

Fire Sprinkler Monitoring Products

Solutions and Service for Sprinkler System Integrity

SYSTEM SENSOR®
advanced ideas. advanced solutions.™

waterflow monitoring



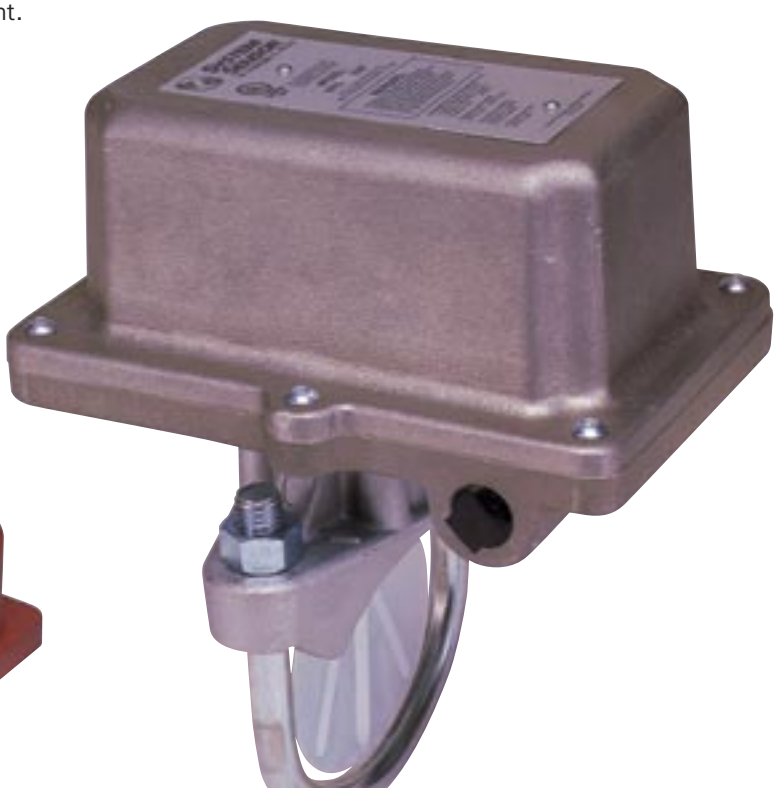
Monitoring Fire Sprinkler System Flow

During a fire condition, sprinkler system reliability is critical, whether it's the operation of a sprinkler or the monitoring of the sprinkler system itself. System Sensor's line of waterflow detectors provides that reliability when monitoring water flow within a wet pipe fire sprinkler system. These vane-type paddle designs are available in a variety of configurations and accommodate 2″ through 8″ pipe for commercial riser applications, as well as 1″ NPT connections for residential or branch line signaling.

The WFD series detectors provide a mechanical delay that is adjusted via an adjustment wheel. This retard mechanism is field replaceable, as is our terminal block. Both are unique features offered only by System Sensor.

We also offer several specialty waterflow detectors, for truly uncommon applications. The WFD-EXP line of explosion-proof waterflow detectors is intended for hazardous locations where volatile vapors or particulates may be present.





pressure monitoring



Monitoring the Fire Sprinkler System's Status

System Sensor's line of pressure switches includes the EPS10 series for use in wet, dry, deluge and pre-action automatic sprinkler systems to indicate a discharge from a sprinkler. The EPS40 and EPS120 series supervisory pressure switches are intended for dry pipe systems or pressure tanks and water supplies of automatic water control valves. These models offer a choice of initiating low, or high/low pressure alarms, in a variety of pressure ranges. And should your system involve a potentially hazardous location, we offer a complete line of explosion-proof alarm and supervisory pressure switches. In every case, you are assured of technically superior choices with System Sensor products.

valve monitoring



Tamper Monitoring and Prevention

The nerve centers of a fire sprinkler system are the switches and valves that control the entire system. System Sensor offers a variety of choices for supervising system control valves. Regardless of valve type: outside screw and yoke, post indicator, butterfly, or non-rising stem gate valve, our OSY2, PIBV2, and PSP1 models provide you with the peace of mind, which comes from knowing that your system's control valves are being monitored.



Completing the System Sensor line of sprinkler monitoring products are the PDRP-1001 control panel and SSV/SSM series alarm bells. Our reliable system provides a way to detect and respond to changes on all initiating and release circuits, reducing the risk of loss from fire. Combined with our alarm bells, signaling any change in your fire sprinkler system is easy.

Information to Help You Act

System Sensor's control panels and alarms provide the information you need to take action — when you need to. The PDRP-1001 includes fault supervision and fuse protection on all initiating and release circuits, with up to 90 hours of standby. Depending upon the model, the PDRP-1001 offers compliance with NFPA 71, NFPA 72, NFPA 12, NFPA 12A, and NFPA 12B standards.

system alarms



For notification in outdoor applications, System Sensor offers the P2RHK-120. This SpectrAlert Advance wall-mount horn/strobe product is outdoor listed and operates on 120VAC. The horn/strobe is watertight when used in conjunction with the weatherproof back box included with the product.



System Sensor's alarm bells deliver high sound pressure output for fire signaling needs. Models are available for 120VAC and 24VDC operating voltage and are offered in 6″, 8″ and 10″ sizes. In all situations, these are the products you can rely on because they carry the System Sensor name.

Specifications

WFD Series Waterflow Detectors*

Model No.	Pipe Size	Pipe Schedule	UL Pressure Rating	Enclosure Rating	Agency Approvals**
WFD20	2″	10 through 40	450 PSI	NEMA 4	UL, FM, CSFM, MEA, CNTC
WFD25	2.5″	10 through 40	450 PSI	NEMA 4	UL, FM, CSFM, MEA, CNTC
WFD30-2	3″	10 through 40	450 PSI	NEMA 4	UL, FM, CSFM, MEA
WFD35	3.5″	10 through 40	450 PSI	NEMA 4	UL, FM, CSFM, MEA, CNTC
WFD40	4″	10 through 40	450 PSI	NEMA 4	UL, FM, CSFM, MEA, CNTC
WFD50	5″	10 through 40	450 PSI	NEMA 4	UL, FM, CSFM, MEA, CNTC
WFD60	6″	10 through 40	450 PSI	NEMA 4	UL, FM, CSFM, MEA, CNTC
WFD80	8″	10 through 40	450 PSI	NEMA 4	UL, FM, CSFM, MEA, CNTC
WFDT	1″ NPT Connection	(Refer to Data Sheets)	250 PSI	NEMA 4	UL, CSFM, MEA, CNTC
WFDTH	1″ NPT Connection	(Refer to Data Sheets)	250 PSI	NEMA 3	UL, CSFM, MEA
WFDTNR	1″ NPT Connection	(Refer to Data Sheets)	250 PSI	NEMA 4	UL, CSFM, MEA

Explosion-proof Waterflow Detectors

Model No.	Pipe Size	Pipe Schedule	UL Pressure Rating	Enclosure Rating	Agency Approvals**
WFD20EXP	2″	10 through 40	450 PSI	NEMA 4	UL, ULC, FM, CSFM, MEA
WFD25EXP	2.5″	10 through 40	450 PSI	NEMA 4	UL, ULC, FM, CSFM, MEA
WFD30-2EXP	3″	10 through 40	450 PSI	NEMA 4	UL, ULC, FM
WFD35EXP	3.5″	10 through 40	450 PSI	NEMA 4	UL, ULC, FM, CSFM, MEA
WFD40EXP	4″	10 through 40	450 PSI	NEMA 4	UL, ULC, FM, CSFM, MEA
WFD50EXP	5″	10 through 40	450 PSI	NEMA 4	UL, ULC, FM, CSFM, MEA
WFD60EXP	6″	10 through 40	450 PSI	NEMA 4	UL, ULC, FM, CSFM, MEA
WFD80EXP	8″	10 through 40	450 PSI	NEMA 4	UL, ULC, FM, CSFM, MEA

These units intended for use in hazardous locations classified as follows: Class I, Groups B, C, D, Division 1 & 2; Class II, Groups E, F, G, Division 1 & 2; Class III, Division 1 & 2.

EPS Series Pressure Switches*

Model No.	Adjustment Pressure Range	Factory Setting	Enclosure Rating	Agency Approvals**
EPS10-1	4 – 20 PSI	Operates at rising pressure 4 – 8 PSI	UL 4X, NEMA 4	UL, FM, CSFM, MEA
EPS10-2	4 – 20 PSI	Operates at rising pressure 4 – 8 PSI	UL 4X, NEMA 4	UL, FM, CSFM, MEA
EPS40-1	10 – 100 PSI	Operates at decreasing pressure at 30 PSI	UL 4X, NEMA 4	UL, FM, CSFM, MEA
EPS40-2	10 – 100 PSI	Operates at increasing pressure at 50 PSI and decreasing pressure at 30 PSI	UL 4X, NEMA 4	UL, FM, CSFM, MEA
EPS120-1	10 – 200 PSI	Operates at decreasing pressure at 105 PSI	UL 4X, NEMA 4	UL, FM, CSFM, MEA
EPS120-2	10 – 200 PSI	Operates at increasing pressure at 125 PSI and decreasing pressure at 105 PSI	UL 4X, NEMA 4	UL, FM, CSFM, MEA

Explosion-proof Pressure Switches

Model No.	Adjustment Pressure Range	Factory Setting	Enclosure Rating	Agency Approvals**
EPS10EXP	4 – 20 PSI	Operates at rising pressure 4 – 8 PSI	NEMA 4	UL, ULC, FM, CSFM, MEA
EPS40EXP	10 – 100 PSI	Operates at increasing pressure at 50 PSI and decreasing pressure at 30 PSI	NEMA 4	UL, ULC, FM, CSFM, MEA
EPS120EXP	10 – 200 PSI	Operates at increasing pressure at 125 PSI and decreasing pressure at 105 PSI	NEMA 4	UL, ULC, FM, CSFM, MEA

These units intended for use in hazardous locations classified as follows: Class I, Groups B, C, D, Division 1 & 2; Class II, Groups E, F, G, Division 1 & 2; Class III, Division 1 & 2.

*Canadian and International models are also available. Call for details. **Additional agency approvals pending. Call for details.

Control Valve Supervisory Switches*

Model No.	Valve Types	Enclosure Rating	Agency Approvals**
OSY2	Outside screw and yoke valves	NEMA 3R	UL, ULC, FM, CSFM, MEA
PIBV2	Post indicator valves, butterfly valves with rising or falling flags	NEMA 3R	UL, ULC, FM, CSFM, MEA
PSP1	Non-rising stem gate valves, ball and angle valves	NEMA 3	UL, ULC, FM, CSFM, MEA

Explosion-proof Control Valve Supervisory Switches

Model No.	Valve Types	Enclosure Rating
OSYEXP	Outside screw and yoke valves	NEMA 1, 7, and 9
PIBVEXP	Post indicator valves, butterfly valves	NEMA 1, 7, and 9

These units intended for use in hazardous locations classified as follows: Class I, Groups C, D, Division 1 & 2; Class II, Groups E, F, G, Division 1 & 2; Class III, Division 1 & 2.

Alarm Bells*

Model No.	Size	Operating Voltage Range	Current Draw	Sound Output	Agency Approvals**
SSV120-6	6″	96 – 132 VAC	53mA	85 dB	UL, FM, CSFM, MEA
SSV120-8	8″	96 – 132 VAC	53mA	82 dB	UL, FM, CSFM, MEA
SSV120-10	10″	96 – 132 VAC	53mA	82 dB	UL, FM, CSFM, MEA
SSM24-6	6″	16 – 33 VDC	DC 31.1mA/FWR 53.5mA	82 dB	UL, FM, CSFM, MEA
SSM24-8	8″	16 – 33 VDC	DC 31.1mA/FWR 53.5mA	80 dB	UL, FM, CSFM, MEA
SSM24-10	10″	16 – 33 VDC	DC 31.1mA/FWR 53.5mA	81 dB	UL, FM, CSFM, MEA

Outdoor Horn/Strobe*

Model No.	Voltage	Candela	Agency Approvals**
P2RHK-120	120 VAC	135, 150, 177, 185	UL, FM, CSFM, MEA

PDRP Series Fire Alarm Control Panels*

Model No.	Description	Agency Approvals**
PDRP-1001	Two-zone pre-action/deluge fire alarm control panel	UL, FM, CSFM, MEA

Sprinkler Monitoring Device Accessories

Model No.	Description
WFDW	Cover wrench for WFD, EPS, OSY2, PIBV2, and PSP1 series products
S07-66-05	Cover tamper screws for WFD, EPS, OSY2, PIBV2, and PSP1 series products
C58-164-01	Replacement cover for WFD series waterflow detectors
546-7000	Cover tamper switch kit for WFD, OSY2, and PIBV2 series products
546-8000	Cover tamper switch kit for EPS series pressure switches
WFDN4	NEMA 4 gasket replacement kit for WFD, AFD, and LFD series waterflow detectors
PRK9	Paddle kit for WFDT series waterflow detectors
A3008-00	Replacement retard kit for WFD series waterflow detectors
A77-01-02	Replacement terminal block kit for WFD series waterflow detectors
HEXW	Replacement hex wrench for OSY2 and PIBV2 supervisory switches
WBB	Weatherproof back box

*Canadian and International models are also available. Call for details. **Additional agency approvals pending. Call for details.

How can you be sure that YOUR system will operate when needed?

The National Fire Protection Association (NFPA) records indicate that 96 percent of all fires occurring in sprinklered buildings were extinguished or held in check by the system, and 80 percent of *those* fires were controlled by the activation of fewer than eight sprinkler heads. The question then becomes: How can you be sure that *your* system will operate when needed?

System Sensor Sprinkler Monitoring Devices

System Sensor products supervise sprinkler systems by monitoring valve positions, system pressure and water flow. They in turn assure system reliability and effectiveness. When it comes to installing the very best, always specify System Sensor fire sprinkler monitoring devices. Trust your fire sprinkler monitoring to System Sensor. Our engineered products help keep people and property safe.

System Sensor is a global manufacturer of fire detection and notification devices, specializing in smoke detection and notification technology. System Sensor places a premium on research and development, resulting in products that are reliable, sophisticated, and designed for real-world applications. With sales, service, and manufacturing facilities throughout the Americas, Europe, and Asia, System Sensor's high quality, innovative products are the most comprehensive in the industry.

SYSTEM SENSOR®

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WFD Series Waterflow Detector



System Sensor's WFD series is compatible with schedule 10 through 40 steel pipe, sizes 2˝ through 8˝, and can be mounted in a vertical or horizontal position.

Features

- Two-inch conduit openings in new WFD30-2 models
- UL listed models are NEMA 4 rated
- Sealed retard mechanism immune to dust and other contaminants
- Visual switch activation
- Field replaceable retard mechanism and SPDT switches
- Rugged, dual SPDT switches enclosed in a durable terminal block
- Accommodates up to 12 AWG wire
- Designed for both indoor/outdoor use
- 100 percent synchronization activates both alarm panel and local bell
- Tamper resistant cover screws

Robust Construction. The WFD series consists of a rugged, NEMA 4 rated enclosure. Designed for both indoor and outdoor use, the WFD series operates across a wide temperature range, from 32°F to 120°F.

Reliable Performance. UL listed models are equipped with tamper resistant cover screws to prevent unauthorized entry. Inside, two sets of SPDT (Form C) synchronized switches are enclosed in a durable terminal block to assure reliable performance.

False Alarm Immunity. The WFD series incorporates a mechanical retard feature, which minimizes the risk of false alarm due to pressure surges or air trapped in the sprinkler system. In addition, the mechanical retard's unique sealed design is immune to dust and other contaminants.

Simplified Operation. The WFD series is designed to simplify installation. Two conduit openings permit easy attachment to the local alarm system. The retard mechanism and dual SPDT switches are field-replaceable.

Agency Listings

S739 CS169 7770-1209:140 167-93-E 1W9A2.AH

Waterflow Detector Specifications

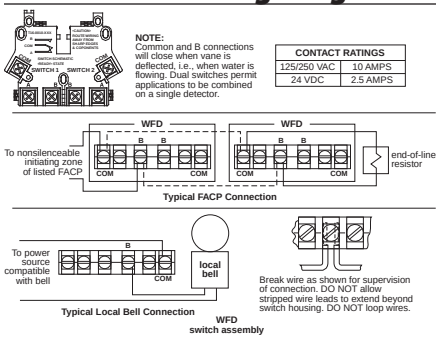
Engineering Specifications

Vane-type waterflow detectors shall be installed on system piping as designated on the drawing and/or as specified herein. Detectors shall mount on any clear pipe span of the appropriate nominal size, either a vertical upflow or horizontal run, at least 6″ from any fittings which may change water direction, flow rate, or pipe diameter or no closer than 24″ from a valve or drain. Detectors shall have a sensitivity in the range of 4 to 10 gallons per minute and a static pressure rating of 450 psi* for 2″ – 8″ pipes. The detector shall respond to waterflow in the specified direction after a preset time delay which is field adjustable. The delay mechanism shall be a sealed mechanical pneumatic unit with visual indication of actuation. The actuation mechanism shall include a polyethylene vane inserted through a hole in the pipe and connected by a mechanical linkage to the delay mechanism. Outputs shall consist of dual SPDT switches (Form C contacts). Two conduit entrances for standard fittings of commonly used electrical conduit shall be provided on the detectors. A grounding provision is provided. Unless noted, enclosures shall be NEMA 4 listed by Underwriters Laboratories Inc. All detectors shall be listed by Underwriters Laboratories Inc. for indoor or outdoor use.

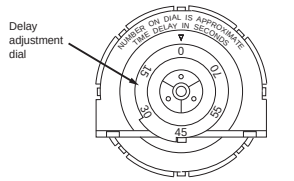
Standard Specifications

Static Pressure Rating	450 PSI*	**Operating Temperature Range**	32°F to 120°F (0°C to 49°C)
Maximum Surge	18 Feet Per Second (FPS)	**Enclosure Rating***	NEMA 4 – suitable for indoor/outdoor use
Triggering Threshold Bandwidth (Flow Rate)	4–10 GPM	**Cover Tamper Switch**	Standard with ULC models, optional for UL models, part no. 546-7000
Conduit Entrances	Two openings for ½″ conduit. One open, one knock-out type	**Service Use**	Automatic Sprinkler: NFPA-13 One or Two Family Dwelling: NFPA 13D Residential Occupancies up to 4 Stories: NFPA 13R National Fire Alarm Code: NFPA-72
Contact Ratings	Two sets of SPDT (Form C) 10.0 A, ½ HP @ 125/250 VAC 2.5 A @ 6/12/24 VDC	**U.S. Patent Numbers**	3,845,259 4,782,333 5,213,205
Compatible Pipe	Steel water pipe, schedule 10 through 40	**Warranty**	3 Years

WFDE Field Wiring Diagram

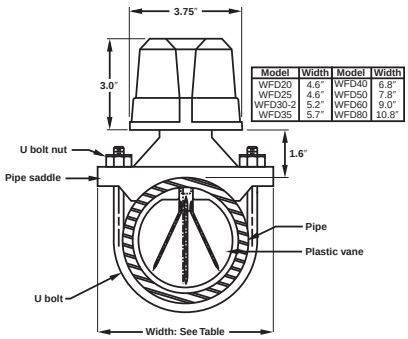


Delay Adjustment Dial



NOTE: Retard time may exceed 90 seconds.
Adjust and verify that time does not exceed 90 seconds.

Overall Dimensions, Installed



Model	Width	Model	Width
WFD20	4.6″	WFD40	6.8″
WFD25	4.6″	WFD50	7.8″
WFD30-2	5.2″	WFD60	9.0″
WFD35	5.7″	WFD80	10.8″

Ordering Information

UL Model	ULC Model	Pipe Size	Hole Size	Shipping Weight
WFD20	WFD20A	2″	1¼″	4.2 lbs.
WFD25	WFD25A	2½″	1¼″	4.3 lbs.
WFD30-2	WFD30-2A	3″	2″	4.5 lbs.
WFD35	WFD35A	3½″	1¼″	4.7 lbs.
WFD40	WFD40A	4″	2″	5.2 lbs.
WFD50	WFD50A	5″	2″	6.3 lbs.
WFD60*	WFD60A	6″	2″	6.8 lbs.
WFD80*	WFD80A	8″	2″	7.5 lbs.

Accessories

A3008-00	Retard mechanism
A77-01-02	Terminal block
546-7000	Tamper proof switch kit
WFDW	Tamper proof wrench for cover
WFDN4	Gasket kit

*Maximum pressure rating 400 psi as approved by Factory Mutual.

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Fire Sprinkler Systems Monitoring

SYSTEM SENSOR®

Fire Sprinkler Systems Monitoring

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Preface

Before the first automatic sprinkler system was developed in the 1870s, a sprinkler system consisted of a perforated pipe, a valve, a person to open the valve, and an elevated barrel or tank filled with water. A more dependable system was created in response to increased fire loads and increased values of buildings and their contents. A more advanced sprinkler system became possible as technology became more sophisticated.

Sprinkler systems automatically detect and then control, suppress, or extinguish fires. Water supplies can come from city water mains, dedicated storage tanks or ponds. Valves and alarm devices control and monitor the water's flow. Distribution pipes send water to the sprinkler heads using a municipal water source to maintain and increase water pressure according to design criteria. Modern systems can detect a fire condition and discharge water quickly, before a fire grows to a fatal or catastrophic size, reducing fire deaths by nearly 100 percent. Understanding your fire sprinkler system can be life saving. After reading this guide, you will be more knowledgeable about the water flow detectors, supervisory switches, pressure switches, explosion proof products, and alarm bells within a fire sprinkler system.

This guide provides information for the proper application, installation and maintenance of System Sensor sprinkler and notification products. Installation must comply with all code requirements such as NFPA and comply with directives from Authorities Having Jurisdiction (AHJ). AHJ directives always take precedence over other codes and have final authority.

System Sensor was founded in 1984, and has become the largest manufacturer of fire detection and notification appliances in the world. More than 1,900 System Sensor associates collaborate to build quality products for conventional detection; intelligent detection; audible and visible (AV) notification; heating, ventilation, air conditioning (HVAC) monitoring; and sprinkler systems monitoring. High production standards and strong customer engagement contribute to the solid demand for System Sensor products.

Every day we aim to develop advanced ideas that deliver advanced solutions.

Section 1

Fire Sprinkler Systems

There are four types of fire sprinkler systems: wet pipe, dry pipe, deluge, and pre-action. These choices allow sprinkler systems to provide an array of of hazard and environmental protection, customized to each individual situation.

Wet Pipe Sprinkler Systems

Wet pipe sprinkler systems are the most common systems. They have the fewest number of components and require less installation time than other systems. A wet pipe sprinkler system has a series of piping systems connected to regularly distributed sprinkler heads, fed by a main riser. Maintenance is minimal, so financial savings are also realized.

Wet pipe sprinkler systems cannot be installed in an area where distribution pipes are exposed to freezing temperatures, such as parking garages, because they always contain water.

The operation of a wet pipe sprinkler system depends on the heat reactive sprinkler heads. When a fire starts, its heat causes a fusible glass bulb or metallic heat sensor within the sprinkler head to shatter or melt and separate. Either action causes water to discharge from the distribution piping, striking the deflector on the open sprinkler head and spraying water onto the fire in an engineered pattern or throw.

Wet pipe systems are fixed temperature installations, meaning each sprinkler head is activated only if exposed to a predetermined temperature as low as 155˚F or as high as 286˚F.

There are three types of wet pipe sprinkler systems: wet pipe sprinkler system with an alarm check valve, wet pipe sprinkler system with maintained excess pressure, or wet pipe sprinkler system with a straight pipe riser.

Wet Pipe Sprinkler System with an Alarm Check Valve

When water enters the fire sprinkler system piping, it becomes non-potable and unsuitable for drinking. To keep the non-potable water from leaking back into the city water supply, an alarm check valve can be installed. The alarm check valve is a small device consisting of a spring, valve clapper and alarm port.

The spring holds the valve clapper closed, so that water will flow only in one direction. Water will not flow out of the sprinkler head until a predetermined temperature causes the individual sprinkler head to activate. When a sprinkler head is activated, the clapper opens allowing water to flow through the valve to feed the system. As the alarm port becomes exposed to water pressure, it causes a water motor gong, mechanical bell, or A/V device to sound. A water flow switch or detector connected to an electric bell, horn, or horn/strobe has become the most common water flow alarm notification device, replacing the mechanical water motor gong. The alarm port also becomes exposed to the incoming water supply where an alarm pressure switch can be installed to send an alarm signal to a panel.

To prevent a city water surge from activating alarms, a retard chamber can be installed. The retard chamber is a metal reservoir that holds the water during a brief city water surge. A drip valve at the bottom of the reservoir allows the water from the surge to slowly drain out. If sustained water flow occurs, as when a sprinkler is activated due to a fire condition, the reservoir cannot drain the water fast enough and the water motor gong or alarm pressure switch is activated.

Wet Pipe Sprinkler System with Maintained Excess Pressure

Wet pipe sprinkler systems with maintained excess pressure are offered with an alarm check valve. In this type of system, excess pressure is pumped in just above the alarm check valve to hold the clapper down even during a city water surge. This type of system eliminates false alarms caused by surges in the municipal water supply.

There are two ways to measure pressure loss in this type of system:

- A pressure switch is connected to the system above the check valve. When a sprinkler head is activated, the switch detects a drop in pressure and sends an alarm. Usually a supervisory pressure switch is used to monitor leaks in the system.
- A pressure switch is connected to the alarm port of the alarm check valve. When the sprinkler head is activated, the alarm check valve opens. When the valve opens, the alarm port is exposed to the incoming water supply. The pressure switch detects the pressure change and sends an alarm.

Wet Pipe Sprinkler System with a Straight Pipe Riser

Wet pipe sprinkler systems with straight pipe risers, located downstream of a check valve or backflow preventer, are the most common wet pipe sprinkler systems. The straight pipe riser, or vertical supply pipe within the sprinkler system, does not have a retard chamber or alarm port like other types of wet pipe sprinkler systems. Instead, this system has a riser check valve.

A riser check valve utilizes a vane type water flow switch to monitor water flow in the sprinkler system. When a continuous flow of water — more than 10 gallons per minute — occurs, a standard check valve or a water flow switch monitors the system and activates an alarm after a predetermined amount of time. The amount of time delay is selected on the flow switch to prevent short duration city water surges from causing false alarms. The time delay mechanism allows a predetermined alarm delay time to be set. If water surges beyond the predetermined time, an alarm will sound.

Dry Pipe Sprinkler Systems

Dry pipe sprinkler systems are installed in areas where distribution pipes are subject to freezing temperatures, such as unheated buildings and parking garages. Unlike wet pipe sprinkler systems that contain water, dry pipe sprinkler systems contain compressed air. The compressed air is supplied by an electric air compressor, nitrogen bottles, or other source.

Dry pipe sprinkler systems also have a valve clapper and alarm port. The dry pipe valve clapper is held closed by a pressure differential between air pressure and water pressure at the valve interface. Supervisory pressure switches are used to maintain the pressure on the system side, and can send a low or high pressure signal to a panel. The panel then either turns on a pump or releases pressure from the system through a ball valve to ensure that the right pressure is maintained in the system. When a fire starts, its heat

causes a sprinkler head to open, and the compressed air is released. When the air pressure drops to a trip point (usually 10 psi below normal), a dry pipe valve opens and a rush of water from the main line floods the distribution pipes. With the rush of water from the main line through the open clapper valve the alarm port is exposed to water. Once exposed, a pressure switch senses the increase in pressure and sounds an alarm.

Dry Pipe Valve
The dry pipe valve is located above the main system control valve and must be installed in a heated area or enclosure to keep the water below the valve from freezing. The purpose of the dry pipe valve is to keep water from entering the pipes and potentially freezing.

The dry pipe valve has a one-way clapper that is partially covered with water called the priming water, to seal the valve seat, and has an intermediate chamber that connects the valve to the alarm line.

Pressure Switches
There are two types of pressure switches connected to the alarm line, an alarm pressure switch and a supervisory air pressure switch. Both switches monitor the air pressure on the system side of the dry pipe valve.

- Alarm pressure switches measure pressure changes within a system and send alerts to the panel and to an annunciator.
- Supervisory air pressure switches monitor air pressure on the system side of the dry pipe valve. They perform the following two functions:
  - The first supervisory switch monitors low air pressure and prevents the accidental operation of the dry pipe valve due to low air pressure from an air compressor failure or other leaks in the system.
  - The second supervisory switch monitors high air pressure to prevent damage to the clapper and rubber gaskets in the dry pipe valve. High pressure can damage the pipe. If air pressure is too high, the valve won't operate until it bleeds off some of the system air.

Note:
- The pressure switch does not require a delay mechanism because water surges are not present with this type of system.
- Vane type switches should not be installed on a dry pipe system because the sudden rush of water could tear the paddle from the switch.
- There are a few specialized applications where wet pipe and dry pipe systems are not suitable. In these instances, deluge or pre-action sprinkler systems are used. These instances are called "special hazards applications."

Deluge Sprinkler Systems

Deluge sprinkler systems are installed in high hazard operations, such as power generating stations, aircraft hangers, petrochemical and munitions plants, and areas that store items such as flammable liquids. These systems work with independent fire detection systems to deliver water immediately to the protected area.

Deluge sprinkler systems work similarly to the wet pipe sprinkler system, except the system incorporates open sprinkler heads or nozzles that do not operate individually. The water is held back by an electric solenoid valve that is connected to a compatible releasing panel. An initiating device, such as a smoke detector, sends a signal to the monitoring panel which energizes the release circuit which opens the solenoid valve.

Water is not adequate to control fires in areas where flammable liquids are manufactured or stored. Sometimes a foam concentrate is mixed with the water in a part of the system referred to as a proportioner. This foam is called Aqueous Fire Fighting Foam or AFFF. The foam and water combination causes the concentrate to expand when released through the sprinkler head, depriving the fire source of oxygen required to support combustion of flammable materials.

Pre-action Sprinkler Systems

Pre-action sprinkler systems are installed in water sensitive environments such as computer rooms and refrigerated warehouses. These areas require systems that will operate only in an actual fire condition to save the building and its components from severe fire damage.

The pre-action system is similar to a dry pipe system, except that air pressure may or may not be used. It is also similar to the deluge system, except that the valve is electronically held closed and standard "closed" sprinkler heads are used. This design eliminates operational delays and water damage. The valve will only open if an independent detection system installed in the same area as the sprinkler system is activated, verifying a fire condition. In effect, opening a pre-action valve turns a pre-action system into a standard wet pipe sprinkler system.

Section 2
Standards

The National Fire Protection Association (NFPA) publishes standards for the proper application, installation and maintenance of fire protection products. The principal standards for sprinkler monitoring products are as follows:

NFPA 13: Standard for Installation of Sprinkler Systems
NFPA 13 guarantees a reasonable degree of protection for life and property from fire by standardizing design, installation and testing requirements for sprinkler systems. These standards are based on engineering principles, test data and field experience.

- A wet pipe system must be fitted with an alarm check valve or other listed water flow detecting alarm device with necessary attachments to provide an alarm.
- A dry pipe system must be fitted with listed alarm attachments to the dry pipe valve.
- In pre-action and deluge systems, the alarm apparatus shall consist of alarms actuated independently by the detection system and the flow of water.
- Paddle-type water flow alarm indicators shall be installed in wet systems only.

NFPA 13D: Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes

NFPA 13D guarantees to provide a sprinkler system that aids in the detection and control of residential fires, specifically in this type of dwelling, and thus provides improved protection against injury, life loss, and property damage.

- If the sprinkler system piping has a separate control valve installed, it must be supervised.
- Local water flow alarms shall be provided on all sprinkler systems in homes not equipped with smoke detectors in accordance with *NFPA 72, National Fire Alarm Code.*

NFPA 13R: Installation of Sprinkler Systems in Residential Occupancies up to and Including Four Stories in Height

NPFA 13R provides design and installation requirements for a sprinkler system to aid in the detection and control of fires in residential occupancies and thus provide improved protection against injury, life loss, and property damage.

- A local water flow alarm shall be provided on all sprinkler systems.
- Where a building fire alarm system is provided, the local water flow alarms shall be connected to the building fire alarm system.

NFPA 25: Standard for the Inspection, Testing and Maintenance of Water-Based Fire Protection

NFPA 25 guarantees a reasonable degree of protection for life and property from fire by inspecting, testing and maintaining water-based fire protection systems to ensure operating conditions are within the standards.

- Alarm devices shall be inspected quarterly to verify that they are free of physical damage.
- Water flow devices including, but not limited to, mechanical water motor gongs and pressure switches shall be tested quarterly.
- Vane type water flow devices shall be tested semiannually.
- Where provided, water flow alarm and supervisory devices shall be tested on a quarterly basis.
- Valve supervisory switches shall be tested semiannually.
- A distinctive signal shall indicate movement from the valve's normal position during either the first two revolutions of a hand wheel or when the stem of the valve has moved one-fifth of the distance from its normal position.
- The signal shall not be restored at any valve position except the normal position.

NFPA 72: National Fire Alarm Code

NFPA 72 guarantees a reasonable degree of protection for life and property from fire by defining requirements for signal initiation, transmission, notification and annunciation, as well as the levels of performance and the reliability of various fire alarm systems.

- Initiation of the alarm signal shall occur within 90 seconds of water flow at the alarm-initiating device when flow occurs that is equal to or greater than that from a single sprinkler of the smallest orifice size installed in the system.
- Movement of water due to waste, surges or variable pressure shall not initiate an alarm signal.
- Two separate and distinct signals shall be initiated: one indicating movement of the valve from its normal position (off-normal), and the other indicating restoration of the valve to its normal position.
- The off-normal signal shall be initiated during the first two revolutions of the hand wheel or during one-fifth of the travel distance of the valve control apparatus from its normal position.
- The off-normal signal shall not be restored at any valve position except normal.
- Two separate and distinct signals shall be initiated: one indicating that the required pressure has increased or decreased (off-normal), and the other indicating restoration of the pressure to its normal value.
- A pressure supervisory signal-initiating device for a dry pipe sprinkler system shall indicate both high and low pressure conditions. The off-normal signal shall be initiated when the pressure increases or decreases by 70 kPa (10 psi).
- A dry pipe or pre-action sprinkler system supplied with water by a connection beyond the alarm-initiating device of a wet pipe system shall be equipped with a separate water flow alarm-initiating pressure switch or other approved means to initiate a water flow alarm.
- The number of water flow switches permitted to be connected to a single initiating device circuit shall not exceed five.
- NFPA 72 states that if anything could cause the system to malfunction, a switch must be added to the system.
- This section leaves it up to the designer to indicate any supervisory device, which will help ensure that the building's suppression systems will work properly.
- The number of supervisory devices permitted to be connected to a single initiating device circuit shall not exceed 20.
- Alarm signals initiated by manual fire alarm boxes, automatic fire detectors, water flow from the automatic sprinkler system, or actuation of other fire suppression system(s) or equipment shall be treated as fire alarms.

NFPA 101: Life Safety Code

NFPA 101 guarantees a reasonable degree of protection for life and property from fire by providing requirements for designing, operating and maintaining buildings. Requirements are based on building type and occupancy.

- Where a sprinkler system provides automatic detection and alarm system initiation, it shall be provided with an approved alarm initiation device that operates when the flow of water is equal to or greater than that from a single automatic sprinkler.
- A supervisory signal shall be provided to indicate a condition that would impair the satisfactory operation of the sprinkler system.
- Monitoring shall include but not be limited to monitoring of control valves, fire pump power supplies and running conditions, water tank levels and temperatures, tank pressure, and air pressure on dry pipe valves.
- Where supervision of automatic sprinkler systems is provided in accordance with another provision of this Code, water flow alarms shall be transmitted to an approved, proprietary alarm receiving facility, or the fire department.

NFPA 5000: Building Construction and Safety Code

NFPA 5000 guarantees a reasonable degree of protection for life and property from fire through three independent regional organizations that write uniform building codes for the country. These codes, based on building type and occupancy, become law when adopted by local and state governments.

- Where a sprinkler system provides automatic detection and alarm system initiation, it shall be provided with an approved alarm initiation device that operates when the flow of water is equal to or greater than that from a single automatic sprinkler.
- In high-rise buildings, a sprinkler control valve and a water flow device shall be provided for each floor.
- Supervisory signals shall sound and be displayed either at a location within the protected building that is constantly attended by qualified personnel or at an approved, remotely located receiving facility.
- Where electrical supervision of automatic sprinkler systems is required by another section of this Code, water flow alarms shall be transmitted to an approved proprietary alarm receiving facility, a remote station, or a central station of the fire department.

The International Building Code and ***International Fire Code*** were created by the International Code Council Inc. (ICC) in an effort to harmonize the country under one set of standards. The purpose of the *International Building Code* and *International Fire Code* is to protect safety to life and property from fire and other hazards attributed to the built environment, and to provide safety to fire fighters and emergency responders during emergency operations.

- All valves controlling the water supply for automatic sprinkler systems, pumps, tanks, water levels, and temperatures, critical air pressures, and water flow switches on all sprinkler systems shall be electrically supervised.
- In occupancies required to be equipped with a fire alarm system, the backflow preventer valves shall be electrically supervised by a tamper switch installed in accordance with NFPA 72 and separately annunciated.
- Approved audible devices shall be connected to every automatic sprinkler system. Such sprinkler water flow alarm devices shall be activated by water flow equivalent to the flow of a single sprinkler of the smallest orifice size installed in the system. Alarm devices shall be provided on the exterior of the building in an approved location.
- Where a fire alarm system is installed, actuation of the automatic sprinkler system shall actuate the building fire alarm system.

The organizations that develop and enforce these standards are located at the following addresses:

Building Officials and Code Administrators (BOCA)
4051 West Flossmoor Road
Country Club Hills, IL 60478

International Conference of Building Officials (ICBO)
5360 Workman Mill Road
Whittier, CA 90601

Southern Building Code Congress International (SBCCI)
900 Montclair Road
Birmingham, AL 35213

International Code Council Inc.
Three different standards organizations, BOCA, ICBO, and SBCCI formed the umbrella organization ICC. The purpose of ICC is to produce a single set of model building and fire codes. ICC is located at 5360 Workman Mill Road in Whittier, California 90601-2298.

Testing Laboratories

Testing laboratories were created to test a wide variety of products and systems to ensure product safety. Today, almost every product sold in the United States must be approved or listed by these testing laboratories. All sprinkler system monitoring products and fire sprinkler system components are tested and approved by these laboratories and feature the testing laboratories' label.

Two common testing laboratories that provide approval of Fire Sprinkler Monitoring products are as follows:

Underwriters Laboratories Inc. (UL)
Laboratory and Testing Facilities

Corporate
333 Pfingsten Road
Northbrook, IL 60062

Also located at:
1285 Walt Whitman Road
Melville, NY 11747

1655 Scott Blvd.
Santa Clara, CA 95050

North Carolina Division
12 Laboratory Drive
P.O. Box 13995
Research Triangle Park, NC 27709

Factory Mutual Research (FM)
1151 Boston-Providence Turnpike
P.O. Box 9102
Norwood, MA 02062

Section 3

Fire Sprinkler System Monitoring Devices

The monitoring of water flow, valve position, or system status is typically needed in fire sprinkler systems in order to alert the fire department and/or facility manager of a fire or trouble condition that needs immediate attention. Vane or paddle type water flow detectors and pressure type switches are used to detect the flow of water in a sprinkler system and to send an alarm signal. Valve supervisory switches are used to monitor the open or closed position of the valves that control the water supply in the fire sprinkler system. Supervisory pressure switches monitor the status of the system air pressure in dry and pre-action systems. In certain situations, they also are used to monitor water pressure in wet pipe sprinkler systems.

Vane Type Water Flow Detectors

Principles of Operation

Vane type water flow detectors, which monitor the flow of water in a wet pipe sprinkler system, send an alarm when a continuous flow of water occurs from an activated sprinkler head or from a leak in the system. Water flow detectors can be mounted to vertical up flow or horizontal run distribution pipes in wet pipe sprinkler systems. Water flow detectors are available for two through eight inch pipe sizes, and can be installed on Schedule 10 or 40 fire sprinkler pipe. T-tap type water flow detectors are also available and are usually installed to one inch NPT outlets of threaded steel, copper and CPVC tees on T-style connectors. T-tap water flow detectors accommodate a wide range of tee and pipe sizes from one inch to two inch tee sizes; different tees require the installation of different paddle sizes.

The detectors include a plastic vane or paddle, which installs through an opening in the wall of the distribution pipe. When the flow of water is greater than 10 gallons per minute, the vane or paddle deflects, which produces a switched output, usually after a preset time delay. To minimize false alarms due to pressure surges or air trapped in the sprinkler system, a mechanical delay is often used to postpone switch activation. This delay is frequently referred to as a retard as it takes the place of the previously mentioned retard chamber in wet pipe systems. If water flow decreases to four gallons per minute or below, the timing mechanism will reset to zero; delays do not accumulate. Time delays are adjustable from 0 to 90 seconds.

Typically, water flow detectors are equipped with dual SPDT (Form C) switches for activation of an alarm panel and alarm bell, or an A/V device. When a water flow detector is connected to a listed sprinkler/fire alarm control panel, the initiating circuit must be non-silenceable. Water flow detec-

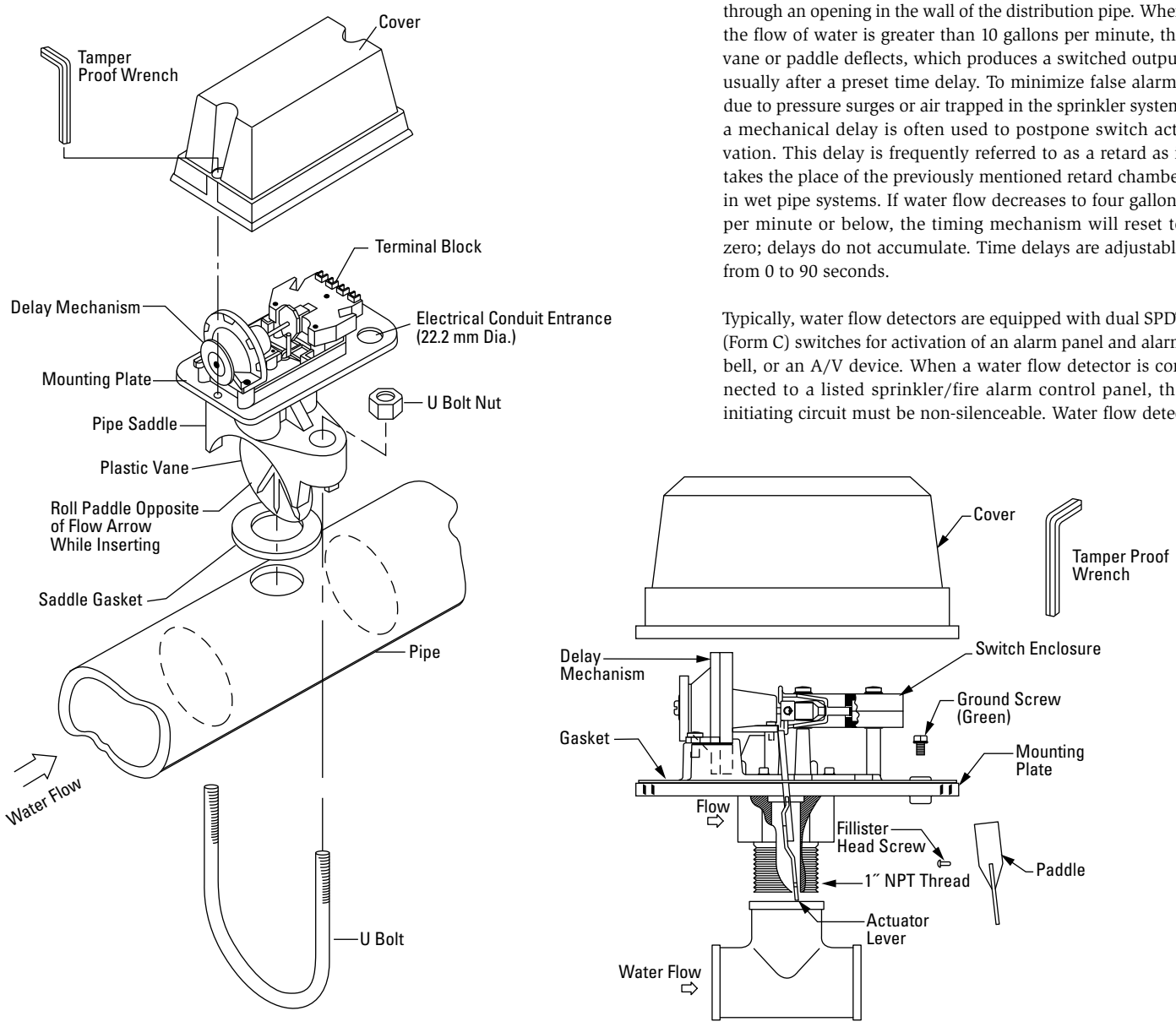


Figure 1: Parts of a vane type water flow detector

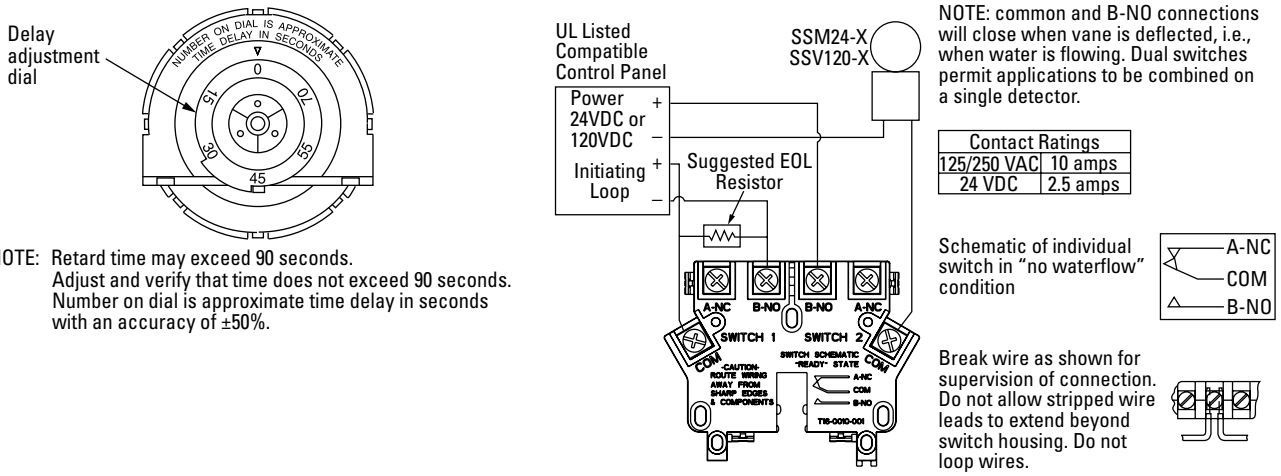


Figure 2: Vane type water flow detector delay settings and wiring diagram

tors are designed to be installed in a variety of environments and are approved for both indoor and outdoor applications. U-bolt type water flow detectors are designed primarily for use in commercial applications; whereas, T-tap style water flow detectors are designed for primary signaling in residential applications and branch line signaling in larger systems. The only differences between U-bolt and T-tap style water flow detectors are the methods in which they attach to the pipe. T-tap style water flow detectors also are available without a time delay mechanism.

Product Placement

For optimal performance water flow detectors should be mounted in an area where there is adequate clearance for installation, removal and inspection. To prevent damage, water flow detectors should be installed between six and seven feet above the floor. When installing a water flow detector on horizontal pipe, the detector should always be placed on top of the pipe to avoid build up of rust or other particles from collecting and interfering with the actuation of the device. When installing a water flow detector on vertical pipes, make sure the detector is installed in an area where there is an upward flow.

For the accurate detection of water flow, detectors should be installed at least six inches from fittings that change the direction of flow in the pipe, and at least 24 inches from a drain or valve. It is important that the detector is installed in the proper flow direction, which is indicated by an arrow on the product.

Testing, Maintenance and Service

System Sensor water flow detectors offer replaceable terminal blocks and timer delay (retard) mechanisms, so the detector can be serviced or maintained without draining the fire sprinkler system and removing the detector. Before repairing, maintaining, or testing water flow devices, it is important to notify the central station monitoring the water flow alarms. To prevent accidental water damage during maintenance, control valves should be closed and the system completely drained before the water flow detectors are removed or replaced. Any detector that shows evidence of water leakage should be replaced. If a detector needs to be removed, the pipe must be drained, then the electrical power must be turned off to the detector before disconnecting wires. Once the wires are removed, the nuts can be loosened and the U-bolt removed. Lift the detector to allow enough room for the paddle to be manually rolled inward and clear the opening in the pipe.

Water flow detectors should be tested at least quarterly to ensure proper operation; however, the AHJ may require detectors to be tested more frequently. When testing the sprinkler system, open the inspector's test valve and time how long it takes for the detector to indicate a flow condition. The water flow detector should stay in alarm until the inspector's test valve is closed. Timing can be adjusted if the desired time is not achieved.

Supervisory Switches

Principles of Operation/Product Placement

Supervisory switches are used primarily to monitor the open position of valves in a fire sprinkler system. One of the major causes of sprinkler system failure occurs when control valves are accidentally left closed, rendering the fire sprinkler system inoperable. Supervisory switches are required to send a signal if a valve is closed one-fifth of its total travel distance.

There are three main types of valves used in fire sprinkler systems: outside screw and yoke (OS&Y), butterfly (BFV), and post indicator valves (PIV).

Any valve that can affect the flow of water in a fire sprinkler system must be monitored. Three different types of supervisory switches are available for monitoring the open position of these different valve types. These switches – OS&Y, PIBV and special purpose – are typically equipped with dual SPDT (Form C) synchronized switches for activation of a supervisory signal at a panel or auxiliary device.

OS&Y type supervisory switches are designed to monitor the open position of OS&Y gate valves. A large hand wheel with a threaded shaft controls the position of the valve. The shaft moves when the valve's position changes. The switch is equipped with an actuator rod, which sits in a groove filed into the shaft or provided by the valve manufacturer. As the valve is closed by the turning of the hand wheel, the actuator rod slides out of the groove in the shaft, causing the switches to operate and send a supervisory/trouble signal. A signal also sounds if the tamper switch is removed from the valve.

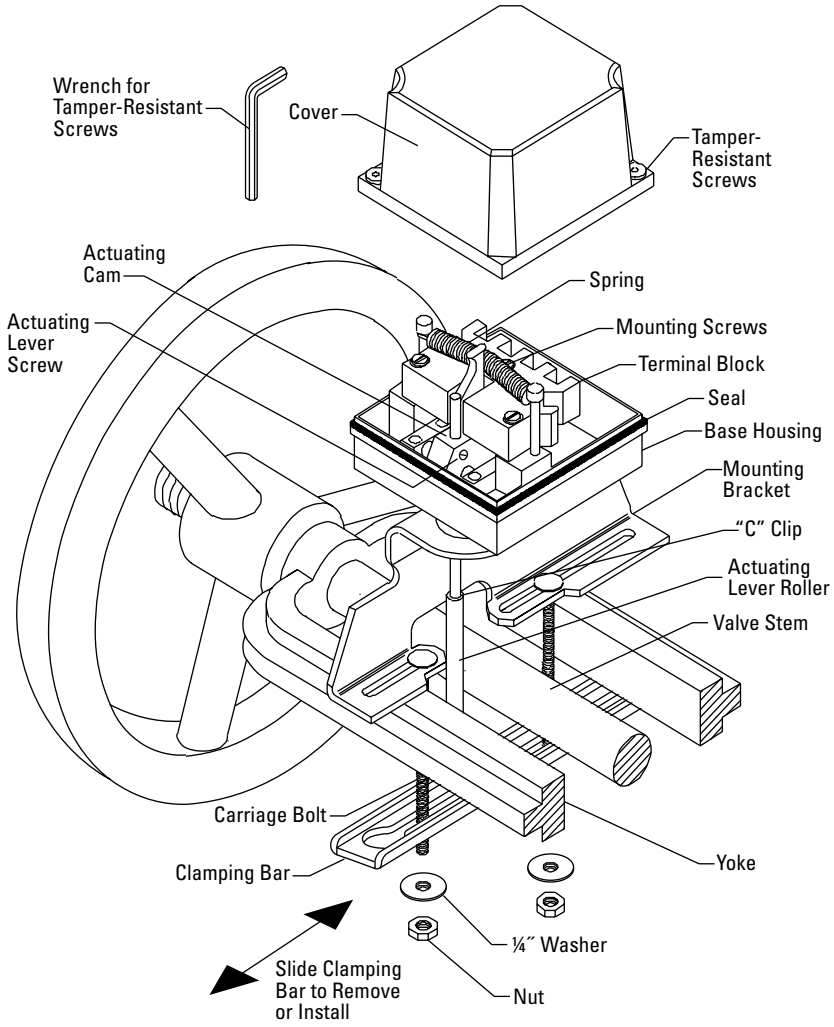


Figure 3: Parts of an outside screw and yoke supervisory switch

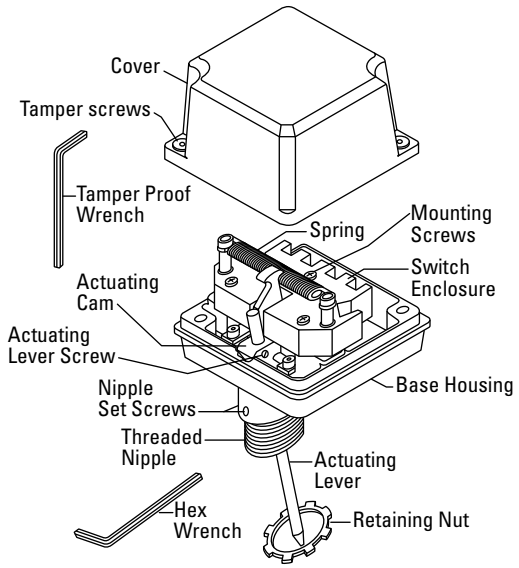


Figure 4: Parts of a post indicator butterfly valve supervisory switch

OS&Y type supervisory switches can be mounted on the yoke of OS&Y valves, which range in size from ½ inch to 12 inches in diameter. The adjustable shaft and mounting brackets allow installation to various sizes of valves. OS&Y supervisory switches are suitable for indoor or outdoor use and can be mounted vertically or horizontally. Two switches simultaneously activate both a local bell and an alarm panel. These supervisory switches are mounted on the yoke of the valve using either "J" hooks or carriage bolts with clamping bars. "J" hooks are typically used for mounting the switch on smaller valves. When mounting the OS&Y switch to the valve, be sure the actuator rod is resting in either the factory-provided or filed groove.

PIBV type supervisory switches monitor the open position of butterfly, pressure reducing, wall post indicator, and yard post indicator valves.

When installing a PIBV supervisory switch on a post indicator type valve, the switch is placed in a one half inch NPT tapped hole located so that the actuating lever of the switch engages the target or flag of the valve. The target or flag is the part of the valve that moves when the state of the valve changes. At times, the target or flag is attached to the display that shows "open" or "shut" through a window on the post to indicate the position of the valve.

There are two types of post indicator valves: rising flag and falling flag. In rising flag applications, the PIBV supervisory switch mounts below the target assembly. When the valve is closed, the target assembly raises and releases the actuating lever on the PIBV switch. In falling flag applications, the opposite holds true. When that valve is in the open position, its target should be pushing the trip rod against the spring force of the actuator. When closing a PIBV type valve, the supervisory switch must trip within one-fifth of the full travel distance of the valve.

When a PIBV supervisory switch is installed on a butterfly valve, it is placed in a one half inch NPT hole on the valve. The actuator rod is operated by a cam inside of the valve that rotates as the valve is opened and closed.

A special purpose supervisory switch is available, also, and is suitable for applications where no other type of listed supervisory switch will work. The special purpose switch is the plug-in type that is used on non-rising stem gate, and

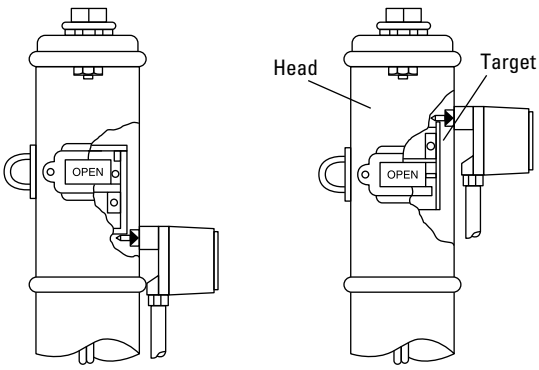


Figure 5: Operation of a post indicator butterfly valve supervisory switch

ball and angle valves. This type of switch has an adjustable-length cord, which allows more freedom during installation, and offers a 360 degree mounting design. The cord can be woven through the handle valve so that the cord plug must be disengaged in order to close the valve, sending a signal to the panel. This type of supervisory switch is wired to the trouble circuit of the fire alarm control panel, and is approved for both indoor and outdoor applications. A lockout feature prevents the plug from being reinserted unless the cover of the switch is removed with a tamper-proof wrench.

Maintenance and Service

All supervisory switches should be tested after the completion of installation and before they are placed into service. Thereafter, the switches should be tested at least semi-annually, or as required by the local AHJ.



Figure 6: A special purpose supervisory switch

Pressure Switches

Principles of Operation/Product Placement

There are two main types of pressure switches, alarm pressure switches and supervisory pressure switches. Alarm pressure switches are suitable for use in wet, dry, deluge and pre-action automatic fire sprinkler systems to indicate a discharge of water from one or more sprinkler heads. They are, however, most commonly installed in dry pipe sprinkler systems. Alarm pressure switches are the only way to detect the flow of water in dry pipe, pre-action and deluge sprinkler systems. Unlike the paddle type switches, these pressure switches are not damaged from the sudden inrush of water. Since the switch does not extend into the open pipe, there is no risk of damage to the switch.

In a dry pipe sprinkler system, the alarm pressure switch is installed on the alarm line trim of the dry pipe, deluge, and pre-action valves. No delay is required since pressure surges from the water supply are not an issue in these types of systems.

In a wet pipe sprinkler system, an alarm pressure switch is typically installed on top of the retard chamber into a one half inch tapped outlet. A time delay is not needed when using a pressure switch because the retard chamber will divert water flowing through the alarm line during pressure surges from the city water supply. A drip valve allows water to drain from the chamber.

Alarm pressure switches are pre-set to alarm at 4 to 8 PSI on rising pressure. The pressure setting can be field adjusted to obtain a specific pressure alarm response between 4 and 20 PSI.

Supervisory pressure switches monitor the status of system conditions, primarily the status of air pressure in dry pipe and pre-action systems. In certain conditions, they also monitor water pressure in wet pipe sprinkler systems.

Air pressure in a dry pipe system is supplied by an air compressor or other source, and is usually kept 15 to 20 PSI above the trip point of the dry pipe valve. A low air supervisory pressure switch should be installed to monitor the air pressure on the system side of the dry pipe valve. The low air supervisory pressure switch monitors the low air pressure within the system, and should be set to signal an alarm when the system air pressure drops 10 PSI below normal. The supervisory alarm will help prevent the accidental operation of the dry pipe valve due to low air pressure from air compressor failure or air leaks in the system.

A second type of supervisory pressure switch monitors the system for both the low and the high air pressure levels. Too much air pressure can damage the clapper and rubber gaskets in the dry pipe valve, delaying the operation of the valve due to the time it would take to bleed off the high air pressure within the system.

The low air and high/low air supervisory pressure switches are installed in the small trim piping that is connected to the automatic air compressor or other source.

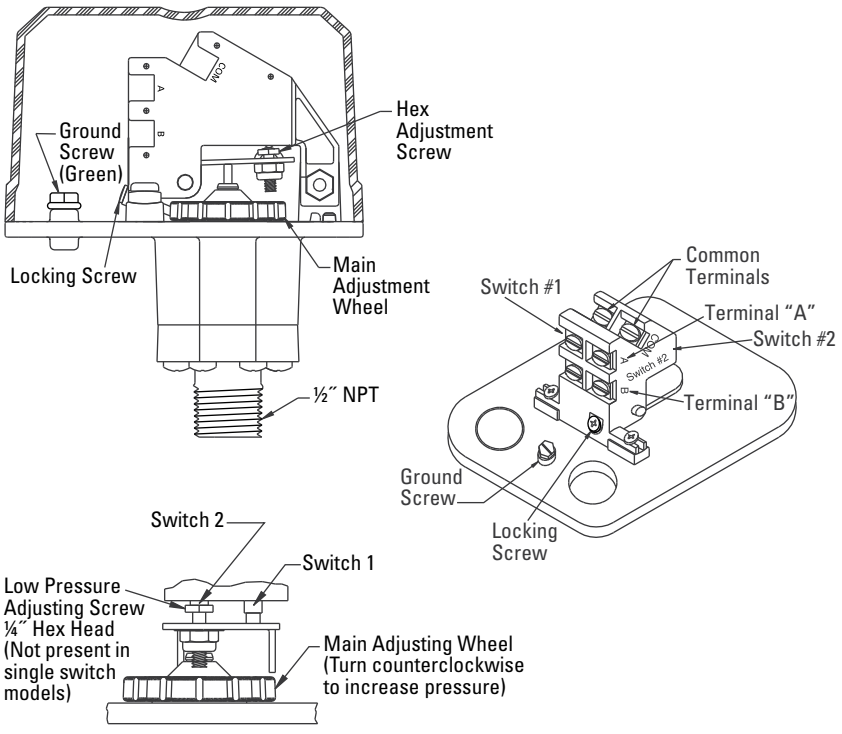


Figure 7: Parts of a pressure switch

Low pressure alarm switches should be installed with a ball valve in the line. A ball valve, which has a small orifice in it, is utilized to exhaust the pressure between the ball valve and the pressure switch. The ball valve allows testing of the pressure switch without any possibility of accidental operation of the dry pipe valve. In addition, it speeds up the testing process since a small amount of air is being released.

Maintenance and Service

After installation is complete, the pressure switch trip points should be tested by slowly introducing pressure from the test source. Test points should be tested several times to ensure accuracy of the setting. Preventative maintenance and periodic testing should be performed as required by the applicable NFPA standards. It is recommended that testing be done at least bi-monthly, or as often as required by the AHJ.

Explosion Proof Detectors

Principles of Operation

The majority of fire sprinkler monitoring devices are available in explosion proof designs. Typically, devices include U-bolt style water flow detectors; alarm and supervisory pressure switches; and OS&Y and PIBV supervisory switches.

Explosion proof products are typically installed in special applications that house high hazard operations. Examples include pulp and paper mills, distilleries, aircraft hangers, munitions plants, petrochemical factories, petroleum tank farms, and other areas that store flammable liquids and materials.

All explosion proof sprinkler monitoring devices are enclosed in rugged housings to prevent any internal spark (that could be caused by the activation of the switches enclosed in the housings) from becoming a secondary ignition point.

Product Placement/Maintenance and Service

Products are placed in the same manner and location as those installed in non-explosive environments. Testing and maintenance would be performed in the same manner.

Testing may be required more frequently to ensure the system is operating properly, since a fire in an explosive environment could have devastating effects.

Alarm Bells and Horn/Strobes

Principles of Operation

Alarm bells are low current, high decibel notification devices, which emit loud resonant tones during fire, burglary, or other alarm situations. The most common sizes of alarm bells are 6 inch, 8 inch, and 10 inch. Alarm bells that operate on 24 VDC are motor driven, and those that operate on 120 VAC have a vibrating mechanism. Alarm bells are suitable for both indoors and outdoors. Indoor alarm bells mount directly to a four inch square electrical box. Outdoor alarm bells must be used with a weatherproof back box. Typically, alarm bells are pre-wired, reducing installation time. The 24 VDC models incorporate a polarized electrical design for use with supervision circuitry.

Alarm bells are usually suitable for surface or semi-flush mounting, and incorporate under dome strikers and operating mechanisms.

Alarm bells are intended to be connected to alarm indication circuits of fire alarm control panels.

An outdoor horn/strobe can be installed in place of an alarm bell with the added benefit of providing both a visible and an audible notification.

Testing and Maintenance

After installation, all bells should be tested in accordance with NFPA 72. Periodic testing should also be performed at least annually, or as often as required by the AHJ.



Figure 7: Explosion proof water flow detector, pressure switch, and supervisory switch



Figure 8: Alarm bell and horn/strobe

Appendix 1

Glossary of Terms

alarm check valve
(non-approved back flow preventer) a single, soft-seated check valve (it may or may not be internally loaded) that will sound an alarm when the check valve opens. The alarm check shall have suitable connections for testing the water tightness and operation of the check valve.

automatic sprinkler system
an integrated system of underground and overhead piping connected to sprinkler heads, usually mounted in the ceiling, that is activated at a relatively low temperature during the initial stage of a fire. The sprinkler heads release a spray of water to extinguish the fire or prevent it from spreading. Insurance underwriters typically require automatic sprinkler systems in certain types of buildings or occupancies. Usually, sprinkler water supply systems must be independent of normal water service to the protected building. Periodic inspection and testing of sprinklers is required. The existence of an approved sprinkler system normally reduces premiums for the insured property.

alarm valve
a valve in automatic sprinkler systems, which automatically sends an alarm (sometimes a water motor gong or signal) directly to a notification device, alarm panel, and or the fire department. An alarm valve operates as a sprinkler head(s) fuses, allowing water to flow through the system.

deluge automatic sprinkler system
an automatic sprinkler system where all the sprinkler heads are open and the water is held back at a main (deluge) valve. When the valve is triggered, water is discharged from all the sprinkler heads simultaneously. The triggering device is usually a heat or smoke detector. This type of system is used where it is necessary to wet down a large area quickly, such as an airplane hangar or explosives factory.

dry pipe automatic sprinkler system
an automatic sprinkler system where all piping contains pressurized air. When a sprinkler head opens, the air is released causing the valve that is being held shut by the compressed air to open, allowing the water to flow into the system and to any open sprinkler heads. This type of system is used in areas where the sprinkler heads and the immediately adjacent piping can be exposed to freezing conditions.

dry valve
an automatic sprinkler valve under air pressure, designed to allow air to escape prior to the release of water. The air prevents freezing and bursting of pipes.

pre-action automatic sprinkler system
an automatic sprinkler system that is similar to a dry pipe system, but air pressure may or may not be used. The main sprinkler system control valve is opened by an actuating device, which permits water to flow to the individual sprinkler heads, and the system then functions as a wet pipe system. It is generally used in areas where piping systems are subject to mechanical damage, and where it is important to prevent accidental discharge of water.

riser
vertical supply pipes, valves and accessories in a sprinkler system.

wet pipe automatic sprinkler system
an automatic sprinkler system where all piping is filled with water under pressure and released by a fusible mechanism in the sprinkler head.



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www.systemsensor.com

WFD Vane-type Waterflow Detectors

SPECIFICATIONS

Contact Ratings:	10 A @ 125/250 VAC ~; 2.5 A @ 24 VDC ⎓
Triggering Threshold Bandwidth (Flow Rate):	4 to 10 gpm
Static Pressure Rating:	See models listed below
Dimensions, Installed:	3.5 in H x 3.0 in W x 6.7 in D
Operating Temperature Range:	32°F to 120°F (0°C to 49°C)
Compatible Pipe:	Steel water pipe, schedule 10 through 40
Shipping Weight:	4 to 7 lb (according to size)
Enclosure Rating:	NEMA Type 4, as tested by Underwriters Laboratories, Inc. (IP56)
U. S. Patent Numbers:	5,213,205

IMPORTANT

Please Read Carefully And Save

This instruction manual contains important information about the installation and operation of waterflow detectors. Purchasers who install waterflow detectors for use by others must leave this manual or a copy of it with the user.

Read all instructions carefully before beginning. Follow only those instructions that apply to the model you are installing.

⚠CAUTION

Use vane-type waterflow detectors in wet-pipe systems only. Do NOT use them in dry pipe, deluge, or preaction systems. The sudden inrush of water in such systems may break the vane or damage the mechanism.

Do not use in potentially explosive atmospheres. Do not allow unused wires to remain exposed.

PRINCIPLES OF OPERATION

Vane-type waterflow detectors mount to water-filled pipes in sprinkler systems. Waterflow in the pipe deflects a vane, which produces a switched output–usually after a specified delay. All waterflow detectors have a pneumatically controlled mechanical delay mechanism. Delays do NOT accumulate; they reset if the flow of water stops before the entire delay has elapsed. All switches actuate when the water flow rate is 10 gallons per minute or greater, but will not actuate if the flow rate is less than 4 gallons per minute. This System Sensor installation manual covers the following waterflow detectors for sprinkler/fire alarm applications.

Model	Pipe Size (inches)	Pipe Schedule	Max. Pressure Rating (psig)
WFD20	2	10 thru 40	450
WFD25	2.5	10 thru 40	450
WFD30-2	3	10 thru 40	450
WFD35	3.5	10 thru 40	450
WFD40	4	10 thru 40	450
WFD50	5	10 thru 40	450
WFD60	6	10 thru 40	450*
WFD80	8	10 thru 40	450*

*Maximum Pressure Rating 400 psig as approved by Factory Mutual Research.

⚠CAUTION

Do NOT use any of the WFD models on copper pipe. The clamping forces of the mounting bolts may collapse the pipe sufficiently to prevent the detector from functioning properly.

Do NOT install steel or iron pipe sections in copper piping for mounting a waterflow detector. Incompatibility between the dissimilar metals causes bimetallic corrosion.

INSTALLATION GUIDELINES

Before installing any waterflow alarm device, be thoroughly familiar with:

NFPA 72: National Fire Alarm Code

NFPA 13: Installation of Sprinkler Systems, Sect. 3.17

NFPA 25: Inspection, Testing and Maintenance of Sprinkler Systems, Sect. 5.3.3.2

Other applicable NFPA standards, local codes, and the requirements of the authority having jurisdiction

NOTE: Installation methods other than those listed in this installation manual may prevent the device from reporting the flow of water in the event the associated sprinkler system is activated by a fire. System Sensor is not responsible for devices that have been improperly installed, tested, or maintained.

1. Mount the detector where there is adequate clearance for installation and removal and a clear view of it for inspections. See Figure 1 for mounting dimensions.
2. Locate the detector 6 to 7 feet above the floor to protect from accidental damage.
3. On horizontal runs, position the detector on the top or side of the pipe. Do not mount it upside down because condensation may collect in the housing and impair the operation of the detector. For vertical flow applications, mount the detector on pipe through which water flows upward. Otherwise, the unit may not operate properly.
4. Mount the detector at least 6 inches from a fitting that changes the direction of water flow and no less than 24 inches from a valve or drain.
5. Be sure the direction-of-flow arrow matches the direction of flow in the pipe.

MOUNTING INSTRUCTIONS

1. Drain the pipe.
2. Cut a hole at the desired location. Center the hole in the pipe, as shown in **Figure 2**, and be sure the hole is perpendicular to the center of the pipe. Before drilling, use a punch or scribe to mark the drill site to prevent the bit from slipping. If the hole is off center, the vane will bind against the inside wall of the pipe. Use a drill or hole saw to cut a hole of the proper diameter. See Table 1 for hole size.

⚠CAUTION

When drilling the hole with a hole saw, make certain that the center of the cut does not remain in the pipe.

3. Remove burrs and sharp edges from the hole. Clean and remove all scale and foreign matter from the inside of the pipe for one diameter on each side of the hole to ensure free movement of the vane. Clean the outside of the pipe to remove dirt, metal chips, and cutting lubricant.
4. Seat the gasket against the saddle and mount the detector directly to the pipe. Carefully roll the vane opposite the direction of flow and insert it through the hole. Seat the saddle firmly against the pipe so that the locating boss goes into the hole.

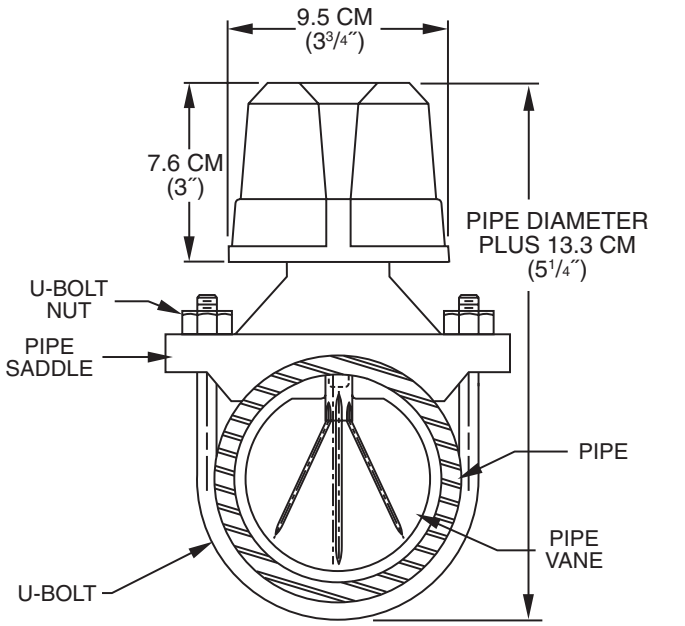
5. Install the U-bolt, tightening the nuts alternately to ensure a uniform seal (see **Table 1** for torque values).

6. Remove the metal cover with the tamper-proof wrench provided. Move the actuator lever back and forth to check for binding. If the vane binds, remove the detector and correct the cause before proceeding.

⚠CAUTION

Be sure the direction-of-flow arrow points in the right direction or else water flow will go unreported. See **Figure 3**.

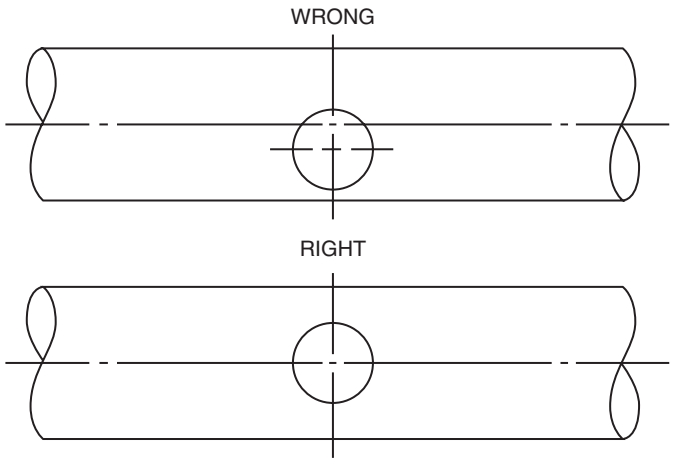
FIGURE 1. MOUNTING DIMENSIONS:



OVERALL WIDTH = PIPE DIAMETER + 7.6 CM (3″)

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FIGURE 2. MOUNTING HOLE LOCATION:



REMOVE BURRS FROM EDGE OF HOLE. CLEAN OUT SCALE AND FOREIGN MATTER FROM INSIDE WALL OF PIPE.

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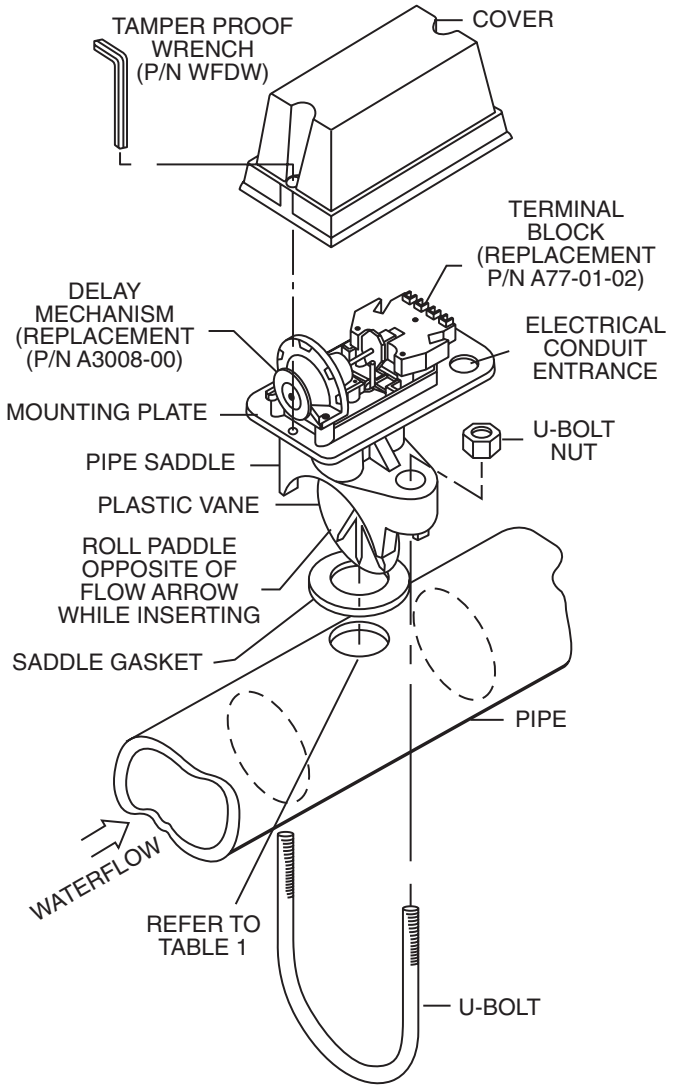
TABLE 1:

WFD MODEL	HOLE SIZE (IN)	TORQUE
20, 25, 35	1¼	30–35 ft.-lb.
30-2, 40, 50, 60, 80	2	55–60 ft.-lb.

PRE-OPERATION TESTING

1. Fill the sprinkler system and check for leaks around the waterflow detector. If it leaks, first check for the proper torque on the U-bolt nuts. If the leak persists, drain the system and remove the detector (refer to Maintenance). Check for dirt or foreign objects under the gasket, and make sure that the pipe surface is not dented. Reinstall the detector and check again for leaks. Do not proceed until all leaks have been stopped.
2. Connect an ohmmeter or continuity tester across the COM and B-NO switch terminals. The ohmmeter should indicate an open circuit.
3. Deflect the actuator lever and hold it until the pneumatic delay shaft releases the switch buttons. The ohmmeter or continuity tester should show a short circuit after the delay has elapsed. If there is no delay, check the setting of the delay adjustment dial.

FIGURE 3. ASSEMBLY DIAGRAM:



W101-01

WIRING

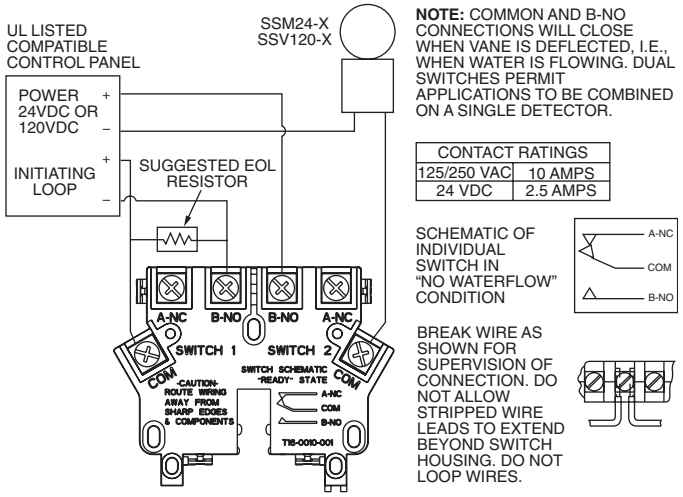
1. All models have two SPDT switches. Switch contacts COM and B-NO are closed when water is flowing and open when it is not. Connect the switches, as shown in Figure 4, depending on the application.
2. When connected to a listed sprinkler/fire alarm control panel, the initiating circuit must be nonsilenceable.
3. A ground screw is provided with all waterflow detectors. When grounding is required, clamp wire with screw in hole located between conduit entrance holes. See Figure 5A, page 4.
4. If a second conduit entry is required, remove the knockout plug using a flat blade screwdriver as shown on Figure 5B, page 4. Strike sharply with a hammer to pierce the wall of the knockout plug. Move to an adjacent wall section and repeat until the plug falls out. Make sure that the waterflow detector is supported adequately during this operation to avoid injury.

⚠WARNING

High Voltage. Electrocution Hazard. Do not handle live AC wiring or work on a device to which AC power is applied. Doing so may result in injury or death.

When utilizing switches at voltages greater than 74VDC ⎓ or 49VAC ~ means to provide all–pole disconnection must be incorporated in the fixed wiring, such as a circuit breaker.

FIGURE 4. WFD WIRING:



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MECHANICAL DELAY ADJUSTMENT

The pneumatic delay is preset at the factory to 30 seconds. To adjust the setting, turn the adjustment dial clockwise to increase the delay, counterclockwise to decrease it. The delay is adjustable from 0 to 90 seconds. See Figure 6, page 4.

NOTE: Set the delay to the minimum required to prevent false alarms from flow surges.

Periodically test time delay as required by Authority Having Jurisdiction or code authority.

OPERATIONAL TESTING

Always notify a central station monitoring waterflow alarms before repairing, maintaining, or testing waterflow alarm devices.

1. Replace the cover and tighten the tamper proof screws with the tamper proof wrench. Store the wrench in a secure place.
2. Open the inspector's test valve and time how long it takes for the detector to indicate a flow condition. The detector should remain activated until the inspector's test valve is closed. Air pockets in the sprinkler system may increase the apparent delay.

MAINTENANCE

To prevent accidental water damage, control valves should be shut tight and the system completely drained before waterflow detectors are removed or replaced.

Inspect detectors in accordance with applicable NFPA codes and standards and/or the authority having jurisdiction for leaks and replace if a leak occurs. Test detectors at least quarterly, as described under Operational Testing, to ensure proper operation. Test more often if required by the authority having jurisdiction.

Under normal conditions, System Sensor waterflow detectors should provide years of trouble-free service. However, if the delay mechanism or switch enclosure needs to be replaced, follow these directions. To replace the delay mechanism or switch enclosure, use a 3/16″ socket head screwdriver to remove the three screws that hold it in place. Either mechanism can be easily replaced without removing the detector from the pipe or draining the pipe. To replace the delay mechanism, request Part No. A3008-00. For switch enclosure, request Part No. A77-01-02. Do not repair or replace any other waterflow detector components. If any other part of the detector does not perform properly, replace the entire detector. Installation methods other than those listed in this installation manual may prevent the device from reporting the flow of water in the event the associated sprinkler system is activated by a fire. System Sensor is not responsible for devices that have been improperly installed, tested, or maintained.

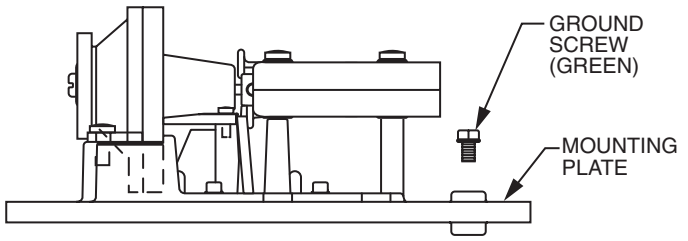
To remove a detector:

1. Drain the pipe.
2. Turn off electrical power to the detector and disconnect the wiring.
3. Loosen the nuts and remove the U-bolts.
4. Gently lift the saddle far enough to get your fingers under it. Then, roll the vane so it will fit through the hole while continuing to lift the waterflow detector saddle.
5. Lift the detector clear of the pipe.

⚠CAUTION

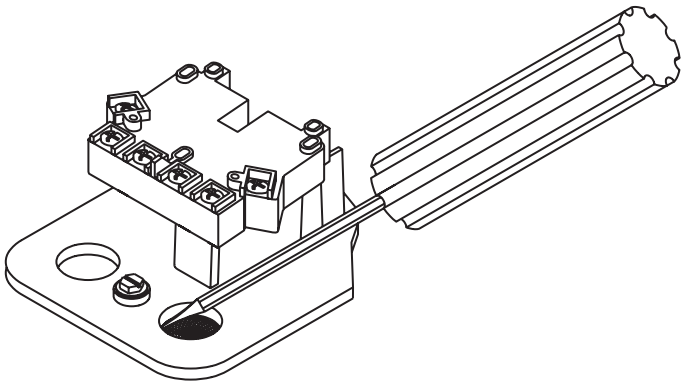
If a vane breaks in a pipe, find and remove it. If it is not removed, the vane may restrict the flow of water to all or part of the sprinkler system.

FIGURE 5A. GROUND SCREW LOCATION:



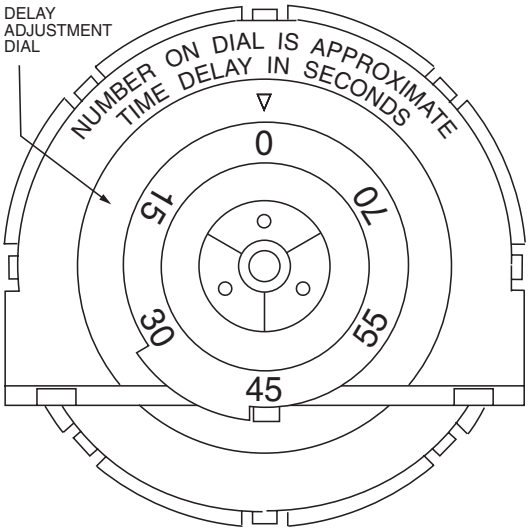
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FIGURE 5B. KNOCKOUT PLUG REMOVAL:



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FIGURE 6. DELAY ADJUSTMENT DIAL:



NOTE: RETARD TIME MAY EXCEED 90 SECONDS. ADJUST AND VERIFY THAT TIME DOES NOT EXCEED 90 SECONDS. NUMBER ON DIAL IS APPROXIMATE TIME DELAY IN SECONDS WITH AN ACCURACY OF +/– 50%.

W0112-02

Please refer to insert for the Limitations of Fire Alarm Systems

⚠WARNING

THE LIMITATIONS OF WATERFLOW ALARM DEVICES

1. Waterflow detectors may not work or operate properly if sprinkler piping being monitored is plugged with pipe scale, mud, stones or other foreign material. Sprinkler systems should be checked regularly for such blocking material, following the instructions in Chapter 5 of NFPA Standard 13A.
2. Alarms generated by the activation of waterflow detectors may not be received by a central station if telephone or other communication lines to the detector are out of service, disabled, or open.
3. Vane-type waterflow detectors have a normal service life of 10-15 years. Hard water systems, however, may substantially reduce waterflow detector service life.
4. Waterflow detectors are not a substitute for insurance. Building owners should always insure property and lives being protected by sprinkler systems.
5. If valves controlling the water supply to a sprinkler system are closed, vane-type waterflow detectors will not work. All valves controlling a sprinkler water supply should be sealed or locked in the normally open position. The normally open position should be monitored by a sprinkler supervisory switch.

THREE-YEAR LIMITED WARRANTY

System Sensor warrants its enclosed waterflow detector to be free from defects in materials and workmanship under normal use and service for a period of three years from date of manufacture. System Sensor makes no other express warranty for this waterflow detector. No agent, representative, dealer, or employee of the Company has the authority to increase or alter the obligations or limitations of this Warranty. The Company's obligation of this Warranty shall be limited to the repair or replacement of any part of the waterflow detector which is found to be defective in materials or workmanship under normal use and service during the three year period commencing with the date of manufacture. After phoning System Sensor's toll free number 800-SENSOR2 (736-7672) for a Return Authorization number, send defective units postage prepaid to: System Sensor, Returns Department, RA #_____, 3825 Ohio Avenue, St. Charles, IL 60174. Please include a note describing the malfunction and suspected cause of failure. The Company shall not be obligated to repair or replace units which are found to be defective because of damage, unreasonable use, modifications, or alterations occurring after the date of manufacture. In no case shall the Company be liable for any consequential or incidental damages for breach of this or any other Warranty, expressed or implied whatsoever, even if the loss or damage is caused by the Company's negligence or fault. Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you. This Warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

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