

CPI THERMAL SWITCHES



CPI[®]

CONTROL PRODUCTS INC.

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OUR MISSION

Control Products Inc., designs and manufactures a broad line of quality thermal and waterproof switches. We specialize in addressing specific switching problems and working with our customers to reach appropriate solutions in the shortest time frame possible. We recognize that constant attention to our customers' needs is the key to our success. Our goal is to continue to grow by providing our customers the highest quality product and our employees, who are our greatest assets, the opportunity to reach their full potential.

CRITICAL TO THE ACHIEVEMENT OF OUR GOALS ARE THE FOLLOWING:

- A constant pursuit of excellence, to continually improve our service and products.
- To maintain the highest ethical standards when dealing with employees, customers and suppliers.
- A commitment to R&D insuring the development of new products as well as constant improvements to our existing product line.
- To strive for defect free manufacturing, meeting or exceeding customer requirements.
- A sense of urgency when dealing with customer needs.



Introduction to CPI Thermal Switches

Thermal switches continue to be the most efficient and reliable means of controlling temperatures as well as warning of over-temperature. Where critical component temperature ranges are involved, thermal switches represent the final safety cutoff for protection of these components. It is imperative, therefore, that engineers be aware of the factors involved in the correct selection of thermal switches. The following factors define and describe every CPI thermal switch:

WHAT IS A CPI THERMAL SWITCH?

- It is an electro-mechanical or electronic device, direct acting without the need for additional instrumentation or amplification.
- It is small and light; average weight ranges from 1/2 to 2 ounces. Average size: 0.31" diameter probe with 3" overall length.
- It is less costly than elaborate control systems using a thermocouple, thermistor or resistance probe.
- It is simple to install since it requires very little space, no special wiring or shock mounts.
- It is simple to check functionally. (Some designs can be made self-testing).
- It is easy to establish specifications for its use in a system.

SELECTING THE PROPER SWITCH

The proper selection of a thermal switch depends on several factors. Analyzing these factors can simplify the application of temperature controls, and guarantee reliability which cannot be attained in any other way.

I. Define what functions the thermal switch must perform.

These usually fall into one of three following categories:

- Warning or indication of overheat** – Typical applications are in aircraft generators, hydraulic systems, radar antenna, gear boxes, ground support equipment and pumps for cooling liquids.
- Control of a system temperature** – Used on cleaning machines, medical lasers, high tech computers and in aircraft heating and air conditioning systems to maintain temperature within a given range.
- As a final safety shutoff** – Thermal switches are used to automatically shut down critical equipment and protect it from a runaway overheat condition. Examples: hydraulic devices, gas turbines and extruders.

II. Outline the parameters within which the unit must operate. This can be done by using the MIL specification on other parts of the equipment involved, or by reference to company-written specifications which can be readily applied to thermal switches.

Basic temperature and environment parameters which must be specified are:

- Calibration temperature and tolerance
- Temperature differential (hysteresis)
- Overshoot temperature on probe and head
- Vibration
- Shock
- Special environmental conditions

III. Define the physical requirements of the application:

- The electrical requirements
- Physical size and shape
- Mounting requirements
- Connector or terminations

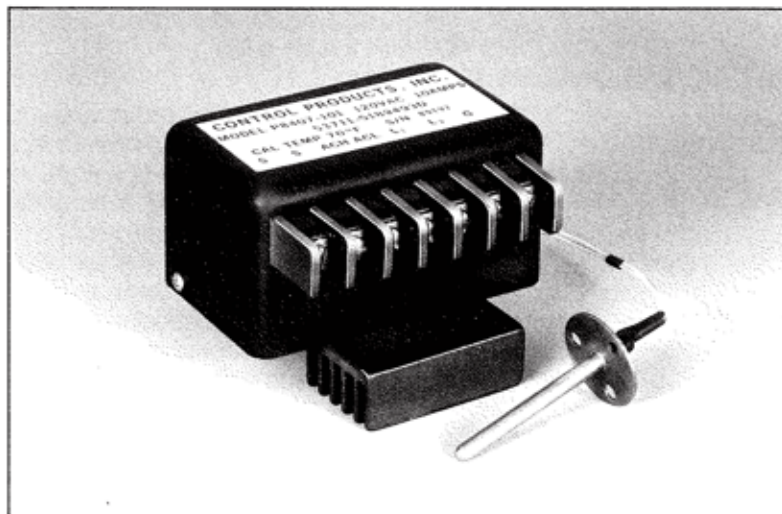
HOW TO DETERMINE WHICH CPI SWITCH IS BEST FOR YOU.

CPI makes four types of thermal switches: SNAP-STAT™, Bimetal, Rod and Tube and Electronic. The following chart will help you quickly identify which type of CPI thermal switch is best for your application. Once you've narrowed your choice, refer to the section on the product type for more complete information on specifications, sizes, mounting details, MIL specs, etc.

Operating Temp. Range(°F)	Max. Current for Resistive Load 28VDC/120VAC	Switch Choice		
		No. of Terminations		
		1	2	3
0 to 350	5 amps			Snap-Stat™ AD Series
0 to 500	1 amp		Bimetal Type R-3	
0 to 600	0.5 amps	Bimetal Types L-1,L-2		
	5 amps			Rod & Tube Type AB
0 to 650	2 amps		Bimetal Types M-1,M-2	
0 to 850	1.5 amps	Rod & Tube Type W-1	Rod & Tube Type X-1	
100 to 1850	1.5 amps	Rod & Tube Type W-2	Rod & Tube Type X-2	

CPI CUSTOM DESIGNED SWITCHES

In addition to the switches shown and described in this catalog, CPI custom designs switches for special applications and/or requirements.

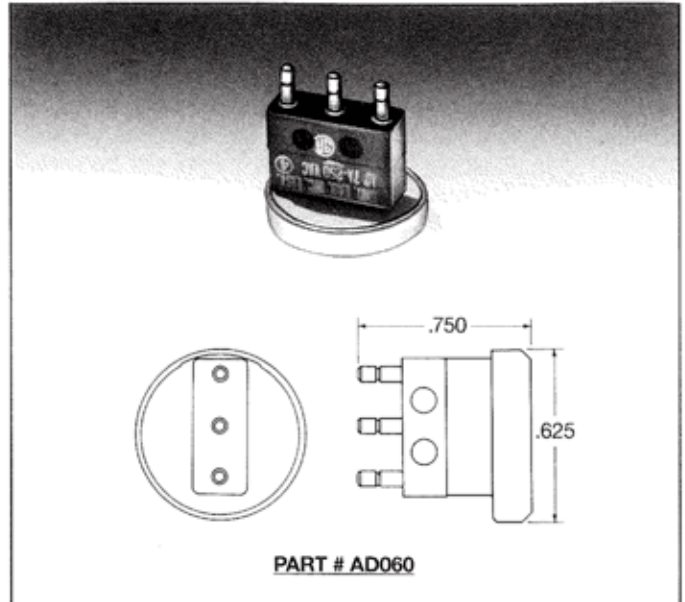


Custom designed 10 amp switch with thermistor probe for a U.S. Navy gun firing system.

Snap-Stat™ Thermal Switches

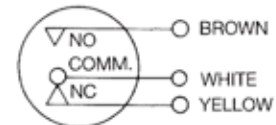
CPI's SNAP-STAT thermal switches have a bimetal snap disc that actuates a miniature microswitch. This double snap action makes these switches virtually immune to shock and vibration. Epoxy sealing or glass-to-metal hermetic sealing makes them ideal for demanding industrial or military applications.

The SNAP-STAT's SPDT action provides both control and indication at the same time – two functions from one switch. Or it can be used as a SPST thermal switch. Calibration temperature range is 0°F to 350°F with a tolerance of ± 7°F. (Dual temperature SNAP-STAT incorporates two separate temperature controls in one mounting). The basic SNAP-STAT switch mechanism AD060 shown is available and is suitable for gluing or clamping in place. We can also design custom brackets for your use.



WIRING DIAGRAM

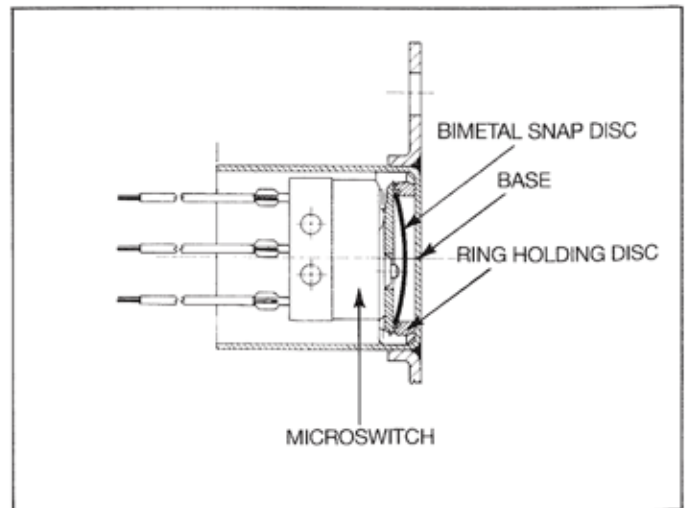
SPDT SINGLE SWITCH



HOW CPI SNAP-STAT SWITCHES WORK

When heat is applied to the bimetal disc, the disc reverses from convex to concave. This reversal of the disc operates the microswitch causing the normally open side to close and the normally closed side to open. When the disc cools, it reverts back to its normal condition, releasing the microswitch and reversing the electrical actions.

Bases of the SNAP-STATS are thin for good heat conductivity, and the ring supporting the snap disc is made of aluminum to help conduct the heat into the disc.



APPLICATIONS FOR CPI SNAP-STAT THERMAL SWITCHES.

CPI SNAP-STAT thermal switches offer a broad array of mounting, probe and termination options for a diverse roster of industrial applications including over-temperature on air compressors, food extruders, distilling machines, industrial steam cleaners, clutches/brakes/transmissions, escalators and elevators. CPI SNAP-STATS are specified where reliability is critical in aircraft fuel systems, environmental control systems, medical equipment such as lasers, incubators, sophisticated electronic equipment including government communication systems and fuel cells.

BASIC SNAP-STAT SWITCH AD060

The basic SNAP-STAT switch shown here, and almost all SNAP-STAT switches, have the same wiring diagram indicated. Exceptions are shown in the listings for each model.

Snap-Stat™ Thermal Switches

ENVIRONMENTAL SPECIFICATIONS:

Test	MIL STD	Method/ Procedure	Comments
High temperature	810	501.2 Proc. 1	Soak temp 350°F -70°F
Low temperature	810	502.2 Proc. 1	
Humidity	810	507.2 Proc. 1	
Salt fog	810	509.2 Proc. 1	
Fungus	810	508.3 Proc. 1	
Dust	810	510.2 Proc. I (Dust) 510.2 Proc. II (Sand)	
Shock Sawtooth	810	Application specific tests can be performed to meet customer requirements	
Vibration	810		

Standard units are available as UL "recognized components".

SPECIFICATIONS

Calibration temp (factory set): 0°F Min. to 350°F Max. (Specify close on rise or close on fall).

Tolerance: ± 7°F (Tighter tolerances available)

Repeatability: ± 3°F under standardized conditions

Actuation/Deactuation differential: 10°F to 25°F (non-adjustable)

Safe momentary undershoot/overshoot: -65°F to +400°F

Electrical action: SPDT (standard), or SPST (specify NO or NC)

Electrical rating: Standard - 28 VDC, 120 VAC, 5 amp resistive, 3 amp inductive, 220 VAC, 5 amp resistive, 50,000 cycles. Gold contacts (for special applications, such as dry circuit or long periods of inactivity) - 28 VDC, 120 VAC, 1 amp resistive, 1/2 amp inductive.

Electrical Terminations: Leads are insulated from mounting, 20 AWG stranded, Teflon insulation. AD049 - 3 pins, .035 dia. Special glass seal connections available.

Weight: 0.6 oz to 2.3 oz.

Response time per MIL S 24236 P4.7.5.1: From 15 secs. to 40 secs. (varies with thermal mass of switch body).

ORDERING INFORMATION

Ordering information required:

1. Part Number.
2. Standard switches are SPDT with 12" leads.
3. Temperature set point. (Specify close on rise or close on fall).
4. Special features available (customer must specify):
 SPST - specify NO or NC
 Lead lengths other than 12" (Specify as dash number added to part number)
 Gold contacts

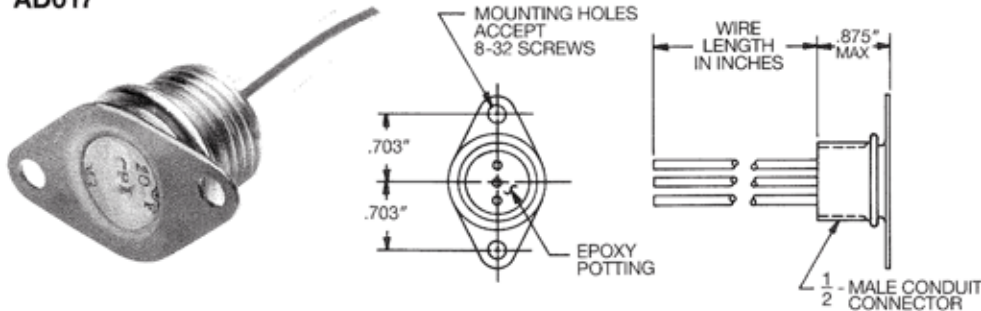
EXAMPLE:



This example designates ADO50 configuration with gold contacts, 12 inch leads, with a 170°F set point.

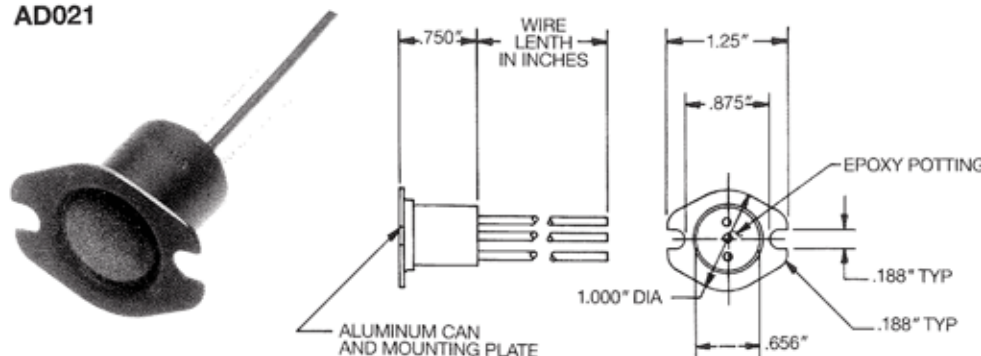
SURFACE MOUNT WITHOUT PROBE

AD017



PART NO.	MAT.
AD017	Al.

AD021

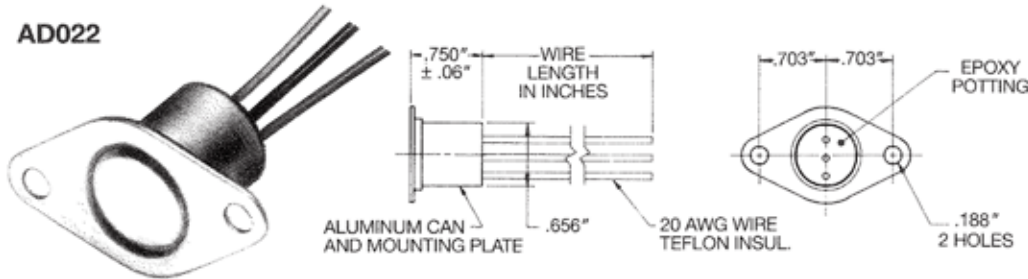


PART NO.	MAT.
AD021	Al.
AD020	Black Anodized Al.

Materials: Al. = Aluminum S.S. = Stainless Steel

Snap-Stat™ Thermal Switches

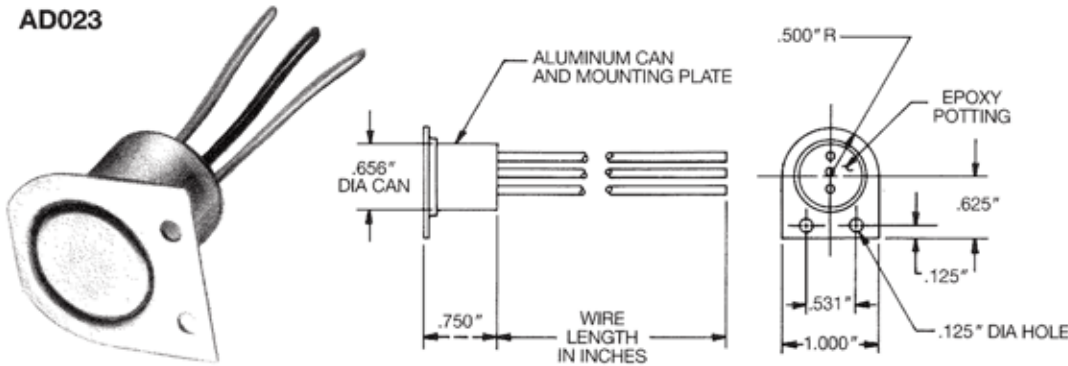
AD022



PART NO.	MAT.
AD022	Al.
AD069	S.S.
AD004*	Al.

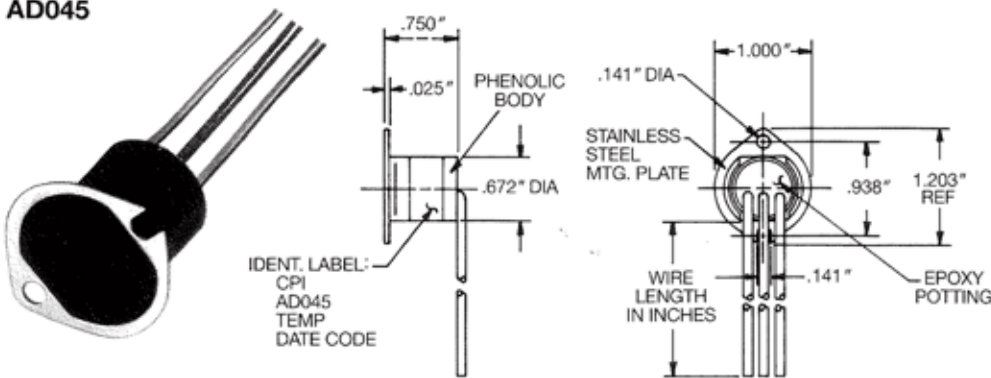
* Mounting holes 0.595 center/center

AD023



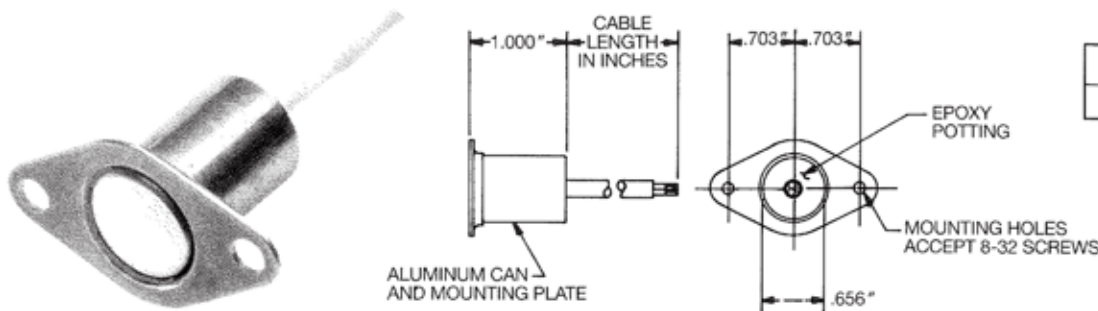
PART NO.	MAT.
AD023	Al.

AD045

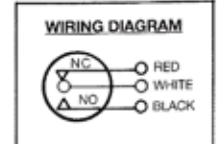


PART NO.	MAT.
AD045	Phenolic body, S.S. mtg. plate

AD093

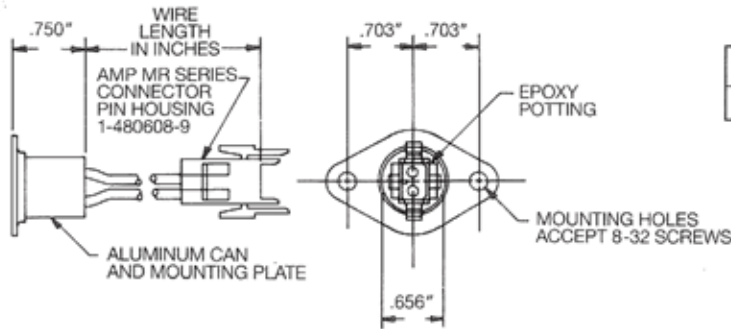


PART NO.	MAT.
AD093	Al.

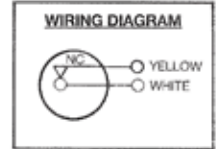


Snap-Stat™ Thermal Switches

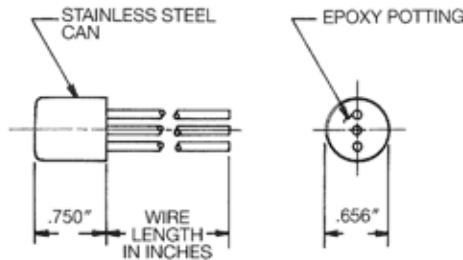
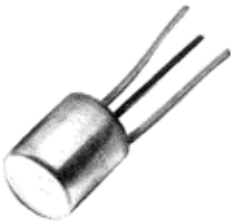
AD103



PART NO.	MAT.
AD103	Al.

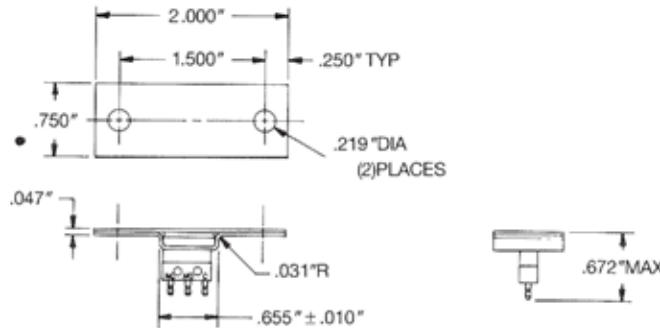
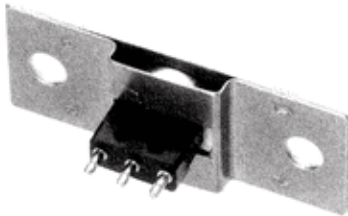


AD048

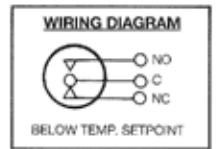


PART NO.	BODY MAT.	PROBE MAT.	PROBE LENGTH(")
AD048	S.S.	S.S.	3/4
AD047	Al.	Al.	3/4

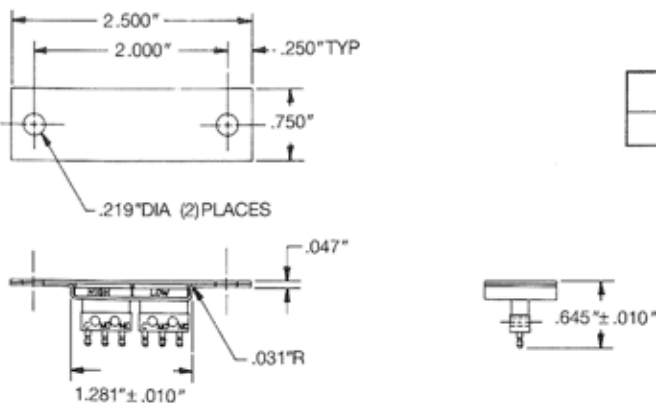
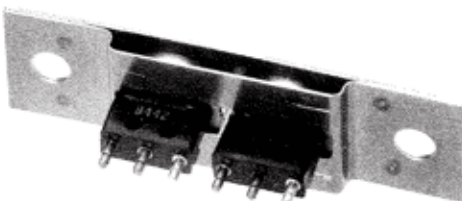
AD116



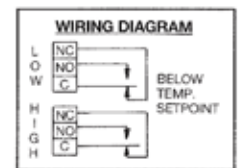
PART NO.	MAT.
AD116	S.S.



AD118



PART NO.	MAT.
AD118	S.S.

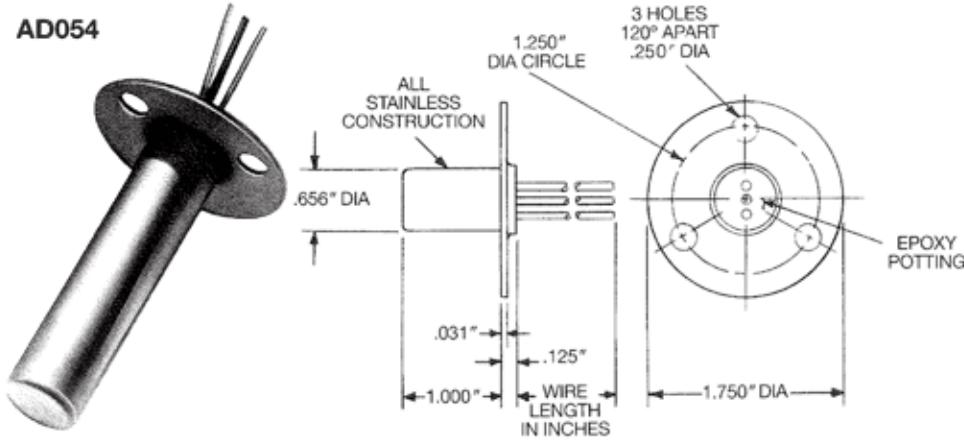


Materials: Al. = Aluminum S.S. = Stainless Steel

Snap-Stat™ Thermal Switches

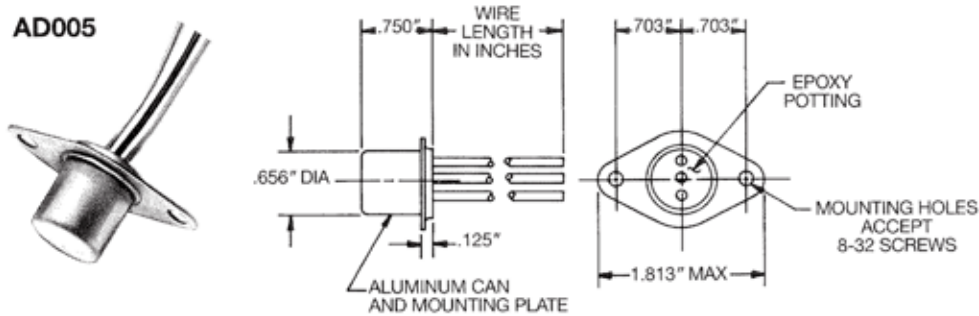
SURFACE MOUNT WITH PROBE

AD054



PART NO.	MAT.	PROBE LENGTH(")
AD071	S.S.	1/2
AD054	S.S.	1
AD074	S.S.	1 1/2
AD070	S.S.	2
AD030	S.S.	3
AD029	S.S.	9
AD028	S.S.	19

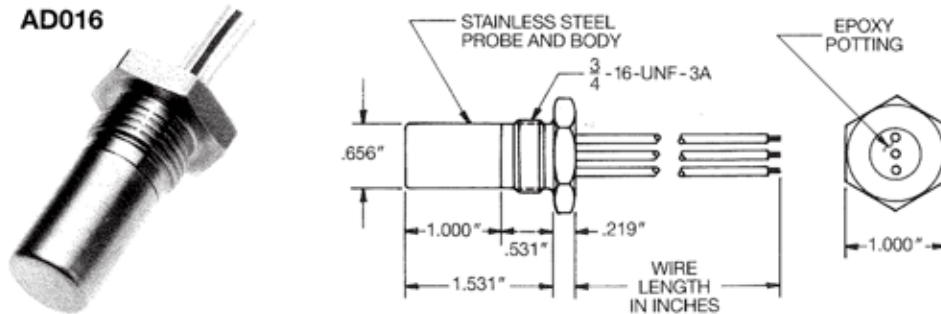
AD005



PART NO.	MAT.	PROBE LENGTH(")
AD075	S.S.	3/4
AD076	S.S.	2 1/8
AD026	S.S.	4
AD027	S.S.	6
AD127	Al.	1/2
AD005	Al.	3/4
AD006	Al.	1

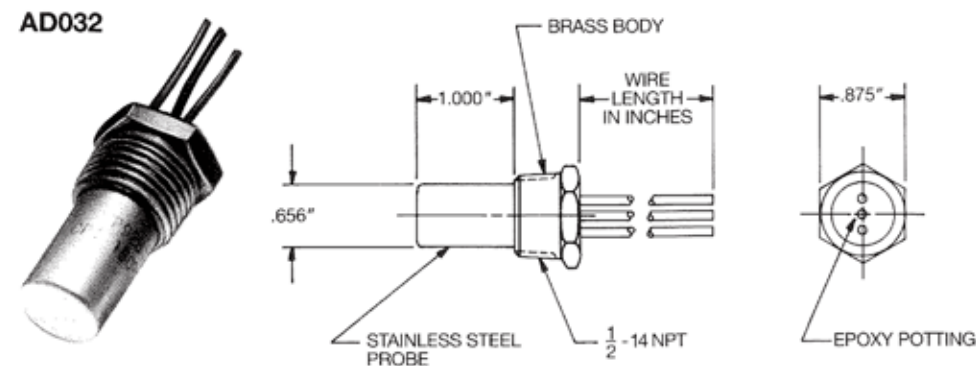
PROBE DEVICES WITH THREADS

AD016



PART NO.	BODY MAT.	PROBE MAT.	PROBE LENGTH(")
AD016	S.S.	S.S.	1

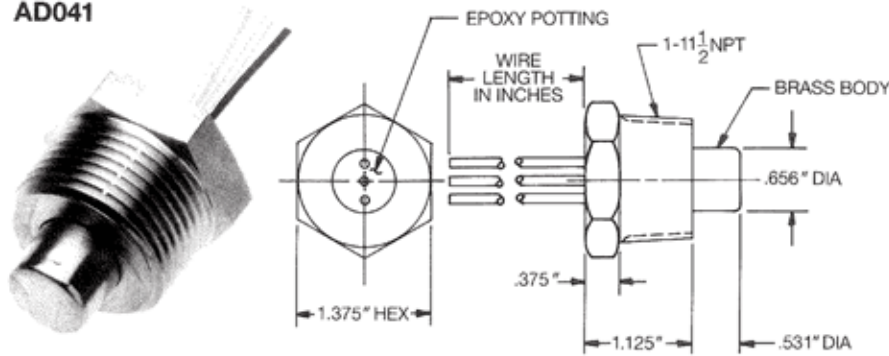
AD032



PART NO.	BODY MAT.	PROBE MAT.	PROBE LENGTH(")
AD040	Brass	S.S.	1/4
AD033	Brass	S.S.	1/2
AD032	Brass	S.S.	1
AD034	Brass	S.S.	1 1/2
AD035	Brass	S.S.	2
AD114	Brass	S.S.	3
AD115	Brass	S.S.	4
AD012	S.S.	S.S.	1/4
AD009	S.S.	S.S.	1/2
AD008	S.S.	S.S.	1
AD010	S.S.	S.S.	1 1/2
AD011	S.S.	S.S.	2

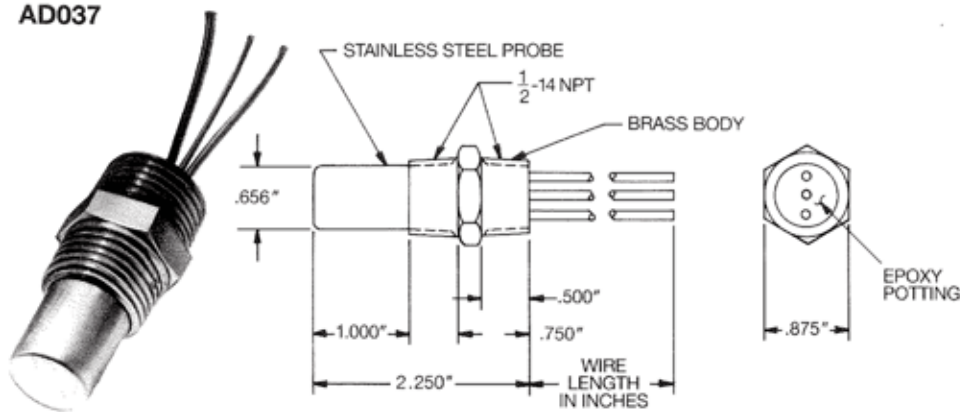
Snap-Stat™ Thermal Switches

AD041



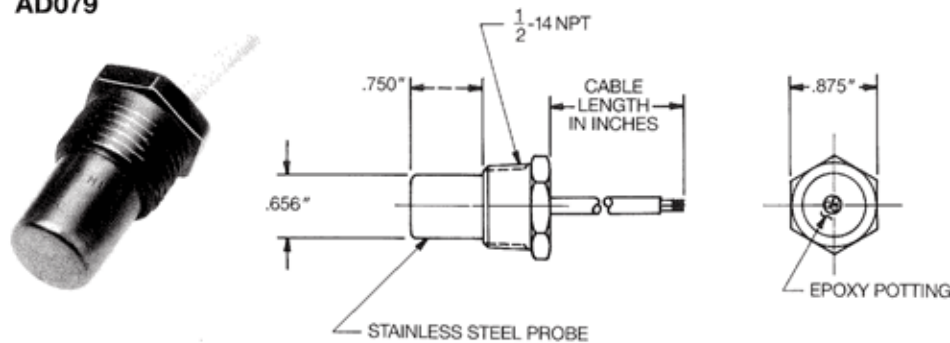
PART NO.	BODY MAT.	PROBE MAT.	PROBE LENGTH(")
AD041	Brass	Brass	17/32

AD037



PART NO.	BODY MAT.	PROBE MAT.	PROBE LENGTH(")
AD125	S.S.	S.S.	1/4
AD131	S.S.	S.S.	1/2
AD042	S.S.	S.S.	3/4
AD044	S.S.	S.S.	2
AD086	S.S.	S.S.	3
AD087	S.S.	S.S.	4
AD126	Brass	S.S.	1/4
AD036	Brass	S.S.	1/2
AD025	Brass	S.S.	3/4
AD037	Brass	S.S.	1
AD038	Brass	S.S.	1 1/2
AD039	Brass	S.S.	2
AD043	Brass	S.S.	2 1/2
AD089	Brass	S.S.	3 3/8
AD088	Brass	S.S.	4
AD062	Brass	Brass	1/4

AD079

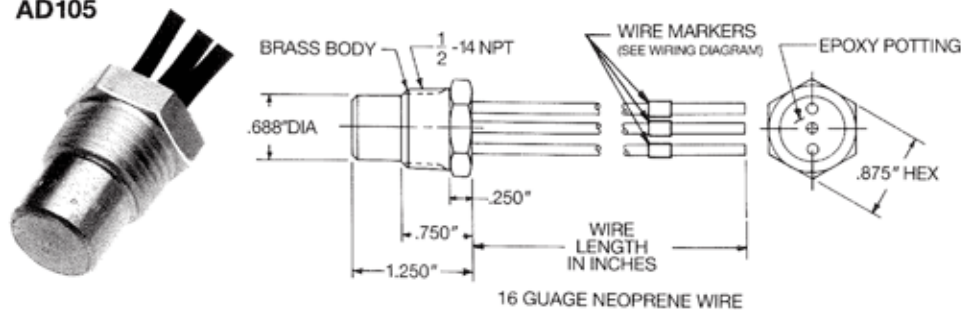


PART NO.	BODY MAT.	PROBE MAT.	PROBE LENGTH(")
AD079	Brass	S.S.	3/4

WIRING DIAGRAM

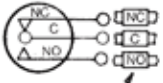


AD105



PART NO.	BODY MAT.	PROBE MAT.	PROBE LENGTH(")
AD105	Brass	Brass	1/2

WIRING DIAGRAM

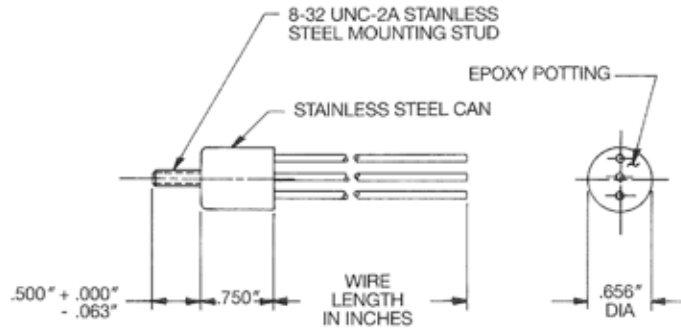
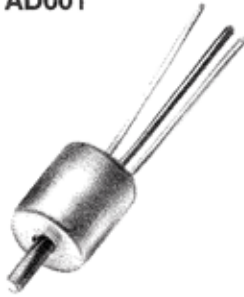


Materials: Al. = Aluminum S.S. = Stainless Steel

Snap-Stat™ Thermal Switches

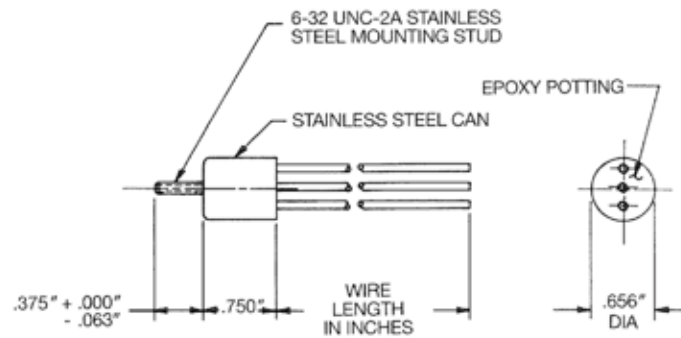
THREADED WITH LEADS (NO PROBES)

AD001



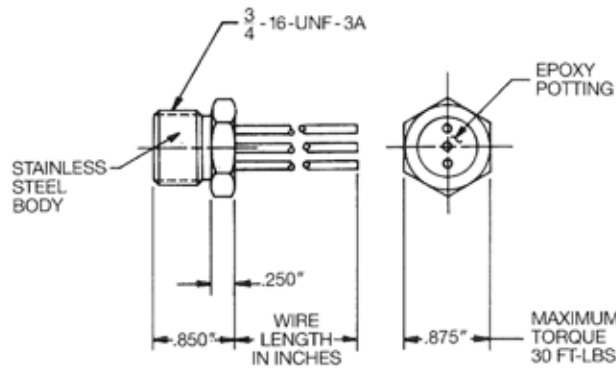
PART NO.	MAT.
AD001	S.S.

AD003



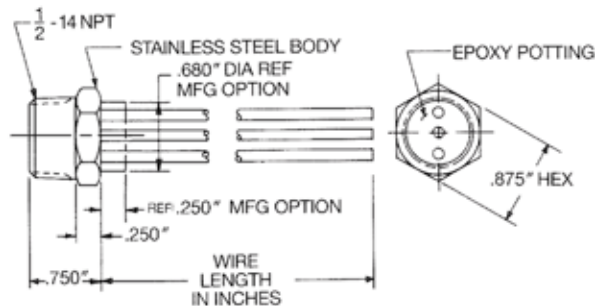
PART NO.	MAT.
AD003	S.S.

AD007



PART NO.	MAT.
AD007	S.S.

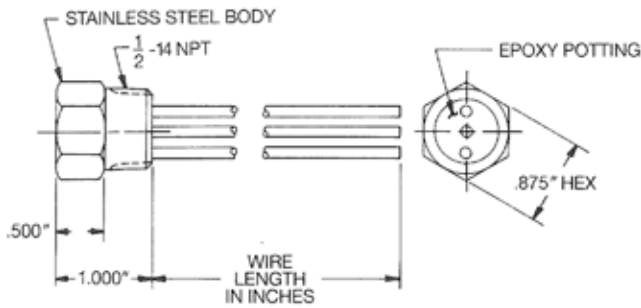
AD013



PART NO.	MAT.
AD013	S.S.
AD019	Brass

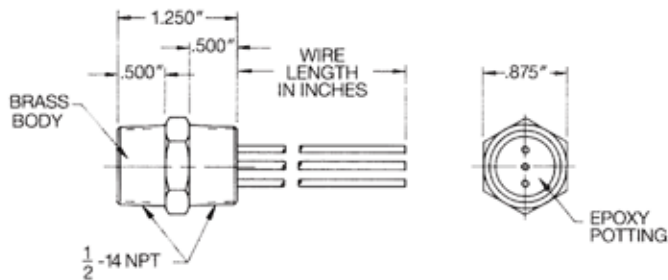
Snap-Stat™ Thermal Switches

AD014



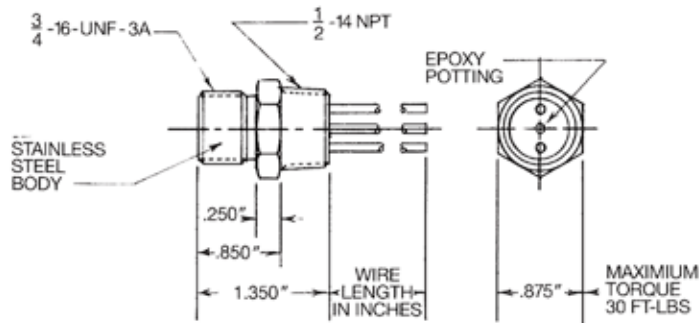
PART NO.	MAT.
AD014	S.S.

AD050



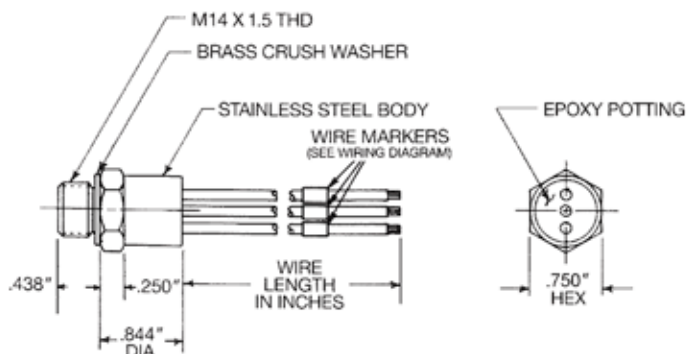
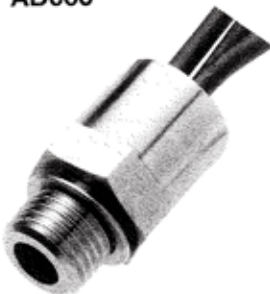
PART NO.	MAT.
AD050	Brass
AD077	S.S.

AD051

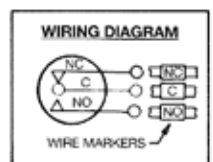


PART NO.	MAT.
AD051	S.S.

AD066



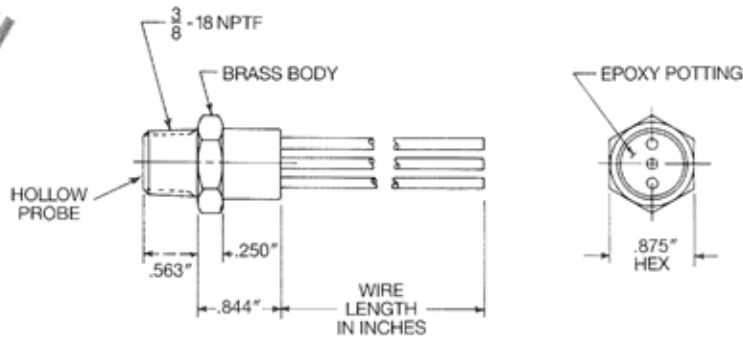
PART NO.	MAT.
AD066	S.S.



Materials: Al. = Aluminum S.S. = Stainless Steel

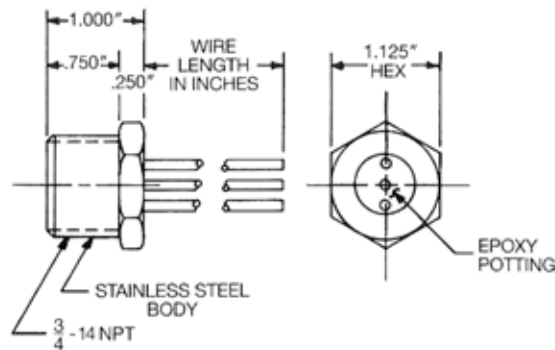
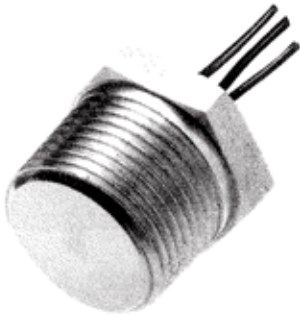
Snap-Stat™ Thermal Switches

AD068



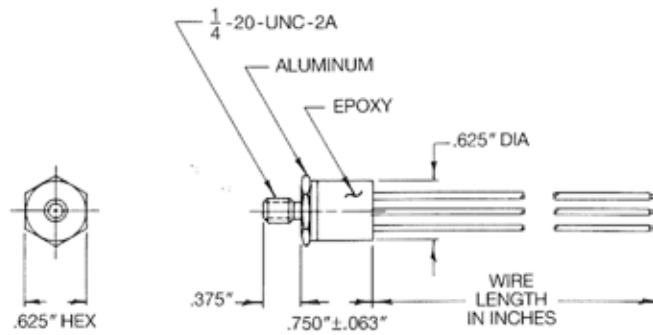
PART NO.	MAT.
AD068	Brass

AD078



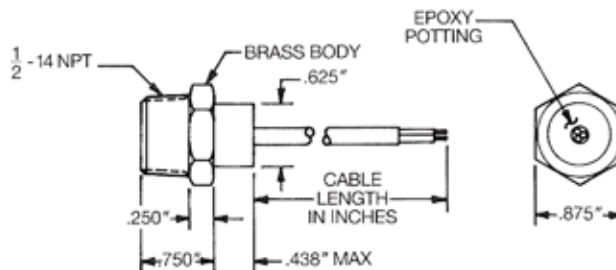
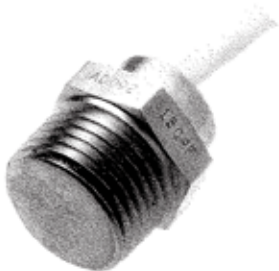
PART NO.	MAT.
AD078	S.S.

AD091

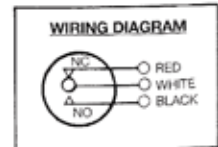


PART NO.	MAT.
AD091	Epoxy

AD092



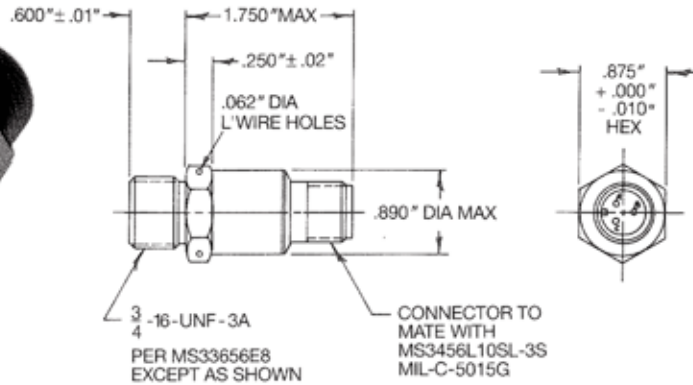
PART NO.	MAT.
AD092	Brass



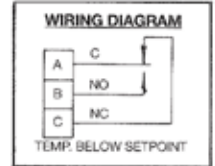
Snap-Stat™ Thermal Switches

SPECIALS WITH CONNECTORS

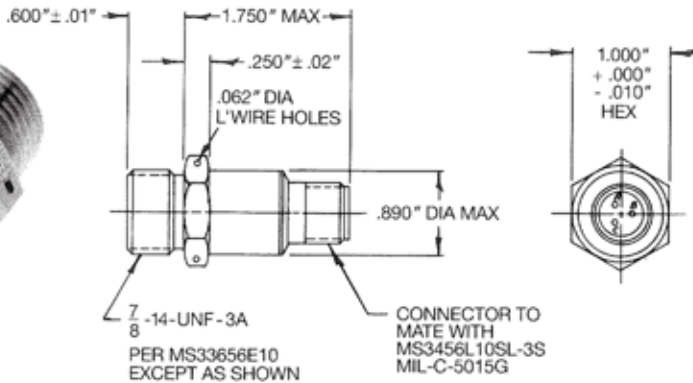
AD057



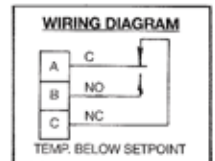
PART NO.	MAT.	CONNECTORS
AD057	S.S.	MATES WITH MS3456L10SL-3S



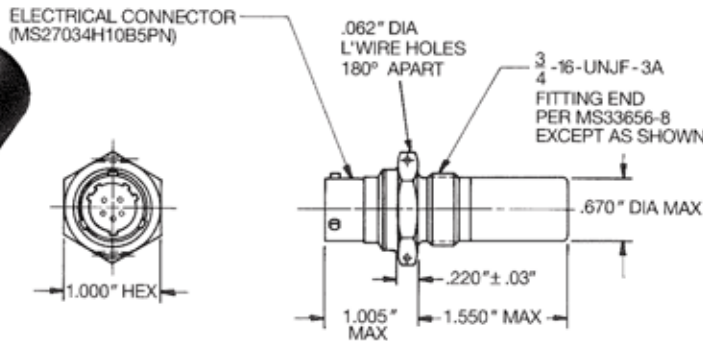
AD058



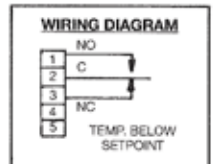
PART NO.	MAT.	CONNECTORS
AD058	S.S.	MATES WITH MS3456L10SL-3S



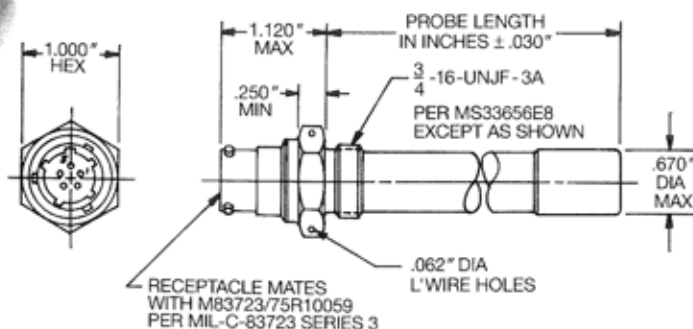
AD059



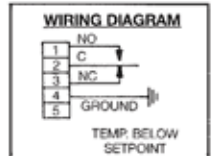
PART NO.	MAT.	CONNECTORS
AD059	S.S.	MATES WITH MS27034H10B5PN



AD064



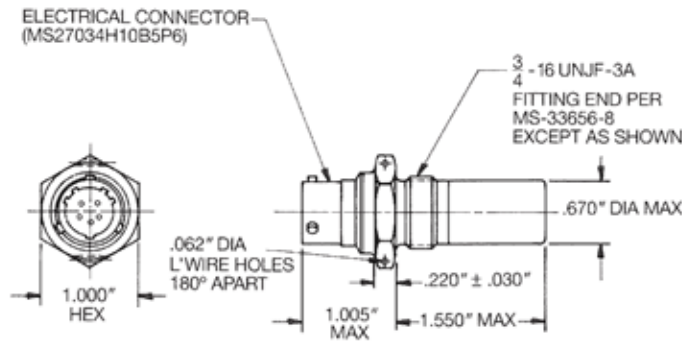
PART NO.	MAT.	CONNECTORS
AD064	S.S.	MATES WITH M83723/75R10059



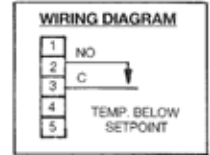
Materials: Al. = Aluminum S.S. = Stainless Steel

Snap-Stat™ Thermal Switches

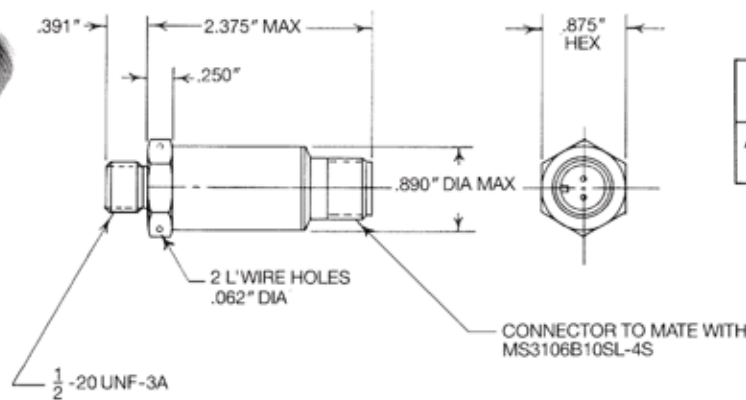
AD065



PART NO.	MAT.	CONNECTORS
AD065	S.S.	MS27034H10B5P6

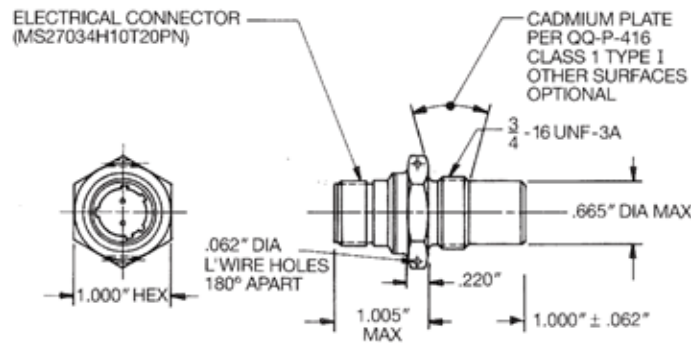


AD095

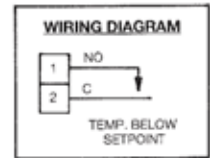


PART NO.	MAT.	CONNECTORS
AD095	S.S.	MATES WITH MS3106B10SL-4S

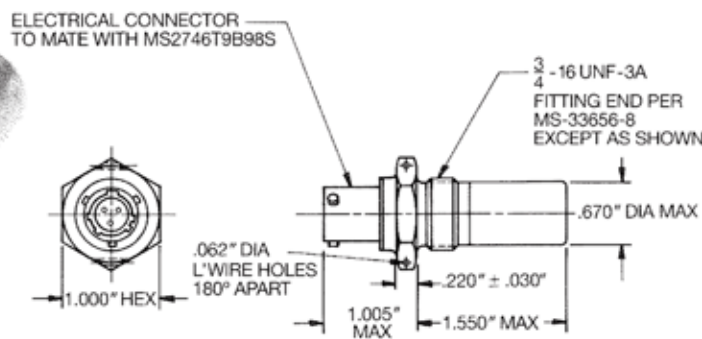
AD096



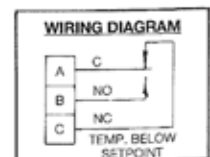
PART NO.	MAT.	CONNECTORS
AD096	S.S.	MS27034H10T20PN



AD097

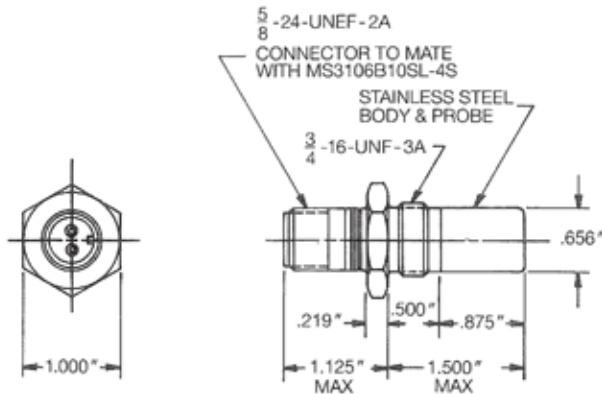


PART NO.	MAT.	CONNECTORS
AD097	S.S.	MATES WITH MS2746T9B98S

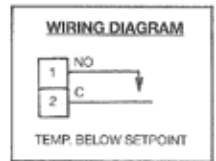


Snap-Stat™ Thermal Switches

AD102

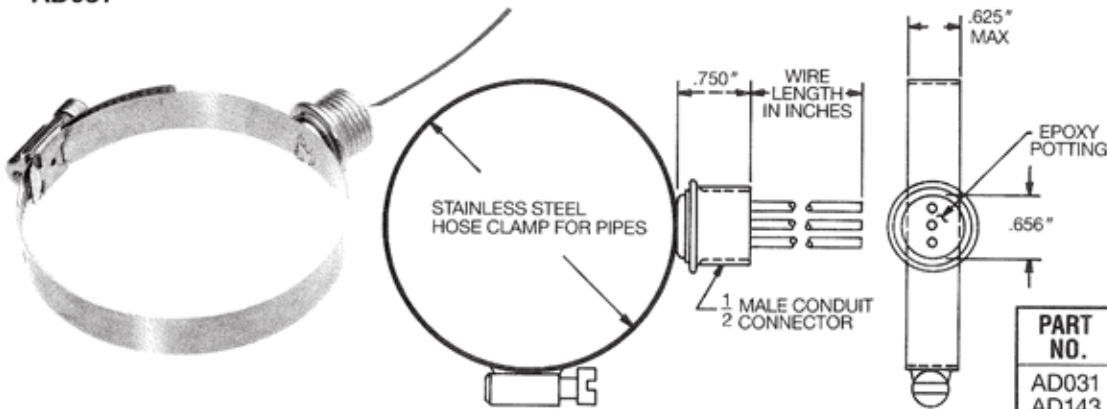


PART NO.	MAT.	CONNECTORS
AD102	S.S.	MATES WITH MS3106B10SL-4S



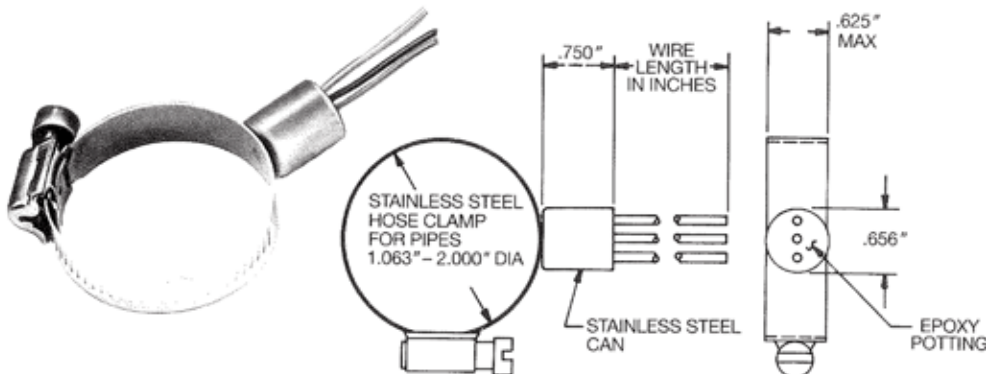
OTHER SPECIALS

AD031



PART NO.	MAT.	CLAMP I.D. (")
AD031	S.S.	3 1/16 - 4
AD143	S.S.	1 - 2

AD080

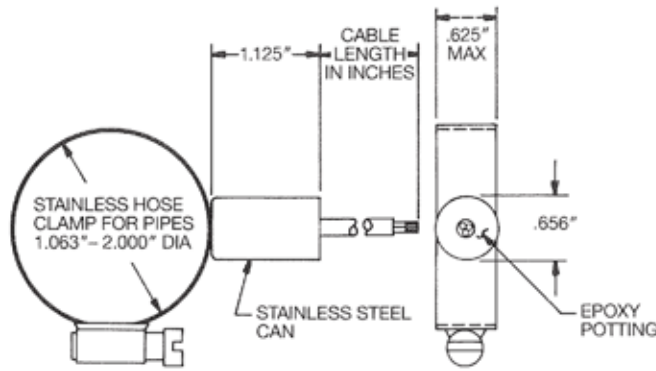


PART NO.	MAT.	CLAMP I.D. (")
AD080	S.S.	1 1/16 - 2
AD081	S.S.	2 1/16 - 3
AD082	S.S.	3 1/16 - 4
AD083	S.S.	4 - 6 1/8
AD084	S.S.	6 1/8 - 9 1/8

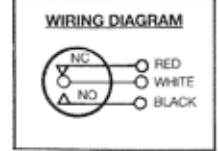
Materials: Al. = Aluminum S.S. = Stainless Steel

Snap-Stat™ Thermal Switches

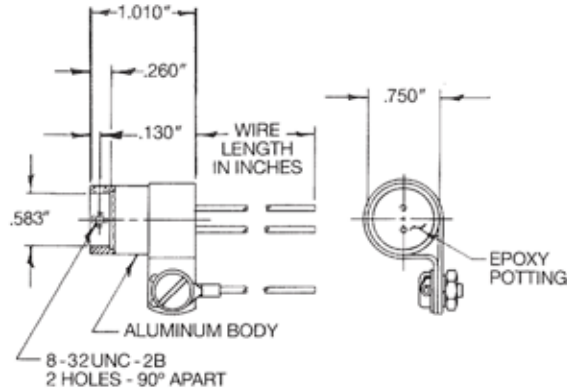
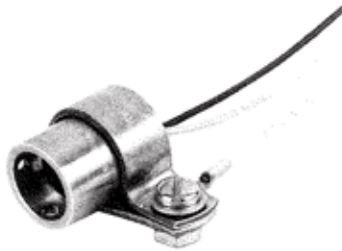
AD085



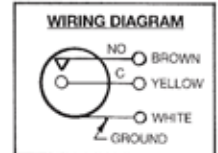
PART NO.	MAT.
AD085	S.S.



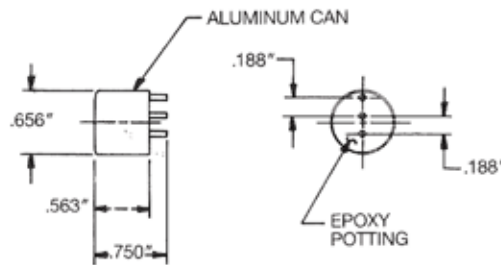
AD056



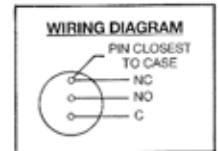
PART NO.	MAT.
AD056	Al.



AD049

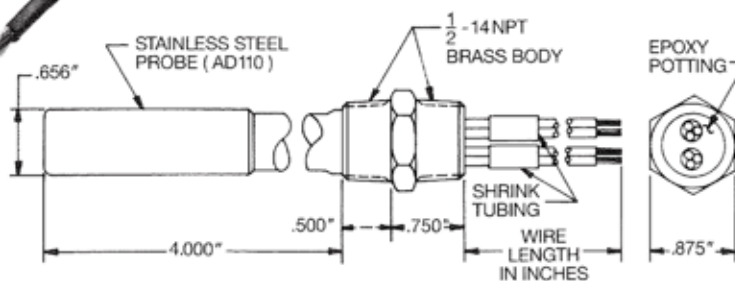
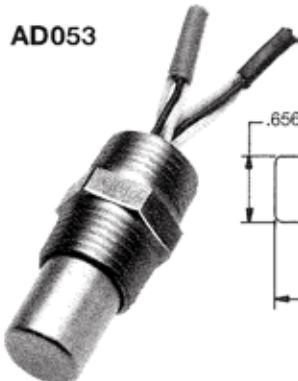


PART NO.	MAT.	
AD049	Al.	For circuit board mounting



DUAL TEMPERATURE

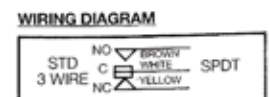
AD053



PART NO.	BODY MAT.	PROBE MAT.	PROBE LENGTH (")
AD110	Brass	S.S.	4
AD053	Brass	S.S.	3/4

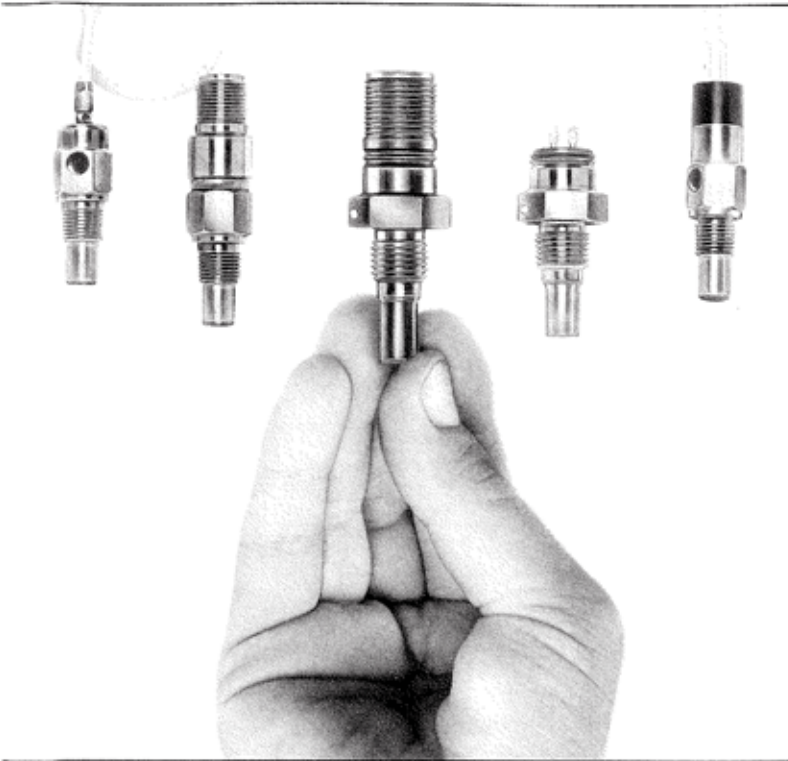
LOW TEMPERATURE
(White Shrink Tubing)

HIGH TEMPERATURE
(Yellow Shrink Tubing)

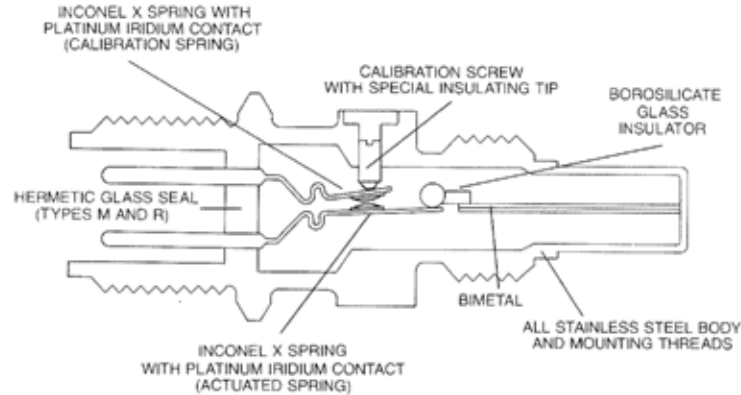


Materials: Al. = Aluminum S.S. = Stainless Steel

Bimetal Thermal Switches



HOW CPI BIMETAL THERMAL SWITCHES WORK



These small, lightweight thermal switches are ruggedly constructed to maintain stability of calibration even under extreme shock, vibration and other severe environmental conditions. They can be used as temperature controllers, safety cutoffs for equipment protection and indicators of overheat conditions.

QUALITY CONSTRUCTION.

- All welded stainless construction
- Glass hermetically sealed connector (Types M and R)
- Specific bimetals can be selected for maximum sensitivity
- Inconel X springs insure high temperature repeatability
- Platinum Iridium contacts provide excellent arc erosion protection and constant contact resistance
- Special glass insulators are used for thermal and electrical isolation
- M-1 and M-2 switches use calibration screws which have a special helicoil insert for extra vibration resistance

Factory calibrated. CPI bimetal thermal switches are factory calibrated at any temperature within the range of 0°F to 650°F (depending on type). They can operate in ambient temperatures from -65°F to +700°F and show excellent resistance to momentary overshoots. Drift free performance is assured throughout their long life.

Immune to problem environments. Hermetically sealed (Types L-1 and L-2 are environmentally sealed) for total protection against the effects of moisture, sand and dirt, these bimetal thermal switches are also designed to withstand severe shock and vibration with no shift in calibration. They meet or exceed the requirements of MIL Std. 810 (See charts).

Bimetal switches are based on a two layer alloy leaf which deflects with changes in temperature. The heat producing the thermal action works through the bimetal leaf mounting in the top of the probe, and enables CPI to design relatively short probe switches with a high degree of accuracy. The outline drawing shows a close-on-rise unit below the closing temperature. This unit has the bimetal so installed that deflection caused by a rise in temperature goes in an upward direction. This deflection causes the insulating glass ball to release the spring and close the contacts at the predetermined temperature. The temperature has been set by turning the calibration screw to ensure contact closure at the desired temperature. Bimetals are available to produce sensitivity in the desired calibration range while still permitting extreme temperature overshoots and undershoots.

APPLICATIONS FOR CPI BIMETAL THERMAL SWITCHES

CPI bimetal thermal switches perform reliably in demanding aircraft applications such as: environmental control systems, hydraulic systems, helicopter gear boxes, generators and bearings. Industrial equipment applications include sterilization equipment, plastic extruders, medical equipment, heavy duty air conditioning units, hydraulic activator overtemp, journal boxes, gear boxes, truck drive trains, piped liquids, solders and vehicle coolant temperature control.

ORDERING INFORMATION

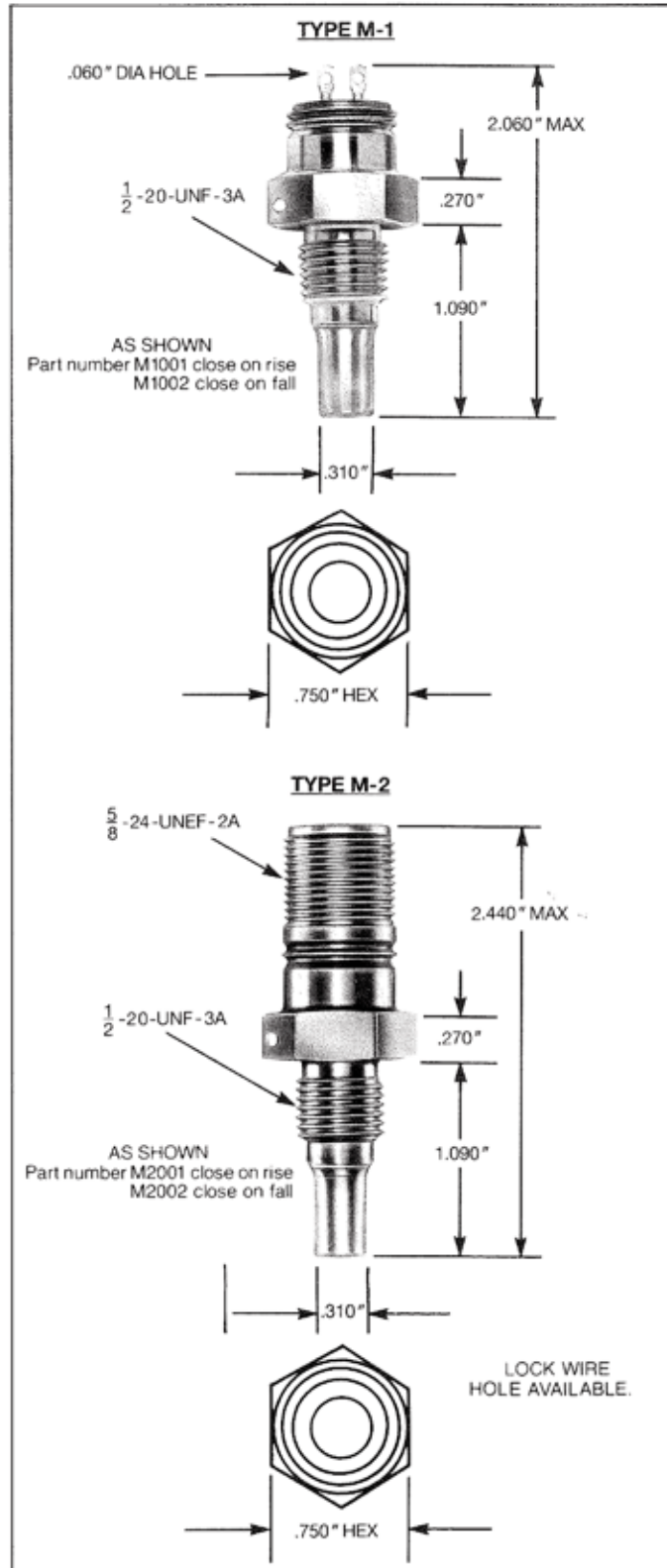
Ordering information required:

1. Part number.
2. Temperature set point.

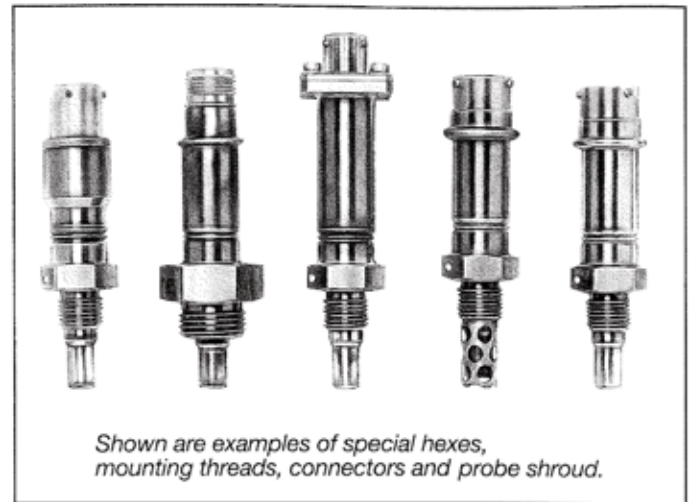
Bimetal Thermal Switches

TYPES M-1 AND M-2 PLUGSTAT™ BIMETAL THERMAL SWITCHES

Hermetically sealed • Calibration to 650°F • All stainless construction • Meets MIL environments • 2 wire construction • Wide range of connectors available.



CUSTOM CONFIGURATIONS



SPECIFICATIONS

M-1, M-2	
Calibration Temp. Max	650°F
Calibration Temp. Min	0°F
Calibration Tolerance (above 440°F, ± 7°F)	± 5°F
Repeatability	± 1°F
Differential (norm)	0°-5°F
Proof Pressure	4000 psi
Safe Momentary Undershoot	-70°F
Safe Momentary Overshoot	800°F
Voltage	115AC/28DC
Current Resistive	2 Amps
Current Inductive	1/2 Amp
Life - Mechanical - Full Rated Load	3,000,000 cyc 10,000 cyc
Weight	M-1 1.1oz M-2 1.5oz
Response time per MIL S 24236, P4.7.5.1	25 to 45 sec.

CPI BIMETAL SWITCHES MEET OR EXCEED ENVIRONMENTAL REQUIREMENTS OF MIL STD 810 AS FOLLOWS

High Temperature	Meth. 501.2 Proc. I Soak Temp. 700°F
Low Temperature	Meth. 502.2 Proc. I Soak Temp. -70°F
Humidity	Meth. 507.2 Proc. I
Salt Fog	Meth. 509.2 Proc. I
Fungus	Meth. 508.3 Proc. I
Dust & Sand	Meth. 510.2 Proc. I Dust Proc. II Sand
Vibration	Test data can be made available to meet customer requirements
Shock	Meth. 514.3 Proc. I Fractional shock
Altitude Temp.	Meth. 504.1 Proc. I
Moisture Resist.	MIL S 24236 P. 4.7.13 10 day

- Close tolerance set points are available at a premium charge.
- Gold Alloy contacts available at a premium charge.
- Values shown are optimum. Consult our Sales Engineering Dept. for specific application information.

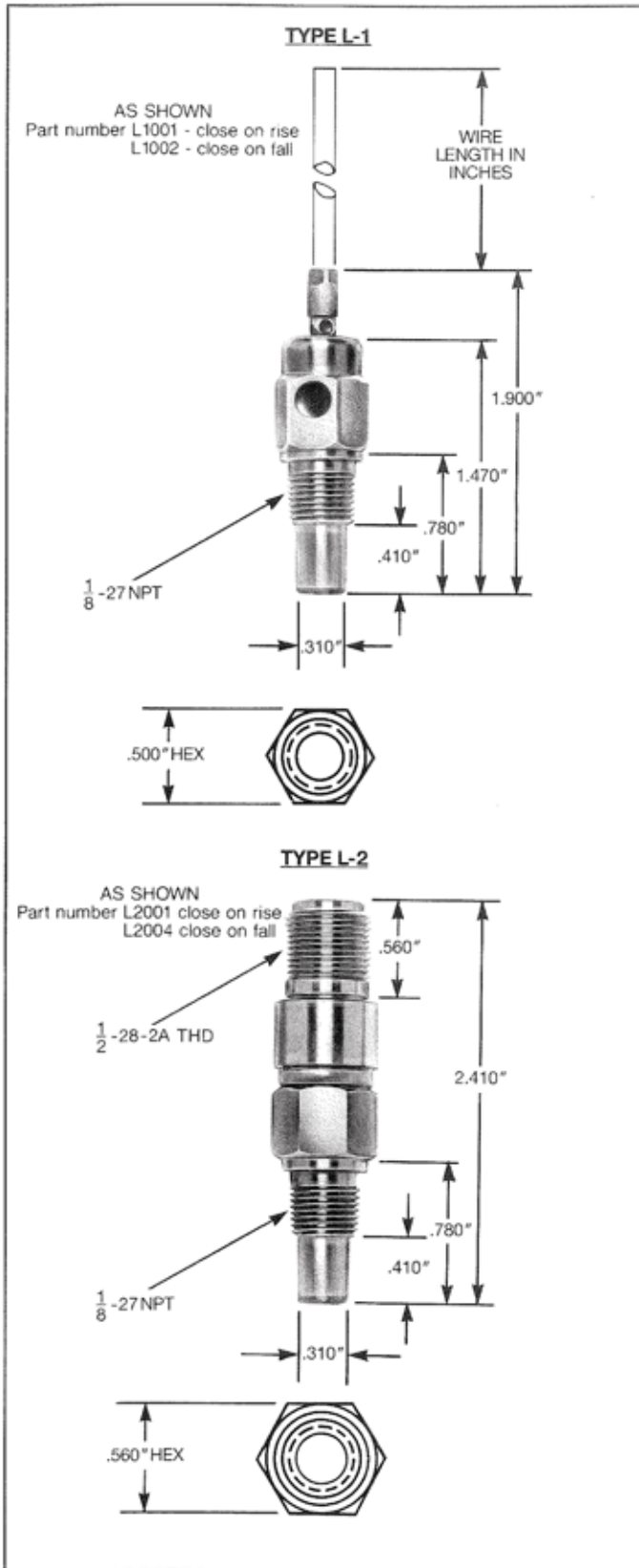
NOTES

1. Contacts available for close on rising or close on falling temperature
2. Electrical Characteristics
 - a. Two wire circuit isolated from ground
 - b. Terminals and AN connector are compression glass hermetically sealed
 - c. M-1 has solder lug connections or wire leads
 - d. M-2 has connector that mates with MS3106B10SL-4S. Can be modified to accept other connectors
3. All safety lock wire holes are .062
4. Alternate thread sizes available

Bimetal Thermal Switches

TYPES L-1 AND L-2 BIMETAL THERMAL SWITCHES

Small • Lightweight • Calibration to 500°F • Environmentally sealed • 1 wire grounded body.



SPECIFICATIONS

L-1, L-2

Calibration Temp. Max	500°F
Calibration Temp. Min	0°F
Calibration Tolerance (above 440°F, ± 7°F)	± 5°F
Repeatability	± 1°F
Differential (norm)	0°- 5°F
Proof Pressure	4000 psi
Safe Momentary Undershoot Overshoot	-70°F 600°F
Voltage	115AC/28DC
Current Resistive Inductive	1/2 Amp 1/4 Amp
Life - Mechanical - Full Rated Load	50,000 cyc 10,000 cyc
Weight	L-1 1oz. L-2 1.5 oz.
Response time per MIL S 24236, P4.7.5.1	25 to 40 sec.

CPI BIMETAL SWITCHES MEET OR EXCEED ENVIRONMENTAL REQUIREMENTS OF MIL STD 810 AS FOLLOWS

High Temperature	Meth. 501.2 Proc. I Soak Temp. 500°F
Low Temperature	Meth. 502.2 Proc. I Soak Temp. -70°F
Humidity	Meth. 507.2 Proc. I (L-2 only)
Salt Fog	Meth. 509.2 Proc. I (L-2 only)
Fungus	Meth. 508.3 Proc. I
Dust & Sand	Meth. 510.2 Proc. I Dust Proc. II Sand
Vibration and Shock	Test data can be made available to meet customer requirements
Altitude Temp.	N/A
Moisture Resist.	N/A

- Close tolerance set points are available at a premium charge.
- Gold Alloy contacts available at a premium charge.
- Values shown are optimum. Consult our Sales Engineering Dept. for specific application information.

NOTES

1. Contacts available for close on rising or close on falling temperature
2. Electrical characteristics:
 - a. Plugstat body grounded to mounting
 - b. L-1 - single wire as shown
 - c. L-2 - mates with MS 3106-8S-1S
3. 100 in/lbs. maximum torque to tighten

TYPE Q-1 TIP-STAT THERMAL SWITCH

This rugged, precision thermal switch responds to tip temperature rather than shell temperature. It is most effectively used where inner temperature must be controlled. Some typical applications are its use in aircraft generators where it serves as a warning device to actuate a control when the windings of generators reach dangerously high temperatures. The Tip-Stat is also used to measure bearing temperature, where it is supported in the bearing housing and pressed against the bearing race or shell.

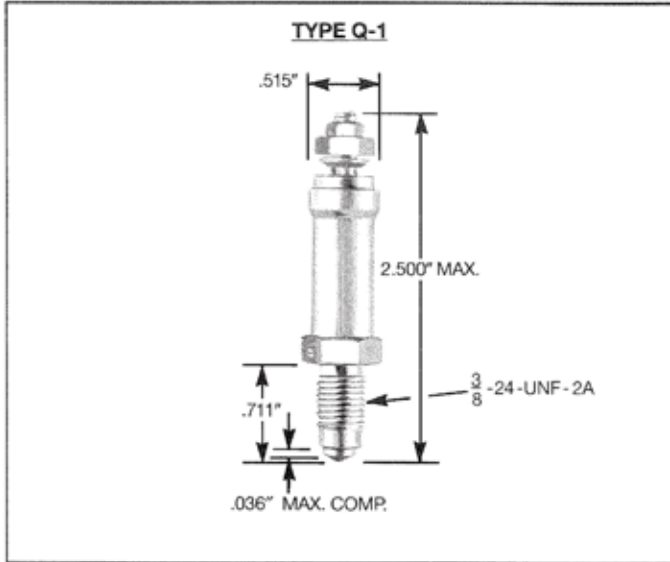
Designed to meet MIL-S25345, the switch employs a spring-loaded inner cartridge which is hermetically sealed. The switch is slow make and break with extremely short response time, due to direct contact between the switch and the surface being monitored.

SPECIFICATIONS

Calibration Temp. Max	550°F
Calibration Temp. Min	0°F
Calibration Tolerance	± 5°F
Differential	1°- 2°F
Safe Momentary Undershoot Overshoot	-80°F 600°F

Voltage	115AC/28DC
Current Resistive Inductive	1 1/2 Amp 1/4 Amp
Repeatability, under std. conditions	± 3°F
Weight	0.96 oz.

Bimetal Thermal Switches



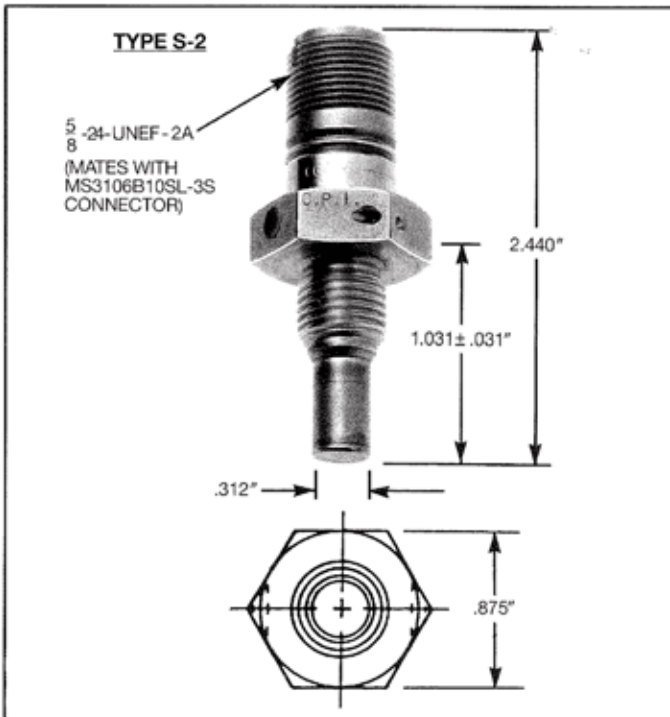
TYPE S-2 BIMETAL THERMAL SWITCH

CPI's S-2 switch is a variant of our M-1, M-2 switches.

The S-2 switch provides a two temperature capability with one set (pins A and B) of contacts, opening on rising temperature. The common contact then continues to move on rising temperature until it makes connection with the contact for pin C at some higher temperature. It is now possible to have a period during which no contact at all is made.

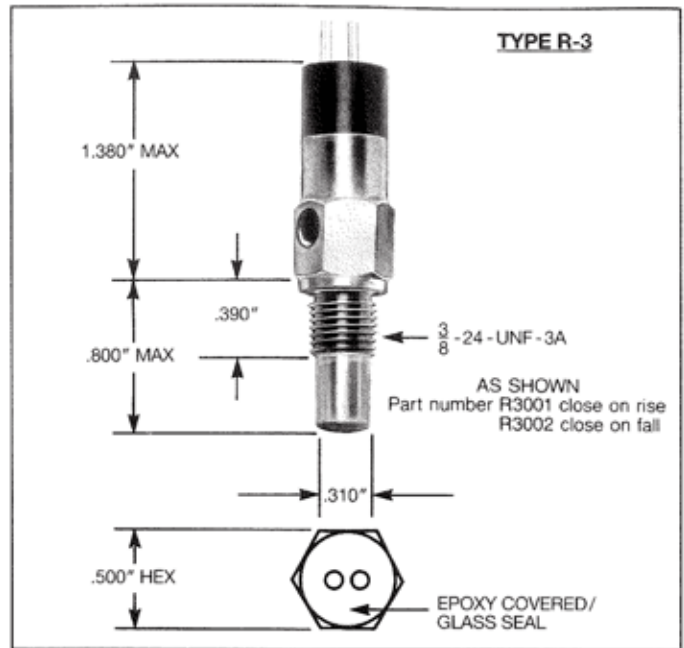
A typical application would utilize the S-2 to control a heater to warm a lube oil, then take no action as long as the oil maintains normal operating temperature. However, in the case of an overheat, the same switch could signal an overheat or initiate a cooling action.

Refer to M-1 – M-2 specifications.



TYPE R-3 BIMETAL THERMAL SWITCH

Small • Lightweight • Hermetically sealed • Calibration to 500°F • 2 wire • All stainless • Withstands MIL environments.



SPECIFICATIONS:

R-3		CPI BIMETAL SWITCHES MEET OR EXCEED ENVIRONMENTAL REQUIREMENTS OF MIL STD 810 AS FOLLOWS	
Calibration Temp. Max	500°F	High Temperature	Meth. 501.2 Proc. I Soak Temp. 500°F
Calibration Temp. Min	0°F	Low Temperature	Meth. 502.2 Proc. I Soak Temp. -70°F
Calibration Tolerance (above 440°F, ± 7°F)	± 5°F	Humidity	Meth. 507.2 Proc. I
Repeatability	± 1°F	Salt Fog	Meth. 509.2 Proc. I
Differential (norm)	0~ 5°F	Fungus	Meth. 508.3 Proc. I
Proof Pressure	4000 psi	Dust & Sand	Meth. 510.2 Proc. I Dust Proc. II Sand
Safe Momentary Undershoot	-70°F	Vibration and Shock	Test data can be made available to meet customer requirements
Undershoot	700°F	Altitude Temp.	Meth. 504.1 Proc. I
Voltage	115AC/28DC	Moisture Resist.	MIL S 24236 P. 4.7.13 10 day
Current Resistive Inductive	1 Amp 1/4 Amp		
Life – Mechanical – Full Rated Load	50,000 cyc 10,000 cyc		
Weight	1oz		
Response time per MIL S 24236, P4.7.5.1	25 to 45 sec		

- Close tolerance set points are available at a premium charge.
- Gold Alloy contacts available at a premium charge.
- Values shown are optimum. Consult our Sales Engineering Dept. for specific application information.

NOTES:

1. Contacts available for close on rising or close on falling temperature
2. Electrical terminations:
 - a. Two wire circuit isolated from ground.
 - b. Terminals are compression glass hermetically sealed.
 - c. Wire leads provided 20 AWG per MIL-W-16878A (Teflon) (Specify wire length when ordering).
3. Mounting - 1/8 - 27 NPT or 3/8 - 24 UNF - 3A

CPI Rod And Tube Thermal Switches



These switches, with their longer probes, are highly resistant to shock and vibration while still maintaining exceptionally close repeatability. Since the entire probe is heat sensitive, it acts as an averaging device, thus compensating for temperature gradients. These switches function as temperature controllers, safety cutoffs for equipment protection, and as indicators of overheat conditions.

QUALITY CONSTRUCTION.

- All welded stainless construction
- Glass hermetically sealed connectors where applicable
- Specific probe materials can be selected for maximum sensitivity
- Inconel X springs insure high temperature repeatability
- Platinum iridium contacts provide excellent arc erosion protection and constant contact resistance
- Special glass insulators or mica are used for thermal and electrical isolation

Factory calibrated. Depending on switch type, CPI Rod and Tube thermal switches are factory calibrated at any temperature within the range of 0° to 1850°F. They can operate in probe ambient temperatures from -65°F to 2000°F, and show excellent resistance to momentary overshoots. Drift free performance is assured throughout their long life.

Immune to problem environments. Sealed for protection against the effects of moisture, sand and dirt, these Rod and Tube thermal switches are also designed to withstand severe shock and vibration with no shift in calibration. They meet or exceed the requirements of MIL Std 810 (See charts).

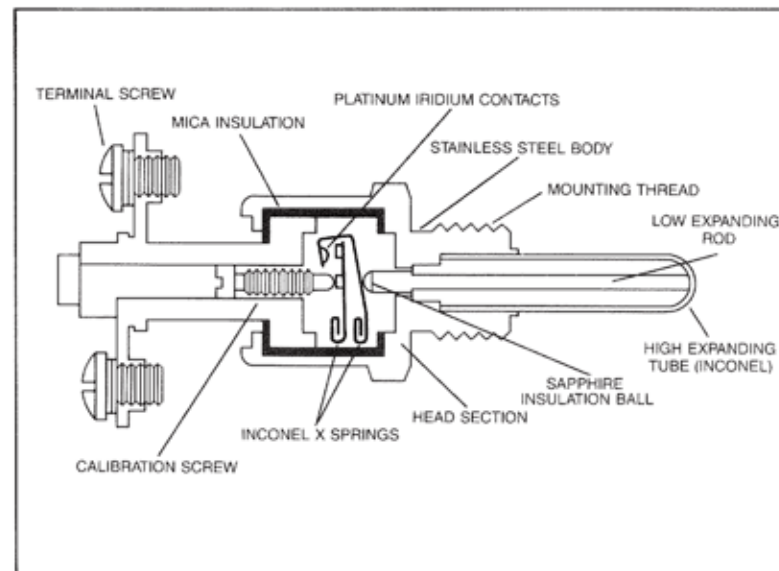
Torque free mounting. Over-torquing during installation will not affect calibration because the mounting threads are isolated from the temperature-sensitive probe.

Special Fine Adjustable Feature. CPI high temperature Rod & Tube switches (X-1, X-2, X-3) can be ordered with a mechanism that permits fine adjustment in the field. The simplified design eliminates the need for special tools to adjust temperature setting. Calibration can be re-set within a range of 250°F (plus or minus) of original factory setting.

HOW CPI ROD AND TUBE THERMAL SWITCHES WORK

CPI utilizes the differential expansion of two metals to operate the switching mechanism in our Rod and Tube thermal switches (a quartz rod is used in the X-3).

The high expanding tube pulls the low expanding rod down in the switch, allowing the hook action spring to make contact with the calibration spring and complete the electrical circuit. (Schematic shown is close on rising temperature). The hook in the spring allows for maximum undershoot temperatures required by the Military. Thermal calibration of the switches is readily accomplished by adjusting the contact spring position with the calibration screw which is then sealed and locked in place. Both the rod material and the tube material can be varied for sensitivity or differing response times in the desired temperature range.



APPLICATIONS FOR CPI ROD AND TUBE THERMAL SWITCHES

CPI Rod and Tube thermal switches are used in harsh applications such as jet engines, gas turbines, ram air temperature systems, after-burners, railroad switch deicers, diesel stack over-heat sensors, extruders, flame detectors and electronic heating and cooling systems.

ORDERING INFORMATION

Ordering information required:

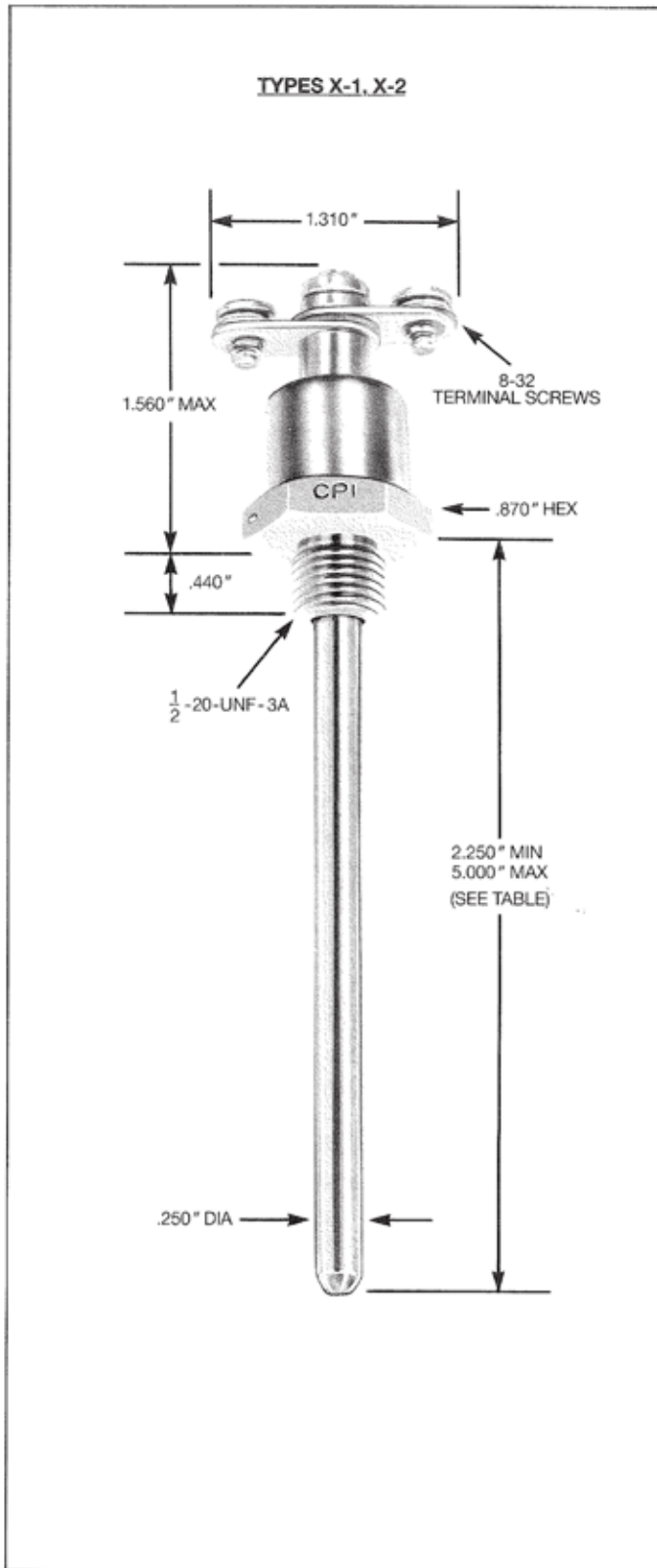
1. Part number.
2. Probe length
3. Temperature set point.

EXAMPLE: X1009 - 2 / 750°F
 Part No. | Probe Length | Temp. Set Point
 (See Table)

CPI Rod And Tube Thermal Switches

TYPES X-1, X-2 ROD AND TUBE THERMAL SWITCHES

Two wire • Operation to 1850° • All stainless • Meets MIL environments • Torque free mounting • Factory calibrated and sealed • Optional field adjustment feature available



SPECIFICATIONS

MIL STD 810
X-1, X-2

High Temperature	Meth. 501.2 Proc.I Soak Temp. 850°F (X-1) 1750°F (X-2)
Low Temperature	Meth. 502.2 Proc.I Soak Temp. -70°F
Fungus	Meth. 508.3 Proc.I
Vibration and Shock	Test data can be made available to meet customer requirements
Moisture Resist.	MIL S 24236 Para. 4.7.13 10 day

	X-1	X-2
Calibration Temp. Max	850°F	1850°F
Calibration Temp. Min	0°F	100°F
Calibration Tolerance	± 5°F	± 10°F
Repeatability	± 1°F	± 1°F
Differential (normal)	3°F	5°F
Proof Pressure (probe only) P.S.I.G.	3000	3000
Safe Momentary Undershoot Probe Overshoot Head	-65°F 1000°F 800°F	-65°F 2000°F 800°F
Voltage	115VAC/28DC	
Current Resistive Inductive	1 1/2 Amps 1/2 Amp	
Weight	1.5oz.	2oz.
Response time per MIL S 24236, P4.7.5.1	5 sec. Max	5 sec. Max

- Contact action available to close on rising or close on falling temperature.
- Close tolerance set points are available at a premium charge.
- Values shown are optimum. Consult our Sales Engineering Dept. for specific application information.
- Electrical connections:
 - Two wire electrically isolated from ground
 - Terminals provided
- Lockwire hole: .067" Max.

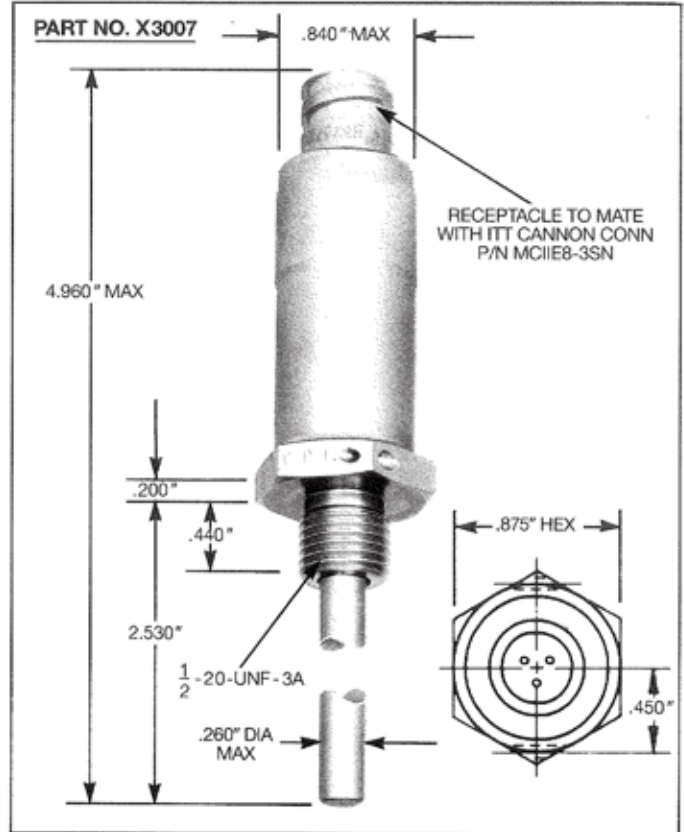
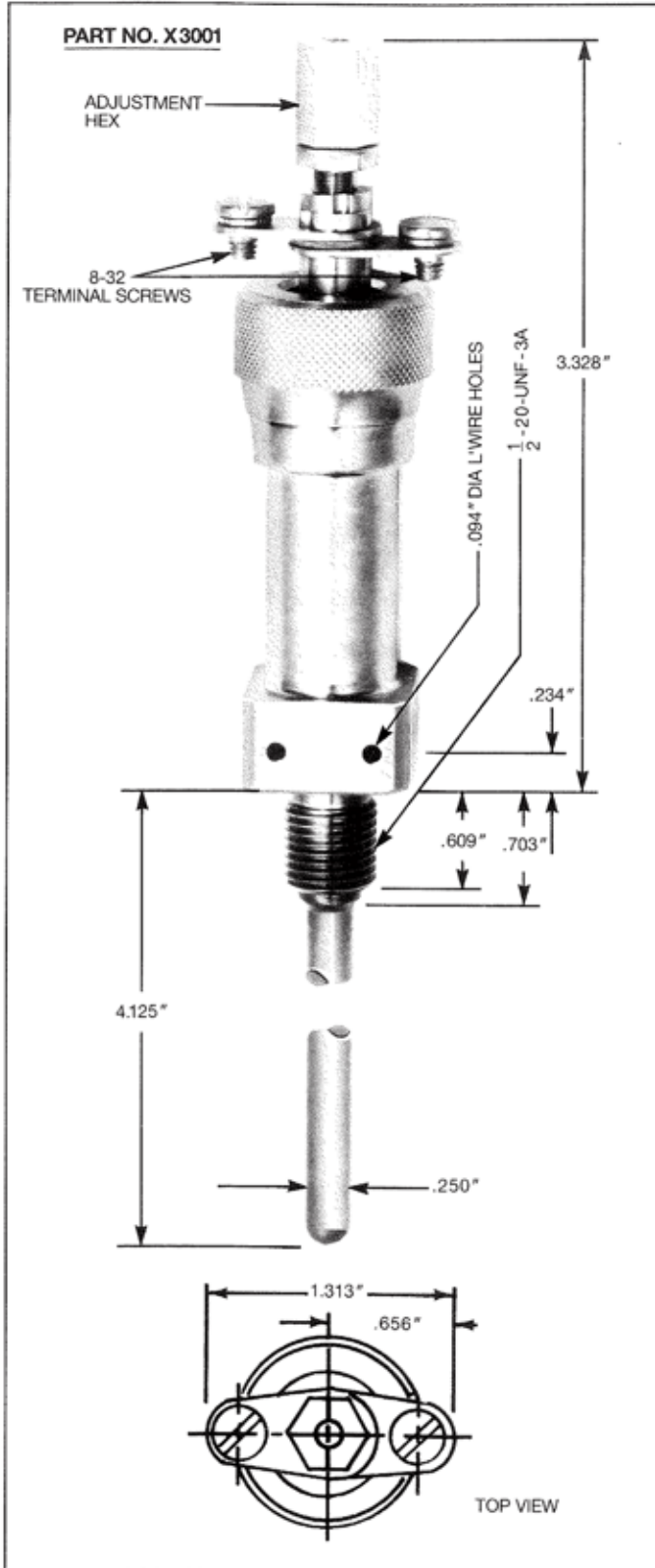
SELECTION TABLE

TYPE X-1 Part No.	TYPE X-2 Part No.	Probe Length Inches	Switch Action
X1009-2 X1010-2	X2003-2 X2004-2	2 1/4 2 1/4	C/R C/F
X1009-4 X1010-4	X2003-4 X2004-4	2 1/2 2 1/2	C/R C/F
X1009-6 X1010-6	X2003-6 X2004-6	2 3/4 2 3/4	C/R C/F
X1009-8 X1010-8	X2003-8 X2004-8	3 3	C/R C/F
X1009-10 X1010-10	X2003-10 X2004-10	3 1/4 3 1/4	C/R C/F
X1009-12 X1010-12	X2003-12 X2004-12	3 1/2 3 1/2	C/R C/F
X1009-14 X1010-14	X2003-14 X2004-14	3 3/4 3 3/4	C/R C/F
X1009-16 X1010-16	X2003-16 X2004-16	4 4	C/R C/F
X1009-18 X1010-18	X2003-18 X2004-18	4 1/4 4 1/4	C/R C/F
X1009-20 X1010-20	X2003-20 X2004-20	4 1/2 4 1/2	C/R C/F
X1009-22 X1010-22	X2003-22 X2004-22	4 3/4 4 3/4	C/R C/F
X1009-24 X1010-24	X2003-24 X2004-24	5 5	C/R C/F

CPI Rod And Tube Thermal Switches

TYPES X-3 ROD AND TUBE THERMAL SWITCH

Internal quartz element • Extremely accurate • Operation to 1850°F • Optional field adjustment feature available (shown in photo)



CPI's X3007 has been designed to reduce size and weight while retaining all of the unique features offered in our original X3001. The X3007 weighs only 2 1/2 ounces as opposed to 6 1/2 ounces for the prior unit, and has a head height approximately 1/2 that of the prior unit.

The X3007 has been designed to accept hermetically sealed connectors, providing interconnect options appropriate for aerospace applications.

CPI capitalizes on the unique low expansion of quartz in order to provide extremely rapid response time and eliminate the anticipation effect which occurs when a sudden change of temperature acts on the outer expanding element and does not have time to reach the inner expanding element.

SPECIFICATIONS

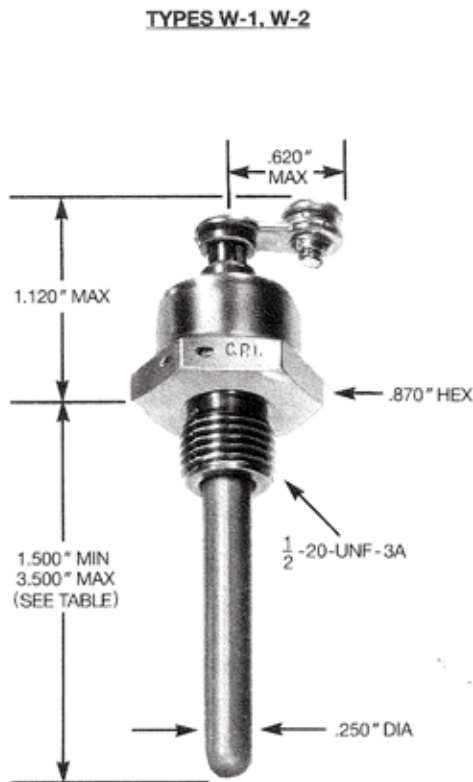
Calibration Temp. Max	1850 °F
Calibration Temp. Min	70 °F
Calibration Tolerance ± min.	10 °F
Safe Momentary Probe Overshoot	2200 °F
Max Head Temp.	800 °F
Voltage	115AC/28DC
Current, Amps, Resistive Load (Inductive Load Approx. 1/3)	1 1/2 @ 28 VDC
Weight, (X3001/X3007)	6 1/2 oz / 2 1/2 oz

- Contact action available to close on rising or close on falling temperature.
- Calibration Temperature Range:
For continuous operation – From ambient (70°F) to 1850°F.
For intermittent operation – From ambient (70°F) to 2000°F.
- Electrical connections: Insulated from mounting will withstand 1250 V.D.C. for 10 seconds.
- Factory calibrated and sealed, or special field adjustable feature.
- Switch will operate without injury in temperature as low as (-70°F).

CPI Rod And Tube Thermal Switches

TYPES W-1, W-2 ROD AND TUBE THERMAL SWITCHES

Small • Lightweight • One wire • Operation to 1850°F • All stainless • Meets MIL environments • Torque free mounting • Factory calibrated and sealed



SPECIFICATIONS

MIL STD 810
W-1, W-2

High Temperature	Meth. 501.2 Proc. I Soak Temp. 850°F (W-1) 1750°F (W-2)
Low Temperature	Meth. 502.2 Proc. I Soak Temp. -70°F
Fungus	Meth. 508.3 Proc. I
Vibration and Shock	Test data can be made available to meet customer requirements
Moisture Resist.	MIL S 24236 Para. 4.7.13 10 day

	W-1	W-2
Calibration Temp. Max	850°F	1850°F
Calibration Temp. Min	0°F	100°F
Calibration Tolerance	± 5°F	± 10°F
Repeatability	± 1°F	± 1°F
Differential (normal)	3°F	5°F
Proof Pressure (probe only) P.S.I.G.	3000	3000
Safe Momentary Undershoot Probe Overshoot Head	-65°F 1000°F 800°F	-65°F 2000°F 800°F
Voltage	115VAC/28DC	
Current Resistive Inductive	1 1/2 Amps 1/2 Amp	
Weight	1.3oz.	1.3oz.
Response time per MIL S 24236, P4.7.5.1	5 sec. Max	5 sec. Max

- Contact action available to close on rising or close on falling temperature.
- Close tolerance set points are available at a premium charge.
- Values shown are optimum. Consult our Sales Engineering Dept. for specific application information.
- Electrical connections:
 - a. One wire to terminal provided
 - b. Switch body grounded to mounting
- Lockwire holes: .067" Max.

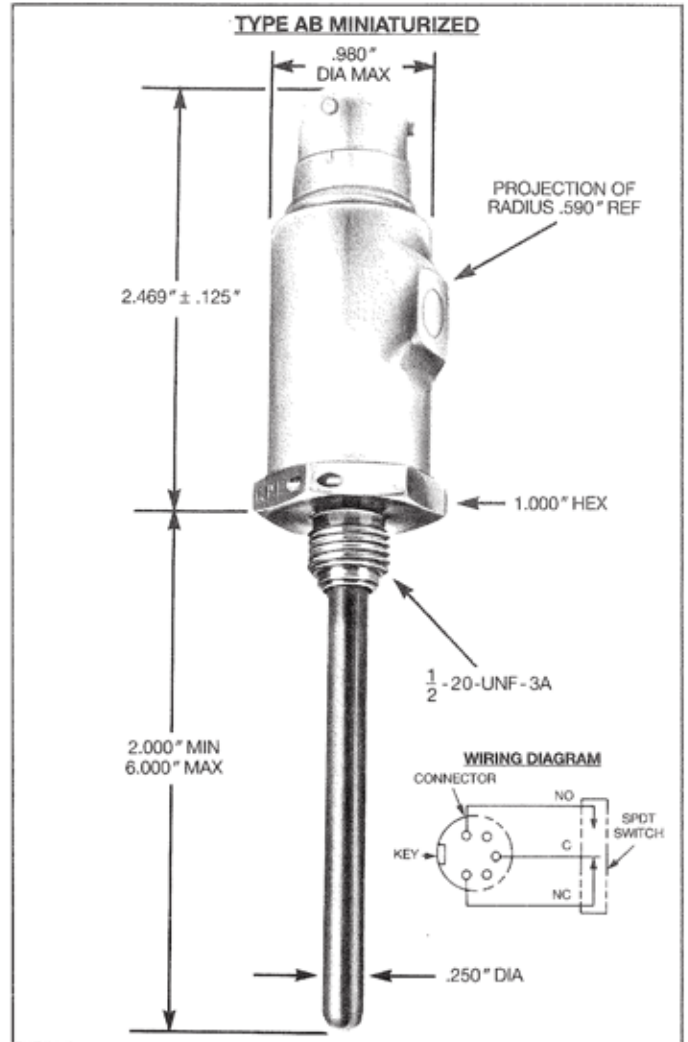
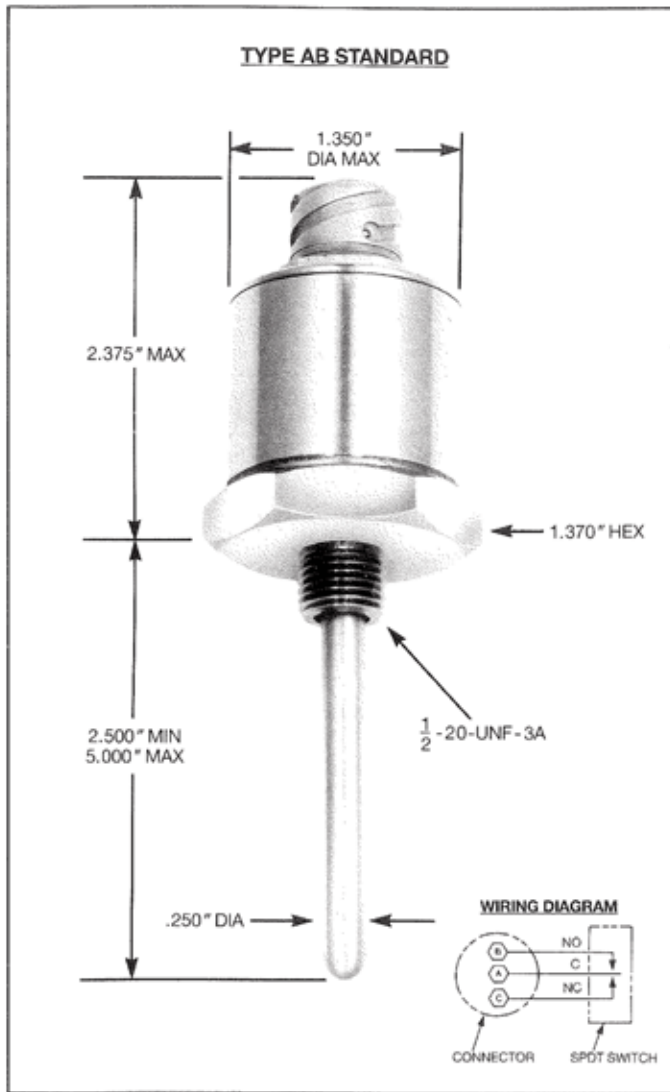
SELECTION TABLE

TYPE W-1	TYPE W-2	Probe Length Inches	Switch Action
Part No.	Part No.		
W1007-2	W2002-2	1 1/2	C/R
W1008-2	W2003-2	1 1/2	C/F
W1007-4	W2002-4	1 3/4	C/R
W1008-4	W2003-4	1 3/4	C/F
W1007-6	W2002-6	2	C/R
W1008-6	W2003-6	2	C/F
W1007-8	W2002-8	2 1/4	C/R
W1008-8	W2003-8	2 1/4	C/F
W1007-10	W2002-10	2 1/2	C/R
W1008-10	W2003-10	2 1/2	C/F
W1007-12	W2002-12	2 3/4	C/R
W1008-12	W2003-12	2 3/4	C/F
W1007-14	W2002-14	3	C/R
W1008-14	W2003-14	3	C/F
W1007-16	W2002-16	3 1/4	C/R
W1008-16	W2003-16	3 1/4	C/F
W1007-18	W2002-18	3 1/2	C/R
W1008-18	W2003-18	3 1/2	C/F

CPI Rod And Tube Thermal Switches

TYPE AB SNAP ACTION SPDT ROD AND TUBE THERMAL SWITCH

Hermetically sealed • Higher current carrying capabilities (5 amp) • Torque free mounting • Calibration to 600°F



SPECIFICATIONS

MIL STD 810

	AB STD	AB MINI
High Temperature	Meth. 501.2 Proc. I Soak Temp. 400°F	Meth. 501.2 Proc. I Soak Temp. 400°F
Low Temperature	Meth. 502.2 Proc. I Soak Temp. -70°F	Meth. 502.2 Proc. I Soak Temp. -70°F
Humidity	Meth. 507.2 Proc. I	Meth. 507.2 Proc. I
Salt Fog	Meth. 509.2 Proc. I	Meth. 509.2 Proc. I
Fungus	Meth. 508.3 Proc. I	Meth. 508.3 Proc. I
Dust & Sand	Meth. 510.2 Proc. I Dust Proc. II Sand	Meth. 510.2 Proc. I Dust Proc. II Sand
Vibration and Shock	Test data can be made available to meet customer requirements	
Moisture Resist.	MIL S 24236 P. 4.7.13 10 day	MIL S 24236 P. 4.7.13 10 day

SPECIFICATIONS

	AB STD	AB MINI
Calibration Temp. Max	600°F	600°F
Calibration Temp. Min	0°F	0°F
Calibration Tolerance	± 7°F	± 7°F
Repeatability	± 1°F	± 1°F
Differential (normal)	6°F	12°F
Proof Pressure (probe only) P.S.I.G.	3000	3000
Safe Momentary Undershoot Probe Overshoot Head	-65°F 600°F 250°F	-65°F 700°F 400°F
Voltage	115VAC/28DC	
Current Resistive Inductive	5 Amps 3 Amps	
Weight	5oz.	4oz.
Response time per MIL S 24236, P4.7.5.1	5 sec.	5 sec.

- Close tolerance set points are available at a premium charge.
- Values shown are optimum. Consult our Sales Engineering Dept. for specific application information.
- Lockwire holes: .067" Max.
- Amphenol connectors:
AB Standard - 67-0312-60P AB Miniaturized - 48-15H10-SP MS27034H10B5P
Other connectors can be fitted

Solid State Electronic Thermal Switches

TYPE ED ELECTRONIC THERMAL SWITCHES

For special applications with unusual requirements, CPI offers stock or custom designed solid state switches. Because of their construction, these electronic switches offer several advantages:

- No moving mechanical parts - provides outstanding immunity to shock and vibration
- Rapid response to temperature changes
- Longer life than conventional switches
- Flexibility in thermal parameters
- Highly stable repeatability

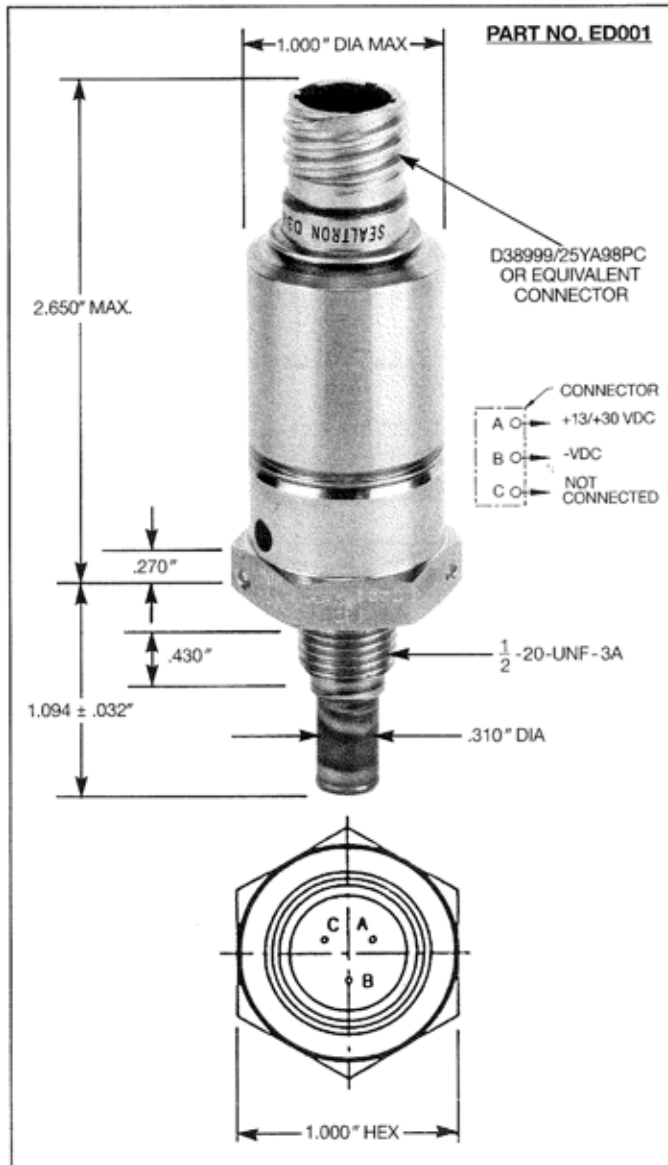
Advantages such as these make these CPI switches ideal for applications in hydraulic systems, environmental control systems, fluid temperature control systems and gas turbines.

CPI solid state electronic switches are available in a variety of configurations, mounting packages, sensor types and terminations. Shown here is our ED001-501 switch and its general specifications. This switch fits into our standard M-2 mounting.

GENERAL SPECIFICATIONS

Construction	Solid State - No moving mechanical parts
Material	Stainless Steel
Actuation Temperature Range	Minimum: -40°F ±2°F Maximum: +212°F ±2°F
Differential	Per customer specification
Safe Momentary Overshoot	+250°F - Entire unit +600°F - Probe only (requires remote electronics)
Electrical Rating *	1 Amp
Power Source *	+13 to +30 VDC
Switch Voltage Drop *	2.5 Volts maximum
Maximum Operating/Storage Temperature	250°F
Vibration	MIL STD 202F, Method 204D, Test Condition G (30 G Peak)
Shock	MIL STD 202F, Method 213B, Test Condition I, (100 Gs, 11ms)

* These parameters are specific to a customer's application. They can be customized as required.



NOTES:

The information and specifications contained in this catalog are subject to change without notice.

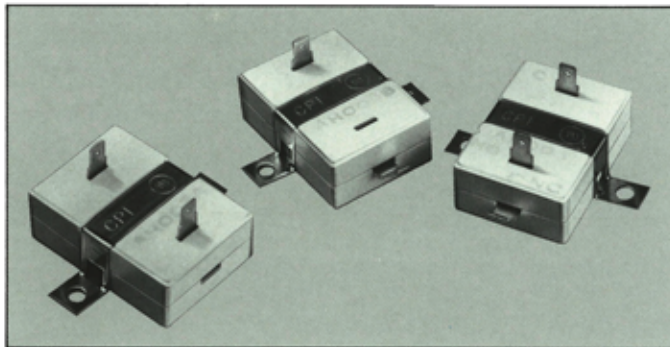
Other CPI Products



THERMAL SWITCH TEST OVENS

CPI offers a test oven for field checking of CPI thermal switches. It is designed primarily for checking temperatures between 1000°F and 2100°F.

Easy to use, the oven temperatures are actually controlled by the switch being tested. Once the switch temperature set point is reached, the oven temperature cycles around the switch set point automatically. A large digital display provides accurate temperature readings. Compact unit requires only 3 square feet of bench space.



STOVE SWITCHES

CPI makes ceramic switches for wood burning stoves or furnaces that turn a blower on and off automatically at pre-set temperatures. Available with any settings between 0° and 350 °F, the switches ensure users maximum useable heat from their fuel. They turn the blower on when the fire gets hot enough, increase blower speed when the fire is the hottest and automatically turn the blower off when the fire dies down.

RECOGNITIONS AND AWARDS

Sundstrand Turbomach – Supplier Approval Status
Cadillac Gage Textron – Quality Control Group Standard Inspection Approval
General Dynamics Pomona Division – Mil-I-45208 Approval
United Technologies Corporation – Sikorsky Quality System Approval
Textron Lycoming – Inspection System Approval
White New Idea Farm Equipment Company – Valued Supplier Gold Seal Award
Rockwell International – Recognition For Contribution to B-1B Program
Hypertherm, Inc. – 1990 Quality Award For Supplying 13,400 Units With An Acceptance Rating of 99.99%
Honorable Mention U.S. Small Business Administration Supplier Of The Year



WATERPROOF SWITCHES

CPI miniature, waterproof, snap-action switches are flat and lightweight. They're designed to operate under exposure to water, oil, humidity, sand, dirt, vibration and shock. The line includes momentary and maintained contacts, normally open, normally closed, and single pole double throw circuits. Individual wire leads and two or three conductor cables are available. All switches are complemented by a wide variety of mounting brackets.

CONTROL PRODUCTS, INC.

Founded in 1946 by a corporation organized in 1871, Control Products, Inc. has pioneered the development of precision thermal switches. CPI research engineers have attained the experience and have the facilities to handle unique problems in the field of precise temperature control.

All CPI thermal switches are precision built of the highest quality material available. We use inert gas shielded arc welding or silver braze for all joints and only glass or mica for insulation. Individual calibration and testing provide a final guarantee of quality.

This brochure is specifically designed to help you find the right thermal switch for your application. Custom configurations can be developed for specific installations. Control Products, Inc. is ready to serve you in all your thermal switch applications.

CPI

CONTROL PRODUCTS, INC.
280 RIDGEDALE AVENUE, EAST HANOVER, NEW JERSEY 07936-2394

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