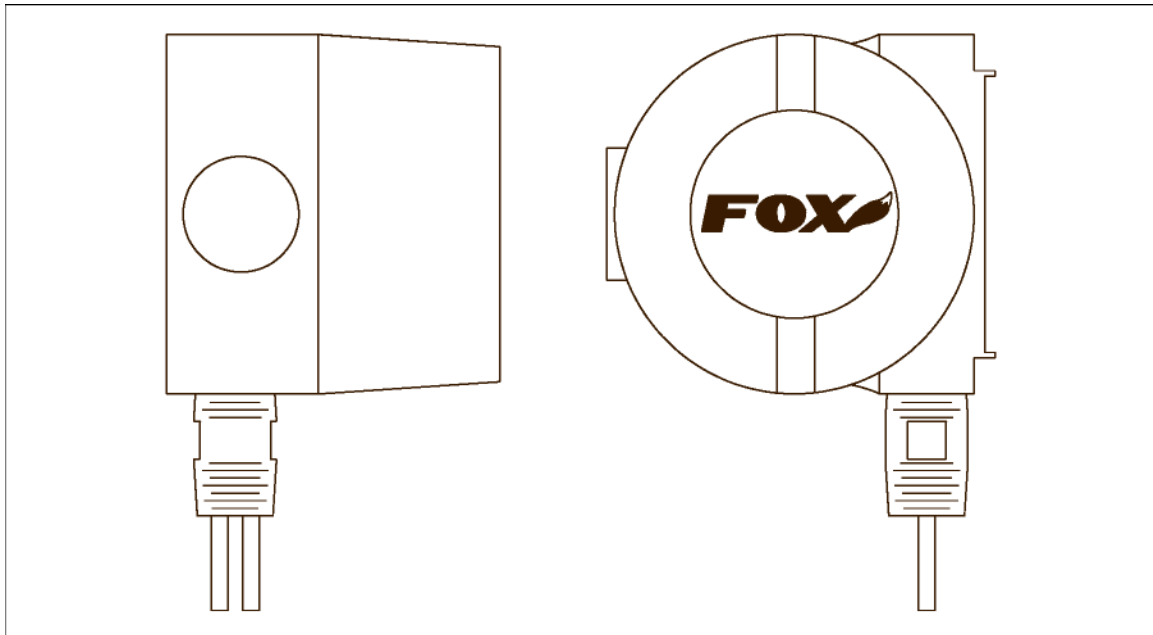




THERMAL INSTRUMENTS, INC.

MODEL SW100



INSTALLATION AND INSTRUCTION MANUAL

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NOTICE

This publication must be read in its entirety before performing any operation. Failure to understand and follow these Instructions could result in serious personal injury and/or damage to the equipment. Should this equipment require repair or adjustment beyond the procedures given herein, contact the factory at:

**FOX THERMAL INSTRUMENTS, INC.
399 RESERVATION ROAD
MARINA, CA 93933
TELEPHONE: (831) 384-4300
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The information provided herein is believed to be accurate. Be advised that the information contained herein is NOT a guarantee for satisfactory results. Specifically, this information is neither a warranty nor guarantee, expressed or implied, regarding performance; merchantability; fitness; or other matter with respect to the products; nor recommendation for the use of the product/process information in conflict with any patent. Please note that Fox Thermal Instruments, Inc. reserves the right to change and/or improve the product design and specifications without notice.

SECTION 1 - INTRODUCTION

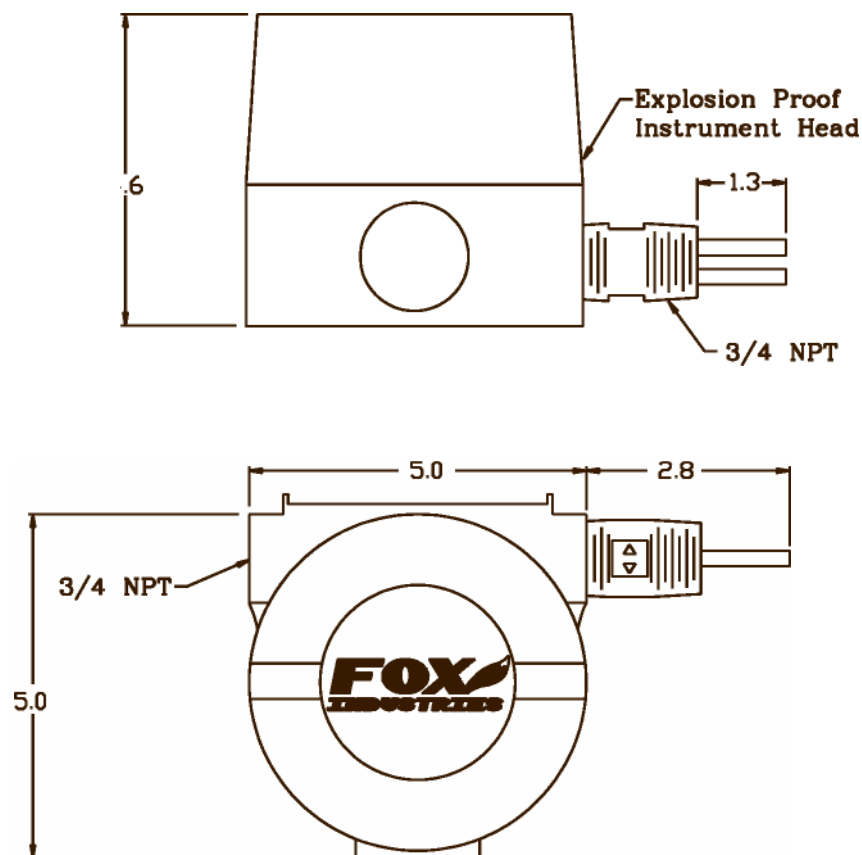
1.1 Theory of Operation

The Model SW100 operates on principal often called "thermal dispersion". An RTD in one thermal well measures fluid temperature. A second RTD measures the temperature of an adjacent thermal well which is heated with constant power through a heater element. The temperature difference between thermal wells provides the signal that can be used to trip the instrument's on board relay. At any customer-specified point, the switch point is set by a single potentiometer adjustment in the factory or in the field by the user.

Flow Detection - The temperature of the heated thermal well is greatest in a no flow condition. As flow increases, the temperature of the heated thermal well decreases providing a settable trip signal for the on board relay.

Level Detection - The temperature of the heated thermal well is greatest in the absence of liquids. When the heated thermal well is submerged, its temperature decreases providing a settable trip signal for the on board relay.

1.2 Dimensions and Mounting Details



1.3 Specifications

Product Specifications

- Repeatability: ± 1 % of reading

Operating Specifications

- Liquid range: 0.015 to 3 fps (0.005 to 1 mps)
- Gas range: 1 to 10 sfps (0.3 to 30 nmpps)
- Sensor: -40 to 300°F (-40 to 150°C); 3000 psig (207 barg)
- Enclosure: -40 to 140°F (-40 to 60°C)
- Response time: 2 to 20 seconds; application dependent
- Input power: 24 VDC, $\pm 10\%$ 0.5 amp or
115/230 VAC, $\pm 10\%$, 50/60 Hz, 0.25 amp
- Relay contact: 2 form C (DPDT) 5 amp, 250 VAC resistive

Physical Specifications

- Materials: Sensor – 316 stainless steel or Hastelloy C-276 (optional); Others available
Sanitary unit body – 316 stainless steel
- Switch point adjustment: Field set with single pot or factory set to specified velocity
- Clean and steam in place
- Enclosure: Cast aluminum; NEMA 4X (IP65); FM approved Explosion Proof: Class I, Division 1, Groups B, C, D T2C Class II/III, Division 1, Groups E, F, G T2A.
- CE approved

SECTION 2 - INSTALLATION

DANGER! HIGH VOLTAGE. DISCONNECT ELECTRICAL POWER AT EXTERNAL SOURCE BEFORE SERVICING OR SERIOUS INJURY INCLUDING DEATH WILL OCCUR.

2.1 Installation

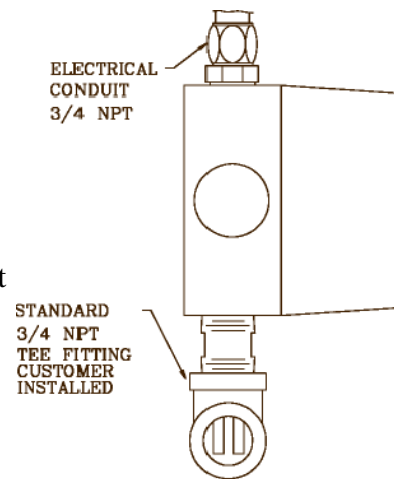
Installation procedures must be a combination of the end user's best engineering practices, in compliance with local codes, and the manufacturer's recommendations.

The following, general precautions should be observed:

- A. Exercise care during handling and installation to avoid damaging probe or probe enclosure.
- B. The enclosure cover must be replaced before and after installation.
- C. **Do not** mount the Model SW100 in direct sunlight.

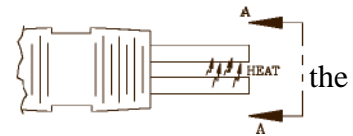
2.2 Mounting

The SW 100 is mounted by way of a 3/4 NPT Female hole provided in the customer's pipe. The SW100 will fit into a standard 3/4" diameter Tee, and no smaller. (See figure to the right.)



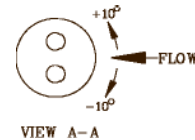
2.3 Sensor Orientation

Avoid mounting the SW100 in an orientation that has the heater element below the reference RTD. Convection for the heated element, as shown in the diagram at right, may cause false switch point detection.



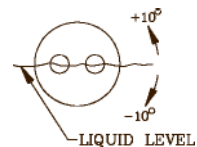
2.3.1 Flow Detection Installation

Install unit with sensor probes perpendicular to the flow within $\pm 10^\circ$. (view A-A)



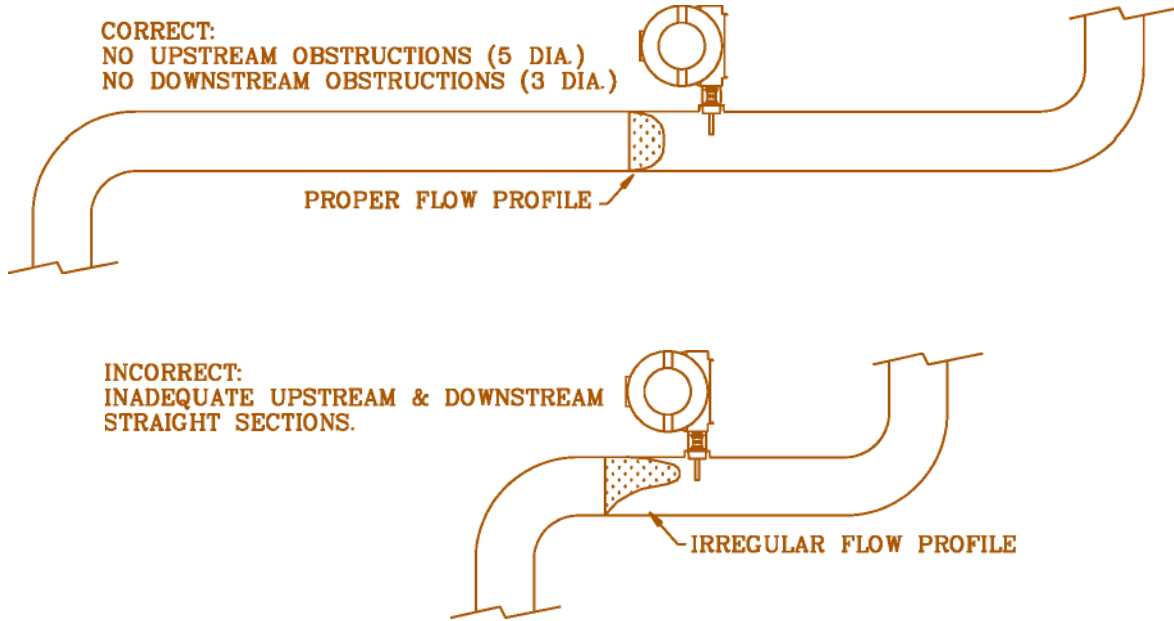
2.3.2 Level Detection Installation

When installing the SW100 on the side of a tank, install the unit with sensor elements parallel to the liquid level within $\pm 10^\circ$.



2.4 Unit Placement

To avoid improper switching, the SW100 should be installed five (5) pipe diameters downstream and three (3) pipe diameters upstream from elbows or valves.



SECTION 3 - WIRING

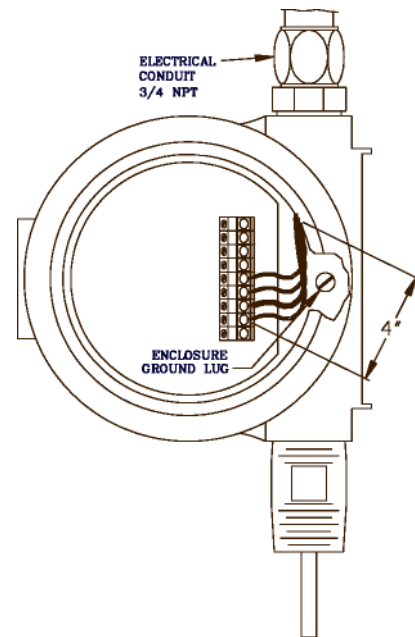
DANGER! HIGH VOLTAGE. DISCONNECT ELECTRICAL POWER AT EXTERNAL SOURCE BEFORE SERVICING OR SERIOUS INJURY, INCLUDING DEATH, WILL OCCUR.

All plumbing and electrical installations must be a combination of the end user's best engineering practices, in compliance with local codes, and the manufacturer's recommendations.

3.1 Wiring Installation

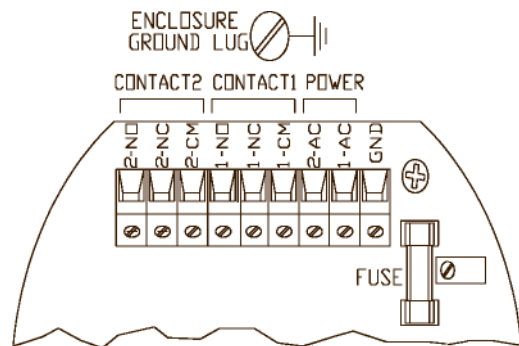
Use Stranded copper wire, no larger than 14 gauge.

- A. Remove SW100 enclosure lid.
- B. Bring customer supplied wires into enclosure through conduit hole. Cut wires to 4" in length from inside of conduit hole. This will insure adequate service loop.
- C. Using wiring diagrams in Section 3.2, attach wires to terminal block.



3.2 Input Power

The SW100 is factory configured in 115 VAC/230 VAC, $\pm 10\%$, 49 to 60 Hz, or 24VDC (min/max 23-28 VDC). Fuse values differ for each configuration. Connect power via an external switch or circuit breaker to allow convenient power disconnection.



- 115 VAC $\pm 10\%$ (.100 Amp. 250 VDC fused)
- 230 VAC $\pm 10\%$ (.050 Amp 250 VDC fused)
- 24 VDC $\pm 10\%$, (.200 Amp 250 VDC fused)

Caution: The input voltage is identified on the SW100 data label. Do not apply other voltages to the unit or damage will occur.

Connection wiring as shown in illustration. Connect AC hot or DC positive to terminal "2-AC". Connect AC neutral or DC negative to terminal "1-AC".

Continued on the next page.

Note: Enclosure **must** be properly grounded to protect electronics from static discharges. An enclosure grounding lug is provided on the inside of enclosure. All wiring contained in the SW100 has an insulation breakdown rating of 1500 VAC and 200 VDC.

3.3 Relay Connection

The relay on the SW100 is a DPDT (2 Form C) type and is rated for 5 Amp resistive at 250 VAC or 30 VDC. (Contact 1 and Contact 2 as illustrated in Section 3.2)

Note: It is recommended that an RC Surge suppressor be installed across the load to minimize transient voltages and extend relay life.

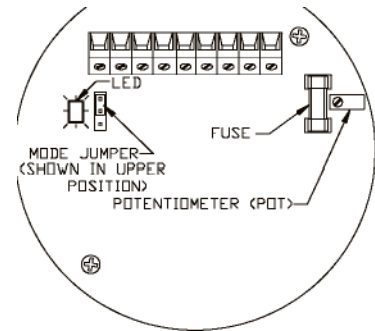
SECTION 4 - SWITCH POINT SET

CAUTION! TERMINALS AND CIRCUIT BOARD CONTAIN LIVE VOLTAGE. EXTREME CAUTION SHOULD BE USED TO PREVENT DAMAGE TO EQUIPMENT, INJURY OR DEATH.

4.1 Setting the Switch point

For optimum operation, calibration must be accomplished at actual process temperature and pressure conditions in gasses and at actual process temperature conditions in liquids. If this cannot be done, consult Factory for assistance.

- A. Remove the SW 100 enclosure lid.
- B. Apply power to the SW100. Ensure that the pipeline is filled with fluid or gas.
- C. Establish desired flow of product in process pipe and allow to stabilize for 2 minutes.



Note: When the LED is illuminated the relay is energized.

4.2 Increase of Flow Mode

Increase of Flow Mode energizes the relay when flow exceeds setpoint. Set "Mode Jumper" in upper position as shown in the figure above.

- A. If LED is ON adjust the potentiometer (POT) counter clockwise (CCW) until the LED goes OFF.

If LED is OFF adjust the POT clockwise (CW) until the LED goes ON.

- B. Adjust the POT back and forth until the switch point is well defined. This switch point position should remain constant.

For **Gas** - Rotate the POT one (1) turn from setpoint.

For **Liquids** - Rotate the POT c turn from setpoint.

The switch point is now set.

4.3 Decrease of Flow Mode

Decrease of Flow Mode energizes the relay when flow drops below setpoint. Set "Mode Jumper" to lower position. This is opposite of what is shown in the figure on the previous page.

- A. If LED is ON adjust the POT clockwise (CW) until the LED goes OFF. If LED is OFF adjust the POT counter clockwise (CCW) until the LED goes ON.
- B. Adjust the POT back and forth until the switch point is well defined. This switch point position should remain constant.

For **Gases** - Rotate the POT one (1) turn from setpoint.

For **Liquids** - Rotate the POT c turn from setpoint.

The switch point is now set.

4.4 Level Switch Mode

The level switch mode energizes the relay when liquid or foam contacts the sensor. Set the "Mode Jumper" to the upper position. Follow instruction under 4.2 Increase of Flow Mode.

4.5 Effects of temperature on Switch point

The switch point should be set when the SW 100 is operating at typical fluid temperature. If the fluid temperature is expected to increase more than 100°F (38°C) after the switch point is set, it is recommended the pot be adjusted one-quarter (1/4) turn counter clockwise (CCW).

SECTION 5 - PREVENTATIVE MAINTENANCE

WARNING! Before attempting any maintenance take the necessary safety precautions before removing probe from pipe (ex., purge lines of toxic and/or explosive gas, depressurize line, etc.).

CAUTION! A SENSOR THAT IS BENT OR DAMAGED IN ANY WAY SHOULD BE REMOVED FROM THE PIPE OR TANK IMMEDIATELY

5.1 Sensor Cleaning

Even though the sensor is insensitive to small amounts of contamination, continued use in dirty environments will necessitate periodic cleaning. Remove the unit from pipe, exposing the sensor elements. If they are visibly dirty, clean them with water or alcohol (ethanol) and an artist's brush until they appear clean again. Even though the sensor elements are rugged and breakage resistant, avoid touching them with any solid object and *use a light touch while cleaning them.*

5.2 Breakage or Damage of Sensor

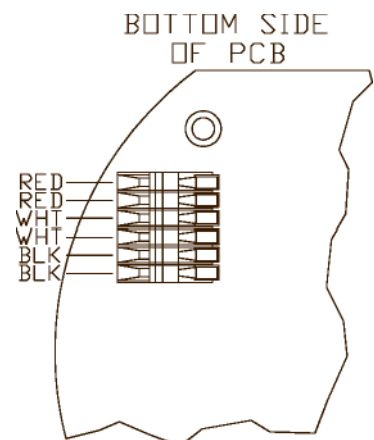
If the sensor is broken or damaged, it will have to be replaced. A new sensor can be installed in the factory or in the field. For factory replacement, Refer to Section 6.5, CUSTOMER SERVICE AND SHIPPING INSTRUCTIONS.

5.3 Sensor Replacement

DANGER! HIGH VOLTAGE. DISCONNECT ELECTRICAL POWER AT EXTERNAL SOURCE BEFORE SERVICING OR SERIOUS INJURY INCLUDING DEATH COULD OCCUR.

The sensor wires are attached to the electronic circuit board (PCB) by means of a connector located on the bottom of the board as shown to the right. There is enough service loop to allow access to all the internal components.

1. Remove enclosure cover.
2. Disconnect Sensor wires from the six (6) pin terminal block.
3. Unscrew sensor CCW from enclosure. This is best accomplished by putting the enclosure in a Vise and use 15/16" wrench on the wrench flats of the sensor.
4. Screw replacement sensor into enclosure. Insuring snug fit and proper rotation. A thread lubricant like "Never Seize" is recommended.
5. Reconnect Sensor wires to six (6) pin terminal block. Figure to the right shows correct terminations.
6. Replace enclosure cover.
7. Resetting of the switch point may be required.



SECTION 6 - TROUBLE SHOOTING

Required Equipment: Digital Volt Meter (DVM)
Trimmer Adjustment Tool or Jeweler Screwdriver
Phillips Screw Driver
Tweezers

6.1 Unit Functional Check

6.1.1 LED is off after warm up.

Using a Trimmer Adjustment Tool or Jeweler Screwdriver turn the potentiometer CW until light illuminates. (Potentiometer is capable of 25 turns.) If light illuminates go to Section 4 to set relay switch point. If after 25 turns light will not illuminate unit is not functioning properly. Proceed to next section for further troubleshooting.

6.1.2 LED is on after warm up.

Using a Trimmer Adjustment Tool or Jeweler Screwdriver turn the potentiometer CCW until light goes OFF. (Potentiometer is capable of 25 turns.) If light goes off, unit is functioning properly, go to Section 4 to set relay switch point. If after 25 turns light will not go OFF, unit is not functioning properly. Proceed to next section for further trouble shooting.

6.2 Electronics Functional Check

6.2.1 Input Voltage

Using a DVM verify the input voltage 120/230 VAC or 24 VDC ($\pm 10\%$ 1 amp).

6.2.2 Fuse Resistance

WARNING! Turn input power OFF before performing sensor wire verification.

Using a DVM verify the fuse resistance is approximately one ohm or less. If fuse is faulty see Section 6.4.

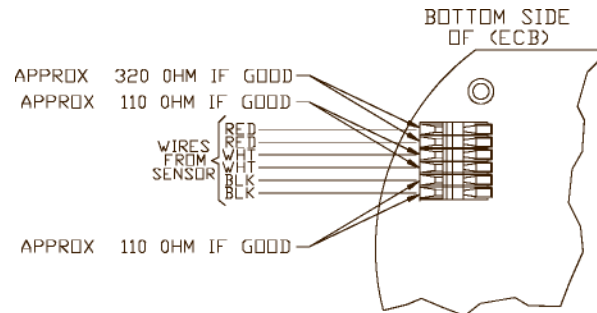
6.2.3 Voltage at TS2.

Using a DVM verify voltage at pin #1 and #2 of TS2 (6 pin terminal located on bottom of PCB). Approximately 20 volts should be present.

6.3 Sensor Wire Verification

WARNING! Turn input power OFF before performing sensor wire verification.

1. Remove the circuit board by removing the two (2) Phillips head screws from the Printed Circuit Board (PCB).
2. Measure Red, White, and Black wires with an ohm meter. Proper resistances are red 320 OHM, white and black are 110 OHMS (as shown in illustration).



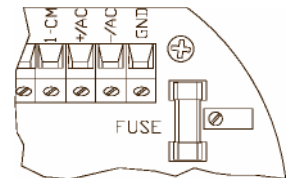
If the values are faulty, the sensor is will have to be replaced.

6.4 Fuse Replacement

DANGER! HIGH VOLTAGE. DISCONNECT ELECTRICAL POWER AT EXTERNAL SOURCE BEFORE SERVICING OR SERIOUS INJURY INCLUDING DEATH COULD OCCUR.

Verify the fuse is bad with an Ohmmeter. Use only recommended fuse replacements. (Two replacement fuses are provided with each unit.)

1. Remove enclosure cover.
2. Pull fuse out of fuse holder with tweezers. Replace with new fuse. (See Replacement Fuses below.)
3. Replace enclosure cover. **Replacement Fuses**



Fox Part No.

101749	Fuse, 5mm x 20mm .100 Amp, 250 VDC (Used on 115 VAC only.)
101748	Fuse, 5mm x 20mm .050 Amp, 250 VDC (Used on 230 VAC only.)
100532	Fuse, 5mm x 20mm .200 Amp, 250 VDC (Used on 24 VDC only.)

6.5 Customer Service and Shipping Instructions

The Fox Thermal Instruments, Inc. Customer Service Department can be reached at:

Telephone: 831-384-4300

Fax: 831-384-4312

[E-Mail: Sales@foxthermalinstruments.com](mailto:Sales@foxthermalinstruments.com)

Please have the model and serial number available when you call.

If it becomes necessary to return a SW100 Flow and Level Switch to FOX, obtain a Return Material Authorization Number from the Customer Service Department.

Unless specifically instructed to do otherwise, the entire flow switch must be returned, including all electronics.

Please include information describing the difficulties experienced, purchase order number under which the equipment was purchased, and a contact name and phone number.

Be sure to include **complete** return shipping instructions. **We cannot deliver to post office boxes.** Ship to the following address:

Fox Thermal Instruments, Inc.
399 Reservation Road
Marina, CA 93933
ATTN: SERVICE DEPT.
RMA NUMBER:



FOX THERMAL INSTRUMENTS, INC.

**399 Reservation Road
Marina, CA, 93933**

Phone: (831) 384-4300

FAX: (831) 384-4312
