20mA (+)" on some devices.
3. If applicable, connect the negative side of the loop load to negative side of the power supply.
4. Apply power to the system.
5. If everything is operating correctly, the green LED on the meter will illuminate and 4mA will be flowing in the loop. As the flow rate increases, the intensity of the green LED will increase in proportion to the mA output signal for trouble shooting purposes.

### **If the LED does not illuminate:**

- Check wiring terminations for good connections
- Check wiring polarity
- Verify correct supply voltage
- Ensure that the load impedance is within allowable limits
- Apply the DC supply voltage directly across the sensor wires. If the LED does illuminate, the load is either: too great of impedance or an open circuit. If the LED does not illuminate, the sensor's lead wires or circuit are defective.

## Installation - Electronic (0-5Vdc Output Only)

1. Connect the red wire (pin 1 for units with the electronic disconnect option) from the sensor to the positive terminal of the 12-35 VDC power supply.
2. Connect the black wire from the transmitter (pin 2 for units with the electronic disconnect option) to the negative terminal of the 12-35 VDC power supply.
3. Connect the green wire from the transmitter (pin 3 for units with electronic disconnect) to the (+) 0-5 Vdc input of the data acquisition device. This connection may be labeled "Voltage Input" or "Analog Input" on some devices.
4. If applicable, connect the negative side of the power supply to the negative side of the pulse input.
5. Apply power to the system.
6. If everything is operating correctly, the green LED will illuminate brightly and the data acquisition device should show an increase in flow rate as fluid starts flowing through the sensor.

If data acquisition device does not show an increase in flow rate:

- Check wiring terminations for good connections
- Verify that the LED is illuminated
- Verify that the DC supply voltage is between 12 and 35 Vdc

## Installation – Electronic (Pulse Output Only)

The KW pulse output circuit is a three-wire DC-powered design that transmits a frequency proportional to flow rate. The circuit operates on 5-24 Vdc and will consume a maximum of 25 mA from the power supply.

1. Connect the red wire (pin 1 for units with the electronic disconnect option) from the sensor to the positive terminal of the 5-24VDC power supply.
2. Connect the black wire from the transmitter (pin 2 for units with the electronic disconnect option) to the negative terminal of the 5-24 Vdc power supply.
3. Connect the green wire from the transmitter (pin 3 for units with electronic disconnect) to the (+) pulse input of the data acquisition device. This connection may be labeled "Pulse In" or "DC Input" on some devices.
4. If applicable, connect the negative side of the power supply to the negative side of the pulse input.
5. Apply power to the system.
6. If everything is operating correctly, the data acquisition device should begin "counting" pulses when fluid starts flowing through the sensor.  
If the data acquisition device is not "counting":
  - Check wiring terminations for good connections
  - Verify correct supply voltage and current
7. The installation should be complete. The relationship between the frequency output and flow rate is shown in the graphs above.

## Installation – Electronic (Relay Output Only)

1. Connect the red wire from the sensor to the positive terminal of the 12-35 Vdc power supply.
2. Connect the black wire from the transmitter to the negative terminal of the 12-35 Vdc power supply.
3. (Versions with stainless steel sensor body only) Be sure to properly ground the KW sensor housing by connecting a ground wire to the sensor body.

This step may be unnecessary if the piping system that the flow sensor is plumbed into is already connected to Earth ground.

4. Wire the appropriate relay contacts to the load that is to be switched per Table 1 below.
5. If the unit is operating correctly, the green power indication LED and the red relay status LED should illuminate after the DC supply voltage is turned on. As fluid flow is increased above the factory-adjusted set point, the red relay status LED should turn off.

If the LEDs do not illuminate when power is applied:

- Check wiring terminations for good connections
- Verify that the DC supply voltage is between 12 and 35 Vdc

**Table 1: Wiring Connections**

Wire Color	Connection
Red	+12-35 Vdc
Black	DC Ground
Green	Relay Common
White	Relay Normally Closed Contact
Brown	Relay Normally Open Contact

*Note: Relay condition shown is with power on & flow rate above setpoint.*

## Set Point Adjustment (Relay Output Only)

1. Adjust the flow rate through the line in which the KW meter is installed to the rate that corresponds to the desired relay trip point.
2. If the red LED on the back side of the sensor is not illuminated, use a small flat bladed screwdriver to slowly turn the adjustment screw on the set point potentiometer counter-clockwise until the red LED illuminates.
3. If the red LED is already illuminated, turn the adjustment screw on the potentiometer clockwise until red LED turns off. Next, slowly rotate the adjustment screw counter-clockwise until the red LED illuminates.
4. Once the set point has been adjusted, the relay will operate as shown in the Truth Table illustrated in Table 2 below.

**Table 2: Truth Table - Relay Operation**

Condition	Relay NC Contact	Relay NO Contact	Red LED	Green LED
Flow rate < set point	Open	Closed	Illuminated	Illuminated
Flow rate > set point	Closed	Open	Not Illuminated	Illuminated
Loss of power to sensor	Open	Closed	Not Illuminated	Not Illuminated

## Service and Maintenance

The sensor is designed to provide years of low maintenance service in industrial environments. As with all mechanical rotating devices, the bearing surfaces will wear with use. The life of the parts will depend on factors such as cleanliness of the fluid, media, mounting orientation, temperature, fluid velocity and frequency of operation. The KW meter was designed with simple field-replacement of the rotating parts in mind. To inspect or replace the rotating components:

1. Relieve pressure in the piping system.
2. Remove the retainer ring that secures the turbine access cover.
3. Remove the access cover with pliers, taking care not to damage the o-ring seal.
4. Pull out the turbine assembly and the shaft.
5. Inspect the shaft for things that may have wrapped around it.
6. Inspect the turbine bearing surface for wear and elongation. Replace as necessary.
7. Clean any rust off of the magnets that may have accumulated.
8. Reassemble the unit by placing the turbine into the body cavity with the two magnet pockets facing inward. Place the shaft into the turbine hole and guide it into the retaining hole in the body cavity. Lubricate the o-ring seal with some glycerin or other lubricant and press it into the pocket of the body. Replace the retaining ring securely before applying pressure to the system.

#### **Circuit recalibration (4-20mA version):**

1. Place a milliamp meter into the current loop.
2. Turn off the flow going through the meter. Adjust the OFFSET control for a reading of 4mA on the milliamp meter.
3. Adjust the flow rate through the meter to full flow rate. Adjust the SPAN control for a reading of 20mA on the milliamp meter. The two controls are not interactive, so further adjustment should not be necessary.

#### **Circuit recalibration (0-5Vdc version):**

1. Place a voltmeter across the black & green wires of the sensor pigtail.
2. Turn off the flow going through the sensor. Verify a reading of less than 50 mVdc on the voltmeter.
3. Adjust the flow rate through the meter to full-scale flow rate. Adjust the SPAN control for a reading of 5 Vdc on the voltmeter.

# Turbine Specifications

---

## Flow Meter with Stainless Steel Body

---

Maximum pressure:	200 PSI clear cover, 500 PSI SS cover
Flow rate accuracy:	±2% of full scale
Repeatability:	±0.5% of scale
Maximum temperature:	225°F
Measuring range*:	½" NPT: 0.5 - 15 GPM; ¾" & 1" NPT: 1.5 - 50 GPM
Wetted materials:	316 SS, acetyl copolymer, Buna, PEEK and polycarbonate
Non-wetted materials:	Epoxy, Lexan® and PVC

---

## Flow Meter with Polypropylene Body

---

Maximum pressure:	150 PSI
Flow rate accuracy:	±2% of full scale
Repeatability:	±0.5% of scale
Maximum temperature:	150°F
Measuring range*:	<b>ES version:</b> 0.5-15 GPM; <b>ES-LF version:</b> 0.25-4.5 GPM
Wetted materials:	316 SS, acetyl copolymer, Buna, PEEK, polycarbonate and polypropylene
Non-wetted materials:	Epoxy, Lexan® and PVC

*\*Important: Choose a maximum flow rate. For ½": 5 - 15 maximum GPM. For ¾" and 1": 15 - 50 maximum GPM. Minimum flow rate will be 10% of maximum flow rate. Example: If your maximum flow rate is 8 GPM, the minimum flow rate would be .8 (8 x .1 = .8). Thus, the correct flow range would be .8 - 8.0 GPM.*

# Electronic Specifications

---

## 4-20 mA Versions

---

Power requirements:	12-35 VDC, loop powered
Load driving capacity:	1150 Ohms maximum
Maximum transmitting distance:	Limited only by wire resistance & supply voltage
Response time:	2 seconds to 90% (step change)
Resolution:	Infinite
Over-current limit:	Self limiting at 35 mA
Other protection:	Reverse polarity

---

## 0-5 VDC Versions

---

Power requirements:	12-35 VDC
Maximum current:	25 mA DC
Minimum load resistance:	1000 Ohms
Maximum transmission distance:	200 feet recommended
Response time:	> 5 seconds to 90% (step change)
Resolution:	Infinite

---

## Pulse Output Versions

---

Power requirements:	5-24 VDC
Maximum current:	25 mA DC
Minimum load resistance:	1000 Ohms
Maximum transmission distance:	200 feet recommended
Response time:	< 100 mS
Protection:	Short circuit & reverse polarity
K-Factor:	1/2" port $\approx$ 200 pulses/gallon 3/4" & 1" ports $\approx$ 60 pulses/gallon

---

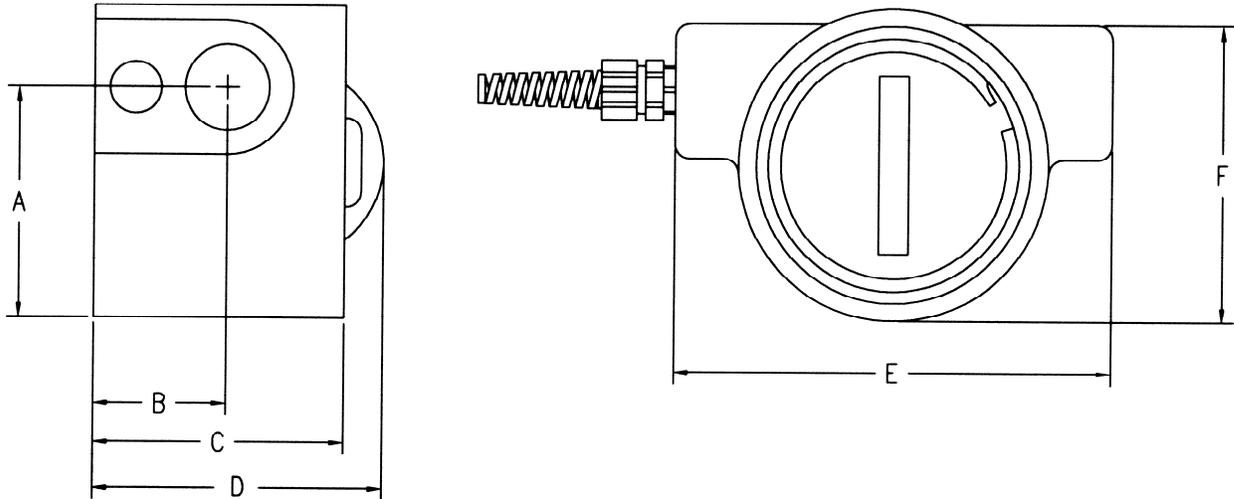
## Relay Output Versions

---

Power requirements:	12-35 VDC
Maximum transmission distance:	200 feet recommended
Switch contact:	Form C, 5A max @ 120 or 240 VAC
Hysteresis:	5% of set point maximum
Set point repeatability:	1% of full scale

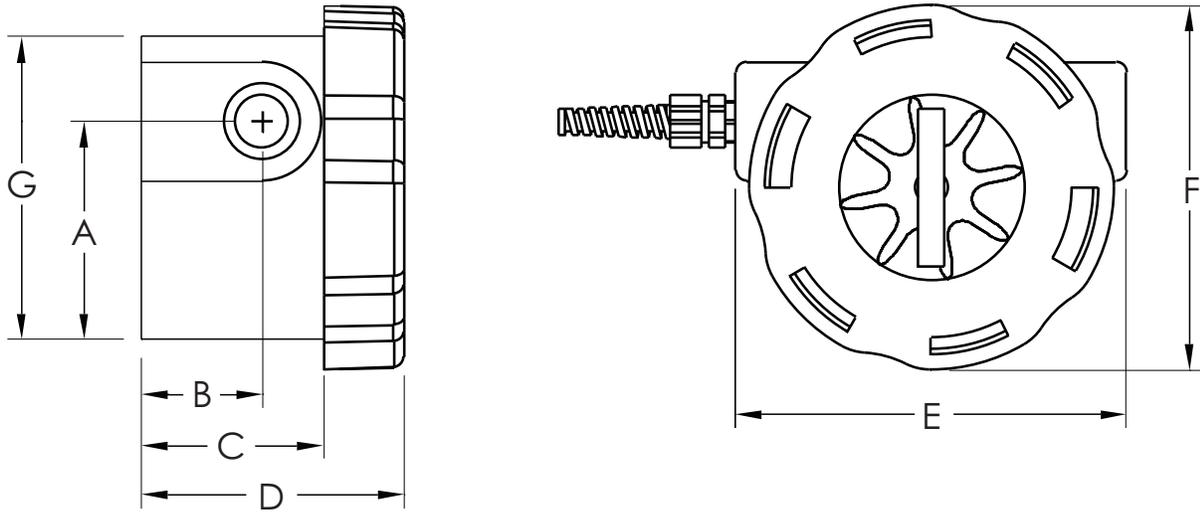
## Dimensional Drawings

### Flow Meter with Stainless Steel Body



Dim	1/2" NPTF Ports	3/4" & 1" NPTF Ports
A	1.94" (49 mm)	3.06" (78 mm)
B	1.13" (29 mm)	1.33" (34 mm)
C	2.00" (51 mm)	2.46" (62 mm)
D	2.60" (66 mm)	2.88" (73 mm)
E	3.70" (94 mm)	5.25" (133 mm)
F	2.63" (67 mm)	3.80" (97 mm)
F2	3.38" (86 mm)	n/a

## Flow Meter with Polypropylene Body



Dim	1/2" NPTF Ports
A	2.10" (53 mm)
B	1.15" (29 mm)
C	1.75" (44 mm)
D	2.50" (63 mm)
E	3.70" (94 mm)
F	3.45" (88 mm)
G	2.85" (72 mm)

For downloadable product manuals, data sheets and technical documents,  
visit SABRE's website today!

[www.sabreturbines.com](http://www.sabreturbines.com)



AW-Lake Company | 8809 Industrial Drive | Franksville, WI 53126  
P: 800-850-6110, 262-884-9800 | F: 262-884-9810