

**Where Do I Find Everything I Need for
Process Measurement and Control?
OMEGA...Of Course!**

TEMPERATURE

- ☑ Thermocouple, RTD & Thermistor Probes, Connectors, Panels & Assemblies
- ☑ Wire: Thermocouple, RTD & Thermistor
- ☑ Calibrators & Ice Point References
- ☑ Recorders, Controllers & Process Monitors
- ☑ Infrared Pyrometers

PRESSURE, STRAIN AND FORCE

- ☑ Transducers & Strain Gauges
- ☑ Load Cells & Pressure Gauges
- ☑ Displacement Transducers
- ☑ Instrumentation & Accessories

FLOW/LEVEL

- ☑ Rotameters, Gas Mass Flowmeters & Flow Computers
- ☑ Air Velocity Indicators
- ☑ Turbine/Paddlewheel Systems
- ☑ Totalizers & Batch Controllers

pH/CONDUCTIVITY

- ☑ pH Electrodes, Testers & Accessories
- ☑ Benchtop/Laboratory Meters
- ☑ Controllers, Calibrators, Simulators & Pumps
- ☑ Industrial pH & Conductivity Equipment

DATA ACQUISITION

- ☑ Data Acquisition & Engineering Software
- ☑ Communications-Based Acquisition Systems
- ☑ Plug-in Cards for Apple, IBM & Compatibles
- ☑ Datalogging Systems
- ☑ Recorders, Printers & Plotters

HEATERS

- ☑ Heating Cable
- ☑ Cartridge & Strip Heaters
- ☑ Immersion & Band Heaters
- ☑ Flexible Heaters
- ☑ Laboratory Heaters

**ENVIRONMENTAL
MONITORING AND CONTROL**

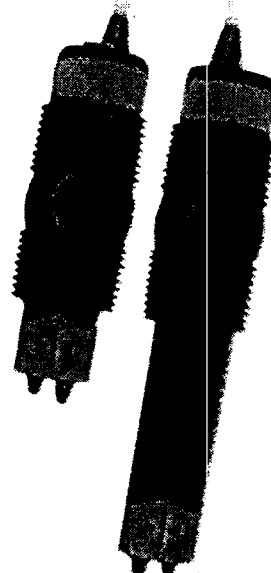
- ☑ Metering & Control Instrumentation
- ☑ Refractometers
- ☑ Pumps & Tubing
- ☑ Air, Soil & Water Monitors
- ☑ Industrial Water & Wastewater Treatment
- ☑ pH, Conductivity & Dissolved Oxygen Instruments

M3948/0403

User's Guide



<http://www.omega.com>
e-mail: info@omega.com



**FST-200/-300 Series
Thermal Dispersion Flow Switch**

WARRANTY/DISCLAIMER

OMEGA ENGINEERING, INC. warrants this unit to be free of defects in materials and workmanship for a period of 13 months from date of purchase. OMEGA's Warranty adds an additional one (1) month grace period to the normal one (1) year product warranty to cover handling and shipping time. This ensures that OMEGA's customers receive maximum coverage on each product.

If the unit malfunctions, it must be returned to the factory for evaluation. OMEGA's Customer Service Department will issue an Authorized Return (AR) number immediately upon phone or written request. Upon examination by OMEGA, if the unit is found to be defective, it will be repaired or replaced at no charge. OMEGA's WARRANTY does not apply to defects resulting from any action of the purchaser, including but not limited to mishandling, improper interfacing, operation outside of design limits, improper repair, or unauthorized modification. This WARRANTY is VOID if the unit shows evidence of having been tampered with or shows evidence of having been damaged as a result of excessive corrosion; or current, heat, moisture or vibration; improper specification; misapplication; misuse or other operating conditions outside of OMEGA's control. Components which wear are not warranted, including but not limited to contact points, fuses, and triacs.

OMEGA is pleased to offer suggestions on the use of its various products. However, OMEGA neither assumes responsibility for any omissions or errors nor assumes liability for any damages that result from the use of its products in accordance with information provided by OMEGA, either verbal or written. OMEGA warrants only that the parts manufactured by it will be as specified and free of defects. OMEGA MAKES NO OTHER WARRANTIES OR REPRESENTATIONS OF ANY KIND WHATSOEVER, EXPRESS OR IMPLIED, EXCEPT THAT OF TITLE, AND ALL IMPLIED WARRANTIES INCLUDING ANY WARRANTY OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE HEREBY DISCLAIMED. LIMITATION OF LIABILITY: The remedies of purchaser set forth herein are exclusive, and the total liability of OMEGA with respect to this order, whether based on contract, warranty, negligence, indemnification, strict liability or otherwise, shall not exceed the purchase price of the component upon which liability is based. In no event shall OMEGA be liable for consequential, incidental or special damages.

CONDITIONS: Equipment sold by OMEGA is not intended to be used, nor shall it be used: (1) as a "Basic Component" under 10 CFR 21 (NRC), used in or with any nuclear installation or activity; or (2) in medical applications or used on humans. Should any Product(s) be used in or with any nuclear installation or activity, medical application, or humans, or misused in any way, OMEGA assumes no responsibility as set forth in our basic WARRANTY/DISCLAIMER language, and, additionally, purchaser will indemnify OMEGA and hold OMEGA harmless from any liability or damage whatsoever arising out of the use of the Product(s) in such a manner.

RETURN REQUESTS/INQUIRIES

Direct all warranty and repair requests/inquiries to the OMEGA Customer Service Department. BEFORE RETURNING ANY PRODUCT(S) TO OMEGA, PURCHASER MUST OBTAIN AN AUTHORIZED RETURN (AR) NUMBER FROM OMEGA'S CUSTOMER SERVICE DEPARTMENT (IN ORDER TO AVOID PROCESSING DELAYS). The assigned AR number should then be marked on the outside of the return package and on any correspondence. The purchaser is responsible for shipping charges, freight, insurance and proper packaging to prevent breakage in transit.

FOR WARRANTY RETURNS, please have the following information available BEFORE contacting OMEGA:

1. Purchase Order number under which the product was PURCHASED.
2. Model and serial number of the product under warranty, and
3. Repair instructions and/or specific problems relative to the product.

FOR NON-WARRANTY REPAIRS, consult OMEGA for current repair charges. Have the following information available BEFORE contacting OMEGA:

1. Purchase Order number to cover the COST of the repair.
2. Model and serial number of the product, and
3. Repair instructions and/or specific problems relative to the product.

OMEGA's policy is to make running changes, not model changes, whenever an improvement is possible. This affords our customers the latest in technology and engineering.

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e-mail: info@omega.com

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Laval (Quebec) H7L 5A1, Canada
Tel: (514) 856-6928
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For immediate technical or application assistance:

USA and Canada:
Sales Service: 1-800-826-6342 / 1-800-TC-OMEGA®
Customer Service: 1-800-622-2378 / 1-800-622-BEST®
Engineering Service: 1-800-872-9436 / 1-800-USA-WHEN®
TELEX: 996404 EASYLINK; 62968934
CABLE: OMEGA

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It is the policy of OMEGA to comply with all worldwide safety and EMC/EMI regulations that apply. OMEGA is constantly pursuing certification of its products to the European New Approach Directives. OMEGA will add the CE mark to every appropriate device upon certification.

The information contained in this document is believed to be correct, but OMEGA Engineering, Inc. accepts no liability for any errors it contains, and reserves the right to alter specifications without notice.
WARNING: These products are not designed for use in, and should not be used for, human applications.

SPECIFICATIONS

Step One

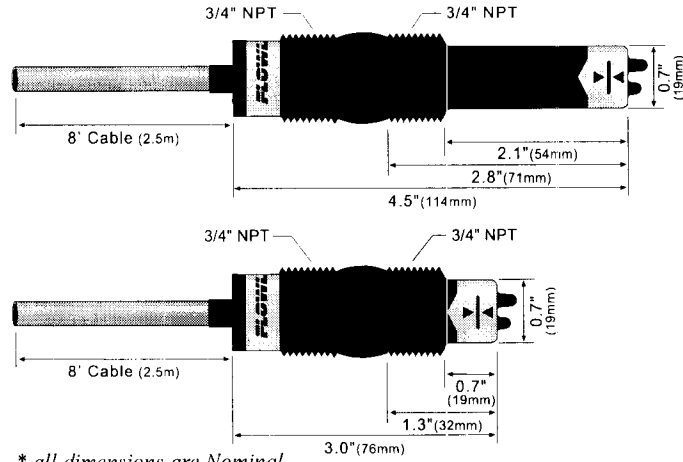
Common Specifications:

- Set point range: -200: .04 to 3 fps
(.012 to .91 mps)
- 300: 1 to 90 fps
(.3 to 27 mps)
- Factory set point: -200: .2 fps (.06 mps)
- 300: 10 fps (3 mps)
- Repeatability: $\pm 5\%$ of set point
- Response time: 1-10 seconds
- Set point adjust.: Potentiometer
- Viscosity range: 1-200 centipoise
(FST-200 only)
- Supply voltage: 12-36 VDC
- Consumption: 70 mA maximum
- Contact type: (1) SPST relay
- Contact rating: 120 VAC/VDC @ 1A
(CE: 60 VAC/VDC @ 1A)
- Contact output: Selectable NO/NC
- Process temp.: F: 32° to 140°
C: 0° to 60°
- Electronics temp.: F: -40° to 140°
C: -40° to 60°
- Pressure: 150 psi (10 bar) @ 25°
C., derated @ 1.667
psi (.113 bar) per °C.
above 25° C.
- Sensor rating: NEMA 4X (IP65)
- Sensor material: FST-2_1/-321/-322:
PP-Ryton®
FST-2_2/-323/-324:
PVDF Kynar®
- Cable jacket mat.: FST-2_1/-321/-322:
PP
FST-2_2/-323/-324:
PFA Teflon®
- Cable type: 4-conductor, #22 AWG
(shielded)
- Cable length: Standard. 10' (3m)
- Process mount: 3/4" NPT
- Classification: General purpose
- CE compliance: EN 50082-2 immunity
EN 55011 emission
EN 61010-1 safety

Pipe Sizes:

- Short Sensors
3/4 to 1-1/2
- Long Sensors
2 to 12

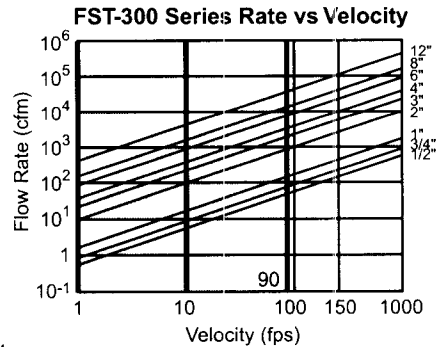
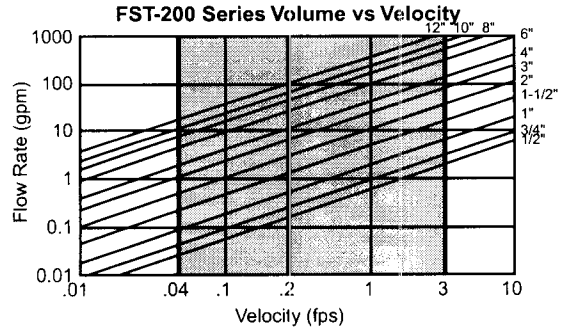
FST-200/-300 Series Dimensions



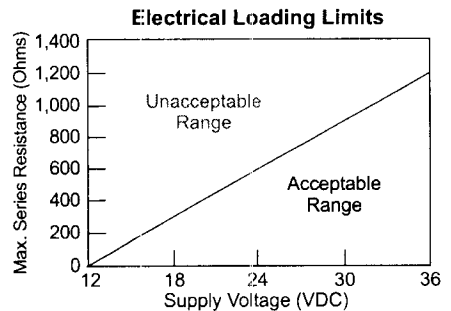
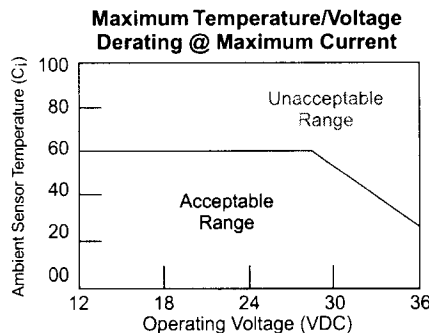
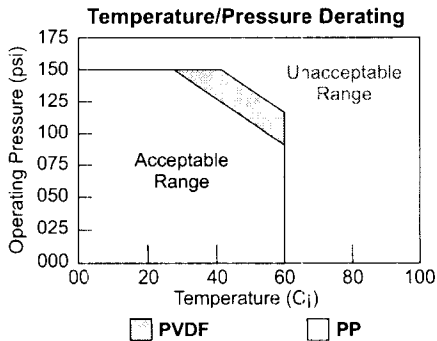
* all dimensions are Nominal

Set Points:

The FST-200 series liquid flow switch set point is factory calibrated to 0.2 fps and the FST-300 series gas flow switch is set to 10 fps. To convert feet/sec to GPM, please refer to the chart below.



Flow Switch	
Liquid	F S T - 2
Sensor Length	3 - Short
	4 - Long
Sensor Material	1 - PP
	5 - PVDF
Gas	F S T - 3 2
Sensor Descript.	1 - Short, PP
	2 - Long, PP
	3 - Short, PVDF
	4 - Long, PVDF



SAFETY PRECAUTIONS

Step Two

About this Manual:

PLEASE READ THE ENTIRE MANUAL PRIOR TO INSTALLING OR USING THIS PRODUCT. This manual includes information on all models of OMEGA's Flow Switches: FST-200 series and FST-300 series. Please refer to the part number located on the switch label to verify the exact model which you have purchased.

User's Responsibility for Safety:

OMEGA manufactures a wide range of flow switches and technologies. While each of these sensors is designed to operate in a wide variety of applications, it is the user's responsibility to select a sensor model that is appropriate for the application, install it properly, perform tests of the installed system, and maintain all components. The failure to do so could result in property damage or serious injury.

Proper Installation and Handling:

Because this is an electrically operated device, only properly-trained staff should install and/or repair this product. Use a proper sealant with all installations. Never overtighten the sensor within the fitting, beyond a maximum of 80 inch-pounds torque. Always check for leaks prior to system start-up.

Material Compatibility:

The flow switches are available in two different wetted materials. Models FST-211/-212/-321/-322 are made of Polypropylene (PP) with Ryton tips. Models FST-221/-222/-323/-324 are made of Polyvinylidene Fluoride (PVDF). Make sure that the model you have selected is compatible with the application liquid. To determine the chemical compatibility between the sensor and its application liquids, refer to an industry reference.

Wiring and Electrical:

The supply voltage used to power the sensor should never exceed a maximum of 36 volts DC. Electrical wiring of the sensor should be performed in accordance with all applicable national, state, and local codes.

Flammable, Explosive and Hazardous Applications:

DO NOT USE THE FST-200 SERIES OR FST-300 SERIES GENERAL PURPOSE FLOW SWITCHES IN HAZARDOUS LOCATIONS.

WARNING

The rating for the relay is 120 VAC/60 VDC @ 1A. For CE rated applications, the relay rating is 60 VAC/60 VDC @ 1A.

The OMEGA flow switches are not recommended for use with electrically charged application liquids. For most reliable operation, the liquid being measured may need to be electrically grounded.

INTRODUCTION

Step Three

Technology:

The thermal dispersion flow switch measures liquid or gas temperature to determine changes in flow velocity. As fluid flows across the sensing tips, the temperature is reduced proportionately as a function of the flow rate. When a temperature or velocity shift reaches the user defined set point, the switch changes state indicating the appropriate flow condition (flow or no-flow).

OMEGA's sophisticated electronics convert the temperature shift into a signal which indicates whether a flow or no-flow condition occurs. Depending on how the sensor is wired, this signal may be wired for normally open or normally closed circuits.

OMEGA's flow switches have no moving parts to clog or foul, making them suitable for a variety of applications, including non-coating and non-scaling liquids. The FST-200 series directly measure mass flow and can operate over a broad range of liquids from 0.4 to 1.2 specific gravity, 1 to 300 cp. The FST-300 series directly measure mass flow and can operate over a broad range of liquids from 0.4 to 1.2 specific gravity, 1 to 300 cp.

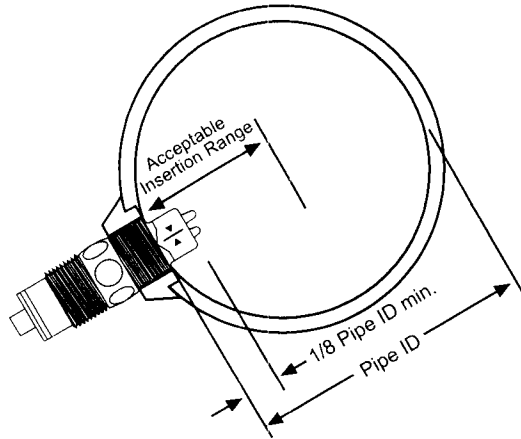
Initialization Sequence for FST-200 series:

Powering up the FST-200 series is different in water and in air. When the flow switch is powered up while submerged, the FST-200 series will immediately indicate flow before switching to its correct state. When the flow switch is powered up while in air, the FST-200 series will immediately indicate no-flow before indicating its correct state. A time delay may be used to eliminate this initialization sequence. Omega's thermal dispersion relay controllers feature a 0 to 60 second time delay for your convenience.

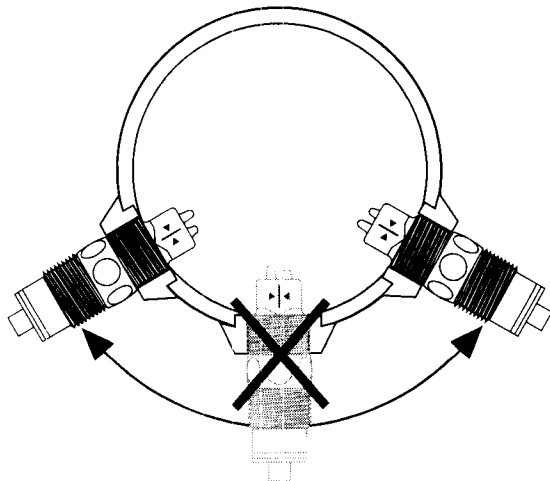
INSTALLATION

Step Four

The FST-200 series flow switch when installed must always be in contact with the liquid being measured. The FST-300 series flow switch when installed must never be submersed in liquid. Both flow switches feature a 3/4" NPT threads which will allow it to be used with various types of fittings. Be sure to check the insertion depth of the flow switch in the fitting after it is installed. See the diagram below for the recommended insertion depth.



When using any type of fitting, the orientation as well as the insertion depth of the flow switch in the pipe is critical. See the diagram below for the recommended orientation depth.



⚠ WARNING ⚠

The flow switch tips have a thin plastic wall which may be damaged if dropped or installed improperly.

The FST-200 series flow switch is designed for use in liquid. For best results, avoid installing the flow switch where bubbles are present or where the tips of the switch may be out of the liquid.

The FST-300 flow switch is designed for use in gas applications. For best results, avoid installing the flow switch where it may be submersed in liquid.

WIRING

Step Five

Supply Voltage:

The supply voltage to the flow switch should never exceed a maximum of 36 VDC. Use controllers or power supplies, with a minimum output of 12 VDC or a maximum output of 36 VDC.

Required Cable Length:

Determine the length of cable required between the flow switch and its point of termination. Allow enough slack to ensure the easy installation, removal and/or maintenance of the sensor. The cable length may be extended up to a maximum of 1000 feet, using a well-insulated, 14 to 20 gauge shielded four conductor cable.

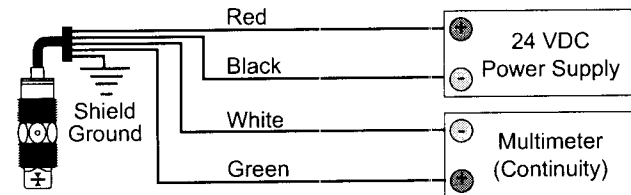
Wire Stripping:

Using a 10 gauge wire stripper, carefully remove the outer layer of insulation from the last 1-1/4" of the sensor's cable. Unwrap and discard the exposed foil shield from around the signal wires, leaving the drain wire attached if desired. With a 20 gauge wire stripper, remove the last 1/4" of the colored insulation from the signal wires.

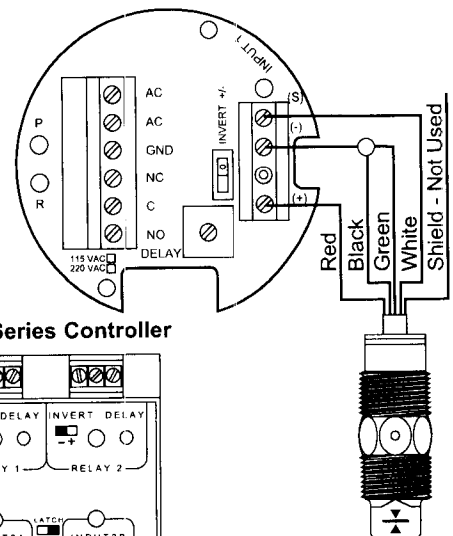
Signal Output (Relay switching):

Allows the sensor to switch a small load on or off directly, using an internal 1A relay [120 VAC/VDC or (CE: 60 VAC/VDC)]. The NO/NC status is set by the polarity of the voltage feeding the red and black wires. The green wire is the common for the relay and the white wire is the NO or NC, depending on the polarity of red and black.

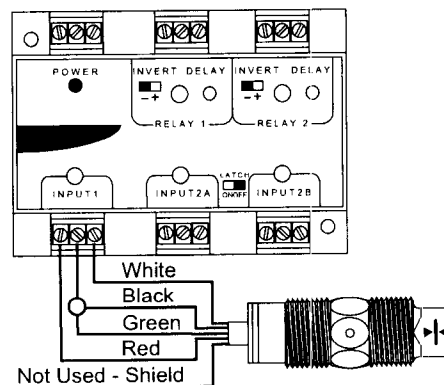
Normally Open Wiring:



Wiring to an OMEGA Controller: LVCN-111 Series Controller



LVCN-131/-141 Series Controller



WIRING

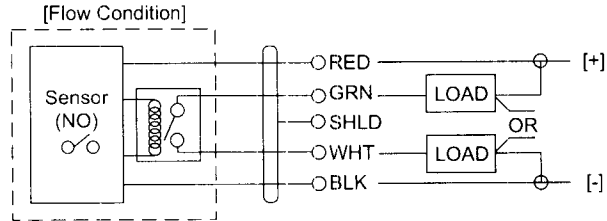
Step Six

Wiring the Relay Output:

The relay output can be wired as a dry contact to a VDC or VAC power source. The flow switch does require 12 - 36 VDC power to operate the sensor and switch the relay. All illustrations below identify a Dry switch state as the normal position of the relay.

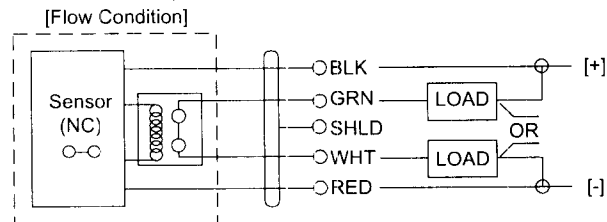
Switching a Normally Open DC Load:

The Red wire connects to Positive (+) of the power supply and the Black wire connects to Negative (-). The LOAD can be attached to either the Green or White wires. Complete the circuit by either connecting the Green to (+) VDC power or White to (-) VDC power (see illustration below).



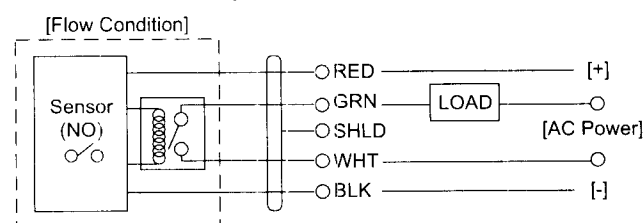
Switching a Normally Closed DC Load:

The Black wire connects to Positive (+) of the power supply and the Red wire connects to Negative (-). The LOAD can be attached to either the Green or White wires. Complete the circuit by either connecting the Green to (+) VDC power or White to (-) VDC power (see illustration below).



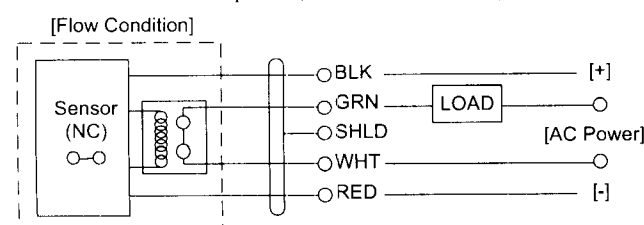
Switching a Normally Open AC Load:

The Red wire connects to Positive (+) of the DC power supply and the Black wire connects to Negative (-). The LOAD can be attached to the Green wire and the Hot of the VAC power. Connect the White to the Neutral of the VAC power (see illustration below).



Switching a Normally Closed AC Load:

The Black wire connects to Positive (+) of the DC power supply and the Red wire connects to Negative (-). The LOAD can be attached to the Green wire and the Hot of the VAC power. Connect the White to the Neutral of the VAC power (see illustration below).



WIRING

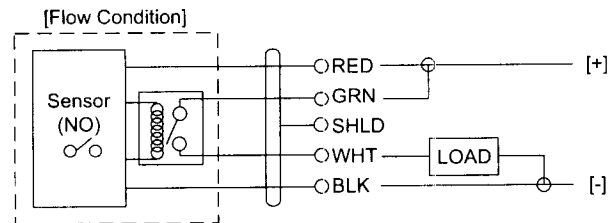
Step Seven

Wiring as a P-Channel or N-Channel output:

The flow switch can be substituted for either a P-Channel (PNP, sourcing) output or a N-Channel (NPN, sinking) output.

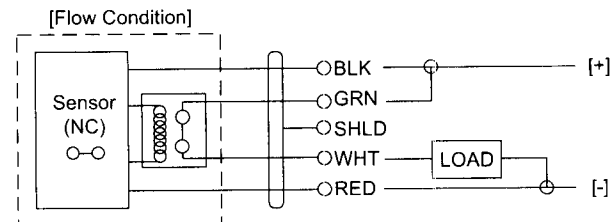
Normally Open DC Load as a P-Channel Output:

To wire as a NO P-Channel output, follow the directions below. The Red wire connects to Positive (+) of the power supply and the Black wire connects to Negative (-). The Green wire is jumpered to the Red wire while the White wire is connected to the LOAD. Jumper the LOAD back to the Negative (-) to complete the circuit.



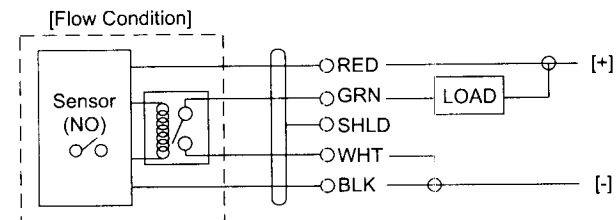
Normally Closed DC Load as a P-Channel Output:

To wire as a NC P-Channel output, follow the directions below. The Black wire connects to Positive (+) of the power supply and the Red wire connects to Negative (-). The Green wire is jumpered to the Black wire while the White wire is connected to the LOAD. Jumper the LOAD back to the Negative (-) to complete the circuit.



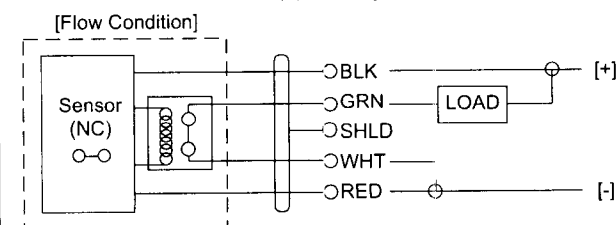
Normally Open DC Load as a N-Channel Output:

To wire as a NO N-Channel output, follow the directions below. The Red wire connects to Positive (+) of the power supply and the Black wire connects to Negative (-). The White wire is jumpered to the Black wire while the Green wire is connected to the LOAD. Jumper the LOAD back to the Positive (+) to complete the circuit.



Normally Closed DC Load as a N-Channel Output:

To wire as a NC N-Channel output, follow the directions below. The Black wire connects to Positive (+) of the power supply and the Red wire connects to Negative (-). The White wire is jumpered to the Red wire while the Green wire is connected to the LOAD. Jumper the LOAD back to the Positive (+) to complete the circuit.



CALIBRATION

Step Eight

Set Points:

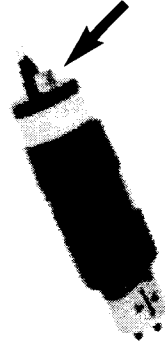
If the preset factory calibration is not adequate for your application, follow the calibration steps listed below. **Note:** the switch's internal LED will be on when the switch detects no-flow and will off when the switch detects flow.

1. Install the fitting and flow switch as described in the Installation section of this manual. Turn the flow switch and controller power on and adjust the flow rate to the application setting. If the medium to be sensed is likely to be subject to high temperature variations, the flow switch should be set at the highest normal temperature likely to be encountered.
2. Locate the potentiometer knob at the top of the flow switch. The red LED is visible through the potentiometer. (If the LED is on, slowly adjust the potentiometer counterclockwise, with a small flat head screwdriver until the LED turns off.) The adjustment is a single turn 270° potentiometer. The initial response time of the flow switch after adjustment is 1 to 10 seconds. Adjust the potentiometer in slow increments and wait for the response.

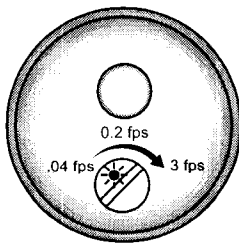
If the LED is off, slowly adjust the potentiometer clockwise until the light turns on. Then turn the potentiometer counterclockwise to bring the LED off at a reliable setting. Remember, adjust the potentiometer in slow increments and wait for the response.

3. Verify that the new calibration is correct by lowering the system flow rate below the set point and check to see that the red LED turns on. Then increase the flow rate above the set point and verify that the red LED turns off accordingly.

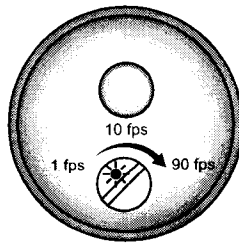
Potentiometer Knob



FST-200 Series



FST-300 Series



MAINTENANCE

Step Nine

General:

The flow switch requires no periodic maintenance except to clean off any deposits or scaling from the sensor tip as necessary. It is the responsibility of the user to determine the appropriate maintenance schedule, based on the specific characteristics of the application liquids.

Cleaning Procedure:

1. **Power:** Make Sure that all power to the sensor, controller and/or power supply is completely disconnected.
2. **Sensor Removal:** Make sure that the flow is off and the pressure is down prior to removing the flow switch. Carefully, remove the sensor from the installation. Replace the sensor with a 3/4" NPT plug to insure that liquid does not leak out during this procedure. **Do not re-install the flow switch if the threads are damaged.**
3. **Cleaning the Sensor:** Use a soft bristle brush and mild detergent, carefully wash the flow switch. Do not use harsh abrasives such as steel wool or sandpaper, which might damage the surface sensor. Do not use incompatible solvents which may damage the sensor's PP/Ryton or PVDF plastic body.
4. **Sensor Installation:** Follow the appropriate steps of installation as outlined in the installation section of this manual.

Testing the installation:

1. **Power:** Turn on power to the controller and/or power supply.
2. **Immersing the switch:** Immerse the sensing tip in its application liquid, by filling the tank up to the switches point of actuation. An alternate method of immersing the switch during preliminary testing is to hold a cup filled with application liquid up to the switch's tip.
3. **Test:** With the switch being fluctuated between wet and dry states, the switch indicator light in the controller should turn on and off. If the controller doesn't have an input indicator, use a voltmeter or ammeter to ensure that the switch produces the correct signal.
4. **Point of actuation:** Observe the point at which the rising or falling fluid level causes the switch to change state, and adjust the installation of the switch if necessary.