SERIES 15000, 16000, 17000 and 18000

THERMOSWITCH® Temperature Controllers

1.10.21

FEATURES

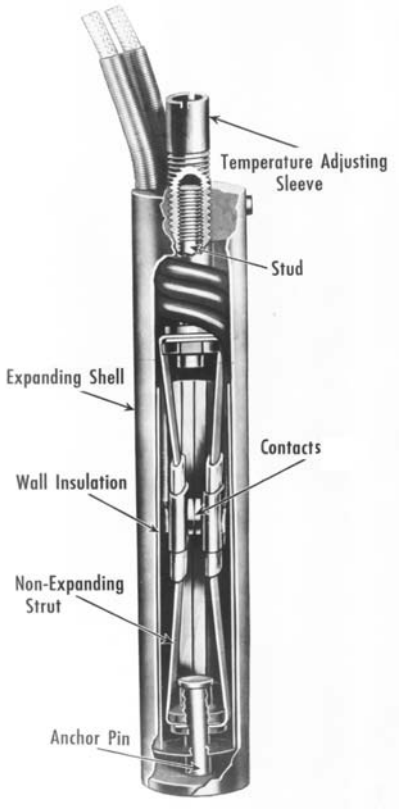
- *Fast response*
- *Close control*
- *Extreme sensitivity*
- *Vibration resistance*

APPLICATIONS

- *Hydraulic Laminating Presses*
- *Livestock Watering Fountains*
- *Label Adhesive Applications*
- *Paint Drying Equipment*
- *Hot Stamp Printers*
- *Vending Machines*
- *Deep Fat Fryers*
- *Textile Platens*

DESCRIPTION

THERMOSWITCH® controllers control temperatures as low as -100ºF (-73ºC) and as high as 1100ºF (593ºC) with the proven dependability of over 65 years of service to satisfied customers.



PRINCIPAL OF OPERATION

The THERMOSWITCH® controller is a strut-and-tube type thermostat comprised of two basic parts: the outer shell, made of high-expanding metal and the strut assembly, made of low-expanding metal.

A pair of electrical contacts is mounted on the strut assembly and installed in the shell under tension or compression. Since each end of the strut assembly is mechanically connected to the ends of the shell, a net change of force is produced on the strut assembly as the shell expands or contracts with changing temperature. The temperature at which the contacts “make” or “break” can be regulated by a temperature adjusting sleeve.

This adaptation of the differential-expansion principle gives several important control advantages:

• Fast Response

Since the outer shell of the THERMOSWITCH® is the active sensing member, and not merely a housing, response to temperature change is almost instantaneous.

• Close Control

The controller’s shell and strut arrangement has “anticipation” characteristics which substantially reduce the amount of overshoot and undershoot during conditions of rapid temperature change. Anticipation is produced by an inherent time lag between the shell and struts, which causes the shell ‘to “lead” the struts by an interval that varies with the rate of temperature change. With rapid temperature rise, the shell exerts a larger net force on the struts and tends to pull them apart sooner than if the temperature were rising slowly. The result is several degrees or more of anticipation which helps produce closer control.

• Extreme Sensitivity

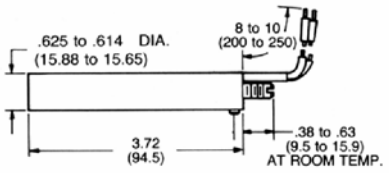
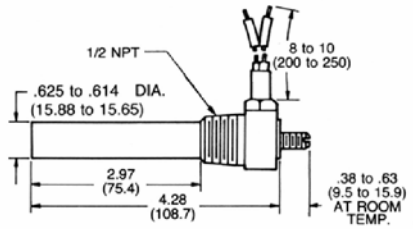
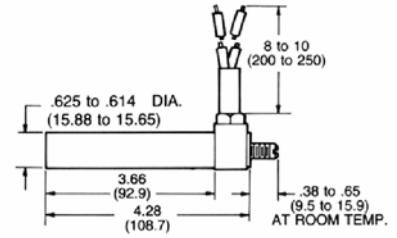
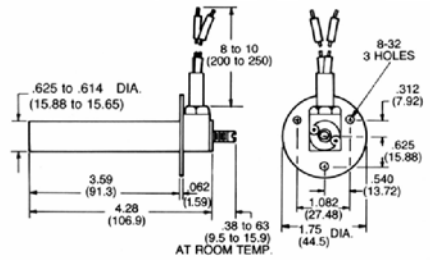
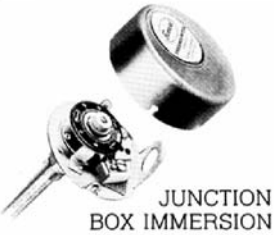
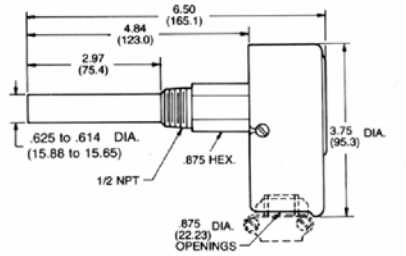
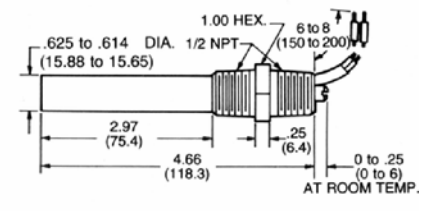
The strut and contact assembly operates by slow make and break. This means that every temperature change, no matter how small, causes a corresponding change in the space between the electrical contacts. Therefore, contact action can be produced by a very small temperature change, which accounts for the THERMOSWITCH® controller’s excellent resolution sensitivity of 0.1ºF (0.05ºC).

• Vibration Resistance

Since the strut assembly is assembled under tension or compression, a properly installed unit has excellent vibration resistance and will provide the best possible control under difficult physical conditions.

• Agency Approved

Various models are listed or component recognized by Underwriters Laboratories (UL) and certified by the Canadian Standards Association (CSA).

THERMOSWITCH UNIT TYPE	DIMENSIONS	DESCRIPTION	CATALOG NUMBER
CARTRIDGE (Series 17000)		The basic element of all THERMOSWITCH® controllers. Has all the desirable features of the ideal thermostat - high sensitivity, wide adjustment range, small size, rugged construction, vibration resistance, and low cost. The unit can be inserted into a .625 in (15.88 mm) reamed hole. Approximate weight is 2.5 ounces (70 grams).	✔ 01-017000-000 ✔ 01-017021-000 ✔ 01-017002-000 ✔ 01-017023-000
HEX HEAD (Series 17100)		Has all the features of the Cartridge Type plus the addition of a pipe thread for mounting. Approximate weight is 5 ounces (140 grams).	✔ 01-017100-000 ✔ 01-017121-000 ✔ 01-017102-000 ✔ 01-017123-000
BLOCK HEAD (Series 17200)		This unit has the same mounting as the Cartridge Type but is designed so modificatons may be included. It also can be inserted into a .625 in (15.88 mm) reamed hole. Approximate weight is 3 ounces (84 grams).	✔ 01-017200-000 01-017221-000 ✔ 01-017202-000 01-017223-000
FLANGE HEAD (Series 17300)		Has all the features of the Block Head Type except a mounting flange has been provided. Approximate weight is 4 ounces (112 grams).	✔ 01-017300-000 ✔ 01-017321-000 ✔ 01-017302-000 01-017323-000
 JUNCTION BOX IMMERSION (Series 17800)		Has electric conduit junction box containing terminal block and temperature adjusting dial and knob. Extended hexagonal section with pipe thread permits easy mounting into tapped hole of boss, immersing shell into fluid medium to be controlled.	✔ 01-017800-000 ✔ 01-017821-000 ✔ 01-017802-000 01-017823-000
COUPLING HEAD (Series 18000)		The Coupling Head Type has a hexagonal mounting section withpipe threads at each end. This unit may be directly attached to electrical conduit. Approximate weight is 5 ounces (140 grams).	✔ 01-018000-000 ✔ 01-018021-000 ✔ 01-018002-000 ✔ 01-018023-000

inch
(mm)

✔ = Normally Stocked

-100 to 600ºF/-73 to 316ºC

TEMP. RANGE	CONTACT OPERATION ON TEMP. RISE	SHELL AND HEAD MATERIAL	APPROX. DEGREES CHANGE PER FULL TURN OF ADJUSTING SLEEVE	EXTREME TEMPERATURE EXPOSURE	CURRENT RATING	FACTORY TEMP. SETTING TOLERANCE (MOD. #3)	APPLICABLE MODIFICATIONS (see Modifications and Special Features Section)	APPLICABLE SPECIAL FEATURES (see Modifications and Special Features Section)
-100 to +400ºF -73 to +204ºC	Opens	Brass	90ºF/50ºC				1 2 3 4 14	31 34 35
	Closes		80ºF/45ºC					
-100 to +600ºF -73 to +316ºC	Opens	300 Series S.S. Shell	110ºF/60ºC					
	Closes		100ºF/55ºC					
-100 to +400ºF -73 to +204ºC	Opens	Brass	80ºF/45ºC	**UNITS THAT OPEN ON TEMPERATURE RISE:** -100ºF/-73ºC indefinitely and 100ºF/55ºC above set point for one hour maximum	*	**UNITS THAT OPEN ON TEMPERATURE RISE**	1 thru 14, 27	31 34 35
	Closes		75ºF/40ºC					
-100 to+600ºF -73 to +316ºC	Opens	300 Series S.S. Shell Brass Head	100ºF/55ºC					
	Closes		90ºF/50ºC					
-100 to +400ºF -73 to +204ºC	Opens	Brass	80ºF/45ºC	**UNITS THAT CLOSE ON TEMPERATURE RISE**: -100º to +400ºF/ -73º to +204ºC -100ºF/-73ºC indefinitely and 500ºF /260ºC for one hour maximum -100º to +600ºF/ -73º to +316ºC -100ºF/-73ºC indefinitely and 700ºF /370ºC for one hour maximum	**AC** 10 amps 120 volts 5 amps 240 volts (non-inductive) DC ratings consult Fenwal	± 5ºF from +32º to +100ºF +3ºF or 2% of Setting Value (whichever is greater) From 100º to 600ºF **UNITS THAT CLOSE ON TEMPERATURE RISE** ± 5ºF or 3% of Setting Value (whichever is greater)	1 thru 14, 27	31 34
	Closes		70ºF/40ºC					
-100 to +600ºF -73 to +316ºC	Opens	300 Series S.S. Shell Brass Head	100ºF/55ºC					
	Closes		90ºF/50ºC					
-100 to +400ºF -73 to +204ºC	Opens	Brass	80ºF/45ºC				1 thru 14, 27	31 34
	Closes		70ºF/40ºC					
-100 to +600ºF -73 to +316ºC	Opens	300 Series S.S. Shell Brass Head	100ºF/55ºC					
	Closes		90ºF/50ºC					
-100 to +400ºF -73 to +204ºC	Opens	Brass	125ºF/70ºC				1 3	31 34
	Closes		75ºF/40ºC					
-100 to +600ºF -73 to +316ºC	Opens	300 Series S.S. Shell Brass Head	160ºF/90ºC					
	Closes		90ºF/50ºC					
-100 to +400ºF -73 to +204ºC	Opens	Brass	80ºF/45ºC				1 2 3 4 14 27	31 34 35
	Closes		75ºF/40ºC					
-100 to +600ºF -73 to +316ºC	Opens	300 Series S.S. Shell Brass Head	100ºF/55ºC					
	Closes		90ºF/50ºC					

Unless otherwise specified, all ratings apply to non-inductive loads such as heaters or resistors. Tungsten filament lamps have an inrush 10 to 15 times the steady state current. Do not exceed ratings.

TEMPERATURE OFFSET VALUES DUE TO PRESSURE (APPROX. ONLY)

Pressure PSI	Set Point Offset
100	+ 3ºF / 2ºC
200	+ 6ºF / 3ºC
300	+ 9ºF / 5ºC
400	+ 12ºF / 7ºC
500	+ 15ºF / 8ºC

Collapsing pressure (brass shell) 1400 psi at room temperature
Collapsing pressure (S.S. shell) 3,500 psi at room temperature

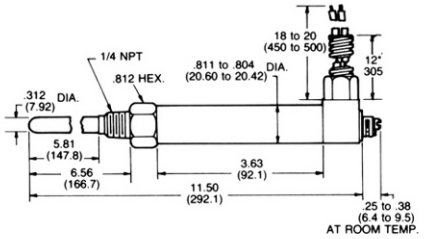
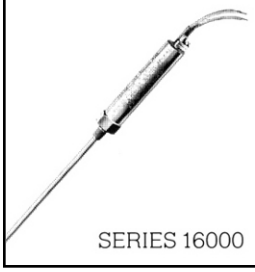
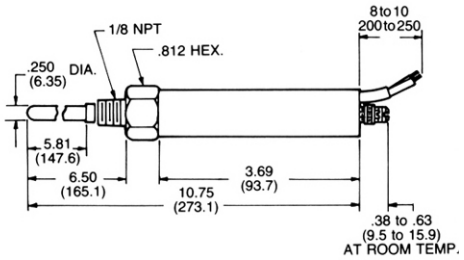
Recognized under the Components Program of Underwriters Laboratories, Inc. (XAPX2)

Underwriters Laboratories Listed (XAPX)

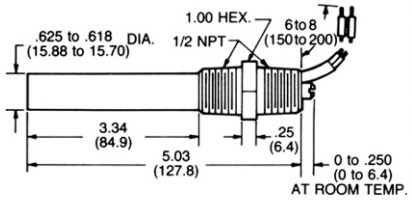
Certified by Canadian Standards Association (Class 4813 02) CSA File No. LR7378

* UL and CSA units rated for AC operation only.

HIGH TEMPERATURE Controller

THERMOSWITCH UNIT TYPE	DIMENSIONS	DESCRIPTION	CATALOG NUMBER
SERIES 15000		Armored cable is standardly available in lengths of 12 in (30 cm). A high expansion stainless steel element is inserted into the medium to be controlled, while the low expansion stainless steel sheath remains exposed to ambient temperature. Approximate weight is 1 pound (336 grams)	✔ 01-015050-000
 SERIES 16000		A high expansion stainless steel element is inserted into the medium to be controlled, while the low expansion stainless steel sheath remains exposed to ambient temperature. Approximate weight is 1 pound (336 grams)	✔ 01-016050-000 ✔ 01-016051-000

CORROSION RESISTANT Controller

COUPLING HEAD (Series 18000)		This model has a hexagonal mounting section with male pipe threads at each end. This unit may be directly attached to electrical conduits or explosion proof fittings. It is ideally suited for photo processing, laboratory and experimental test work, food processing, bleaching & dyeing and many other similar applications. Approximate weight is 5 ounces (140 grams).	01-180020-029 ✔ 01-018002-021 ✔ 01-018023-007

✔ = Normally Stocked

APPLICATION HINTS - Contact Protection

Capacitors are not needed under average conditions. For smoother control of small loads (below 1/10th the controller rating or to prevent contact bounce due to vibration use capacitance in µF) of 0.28 divided by line voltage.

NOTE: *Capacitors should be rated a minimum of 600 volts for 120 volt circuits and a minimum of 1000 volts for 240 volt circuit.*

VOLTAGE	SERVICE	CAPACITANCE (µF)
120 VAC	Resistance	None Required
240 VAC	Resistance	0.1
120 or 240 VAC	Relays	0.001 to 0.01
15 to 25 VAC	Relays	0.02
120 or 240 VAC	Motors	Use Relay

NOTE: *Capacitors should be wired in parallel with thermostat leads. For exceptional vibration, increase above values 5 to 10 times.*

200 to 1500ºF/93 to 816ºC

TEMP. RANGE	CONTACT OPERATION ON TEMP. RISE	SHELL AND HEAD MATERIAL	APPROX. DEGREES CHANGE PER FULL TURN OF ADJUSTING SLEEVE	EXTREME TEMPERATURE EXPOSURE	CURRENT RATING	FACTORY TEMPERATURE SETTING TOLERANCE (MOD. #3)	APPLICABLE MODIFICATIONS AND SPECIAL FEATURES *(see Modifications and Special Features Section)*
300 to 1100ºF/ 149 to 593ºC	Opens	S.S. Shell Brass Head	165ºF / 90ºC	-100ºF/-73ºC indefinitely and 100ºF/55ºC above set point for 1/2 hour maximum Ambient temperature surrounding switch shell should not exceed 600ºF/315ºC	AC 25 amps 120 volts 12.5 amps 240 volts DC ratings consult Fenwal	± 4% of setting	1 2 3 5 11 12 13 **NOTE**: *Mod. 4 is standard with this unit*
300 to 1100ºF 149 to 593ºC	Opens	All S.S.					1 2 3 14 **NOTE**: *Mod. 4 is standard with this unit*
	Closes						

-100 to 600ºF/-93 to 316ºC

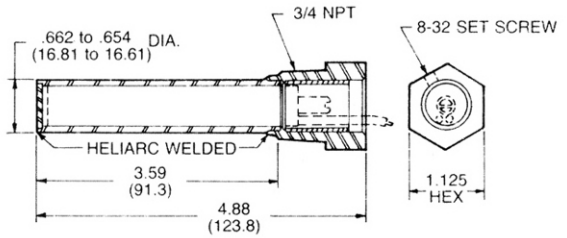
-100 to +500ºF/ -73 to 260ºC	Opens	All Type 316 S.S.	100ºF/ 55ºC	-100ºF/-73ºC indefinitely and 100ºF/55ºC above set point for 1 hour maximum	AC 10 amps 120 volts 5 amps 240 volts DC ratings consult Fenwal	± 5ºF from -100 to 100ºF ± 3ºF or 2% of setting value (whichever is greater) from 100 to 600ºF	1 2 3 4 14 SPECIAL FEATURE 31
-100 to +600ºF -73 to +316ºC	Closes			-100ºF/-73ºC indefinitely and 700ºF/370ºC for 1 hour maximum		± 5ºF or 3% of setting value (whichever is greater)	

RATINGS

Unless otherwise specified, all rating apply to non-inductive loads, such as heaters or resistors. Tungsten filament lamps have an inrush of 10 to 15 times the steady state current. Do not exceed switch rating at any time.

PROTECTIVE WELLS

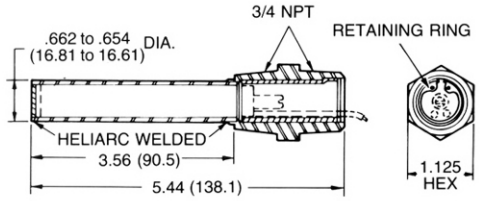
For use with 170XX 5/8" Diameter Cartridge THERMOSWITCH Controllers



Catalog No. 34-011201-000
Hex Head Well
(321 Stainless Steel Well & Head)

Applicable Modifications
1 Special Marking

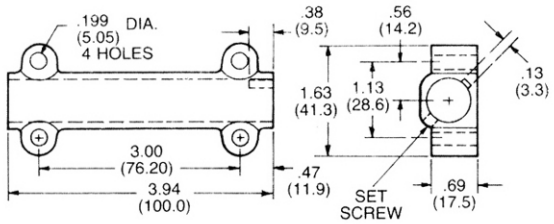
Applicable Special Features
31A Extended Shell
Approximate weight is 4 ounces (112 grams)
Pressure Ratings: 100 psi at -100ºF to +250ºF
60psi at 600ºF



Catalog No. 34-011204-000
Coupling Head Well
(321 Stainless Steel Well & Head)

Applicable Modifications
1 Special Marking

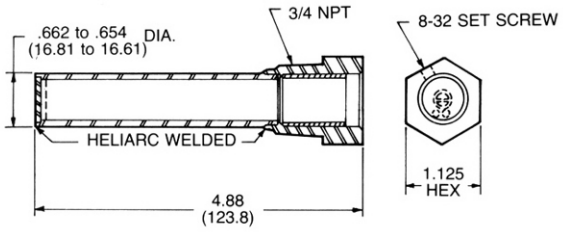
Applicable Special Features
31A Extended Shell
Approximate weight is 5 ounces (140 grams)
Pressure Ratings: 100 psi at -100ºF to +250ºF
60 psi at 600ºF



Catalog No. 34-011100-002
Aluminum Surface Mounting Well

Approximate weight is 4 ounces (112 grams)
Pressure Ratings: 100 psi at -100ºF to +250ºF
60 psi at 600ºF

For use with 172XX and 173XX THERMOSWITCH® Controllers



Catalog No. 34-011208-000
Low Pressure Hex Head Well
(321 Stainless Steel Well & Head)

Applicable Modifications
Special Marking

Applicable Special Features
31A Extended Shell

Approximate weight is 4 ounces (112 grams)
Pressure Ratings: 100 psi at -100ºF to +250ºF
60 psi at 600ºF

In many applications involving liquids and gases, the use of a well is recommended. When the removal of a hex or coupling head THERMOSWITCH® controller would require draining of the container in which it is inserted, the use of a well assembly permits removal of the controller at any time without other disturbances.

When surrounding ambients are subject to extreme changes thus affecting THERMOSWITCH® control, the well makes it possible to insert the THERMOSWITCH® controller completely into the medium being controlled thereby eliminating these ambient temperature effects or "head effect".

A well offers protection in applications where fluids have a corrosive effect on the brass shell of the THERMOSWITCH® controller.

NOTE: *Certain gases or liquids (including water at elevated temperatures) could be corrosive and/or cause electrolytic action, which could severely shorten the life of the controller. Where corrosion or electrolysis is suspect, the use of stainless steel heliarc welded thermowells or various platings or coatings may increase controller life. The rate of corrosion or electrolysis is influenced by a great many system parameters such as chemical makeup and temperature of the solution, stray electric currents, etc. Consult the supplier of your chemicals or Fenwal for suggestions.*

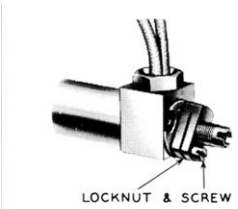
In addition, use a well to protect the THERMOSWITCH® controller from external forces or blows which could affect its operation.

MODIFICATIONS

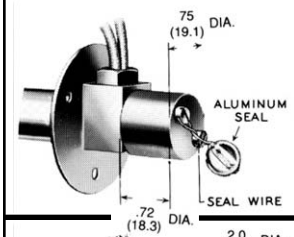
(1) Special Marking
01-990010-XXX
Special marking may be rubber stamped in indelible ink at points A, B, or C. Amount of marking is limited to the space available. Specify text and location of marking.

(2) Extended Lead Wires
01-9902X-XXX
Lead wires may be extended to any length. Wire lengths are specified at that portion of lead wire outside of the THERMOSWITCH® controller, indicated by dimension "L". Special lead wire stripping may also be obtained by specifying length shown as dimension "X".

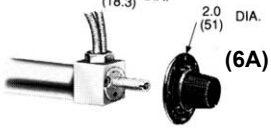
(3) Factory Temperature Setting
01-990030-00X
The controller may be preset at Fenwal to any temperature within its listed range to a minimum of 32ºF (0ºC). Unless this modification is specified, units are preset at approximately 75ºF (25ºC). Modification 4 is recommended when ordering a factory set unit to preclude a possible shift in set point due to mishandling.



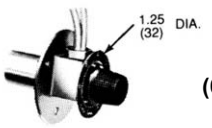
(4) Temperature Restraining Device
01-990040-000
A restraining device may be added to secure the temperature adjustment sleeve after calibration. This modification deters tampering with the setting. It also minimizes the possibility of a shift in calibration due to vibration.



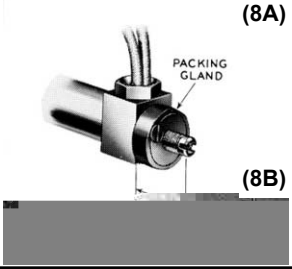
(5) Tamper-proof Cap
01-990050-000
A tamper-proof cap can be furnished to prevent tampering with a THERMOSWITCH controller equipped with Modification 4 above.



(6) Dial and Knob
01-990061-0XX
(6A) A large dial and knob may be added to certain THERMOSWITCH controllers. Graduations are marked from "1" to "7" for adjustment to higher or lower temperature. Controllers may be ordered unset or factory preset. Dial will be set on NO. 4 position unless otherwise specified.



01-990062-0XX
(6B) Same as 6A above except small dial and knob.



(8) Moisture Resistant Seal
01-990080-001
(8A) Under certain conditions where there is excessive moisture or vapor, a moisture resistant seal may be added to protect the interior of the THERMOSWITCH controller. Modification 13 should be ordered with this modification.

01-990080-002
(8B) A same as 8A above except seal is four hole type so dial and knob may be used. Modification 13 should be ordered with this modification.

■ *Modiifications which cannot be combined.*

(10) Moisture Resistant Tamper-proof Cap
01-99011X-XXX
To seal a controller against moisture and tampering, a moisture resistant, tamper-proof cap may be mounted over the adjusting sleeve. It may be used with unset or factory preset units.

(13) Packing Gland on Lead Wires
01-990130-00X
In installations where moisture may enter THERMOSWITCH® controller around lead wires, a packing gland is recommended. Modification 8 should be used with this modification.

(14) Extended Temperature Adjusting Sleeve
01-990140-XXX
Adjustment sleeve extensions are available only in multiples of one inch. When ordering, the length specified is the "extended by" length "L". For example, if the standard adjusting sleeve length for the controller ordered is $\frac{3}{8}$ to $\frac{5}{8}$ inch, and a 4 inch extension is ordered, the overall length will be $4\frac{3}{8}$ to $4\frac{5}{8}$ inches. Minimum ordering quantities apply.