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® Controllers

<table>
<thead>
<tr>
<th>THERMOSWITCH UNIT TYPE</th>
<th>DIMENSIONS</th>
<th>DESCRIPTION</th>
<th>CATALOG NUMBER</th>
</tr>
</thead>
</table>
| CARTRIDGE (Series 17000) | ![Diagram](image1.png) | 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
|                      | ![Diagram](image2.png) | 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
|                      | ![Diagram](image3.png) | This unit has the same mounting as the Cartridge Type but is designed so modifications 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
|                      | ![Diagram](image4.png) | 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
|                      | ![Diagram](image5.png) | 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
|                      | ![Diagram](image6.png) | The Coupling Head Type has a hexagonal mounting section with pipe threads at each end. This unit may be directly attached to electrical conduit. Approximate weight is 5 ounces (140 grams). | ✔️-01-018000-000

| ✔️ = Normally Stocked |

---

inch (mm)
**-100 to 600°F/-73 to 316°C**

<table>
<thead>
<tr>
<th>TEMP. RANGE</th>
<th>CONTACT OPERATION ON TEMP. RISE</th>
<th>SHELL AND HEAD MATERIAL</th>
<th>APPROX. DEGREES CHANGE PER FULL TURN OF ADJUSTING SLEEVE</th>
<th>EXTRME TEMPERATURE EXPOSURE</th>
<th>CURRENT RATING</th>
<th>FACTORY TEMP. SETTING TOLERANCE (MOD. #2)</th>
<th>APPLICABLE MODIFICATIONS</th>
<th>APPLICABLE SPECIAL FEATURES</th>
</tr>
</thead>
<tbody>
<tr>
<td>-100 to +400°F</td>
<td>Opens Brass</td>
<td>90°F/50°C</td>
<td></td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-73 to +204°C</td>
<td>Closes</td>
<td>80°F/45°C</td>
<td></td>
<td></td>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-100 to +600°F</td>
<td>Opens 300 Series S.S. Shell</td>
<td>110°F/60°C</td>
<td></td>
<td></td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-73 to +316°C</td>
<td>Closes Brass Head</td>
<td>100°F/55°C</td>
<td></td>
<td></td>
<td>4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-100 to +400°F</td>
<td>Opens Brass</td>
<td>80°F/45°C</td>
<td></td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-73 to +204°C</td>
<td>Closes</td>
<td>75°F/40°C</td>
<td></td>
<td></td>
<td>2</td>
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<tr>
<td>-100 to +600°F</td>
<td>Opens 300 Series S.S. Shell</td>
<td>100°F/55°C</td>
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<td></td>
<td>3</td>
<td></td>
<td></td>
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<tr>
<td>-73 to +316°C</td>
<td>Closes Brass Head</td>
<td>90°F/50°C</td>
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<td>4</td>
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<td></td>
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<tr>
<td>-100 to +400°F</td>
<td>Opens Brass</td>
<td>80°F/45°C</td>
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<tr>
<td>-73 to +204°C</td>
<td>Closes</td>
<td>70°F/40°C</td>
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<td>3</td>
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</tr>
<tr>
<td>-73 to +316°C</td>
<td>Closes Brass Head</td>
<td>90°F/50°C</td>
<td></td>
<td></td>
<td>4</td>
<td></td>
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<tr>
<td>-100 to +400°F</td>
<td>Opens Brass</td>
<td>125°F/70°C</td>
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<td>1</td>
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<tr>
<td>-73 to +204°C</td>
<td>Closes</td>
<td>75°F/40°C</td>
<td></td>
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<td>2</td>
<td></td>
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<tr>
<td>-100 to +600°F</td>
<td>Opens 300 Series S.S. Shell</td>
<td>160°F/90°C</td>
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<td>3</td>
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<tr>
<td>-73 to +316°C</td>
<td>Closes Brass Head</td>
<td>90°F/50°C</td>
<td></td>
<td></td>
<td>4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-100 to +400°F</td>
<td>Opens Brass</td>
<td>80°F/45°C</td>
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<tr>
<td>-73 to +204°C</td>
<td>Closes</td>
<td>75°F/40°C</td>
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<td></td>
<td>2</td>
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<tr>
<td>-100 to +600°F</td>
<td>Opens 300 Series S.S. Shell</td>
<td>100°F/55°C</td>
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<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-73 to +316°C</td>
<td>Closes Brass Head</td>
<td>90°F/50°C</td>
<td></td>
<td></td>
<td>4</td>
<td></td>
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</table>

**TEMPERATURE OFFSET VALUES DUE TO PRESSURE (APPROX. ONLY)**

<table>
<thead>
<tr>
<th>Pressure PSI</th>
<th>Set Point Offset</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>14</th>
<th>35</th>
<th>27</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>+3°F / 2°C</td>
<td>1</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>200</td>
<td>+6°F / 3°C</td>
<td>2</td>
<td>3</td>
<td>31</td>
<td>34</td>
<td></td>
<td></td>
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<tr>
<td>300</td>
<td>+9°F / 5°C</td>
<td>3</td>
<td>4</td>
<td>34</td>
<td>35</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>400</td>
<td>+12°F / 7°C</td>
<td>4</td>
<td>5</td>
<td>35</td>
<td>31</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>500</td>
<td>+15°F / 8°C</td>
<td>5</td>
<td>14</td>
<td>31</td>
<td>34</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* UL and CSA units rated for AC operation only.
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).

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).

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).

### 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 thermostal leads. For exceptional vibration, increase above values 5 to 10 times.
### 200 to 1500°F/93 to 816°C

<table>
<thead>
<tr>
<th>TEMP. RANGE</th>
<th>CONTACT OPERATION ON TEMP. RISE</th>
<th>SHELL AND HEAD MATERIAL</th>
<th>APPROX. DEGREES CHANGE PER FULL TURN OF ADJUSTING SLEEVE</th>
<th>EXTREME TEMPERATURE EXPOSURE</th>
<th>CURRENT RATING</th>
<th>FACTORY TEMPERATURE SETTING TOLERANCE (MOD. #3)</th>
<th>APPLICABLE MODIFICATIONS AND SPECIAL FEATURES (see Modifications and Special Features Section)</th>
</tr>
</thead>
<tbody>
<tr>
<td>300 to 1100°F/149 to 593°C</td>
<td>Opens</td>
<td>S.S. Shell Brass Head</td>
<td>165°F / 90°C</td>
<td>-100°F/-73°C indefinitely and 100°F/55°C above set point for 1/2 hour maximum</td>
<td>AC 25 amps 120 volts 12.5 amps 240 volts</td>
<td>± 4% of setting</td>
<td>1 2 3 5 11 12 13 NOTE: Mod. 4 is standard with this unit</td>
</tr>
<tr>
<td>300 to 1100°F/149 to 593°C</td>
<td>Opens</td>
<td>All S.S.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1 2 3 14 NOTE: Mod. 4 is standard with this unit</td>
</tr>
</tbody>
</table>

### -100 to 600°F/-93 to 316°C

<table>
<thead>
<tr>
<th>TEMP. RANGE</th>
<th>CONTACT OPERATION ON TEMP. RISE</th>
<th>SHELL AND HEAD MATERIAL</th>
<th>APPROX. DEGREES CHANGE PER FULL TURN OF ADJUSTING SLEEVE</th>
<th>EXTREME TEMPERATURE EXPOSURE</th>
<th>CURRENT RATING</th>
<th>FACTORY TEMPERATURE SETTING TOLERANCE (MOD. #3)</th>
<th>APPLICABLE MODIFICATIONS AND SPECIAL FEATURES</th>
<th>SPECIAL FEATURE</th>
</tr>
</thead>
<tbody>
<tr>
<td>-100 to +500°F/ -73 to 260°C</td>
<td>Opens</td>
<td>All Type 316 S.S.</td>
<td>100°F/ 55°C</td>
<td>-100°F/-73°C indefinitely and 100°F/55°C above set point for 1 hour maximum</td>
<td>AC 10 amps 120 volts 5 amps 240 volts</td>
<td>± 5°F from -100 to 100°F ± 3°F or 2% of setting value (whichever is greater) from 100 to 600°F</td>
<td>1 2 3 4 14 SPECIAL FEATURE 31</td>
<td></td>
</tr>
<tr>
<td>-100 to +600°F/ -73 to +316°C</td>
<td>Closes</td>
<td>All Type 316 S.S.</td>
<td></td>
<td>-100°F/-73°C indefinitely and 700°F/370°C for 1 hour maximum</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**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 -100°F to +250°F
60 psi at 600°F

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 -100°F to +250°F
60 psi at 600°F

Catalog No. 34-011100-002
Aluminum Surface Mounting Well
Approximate weight is 4 ounces (112 grams)
Pressure Ratings: 100 psi at -100°F to +250°F
60 psi at 600°F

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 -100°F to +250°F
60 psi at 600°F

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
01-99030-00X
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
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.

(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 ½ to ¾ inch, and a 4 inch extension is ordered, the overall length will be 4¾ to 5¼ inches. Minimum ordering quantities apply.

Modifications which cannot be combined:

<table>
<thead>
<tr>
<th>MOD</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>8</th>
<th>10</th>
<th>14</th>
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<tbody>
<tr>
<td>5</td>
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<td>6</td>
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<td>8</td>
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<td>10</td>
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</table>

01-990080-001
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
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.
SPECIAL FEATURES

When special features are specified, THERMOSWITCH® controllers are assigned a special catalog number. As a result, THERMOSWITCH® controllers as received may bear a different catalog number than the one specified on the customer order.

31 Extended Shell - THERMOSWITCH® Controllers

In applications where a standard THERMOSWITCH® controller is too short to reach the medium to be controlled, the shell length may be extended. Extension must be ordered in increments of 1 inch beyond standard length.

31A Extended Shell - Protective Wells

Wells may be extended in increments of one inch. The THERMOSWITCH® controller must also be extended equally in length.

34 Plating Of All Exposed Brass Parts

To overcome certain corrosive conditions, all exposed brass parts may be plated with tin, zinc, or nickel. Specify S.F.34 and plating material.

NOTE: Plating restricts the maximum temperature of the controllers as follows:
- Tin 300°F (149°C)
- Nickel 600°F (316°C)
- Tin 400°F (204°C)

35 Polyvinyl Chloride (PVC) Lead Wires

PVC insulated wire can be supplied as a moisture-resistant leadwire for those applications where the operating temperature does not exceed 175°F (80°C).

Armored Cable

SF 01-982122-XXX 5/8 diameter units
SF 01-982123-XXX 13/16 diameter units

Armored Cable provides protection for the leadwires. (Cable is not moisture resistant.) Leadwires will be 2 inches longer than cable if cable is over 12 inches unless otherwise specified. Specify cable length “L.” This feature includes a ground wire provision as required by approval agencies.

HOW TO ORDER

1. Select controller and/or protective well detailed on Pages 2 - 7.
2. Order using catalog number.
3. Select applicable Modifications and/or Special Features detailed on Page 8 and order using 11 digit number shown

In applications where a standard THERMOSWITCH® controller is too short to reach the medium to be controlled, the shell length may be extended. Extension must be ordered in increments of 1 inch beyond standard length.

Operation outside specifications could result in failure of the Fenwal product and other equipment with injury to people and property.

NOTE: Specifications subject to change without notice