



Flow Sensor

Plastic Tee Type Flow Sensor

Model: FS-735-10



USER MANUAL

TABLE OF CONTENTS

Introduction	2
Scope of This Manual	2
Unpacking and Inspection	2
Safety	3
Terminology and Symbols	3
Considerations	3
Electronic Types	4
Series 735	4
Mechanical Installation	4
Electrical Installation Guidelines	5
Flow Sensor Installation	6
Additional Information	6
Calibration	7
Calibration Table	7
Dimensions	8
Specifications	9

INTRODUCTION

Used in conjunction with any K-Rain® flow monitor or endpoint, K-Rain® non-magnetic flow sensors provide an accurate reading of the rate of liquid flow as well as total accumulated flow. A number of sensor models are offered, which cover applications for a wide range of pipe sizes and pressure/temperature specifications.

The flow sensors generate a frequency which is proportional to flow rate. An internal preamplifier allows the pulse signal to travel up to 2000 feet without further amplification. The bearing assembly, shaft and O-rings are replaceable in the field.

The FS-735-10 flow sensor features a four-blade impeller design, using a proprietary, non-magnetic sensing technology. As the liquid flow turns the impeller, a low impedance signal is transmitted with a frequency proportional to the flow rate. Sensors of similar type are interchangeable, so there is no need for recalibration after servicing or replacement.

SCOPE OF THIS MANUAL

This manual is intended to help you get the K-Rain® FS-735-10 flow sensor up and running quickly.

IMPORTANT: *Read this manual carefully before attempting any installation or operation. Keep the manual accessible for future reference.*




UNPACKING AND INSPECTION

Upon opening the shipping container, visually inspect the product and applicable accessories for any physical damage such as scratches, loose or broken parts, or any other sign of damage that may have occurred during shipment.





NOTE: *If damage is found, request an inspection by the carrier's agent within 48 hours of delivery and file a claim with the carrier. A claim for equipment damage in transit is the sole responsibility of the purchaser.*

SAFETY

Terminology and Symbols

-  **DANGER** *Indicates a hazardous situation, which, if not avoided, is estimated to be capable of causing death or serious personal injury.*
-  **WARNING** *Indicates a hazardous situation, which, if not avoided, could result in severe personal injury or death.*
-  **CAUTION** *Indicates a hazardous situation, which, if not avoided, is estimated to be capable of causing minor or moderate personal injury or damage to property.*

Considerations

-  **CAUTION** *The flow sensor described in this manual is not intended for use in safety critical applications. Use of the device in this manner is done at the sole discretion of the customer and/or end user of the device.*
-  **CAUTION** *The flow sensor described in this manual is not intended for use in systems with flammable liquids or gases. Additionally, the device is not intended for systems containing hazardous fluids, or fluids other than water.*
-  **CAUTION** *The flow sensor described in this manual must be installed in accordance with all local and federal codes or end use standards as applicable.*
-  **CAUTION** *If the devices described in this manual are used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.*

IMPORTANT: *Not following instructions properly may impair safety of equipment and/or personnel.*

ELECTRONIC TYPES

K-Rain® FS-735-10 sensor electrical components are self-contained. See “Specifications” on page 9 for pressure and temperature ratings.

These models feature a modified PVC tee with solvent weld socket end connections and a removable PPS sensor insert. BSP threaded adapters are available.

MECHANICAL INSTALLATION



CAUTION

Depressurize and vent piping system prior to any installation or maintenance of the flow sensor.

The accuracy of flow measurement for all flow measuring devices is highly dependent on proper location of the sensor in the piping system. Irregular flow velocity profiles caused by valves, fittings, and pipe bends can lead to inaccurate overall flow rate indications, even though local flow velocity measurement may be accurate. A sensor located in the pipe where it can be affected by air bubbles, floating debris or sediment may not achieve full accuracy and could be damaged. K-Rain® flow sensors are designed to operate reliably under adverse conditions, but the following recommendations should be followed to ensure maximum system accuracy:

- Choose a location along the pipe with ten pipe diameters upstream and five pipe diameters downstream of the sensor provide no flow disturbance. Pipe bends, valves, other fittings, pipe enlargements and reductions should not be present in this length of pipe.
- The preferred location for the sensor around the circumference of a horizontal pipe is on top. If trapped air or debris will interfere, then the sensor should be located further around the pipe from the top but not more than 45 degrees from top dead center. The sensor should never be located at the bottom of the pipe, as sediment may collect there. Locations off top dead center cause the impeller friction to increase, which may affect performance at low flow rates and increase wear. Any circumferential location is correct for installation in vertical pipes. Rising flow preferred to reduce effects of any trapped air.

ELECTRICAL INSTALLATION GUIDELINES



DANGER *Disconnect power from flow sensor source and/or receiving device prior to any installation or maintenance of the system.*



DANGER *Flow sensor source and/or receiving device must provide basic isolation from mains for safe operation of the system.*

The sensor leads are supplied with watertight caps over the ends.

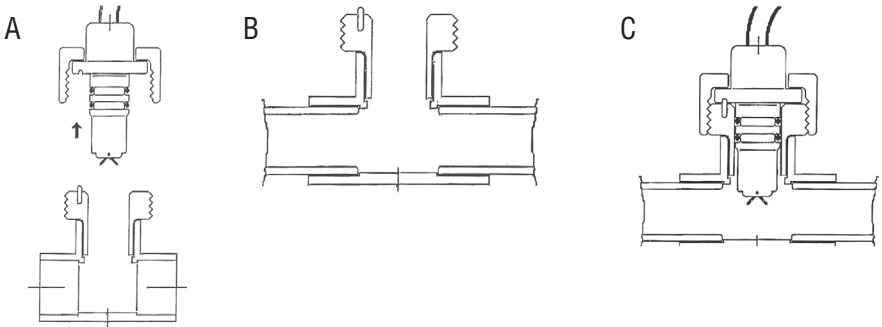
- Do not remove the plastic caps from the sensor leads until you are ready to splice.
- Use a twisted pair cable suitable for direct burial to connect the sensor to the endpoint, monitor, or controller. Multi-pair telecommunication cable or direct burial cables may be used.
- Make a watertight splice using a two-part epoxy type waterproof kit. Be sure the epoxy seals the ends of the cable jacket.
- Make sure the epoxy is hardened before inverting the splice or dropping it in standing water.
- Do not make an underground splice unless absolutely necessary.
- Route the cable from the sensor to a K-Rain® flow monitor or endpoint. The cable may be extended up to 2000 ft, using two-conductor shielded 20 AWG or larger stranded copper wire with appropriate ratings. Leave enough flexibility in the cable or conduit to allow for future service.
- When connecting to a K-Rain® flow monitor or endpoint, locate the section of terminal strip on the monitor labeled SENSOR INPUT or SENSOR. Connect the red wire to IN, SIGNAL(+) or SIGNAL terminal and the black wire to GND, SIGNAL(-) or COM terminal and the shield drain wire (if applicable) to SLD.
- When interfacing with other equipment, the signal wave forms and power requirements are as shown in “Specifications” on page 9.

FLOW SENSOR INSTALLATION

⚠ CAUTION *Depressurize and vent piping system prior to any installation or maintenance of the flow sensor.*

⚠ DANGER *Disconnect power from flow sensor source and/or receiving device prior to any installation or maintenance of the system.*

1. Remove the sensor assembly and the nut from the tee (A).
2. Remove burrs from the pipe ends and remove dirt and loose debris from pipe and tee sockets.
3. Glue the line pipe into the tee using an appropriate primer and cement according to the manufacturer's instructions. Do not use or leave excess glue. Glue build-up in the tee can affect the measurement performance of the unit and/or prevent the impeller from turning. Do not let the glue or primer contact the bore where the O-rings seal (B).
4. Insert the sensor into the tee, carefully lining up the locating hole in the sensor with the locating pin in the tee.
5. Install and hand-tighten the retaining nut.
6. Complete the wiring connections. See "Electrical Installation Guidelines" on page 5 for details.
7. Complete the wiring connections (7).



Additional Information

- The unit functions best with a pipe wall schedule 40 or thinner.
- Keep all parts as clean as possible. Do not let the glue or primer contact the surfaces where the O-rings make their seal.
- Although the meter can measure at velocities up to 20 ft/sec, do not exceed velocities above 7.5 ft/sec.

CALIBRATION

K-Rain® FS-735-10 sensors use unique K and offset numbers for calibration. These numbers are derived from calibration runs using NIST traceable instruments. Using both a K and an offset number provides higher accuracy than using a K-factor alone. The K and offset numbers for each tee configuration are listed in the table below.

Calibration Table

Size/Schedule	K	Offset
1/2" S40	0.078000	0.9
1/2" SDR 13.5	0.120119	0.1
3/4" S40	0.156300	0.9
3/4" SDR 21	0.197000	-0.6
1" S40	0.261119	1.2
1" SDR 21	0.321739	0.6

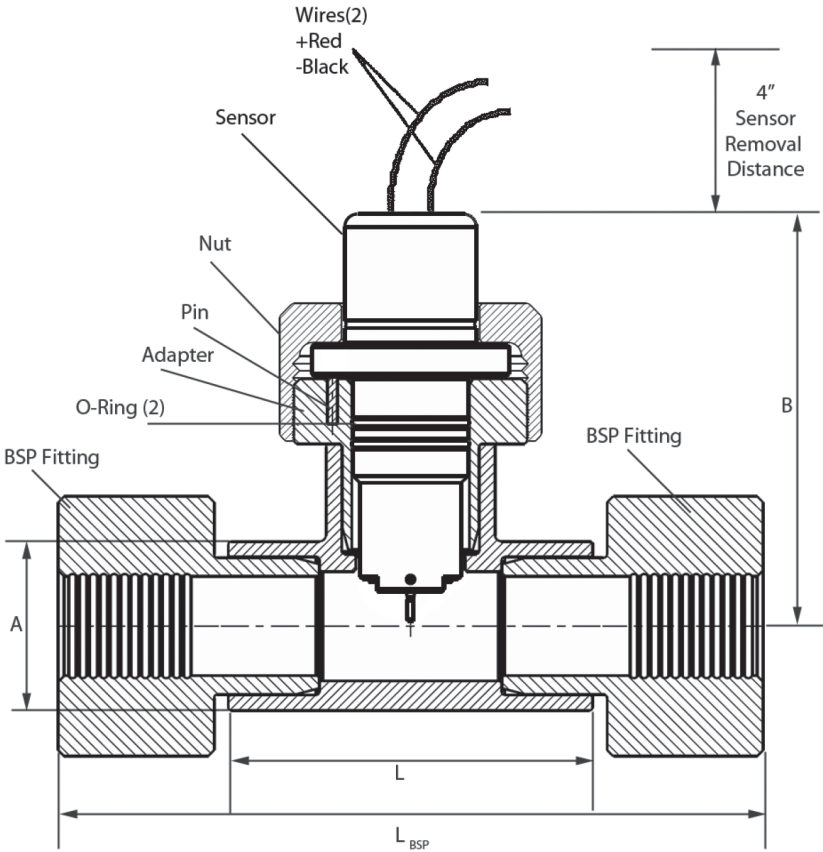
Input the information in the table above into the following equation to determine the frequency of the K-Rain® FS-735-10 flow sensors:

$$\text{Freq} = \frac{\text{Gpm}}{K} - \text{offset}$$

This information is required when calibrating an output board when using the raw sensor data as direct output to interface with a device that is not a K-Rain® product.

DIMENSIONS

A Size, NPS	B Centerline to Top	L	L _{BSP} Optional
1" [Ø 1.315"]	3.94" (100.1 mm)	3.50" (88.9 mm)	6.775" (172.1 mm)



SPECIFICATIONS

Wetted Materials (except tees)	See "Ordering Matrix" on page 11 for material specifications
Materials	
Tee	PVC Type 1, white
Adapter	PVC Type 1, gray
BSP Fitting	PVC Type 1
Sensor Housing	PPS
Retaining Nut	Acetal copolymer, black
Locating Pin	300SST
Impeller	300SST
Shaft	Tungsten Carbide
Bearing	UHMWPE
O-Rings	EPDM
Wires	18 AWG Irrigation Wire (solid copper)
Pressure/Temp. Ratings	150 psig @ 73° F (22.8° C) 75 psig @ 110° F (43.3° C)
Rated Temp.	Operating: 35°–110° F (1.67°–43.3° C) Storage 14°–110° F (–10°–43.3° C)
Design Flow Range	Recommended: 2–20 ft/sec (0.6–6.1 m/sec)
Accuracy	± 3.0% of full scale over recommended design flow range
Repeatability	± 1.5% of full scale over recommended design flow range
Linearity	± 1.5% of full scale over recommended design flow range
Transducer Excitation	8–35V DC max. input, source limited to 100 mA Quiescent current 600 uA @ 8–35V DC max. Quiescent voltage (V _{high} =Supply Voltage–(600 uA*Supply impedance)) ON State (V _{low}) Max. 1.2V DC @ 40 mA current limit (15 Ω + 0.7V DC)
Output Frequency	3.2–200 Hz
Output Pulse Width	5 msec ±25%
Environmental	IP 68 / NEMA 4X Suitable for pollution degree 4 environments Suitable for outdoor use above or below grade Suitable for use in 100% humidity



K-Rain Manufacturing Corp.

1640 Australian Avenue

Riviera Beach, FL 33404

561.844.1002 800.735.7246

561.842.9493 FAX

www.krain.com

© K-Rain Manufacturing Corp.
AN ISO 9001 CERTIFIED COMPANY