



THERMOSTAT SE


Commercial Thermostats

Page	Device	Operating Temperature Range	Ambient Temperature Range	Maximum Resistive Load	Switch Action	Weight	
6-9	4344 Series	-65°F to 550°F (-54°C to 288°C)	-80°F to 550°F (-62°C to 288°C)	7 amp	SPST	4.8 grams	
10-11	6786 Series	-20°F to 350°F (-29°C to 177°C)	-65°F to 400°F (54°C to 204°C)	7 amp	SPST	2.5 grams	
12-13	7BT Series	+30°F to 350°F (-1°C to 177°C)	-20°F to 350°F (-29°C to 177°C)	15 amp	SPST	4 grams	
14-17	Probes & Custom Packages	-65°F to 550°F (-54°C to 288°C)	-80°F to 550°F (-62°C to 288°C)	7 amp	SPST or SPDT	Dependant on selected configuration	

Military & High Reliability Thermostats


Page	Device	Operating Temperature Range	Ambient Temperature Range	Maximum Resistive Load	Switch Action	Weight	
14-17	Probes & Custom Packages	-65°F to 550°F (-54°C to 288°C)	-80°F to 550°F (-62°C to 288°C)	7 amp	SPST or SPDT	Dependant on selected configuration	
18-21	3BT Series	0°F to 350°F (-16°C to 177°C)	-80°F to 350°F (-62°C to 177°C)	1 amp	SPST	0.9 grams	
18-21	4BT Series	0°F to 350°F (-16°C to 177°C)	-80°F to 350°F (-62°C to 177°C)	1 amp	SPST	0.2 grams	
22-23	5BT Series	-65°F to 400°F (-54°C to 204°C)	-65°F to 450°F (-54°C to 232°C)	3 amp	SPDT	6 grams	
24-25	M2 Series	0°F to 300°F (-16°C to 149°C)	-65°F to 400°F (-54°C to 204°C)	2 amp	SPST	5.4 grams	
26-29	M1/11041 Series	-65°F to 550°F (-54°C to 288°C)	-80°F to 550°F (-62°C to 288°C)	7 amp	SPST	4.8 grams	

Special Application Thermostats & Motor Protectors


Page	Device	Operating Temperature Range	Ambient Temperature Range	Maximum Resistive Load	Switch Action	Weight	
30-31	4286 Series	0°F to 270°F (-18°C to 132°C)	-65°F to 275°F (-54°C to 135°C)	4 amp	SPST	3.5 grams	
32-33	4391 Series	-65°F to 450°F (-54°C to 232°C)	-65°F to 450°F (-54°C to 232°C)	14 amp	SPST or SPDT	21 grams without overmold 56 grams with overmold	
34-35	Aircraft Motor Protectors	>Single or Three Phase >Locked Rotor Protection >Meets Thermal Protection Requirements of MIL-M-7969, Direct Acting Type, Method III					

LECTION GUIDE


Commercial Thermostats

	Features	Qualifications	Common Applications	Device	Page
	<ul style="list-style-type: none"> >Snap-Action Switching >Pre-Set Non-Adjustable Calibration >Normally Open or Normally Closed >Hermetically Sealed 	UL & CSA Recognized	<ul style="list-style-type: none"> >Water Temperature Control >Motor Protection >Medical Equipment >Battery Packs 	4344 Series	6-9
	<ul style="list-style-type: none"> >Snap-Action Switching >Pre-Set Non-Adjustable Calibration >Normally Open or Normally Closed >Environmentally Sealed >Low Profile Design 	UL & CSA Recognized	<ul style="list-style-type: none"> >Variable Speed Drives >Compressors >Electronics Overheat Protection 	6786 Series	10-11
	<ul style="list-style-type: none"> >Snap-Action Switching >Pre-Set Non-Adjustable Calibration >Normally Open or Normally Closed >Environmentally Sealed 	UL, CSA, & VDE Recognized	<ul style="list-style-type: none"> >Water Temperature Control >Motor Protection >Medical Equipment >Battery Packs 	7BT Series	12-13
	<ul style="list-style-type: none"> >Snap-Action Switching >Pre-Set Non-Adjustable Calibration >Normally Open or Normally Closed >Hermetically Sealed (Probes) >Narrow Differential >Fast Response 	UL & CSA Recognized	<ul style="list-style-type: none"> >Air & Fluid Temperature Sensing >Food Processing Equipment >Compressor Overheat Protection 	Probes & Custom Packages	14-17

Military & High Reliability Thermostats

	Features	Qualifications	Common Applications	Device	Page
	<ul style="list-style-type: none"> >Snap-Action Switching >Pre-Set Non-Adjustable Calibration >Normally Open or Normally Closed >Hermetically Sealed (Probes) >Narrow Differential >Fast Response 	MIL-S-24236/2 MIL-S-24236/11 MIL-S-24236/25	<ul style="list-style-type: none"> >Radar Systems >Air & Fluid Temperature Sensing >Missile Hydraulics >Aircraft Refrigeration Systems 	Probes & Custom Packages	14-17
	<ul style="list-style-type: none"> >Snap-Action Switching >Pre-Set Non-Adjustable Calibration >Normally Open or Normally Closed >Sub-Miniature Size >Extremely Fast Thermal Response 	MIL-S-24236/19	<ul style="list-style-type: none"> >Radar Systems >Circuit Boards >Battery Packs >Chemical Detection Systems 	3BT Series	18-21
	<ul style="list-style-type: none"> >Snap-Action Switching >Pre-Set Non-Adjustable Calibration >Normally Open or Normally Closed >Sub-Miniature Size >Extremely Fast Thermal Response 	MIL-S-24236/13	<ul style="list-style-type: none"> >Motor Windings >Transformers >Circuit Boards >Battery Packs 	4BT Series	18-21
	<ul style="list-style-type: none"> >Snap-Action Switching >Pre-Set Non-Adjustable Calibration >Normally Open or Normally Closed >Hermetically Sealed >High Shock & Vibration Resistance 	MIL-S-24236/24	<ul style="list-style-type: none"> >Water Temperature Control >Motor Protection >Medical Equipment >Battery Packs 	5BT Series	22-23
	<ul style="list-style-type: none"> >Snap-Action Switching >Pre-Set Non-Adjustable Calibration >Normally Open or Normally Closed >Narrow Differential >Hermetically Sealed 	MIL-S-24236/20	<ul style="list-style-type: none"> >Satellites >Radar Systems >Air-Flow Temperature Sensor >Chemical Detection Systems 	M2 Series	24-25
	<ul style="list-style-type: none"> >Snap-Action Switching >Pre-Set Non-Adjustable Calibration >Normally Open or Normally Closed >Hermetically Sealed 	MIL-S-24236/1	<ul style="list-style-type: none"> >Satellites >Radar Systems >Electronics Overheat Protection 	M1/11041 Series	26-29

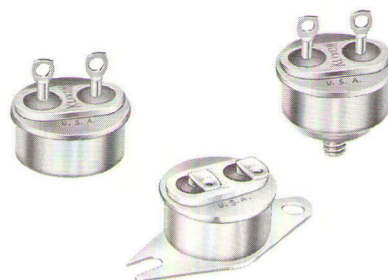
Special Application Thermostats & Motor Protectors

	Features		Common Applications	Device	Page
	>Snap-Action Switching	>Epoxy Sealed	>Guided Missiles	4286 Series	30-31
	>Pre-Set Non-Adjustable Calibration	>Narrow Differential	>Servomechanisms		
	>Normally Open or Normally Closed	>Low Profile Design	>Surface Heaters		
	>Snap-Action Switching	>Automatic or Manual Reset	>Water Temperature Control	4391 Series	32-33
>Pre-Set Non-Adjustable Calibration	>Hermetically Sealed	>Motor Protection			
>Normally Open or Normally Closed	>Overmold Available	>Appliances			
	>Complete Motor Analog		> Aircraft & Marine Motor Protection	Aircraft Motor Protectors	34-35
	>Ultimate Trip Protection				
	>Neutral Tap				

4344 Series Hermetically Sealed Thermostat

Commercial

- Snap-action switching
- Rapid thermal response
- Single pole, single throw
- Normally open or normally closed
- Pre-set, non-adjustable calibration
- Various mounting configurations available
- UL recognized, file #34618, see page 36 for details
- CSA recognized, file #LR24458, see page 36 for details



Description

The Klixon 4344 precision thermostat is constructed with a snap-acting bi-metal disc which serves as the actuating element. As the temperature reaches a predetermined calibration point, the disc snaps to its reverse curvature producing the crisp, positive switching action inherent to Klixon thermostats. This feature assures reliable, consistent operating temperature over long cycle life. The standard thermostat is copper-nickel plated with silver contacts. Other plating finishes are available upon request. Gold plated contacts can be furnished for the electrical loads listed in the following table to assure reliable circuit switching under low wattage conditions. Gold plated contacts are not suitable for higher loads.

Gold Contact Ratings (Resistive)

30 VAC/DC	500 mA and below
115 VAC	200 mA and below
230 VAC	100 mA and below

Our most common mounting configurations are depicted. Many other varieties are available.

Leads can be welded to pin type terminals to form an integral unit.

The switch can be custom packaged into a probe, strap mount, or immersion thermostat. Consult the factory for special requests.

Switching Action

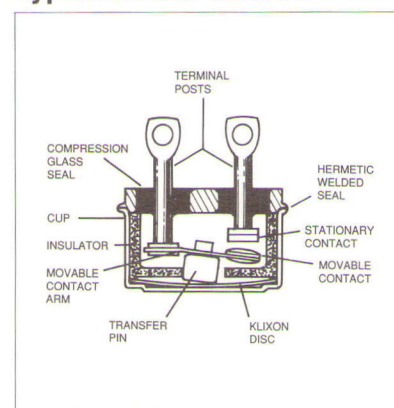
All thermostats are supplied with single pole, single throw switching. The contacts can be constructed as:

Normally closed - limit type application; contacts open on temperature rise at a pre-determined temperature to de-energize the circuit. Contacts automatically re-close as the device cools to a pre-determined temperature.

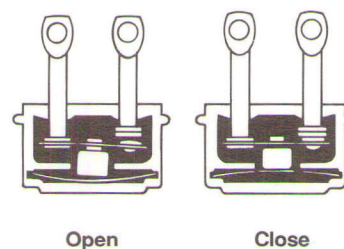
Normally open - fan type application; contacts close on temperature rise at a pre-determined temperature to energize the circuit. Contacts automatically re-open as the device cools to a pre-determined temperature.

The opening and closing temperatures are pre-set and non-adjustable.

Typical Cross Section View



Operation



When heated, the internal stresses of the bi-metal cause the disc to reverse its curvature with a snap-action at a fixed, preset temperature and operate the electrical contacts.

A decrease in the ambient temperature below the reset temperature of the disc relieves the internal stresses in the disc. The disc returns to its normal curvature and the contacts assume their normal operating position.

Common Applications

The Klixon 4344 series thermostat is commonly used in battery packs and for water temperature control. This UL/CSA recognized, hermetically sealed device is also widely used in medical and dental equipment. Below is a description of the 4344 as a motor winding thermostat.

Motor Protection

As a motor winding thermostat, the Klixon 4344 can be mounted conveniently on the end turns of the motor windings. The small size and variety of available brackets afford flexibility in the method of attaching the thermostat. The hermetic construction

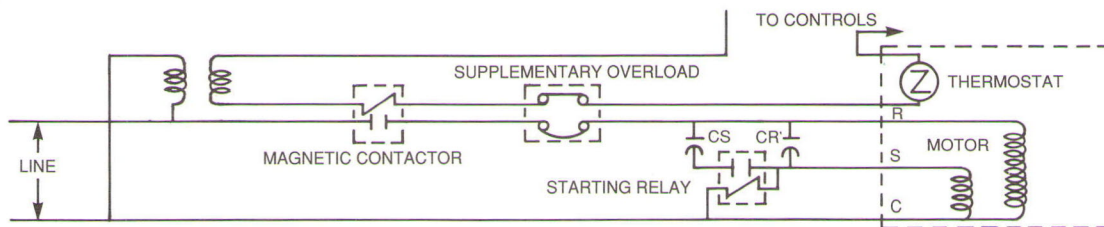
allows the thermostat to withstand dipping and baking operations on the windings.

The thermostat is designed for use on single and three phase motors.

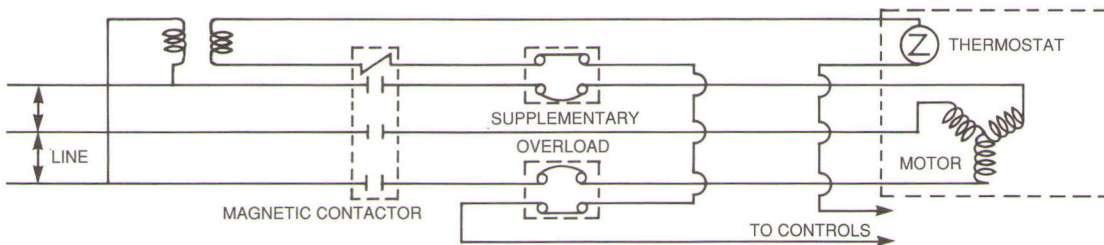
It provides positive protection against overheating from all running conditions including:

- Running overloads
- Increased ambient temperatures
- Blocked motor ventilation
- Line voltage fluctuation

Single-phase



Three-phase

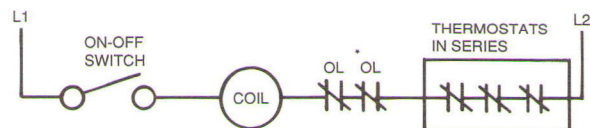


The thermostat should be used in conjunction with a supplementary overload or a remote thermal relay since the thermostat is responsive to motor winding temperature only. The overload is necessary to protect for conditions such as stalling, locked rotor, single-phasing and heavy external overloads.

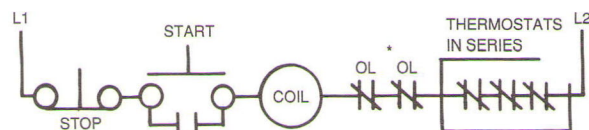
Automatic & Manual Reset

Automatic or manual reset systems may be obtained using these thermostats with either manual or automatic type motor starters. When more than one motor winding thermostat is used, they should be connected in series so that the opening of any one thermostat will actuate the controller and shut down the motor. Shown below are typical wiring diagrams for automatic and manual reset installation.

Two wire control offering automatic reset



Three wire control offering manual reset



* In certain applications the NEC may require three (3) overload relays.

Performance Characteristics

Switch Action

SPST (snap-action)

Contact Resistance

0.050 ohms maximum

per MIL-STD-202, Method 307

Contact Ratings (Resistive)

30 VAC/DC	125 VAC	250VAC	Life Cycles
Amperes			
5.0	2.5	1.0	100,000
5.5	3.0	1.5	50,000
6.0	4.0	2.0	25,000
6.5	5.0	2.5	10,000
7.0	6.0	3.0	5,000

Based on standard differential

Dielectric Strength

1250 VAC, rms,

60 Cycles for 1 minute,

terminal to case,

per MIL-STD-202, Method 301

Vibration Resistance

5-2000 Hz, 20G,

per MIL-STD-202, Method 204,

Condition D, (unmonitored)

Shock Resistance

100G, 6 milliseconds,

per MIL-STD-202, Method 213

Hermeticity

1 X 10⁻⁵ atm cc/sec. max,

per MIL-STD-202, Method 112,

Condition C

Salt Spray

per MIL-STD-202, Method 101,

Condition B, 5% solution

Weight

Basic unit 4.8 grams

with bracket 5.9 grams

Electrical Ratings

*720 VA, 110-600 VAC, break but
not make, ungrounded cup

360 VA, 600 VAC, make and
break, ungrounded cup

125 VA Pilot Duty, 24-240 VAC,
make and break, grounded or
ungrounded cup

* At this rating, suitable as a control circuit,
temperature limiting device for hazardous
location motors and generators.

Temperature (Use table below for common operating temperatures).

Ambient Temperature Range:

-80°F to +550°F, (-62.2°C to 287.8°C)

Maximum ambient exposure while in the closed contact position is 200°F
above contact closing temperature.

Operating temperature

Temperature at which normally closed contacts open or normally open
contacts close.

Tolerance

Allowable range above and below setpoint and reset temperatures.

Differential

Subtract the differential from the operating temperature to determine the
temperature at which the contacts will return to the normal position
(reset temperature).

Operating Temperature		Differential		Tolerance*	
°F	°C	°F	°C	±°F	±°C
-65	-53.9	30	16.7	10	5.6
-40	-40.0	30	16.7	10	5.6
-15	-26.1	30	16.7	10	5.6
0	-17.8	20	11.1	5	2.8
10	-12.2	20	11.1	5	2.8
20	-6.7	20	11.1	5	2.8
30	-1.1	20	11.1	5	2.8
40	4.4	20	11.1	5	2.8
50	10.0	20	11.1	5	2.8
60	15.6	20	11.1	5	2.8
70	21.1	20	11.1	5	2.8
80	26.7	20	11.1	5	2.8
90	32.2	20	11.1	5	2.8
100	37.8	20	11.1	5	2.8
110	43.3	20	11.1	5	2.8
120	48.9	20	11.1	5	2.8
130	54.4	20	11.1	5	2.8
140	60.0	20	11.1	5	2.8
150	65.6	20	11.1	5	2.8
160	71.1	20	11.1	5	2.8
170	76.7	20	11.1	5	2.8
180	82.2	20	11.1	5	2.9
190	87.8	20	11.1	5	2.8
200	93.3	20	11.1	5	2.8

Operating Temperature		Differential		Tolerance*	
°F	°C	°F	°C	±°F	±°C
210	98.9	30	16.7	8	4.4
220	104.4	30	16.7	8	4.4
230	110.0	30	16.7	8	4.4
240	115.6	30	16.7	8	4.4
250	121.1	30	16.7	8	4.4
260	126.7	30	16.7	8	4.4
270	132.2	30	16.7	8	4.4
280	137.8	30	16.7	8	4.4
290	143.3	30	16.7	8	4.4
300	148.9	30	16.7	8	4.4
310	154.4	40	22.2	12	6.7
320	160.0	40	22.2	12	6.7
330	165.6	40	22.2	12	6.7
340	171.1	40	22.2	12	6.7
350	176.7	40	22.2	12	6.7
375	190.6	40	22.2	12	6.7
400	204.4	40	22.2	12	6.7
425	218.3	40	22.2	12	6.7
450	232.2	40	22.2	12	6.7
475	246.1	70	38.9	25	13.9
500	260.0	70	38.9	25	13.9
525	273.9	70	38.9	25	13.9
550	287.8	70	38.9	25	13.9

Consult factory if desired operating temperature does not appear in the table.

* An additional ±3°F tolerance is required for overmolded devices.

Qualifications

UL/CSA recognition

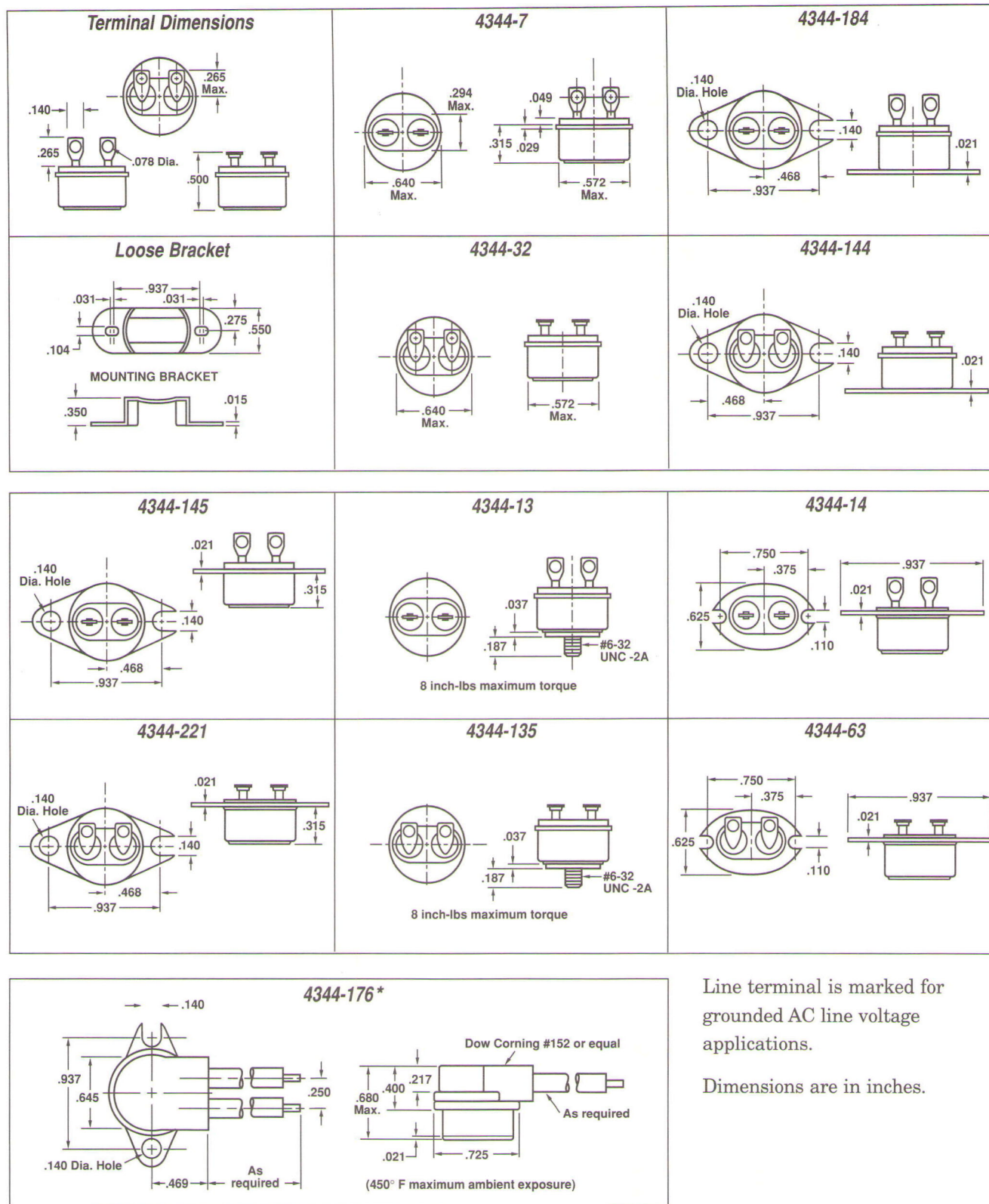
see page 36 for details.

Plating

Copper-nickel

(other finishes available upon request)

Common Mounting Configurations



* An additional $\pm 3^{\circ}\text{F}$ tolerance is required for overmolded devices.

Standard Lead Connections

Leads are available in heat-resistant rubber, neoprene, silicone-rubber and Teflon* in #18 gauge stranded wire in standard incremental lengths of 4" to 36".

Other gauges and lengths available upon request.

* Trademark of E.I. DuPont de Nemours and Co.

6786 Series

Environmentally Sealed

Commercial

- Low silhouette
- Normally open or closed
- Tamperproof, pre-set temperature calibration
- UL recognized, file #34618, see page 36 for details
- CSA certified, file # LR24458, see page 36 for details



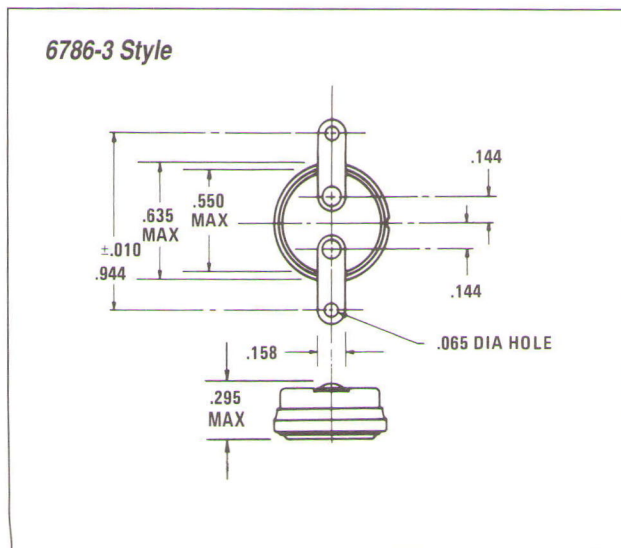
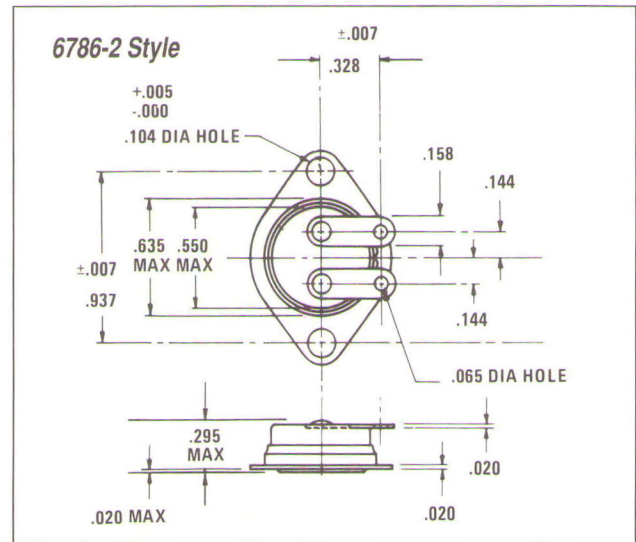
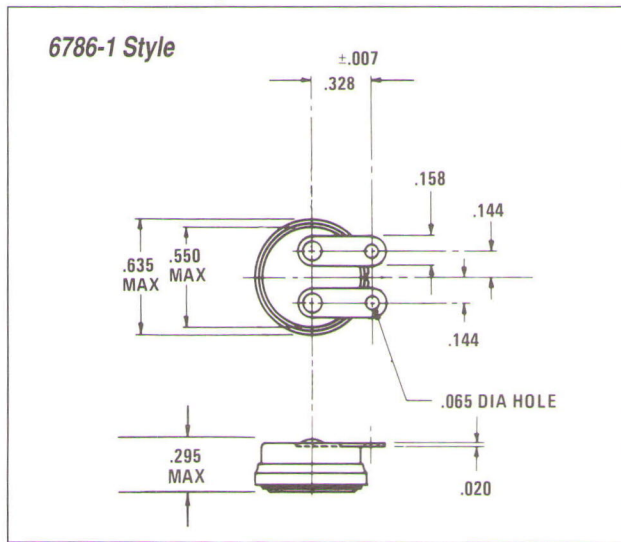
Actual size
6786-1 Style

The Klixon 6786 thermostat is a snap-acting disc type control designed for applications where maximum shock and vibration resistance is required. The Klixon snap-acting disc and fine silver

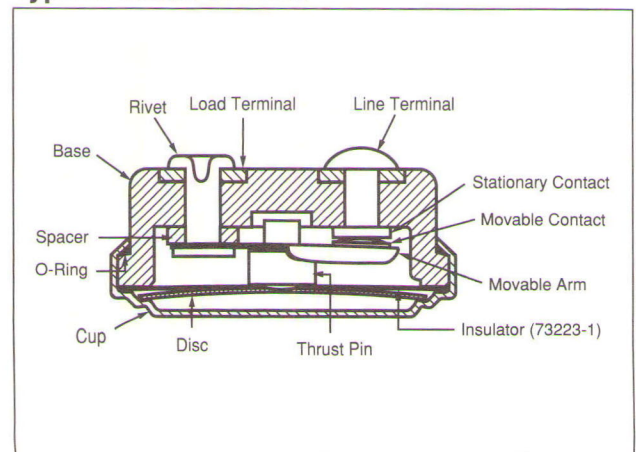
electrical contacts are enclosed in a stainless steel cup to provide protection from dust and other foreign particles. This construction also assures rapid thermal response plus dependable circuit

operation at all times. The miniature size of the 6786 makes it particularly suitable where space and weight accommodations are limited.

Mounting Configurations



Typical Cross Section



Performance Characteristics

Switch Action

SPST, (snap-action)

Contact Ratings (Resistive)

30 VAC/DC	125 VAC	250VAC	Life Cycles
Amperes			
5.0	2.0	1.0	100,000
5.5	3.0	1.5	50,000
6.0	4.0	2.0	25,000
6.5	5.0	2.5	10,000
7.0	6.0	3.0	5,000

Based on standard differential

Vibration Resistance

MIL-STD-202, Method 204,
Condition A

Shock Resistance

30G, 11 milliseconds

Weight

2.5 grams

Qualifications

UL/CSA recognized
see page 36 for details

Terminals

The 6786 thermostat is available with solder type terminals in either the parallel or opposed alignments as shown in the drawings. Other configurations are available.

Mounting

The unit can be mounted in any position; in casting wells, through openings in metal enclosures and in space for control of air temperature. The unit can be supplied with or without the surface mounting bracket as shown in the drawings. Other brackets and studs are available.

Temperature (Use table below for common operating temperatures).

Ambient Temperature Range:

-65°F to +400°F, (-53.9°C to 204.4°C)

Maximum ambient exposure while in the closed contact position is 200°F above contact closing temperature.

Operating temperature

Temperature at which normally closed contacts open or normally open contacts close.

Tolerance

Allowable range above and below setpoint and reset temperatures.

Differential

Subtract the differential from the operating temperature to determine the temperature at which the contacts will return to the normal position (reset temperature).

Operating Temperature		Differential		Tolerance	
°F	°C	°F	°C	±°F	±°C
-20	-28.9	30	16.7	10	5.6
0	-17.8	30	16.7	10	5.6
10	-12.2	30	16.7	10	5.6
20	-6.7	20	11.1	8	4.4
30	-1.1	20	11.1	8	4.4
40	4.4	20	11.1	8	4.4
50	10.0	20	11.1	8	4.4
60	15.6	20	11.1	8	4.4
70	21.1	20	11.1	8	4.4
80	26.7	20	11.1	8	4.4
90	32.2	20	11.1	8	4.4
100	37.8	20	11.1	8	4.4
110	43.3	20	11.1	8	4.4
120	48.9	20	11.1	8	4.4
130	54.4	20	11.1	8	4.4
140	60.0	20	11.1	8	4.4
150	65.6	20	11.1	8	4.4
160	71.1	20	11.1	8	4.4
170	76.7	20	11.1	8	4.4
180	82.2	20	11.1	8	4.4
190	87.8	20	11.1	8	4.4

Operating Temperature		Differential		Tolerance	
°F	°C	°F	°C	±°F	±°C
200	93.3	30	16.7	10	5.6
210	98.9	30	16.7	10	5.6
220	104.4	30	16.7	10	5.6
230	110.0	30	16.7	10	5.6
240	115.6	30	16.7	10	5.6
250	121.1	30	16.7	10	5.6
260	126.7	30	16.7	10	5.6
270	132.2	30	16.7	10	5.6
280	137.8	30	16.7	10	5.6
290	143.3	30	16.7	10	5.6
300	148.9	30	16.7	10	5.6
310	154.4	40	22.2	12	6.7
320	160.0	40	22.2	12	6.7
330	165.6	40	22.2	12	6.7
340	171.1	40	22.2	12	6.7
350	176.7	40	22.2	12	6.7
375	190.6	40	22.2	12	6.7
400	204.4	40	22.2	12	6.7
425	218.3	40	22.2	12	6.7
450	232.2	40	22.2	12	6.7

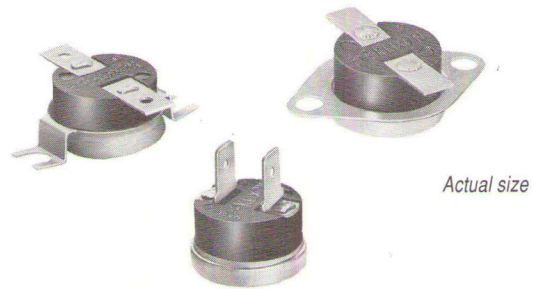
Consult factory if desired operating temperature does not appear in the table.

7BT Series

High Capacity, Environmentally Sealed

Commercial

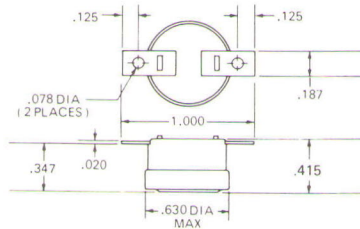
- Reliable, snap-action switching
- Tamperproof, preset calibration
- Normally open or normally closed
- UL recognized, file #34618, see page 36 for details
- CSA recognized, file #LR24458, see page 36 for details
- VDE recognized, file #4464.4-451-1/A-1, see page 36 for details



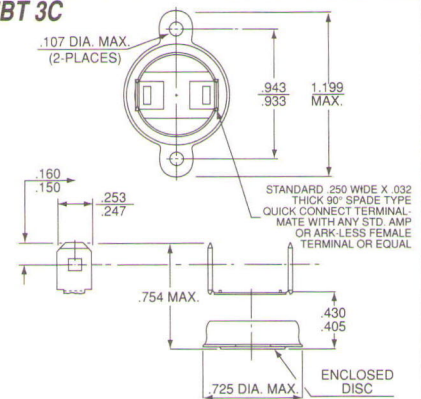
These drawings are representative of the combinations that are available. Any terminal may be matched with any mounting.

All dimensions are nominal and in inches.

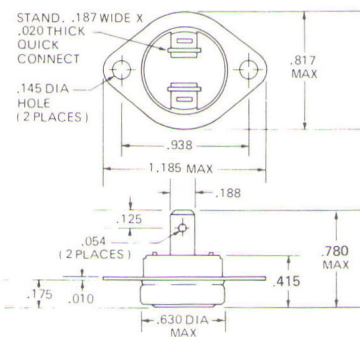
7BT 2A



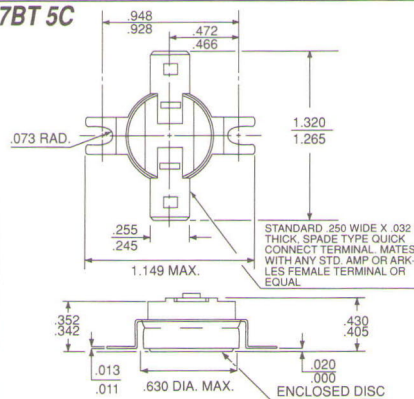
7BT 3C



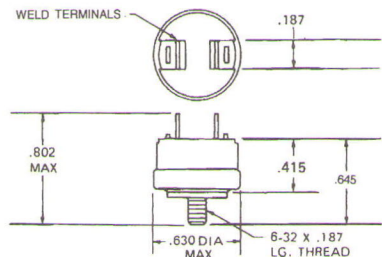
7BT 4B



7BT 5C



7BT 6D



If your application requires a combination of features which are not mentioned in this bulletin please contact our marketing department. The features included here are only a representative sampling of the combinations available in the 7BT series.

VDE recognized
(with factory surveillance)

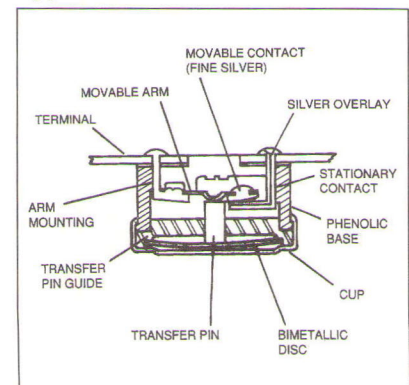
Type 7BT - XXX - XXX

10 (1.66)

250 ~

Class II, T175

Typical Cross Section View



Performance Characteristics

Switch Action

SPST (snap-action)

Contact Ratings (Resistive) 100,000 Cycles

Voltage	120VAC	240 VAC	30 VDC
Amperes	15	7.5	10

Based on standard differential

Dielectric Strength

2000 VAC, rms 60 cycles for 1 min.

Weight

4 grams

Temperature

(Use table at right for common operating temperatures).

Ambient Temperature Range:

-20°F to +350°F, (-28.9°C to 176.7°C)

Operating temperature

Temperature at which normally closed contacts open or normally open contacts close.

Tolerance

Allowable range above and below setpoint and reset temperatures.

Differential

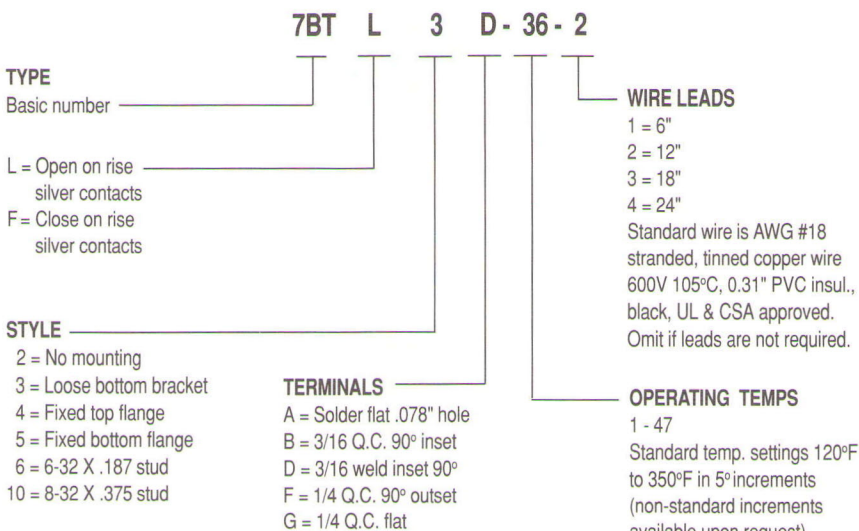
Subtract the differential from the operating temperature to determine the temperature at which the contacts will return to the normal position (reset temperature).

Qualifications

UL/CSA/VDE recognized
see page 36 for details

Part Numbering System

To facilitate the ordering of 7BT thermostats to your specifications use the part number code below. The code permits you to call out a complete production part number at the time of component selection.



Dash #	Oper. Temp.		Differential		Tolerance	
	°F	°C	°F	°C	±°F	±°C
* 30	-1.1	20	11.1	5	2.8	
* 40	4.4	20	11.1	5	2.8	
* 50	10.0	20	11.1	5	2.8	
* 60	15.6	20	11.1	5	2.8	
* 70	21.1	20	11.1	5	2.8	
* 80	26.7	20	11.1	5	2.8	
* 90	32.2	20	11.1	5	2.8	
* 100	37.8	20	11.1	5	2.8	
* 110	43.3	20	11.1	5	2.8	
1 120	48.9	20	11.1	5	2.8	
2 125	51.7	20	11.1	5	2.8	
3 130	54.4	20	11.1	5	2.8	
4 135	57.2	20	11.1	5	2.8	
5 140	60.0	20	11.1	5	2.8	
6 145	62.8	20	11.1	5	2.8	
7 150	65.6	20	11.1	5	2.8	
8 155	68.3	20	11.1	5	2.8	
9 160	71.1	20	11.1	5	2.8	
10 165	73.9	20	11.1	5	2.8	
11 170	76.7	20	11.1	5	2.8	
12 175	79.4	20	11.1	5	2.8	
13 180	82.2	20	11.1	5	2.8	
14 185	85.0	20	11.1	5	2.8	
15 190	87.8	20	11.1	5	2.8	
16 195	90.6	20	11.1	5	2.8	
17 200	93.3	20	11.1	5	2.8	
18 205	96.1	30	16.7	8	4.4	
19 210	98.9	30	16.7	8	4.4	

Dash #	Oper. Temp.		Differential		Tolerance	
	°F	°C	°F	°C	±°F	±°C
20 215	101.7	30	16.7	8	4.4	
21 220	104.4	30	16.7	8	4.4	
22 225	107.2	30	16.7	8	4.4	
23 230	110.0	30	16.7	8	4.4	
24 235	112.8	30	16.7	8	4.4	
25 240	115.6	30	16.7	8	4.4	
26 245	118.3	30	16.7	8	4.4	
27 250	121.1	30	16.7	8	4.4	
28 255	123.9	30	16.7	8	4.4	
29 260	126.7	30	16.7	8	4.4	
30 265	129.4	30	16.7	8	4.4	
31 270	132.2	30	16.7	8	4.4	
32 275	135.0	30	16.7	8	4.4	
33 280	137.8	30	16.7	8	4.4	
34 285	140.6	30	16.7	8	4.4	
35 290	143.3	30	16.7	8	4.4	
36 295	146.1	30	16.7	8	4.4	
37 300	148.9	30	16.7	8	4.4	
38 305	151.7	40	22.2	12	6.7	
39 310	154.4	40	22.2	12	6.7	
40 315	157.2	40	22.2	12	6.7	
41 320	160.0	40	22.2	12	6.7	
42 325	162.8	40	22.2	12	6.7	
43 330	165.6	40	22.2	12	6.7	
44 335	168.3	40	22.2	12	6.7	
45 340	171.1	40	22.2	12	6.7	
46 345	173.9	40	22.2	12	6.7	
47 350	176.7	40	22.2	12	6.7	

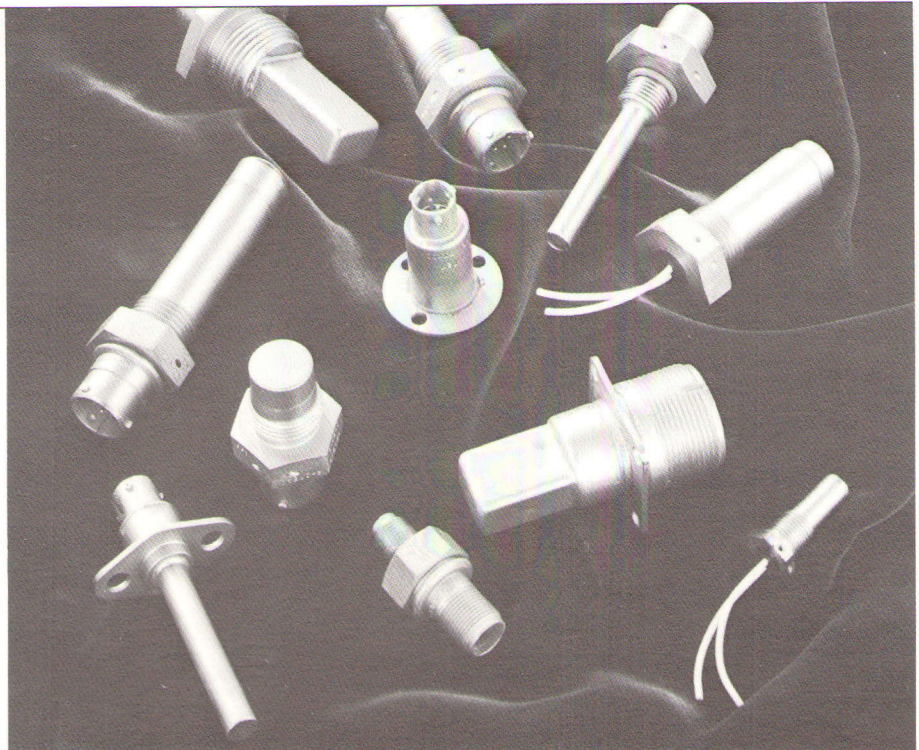
Consult factory if desired operating temperature does not appear in the table.

* Dash number does not apply. Order by operating temperature.

Probe Packages Immersion Type

Commercial & Military

- Calibrated to open or close on temperature rise
- Snap-action switching
- Factory calibrated - non-adjustable
- Hermetically sealed (probe only)
- Shock and vibration resistant
- Qualified to MIL-S-24236 / 2, /11, and /25 (order by MS number)



To meet a wide range of application requirements, Klixon probe type thermostat packages are available in a variety of sizes, configurations and thermal characteristics.

This publication shows three basic packages of immersion probes suitable for fluid temperature sensing. Many other varieties and configurations are available to give design engineers complete versatility. If none of these standard designs meet your need, our application engineering group is readily available to

review your parameters and custom design a device to satisfy your application.

Extreme Temperature Protection

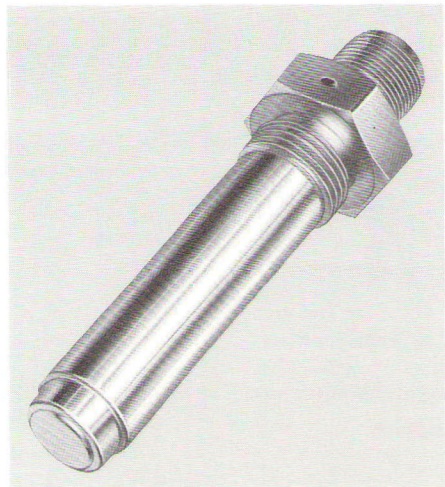
Constant speed drives, aircraft refrigeration systems, food processing equipment, and missile hydraulic systems often require protection from or indication of extreme high or low temperatures.

Narrow Differential Control

These thermostat probes accurately open and close with a narrow 2° to 8°F differential providing close temperature control in applications ranging from environmental to power tube coolant systems.

Fast Response

Quick response to rapidly changing temperature is a virtue of the low thermal mass series probes. The unique Klixon 3BT "Tiny-Stat" is located at the top of the probe for ultimate sensitivity.



This snap-acting, probe-type thermal switch incorporates the reliable Klaxon M1 thermostat.

Part Numbers

21542 3/4" - 16 thd/connector

21548 3/4" - 16 thd/leads

21549 1/2" pipe thd/connector

21543 1/2" pipe thd/leads

(SPDT available)

Electrical Characteristics

Dielectric Strength

1250 VAC, rms,

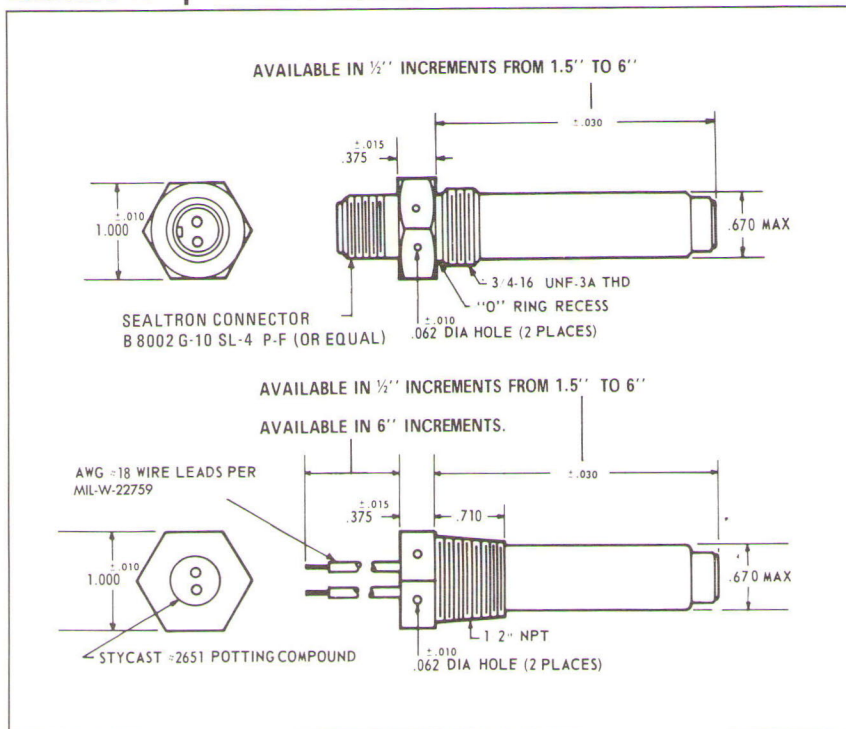
60 Cycles for 1 minute,
terminal to case;

1000 VAC, 60 cycles for 1 min.
terminal to terminal with con-
tacts open; per MIL-STD-202,
Method 301

Contact Resistance

0.100 ohms per MIL-STD-202,
Method 307

Extreme Temperature Protection



Temperature Settings

Operating Temp. Range		Differential		Tolerance	
°F	°C	°F	°C	°F	°C
-65 to -1	-53.9 to -18.4	30	16.7	12	6.7
0 to 200	-17.8 to 93.3	20	11.1	7	3.9
201 to 300	93.9 to 148.9	30	16.7	10	5.6
301 to 450	149.5 to 223.2	40	22.2	14	7.8
451 to 550	223.8 to 287.8	70	38.9	30	16.7

Maximum temperature exposure while in the closed contact position is 200°F above closing temperature.

Tolerances are based on precision factory calibration and test equipment. Customers checking tolerances should allow for differences in test equipment of ±1°F. Temperature settings outside the ranges indicated or to closer tolerances will be considered on special request.

Contact Ratings (Resistive)

30 VAC/DC	125 VAC	250 VAC	Life Cycles
Amperes			
5.0	2.0	1.0	100,000
5.5	3.0	1.5	50,000
6.0	4.0	2.0	25,000
6.5	5.0	2.5	10,000
7.0	6.0	3.0	5,000

Based on standard differential

Special Contacts

Gold plated contacts can be furnished for the electrical loads listed in the following table to assure reliable circuit switching under low wattage conditions. Gold plated contacts are not suitable for higher loads.

Gold Contact Ratings (Resistive)

30 VAC/DC	500 mA and below
115 VAC	200 mA and below
230 VAC	100 mA and below



This snap-acting, probe-type thermal switch incorporates the reliable Klixon 4286 thermostat.

Part Numbers

21546 3/4" - 16 thd/connector

21547 3/4" - 16 thd/leads

21550 1/2" pipe thd/connector

21545 1/2" pipe thd/leads

Electrical Characteristics

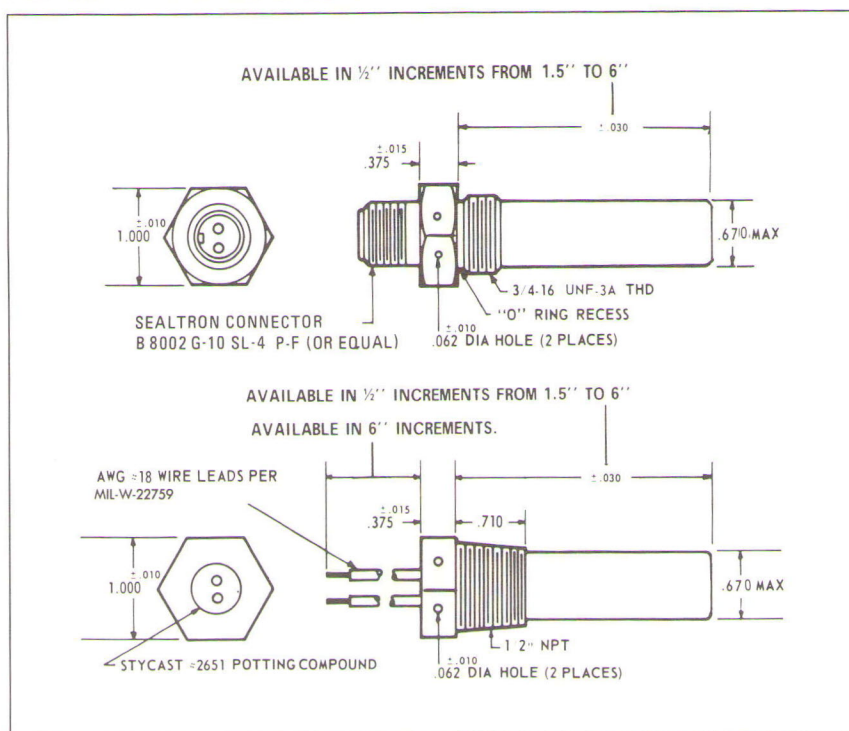
Dielectric Strength

1250 VAC, rms,
60 Cycles for 1 minute,
per MIL-STD-202, Method 301

Contact Resistance

0.100 ohms per MIL-STD-202,
Method 307

Narrow Differential Control



Temperature Settings

Operating Temperature Range	Differentials Available	Closing Temperature Tolerance*	
		Standard	Special (°F)
0° to 250°F (-17.8° to 121.1°C)	2° to 5°F (1.1° to 2.8°C)	± 5°F (± 2.8°C)	± 4°F (± 2.2°C)
251° to 275°F (121.7° to 135°C)	3° to 8°F (1.7° to 4.4°C)	± 6°F (± 3.4°C)	± 5°F (± 2.8°C)

Tolerances are based on precision factory calibration and test equipment. Customers checking tolerances should allow for differences in test equipment of $\pm 1^\circ\text{F}$.

Temperature exposure should be limited to 100°F above operating temperature for close on rise devices or 100°F below the operating temperature for open on rise devices.

Contact Ratings (Resistive)

2 amps, 30 VDC/120 VAC,
250,000 cycles

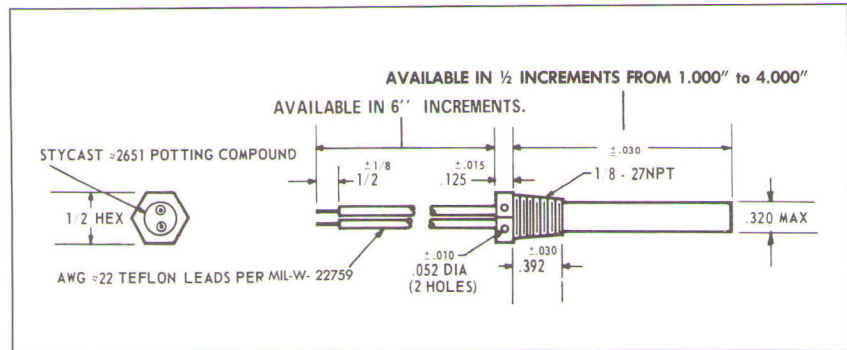
Special Contacts

Gold plated contacts can be furnished for the electrical loads listed in the following table to assure reliable circuit switching under low wattage conditions. Gold plated contacts are not suitable for higher loads.

Gold Contact Ratings (Resistive)

30 VAC/DC	500 mA and below
115 VAC	200 mA and below
230 VAC	100 mA and below

Fast Response Probe Thermostat



Here is an explanation of the part numbering system. This shows the information required before an order can be entered.

This miniature immersion thermostat incorporates the Klixon 3BT "Tiny-Stat" - The smallest - lightest - fastest snap-acting thermostat ever made.

Part Numbers

21557 1/8" - pipe thd/connector

21544 1/8" - pipe thd/leads

21562 7/16-20 thd/connector

21561 7/16-20 thd/leads

Temperature Settings

Operating Temperature Range

0° to 350°F (-17.8° to 176.7°C)

Operating Temperature Tolerances

± 10°F (± 5.6°C)

Differential (between opening and closing temps)

30°F (16.7°C) minimum

Electrical Characteristics

Dielectric Strength

1250 VAC, 60 cycles for 1 min.
(leads to case); MIL-STD-202,
Method 301

Contact Resistance

0.100 ohms max., per MIL-STD-202,
method 307

0.150 ohms max., per MIL-STD-202,
method 307 for close on rise devices
with setpoints greater than 175°F

Field 1
21542

Basic package describes the general physical appearance and the basic thermostat which is incorporated in the device.

Field 2
xx

Physical changes, primarily the probe length.

Field 3
xxx

Operating characteristics, assigned consecutively.

Field 4
xx

Lead length or connector, as required.

To order prototypes or production units, you need only furnish the information required in the four fields. We will then assign a full part number to meet your application.

Contact Ratings (Resistive)

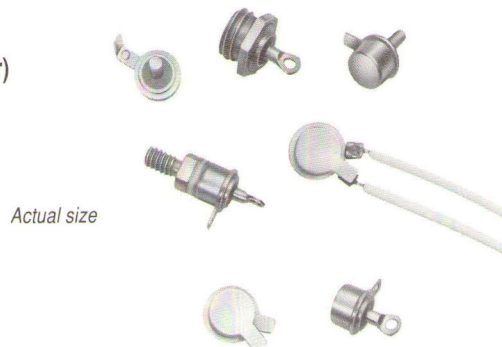
30 VAC/DC Amperes	115 VAC	Life Cycles	Contacts
1.0	1.0	10,000	Silver
0.5	0.5	10,000	Gold

Based on standard differential

3BT & 4BT Series

Tiny Stat Miniature Thermostat

- Smallest snap-acting thermal switches ever made
- Qualified to MIL-S-24236/13 & /19, Type 1, Class 4 (order by MS number)
- Extremely fast response
- Single pole, single throw
- Normally open or normally closed
- Pre-set, non-adjustable calibration
- Various mounting configurations available
- Hermetically sealed and back-filled with nitrogen
- GAM - T1



Description

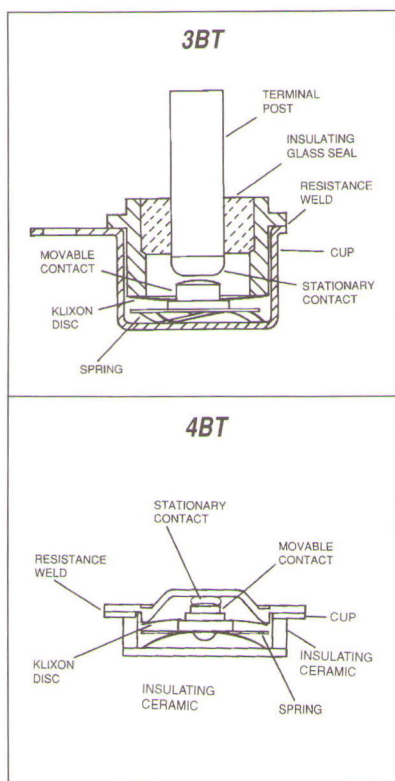
Tiny-Stat miniature thermostats combine an impressive list of superlatives in a reliable, hermetically-sealed, snap-acting Klaxon design. They are the smallest envelope size ever developed – ideal for remote sensing applications in locations having severe space limitations. They are the lightest construction available for applications where weight is an important consideration. They have extremely fast response to permit early warning of overheat conditions and their low mass internal components allow Tiny-Stat miniature thermostats to meet the most demanding standards of MIL-S-24236 for shock and vibration.

Gold plated contacts can be furnished for the electrical loads listed in the following table to assure reliable circuit switching under low wattage conditions. Gold plated contacts are not suitable for higher loads.

Gold Contact Ratings (Resistive)

30 VAC/DC	500 mA and below
115 VAC	200 mA and below

Typical Cross-Section View



Switching Action

All thermostats are supplied with single pole, single throw switching. The contacts can be constructed as:

Normally closed - limit type application, contacts open on temperature rise at a pre-determined temperature to de-energize the circuit. Contacts automatically re-close as the device cools to a pre-determined temperature.

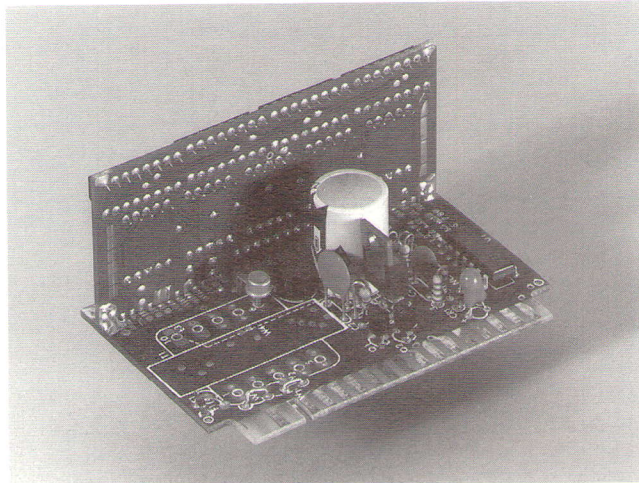
Normally open - fan type application, contacts close on temperature rise at a pre-determined temperature to de-energize the circuit. Contacts automatically re-open as the device cools to a pre-determined temperature.

The opening and closing temperatures are pre-set and non-adjustable.

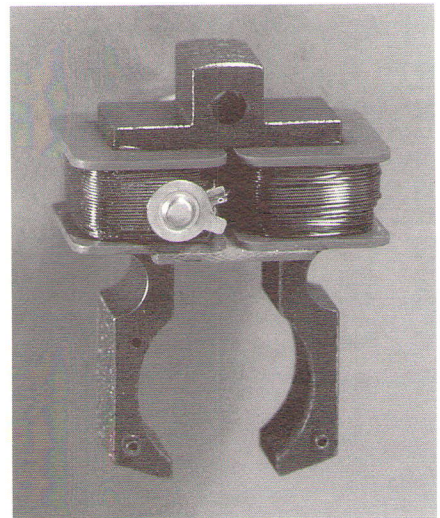
Common Applications

The Tiny Stat® Thermostats afford the user the quality and performance of a Klixon® Thermostat in a sub-miniature package. Tiny Stats® are the smallest snap-acting thermal switches ever made which makes them the ideal choice in applications where *size* and *weight* are critical. This small envelope design translates to a low thermal mass which yields one more key feature, an *extremely fast thermal response*.

Tiny Stats® are commonly used . . .

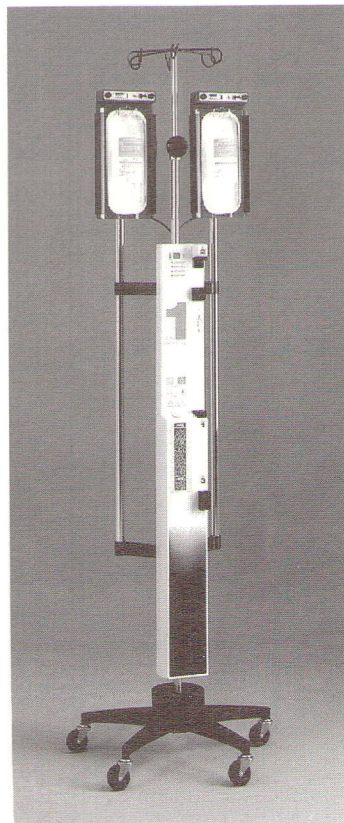


. . . for electronics overheat protection.
The 3BT-15 configuration is printed circuit board mountable. Other configurations can be epoxied in place.



. . . in transformer windings.
The low profile design of the 4BT-2 is optimal for this application.

. . . in medical equipment.
Where rapid thermal response is paramount, the Tinstat® is the solution.



Performance Characteristics

Switch Action

SPST (snap-action)

Contact Resistance

0.050 ohms maximum

per MIL-STD-202, Method 307

0.100 ohms maximum for close on rise devices with setpoints greater than 175°F

Contact Ratings (Resistive) 10,000 Cycles

Voltage	115VAC/ 30VDC	30mVAC*	30mVDC*
Amperes	1.0 (silver contacts)	0.01	0.01

Based on standard differential

*Specify gold contacts

Dielectric Strength

500 VAC, rms, 60 cycles for 1 min.,
across open contacts,
per MIL-STD-202, Method 301

Vibration Resistance*

5-2000 Hz, 30G,
per MIL-STD-202, Method 204

Shock Resistance

100G, 6 milliseconds,
per MIL-STD-202, Method 213

Hermeticity

1 X 10⁻⁸ atm cc/sec. max.,
per MIL-STD-202, Method 112,
Condition C

Salt Spray

per MIL-STD-202, Method 101,
Condition B, 5% solution

Weight

Basic unit 0.2 to 0.9grams

* Devices which open on temperature rise should not be subjected to vibration while at temperatures of 75°F or more below the opening temperature.

Devices which close on temperature rise should not be subjected to vibration while at temperatures of 75°F or more above the closing temperature.

Temperature (Use table below for common operating temperatures).

Ambient Temperature Range:

-80°F to +350°F, (-62.2°C to 176.7°C)

Operating temperature

Temperature at which normally closed contacts open or normally open contacts close.

Tolerance

Allowable range above and below setpoint and reset temperatures.

Differential

Subtract the differential from the operating temperature to determine the temperature at which the contacts will return to the normal position (reset temperature).

Dash #	Oper. Temp.		Differential		Tolerance	
	°F	°C	°F	°C	±°F	±°C
1	0	-17.8	30	16.7	8	4.4
2	5	-15.0	30	16.7	8	4.4
3	10	-12.2	30	16.7	8	4.4
4	15	-9.4	30	16.7	8	4.4
5	20	-6.7	30	16.7	8	4.4
6	25	-3.9	30	16.7	8	4.4
7	30	-1.1	30	16.7	8	4.4
8	35	1.7	30	16.7	8	4.4
9	40	4.4	30	16.7	8	4.4
10	45	7.2	30	16.7	8	4.4
11	50	10.0	30	16.7	8	4.4
12	55	12.8	30	16.7	8	4.4
13	60	15.6	30	16.7	8	4.4
14	65	18.3	30	16.7	8	4.4
15	70	21.1	30	16.7	8	4.4
16	75	23.9	30	16.7	8	4.4
17	80	26.7	30	16.7	8	4.4
18	85	29.4	30	16.7	8	4.4
19	90	32.2	30	16.7	8	4.4
20	95	35.0	30	16.7	8	4.4
21	100	37.8	30	16.7	8	4.4
22	105	40.6	30	16.7	8	4.4
23	110	43.3	30	16.7	8	4.4
24	115	46.1	30	16.7	8	4.4
25	120	48.9	30	16.7	8	4.4
26	125	51.7	30	16.7	8	4.4
27	130	54.4	30	16.7	8	4.4
28	135	57.2	30	16.7	8	4.4
29	140	60.0	30	16.7	8	4.4
30	145	62.8	30	16.7	8	4.4
31	150	65.6	30	16.7	8	4.4
32	155	68.3	30	16.7	8	4.4
33	160	71.1	30	16.7	8	4.4
34	165	73.9	30	16.7	8	4.4
35	170	76.7	30	16.7	8	4.4
36	175	79.4	30	16.7	8	4.4

Dash #	Oper. Temp.		Differential		Tolerance	
	°F	°C	°F	°C	±°F	±°C
37	180	82.2	30	16.7	8	4.4
38	185	85.0	30	16.7	8	4.4
39	190	87.8	30	16.7	8	4.4
40	195	90.6	30	16.7	8	4.4
41	200	93.3	30	16.7	8	4.4
42	205	96.1	30	16.7	8	4.4
43	210	98.9	30	16.7	8	4.4
44	215	101.7	30	16.7	8	4.4
45	220	104.4	30	16.7	8	4.4
46	225	107.2	30	16.7	8	4.4
47	230	110.0	30	16.7	8	4.4
48	235	112.8	30	16.7	8	4.4
49	240	115.6	30	16.7	8	4.4
50	245	118.3	30	16.7	8	4.4
51	250	121.1	30	16.7	8	4.4
52	255	123.9	30	16.7	8	4.4
53	260	126.7	30	16.7	8	4.4
54	265	129.4	30	16.7	8	4.4
55	270	132.2	30	16.7	8	4.4
56	275	135.0	30	16.7	8	4.4
57	280	137.8	30	16.7	8	4.4
58	285	140.6	30	16.7	8	4.4
59	290	143.3	30	16.7	8	4.4
60	295	146.1	30	16.7	8	4.4
61	300	148.9	30	16.7	8	4.4
62	305	151.7	30	16.7	8	4.4
63	310	154.4	30	16.7	8	4.4
64	315	157.2	30	16.7	8	4.4
65	320	160.0	30	16.7	8	4.4
66	325	162.8	30	16.7	8	4.4
67	330	165.6	30	16.7	8	4.4
68	335	168.3	30	16.7	8	4.4
69	340	171.1	30	16.7	8	4.4
70	345	173.9	30	16.7	8	4.4
71	350	176.7	30	16.7	8	4.4

Consult factory if desired operating temperature does not appear in the table.

Standard Configurations

Many standard configurations are available including pin type terminals for quick assembly to printed circuit boards (3BT-2 and 3BT-15), threaded plug for surface temperature sensing (3BT-3), and

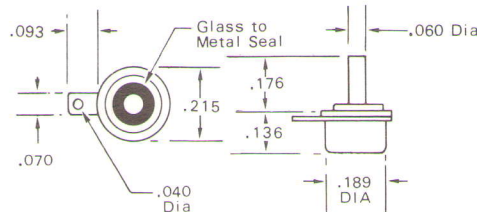
an insulated version for applications where grounded case construction is not suitable (3BT-6). The 4BT-2 is designed specifically for applications where an extremely low profile is critical.

3BT-2



Actual size

Grounded case construction
Approx. wt. 0.4 grams
Conforms to MIL-S-24236/19 configuration 1

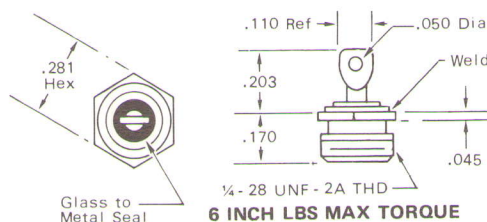


3BT-3



Actual size

Grounded case construction
Approx. wt. 0.9 grams
Conforms to MIL-S-24236/19 configuration 2

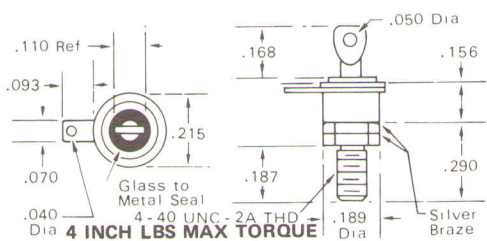


3BT-6



Actual size

Case insulated
Approx. wt. 0.9 grams
Conforms to MIL-S-24236/19 configuration 3

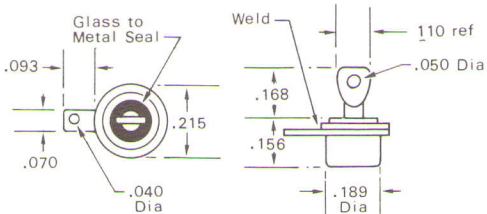


3BT-8



Actual size

Grounded case construction
Approx. wt. 0.4 grams
Conforms to MIL-S-24236/19 configuration 4

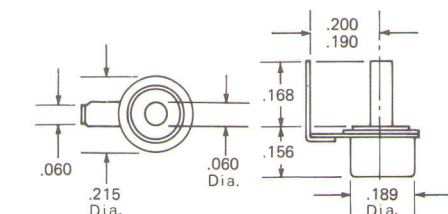


3BT-15



Printed circuit board mount
Approx. wt. 0.4 grams
Conforms to MIL-S-24236/19 configuration 5

Actual size

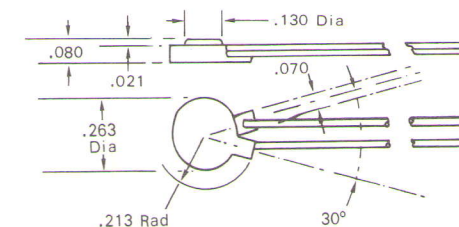


4BT-2



Actual size

Grounded case construction
Approx. wt. 0.2 grams
Conforms to MIL-S-24236/13



Part Numbering System for Standard 3BT & 4BT Thermostats

4BT L 2 - 22 - 98

TYPE
3BT or 4BT

L = Open on rise
silver contacts

R = Open on rise
gold contacts

F = Close on rise
silver contacts

D = Close on rise
gold contacts

STYLE

STANDARD
OPERATING
TEMPERATURES
#1 through 71
starting at 0°F
in 5°F increments
Reset 30°F lower

OPTIONAL WIRE LEAD
FOR 4BT

Teflon* insulated, 12" long

98 - Stranded, fig. A
103 - Solid, fig. B

(Others available)
Omit if leads are not
required.

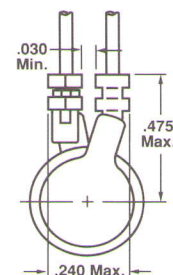


Figure A

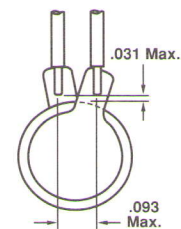


Figure B

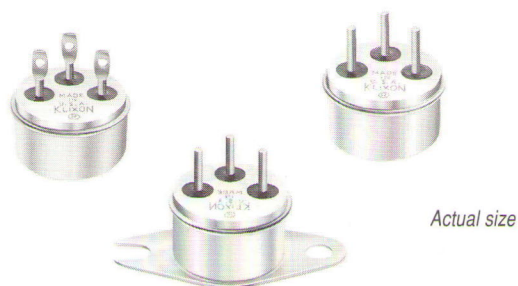
All dimensions nominal, in inches.

* Trademark of E.I. DuPont de Nemours and Co.

5BT Series

Single Pole, Double Throw, Welded, Hermetic Seal

- Single pole, double throw
- Snap-action switching
- High resistance to shock and vibration
- Tamperproof, preset calibration
- Hermetically sealed and backfilled with nitrogen
- Qualified to MIL-S-24236/24 (order by MS number)
- GAM-T1



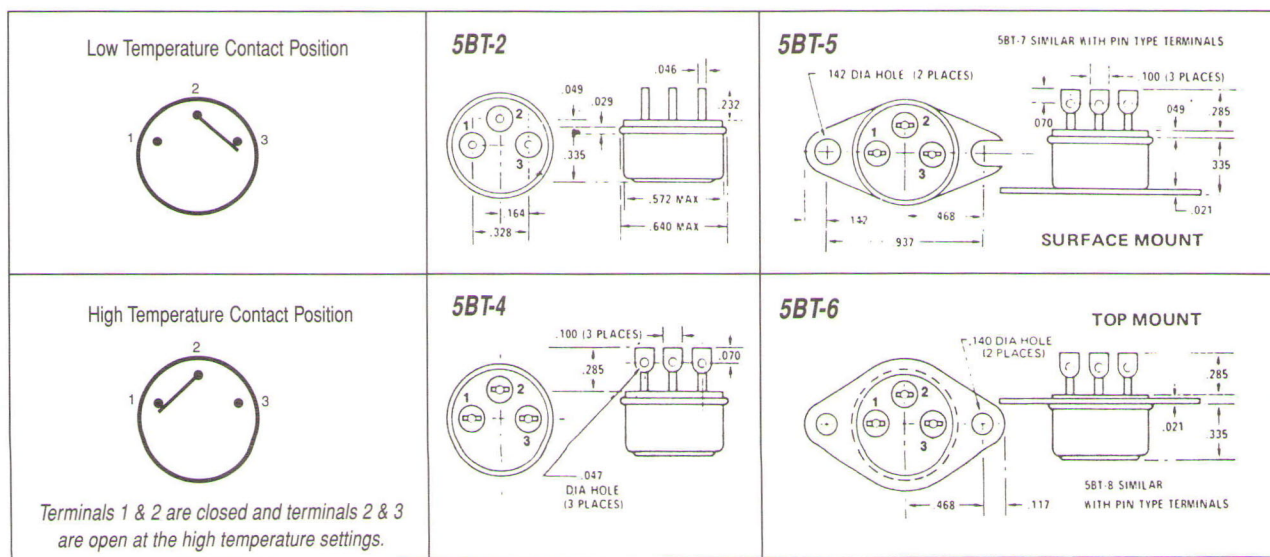
The Klixon 5BT series thermostat is a high reliability, hermetically sealed thermal switch. The single pole, double throw design allows versatility and economy in providing two functions within the same device. Typically these Klixon switches are used to control and indicate at a preset temperature. One pole can control a cooling fan and the other pole can indicate impending danger. These switches are used in data processing equipment, computers, electronic and communication equipment, or cooling and heating systems. The applications are only limited by the imagination of the design engineer.

Construction

The single pole, double throw construction instantly switches loads from one terminal to the other. This is accomplished through the temperature sensitive, actuating element - a snap action, bimetal disc. This in turn activates a snap acting, switching mechanism. As the temperature reaches a predetermined point, the disc snaps to its reverse curvature, producing the crisp, positive switching action inherent to Klixon thermostats. This feature assures reliable, consistent operating temperatures over long cycle life with a minimum of electromagnetic interference.

Configuration

The switches are offered in several versions. Terminals may be either flattened and pierced, or pin type. Flattened and pierced terminals can also be bent at right angles to reduce the overall height. Leads can be welded to pin type terminals to form an integral unit. Top or bottom mounting flanges are available. Copper-nickel plating is standard. Several others are available. The device can also be custom designed into a package such as a probe thermostat.



All dimensions nominal / in inches - dimensions not shown, same as above.

Performance Characteristics

Switch Action

SPDT, (snap-action)

Contact Ratings (Resistive)

30 VDC / 125 VAC	Life Cycles
Amperes	
2.0	100,000
3.0	50,000

Based on standard differential

Dielectric Strength

1250 VAC, rms,
60 Cycles for 1 minute,
terminal to case,
per MIL-STD-202, Method 301

Insulation Resistance

100 megohms min. at 500 VDC

Vibration Resistance

10-2000 Hz, 10G,

Shock Resistance

60 G, 11 milliseconds,

Acceleration

60 G

Hermeticity

1 X 10⁻⁸ atm cc/sec. max. per
MIL-STD-202, Method 112,
Condition C

Salt Spray

MIL-STD-202, Method 101

Humidity

MIL-STD-202, Method 103,
Test Condition A

Sand and Dust

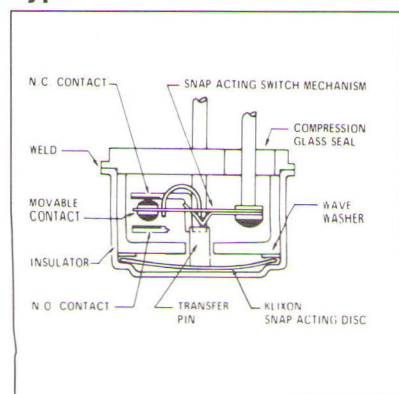
MIL-STD-202, Method 110
Test Condition A

Weight (average)

Basic unit 6 grams

With bracket 7 grams

Typical Cross Section View



Temperature (Use table below for common operating temperatures).

Ambient Temperature:

-65°F to +450°F, (-53.9°C to 232.2°C)

Operating temperature

Temperature at which normally closed contacts open or normally open contacts close.

Tolerance

Allowable range above and below setpoint and reset temperatures.

Differential

Subtract the differential from the operating temperature to determine the temperature at which the contacts will return to the normal position (reset temperature).

Operating Temperature		Differential		Tolerance	
°F	°C	°F	°C	±°F	±°C
-65	-53.9	30	16.7	10	5.6
-40	-40.0	30	16.7	10	5.6
-15	-26.1	30	16.7	10	5.6
0	-17.8	20	11.1	8	4.4
10	-12.2	20	11.1	8	4.4
20	-6.7	20	11.1	8	4.4
30	-1.1	20	11.1	8	4.4
40	4.4	20	11.1	8	4.4
50	10.0	20	11.1	8	4.4
60	15.6	20	11.1	8	4.4
70	21.1	20	11.1	8	4.4
80	26.7	20	11.1	8	4.4
90	32.2	20	11.1	8	4.4
100	37.8	20	11.1	8	4.4
110	43.3	20	11.1	8	4.4
120	48.9	20	11.1	8	4.4
130	54.4	20	11.1	8	4.4
140	60.0	20	11.1	8	4.4
150	65.6	20	11.1	8	4.4
160	71.1	20	11.1	8	4.4
170	76.7	20	11.1	8	4.4

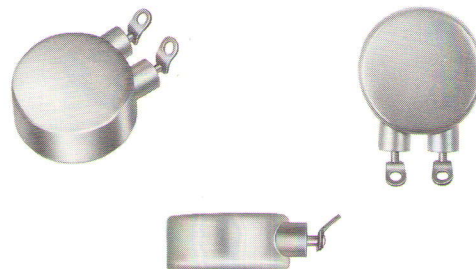
Operating Temperature		Differential		Tolerance	
°F	°C	°F	°C	±°F	±°C
180	82.2	20	11.1	8	4.4
190	87.8	20	11.1	8	4.4
200	93.3	20	11.1	8	4.4
210	98.9	20	11.1	8	4.4
220	104.4	20	11.1	8	4.4
230	110.0	20	11.1	8	4.4
240	115.6	20	11.1	8	4.4
250	121.1	20	11.1	8	4.4
260	126.7	20	11.1	8	4.4
270	132.2	20	11.1	8	4.4
280	137.8	20	11.1	8	4.4
290	143.3	20	11.1	8	4.4
300	148.9	20	13.9	8	4.4
310	154.4	25	13.9	10	5.6
320	160.0	25	13.9	10	5.6
330	165.6	25	13.9	10	5.6
340	171.1	25	13.9	10	5.6
350	176.7	25	13.9	10	5.6
375	190.6	35	19.4	12	6.7
400	204.4	35	19.4	12	6.7

Consult factory if desired operating temperature does not appear in the table.

M2 Series

Narrow Differential Welded, Hermetic Seal

- Snap-action switching
- Single pole, single throw
- Preset, non-adjustable calibration
- Welded, hermetic seal and backfilled with nitrogen
- Normally open or normally closed
- Qualified to MIL-S-24236 / 20 (order by MS number)
- GAM-T1



Actual size

M2 thermostats are recommended for use as controls and warning devices in guided missiles, aircraft controls, heating blankets, electronic circuit components, servomechanisms, gyroscopes, aerial cameras, crystal ovens, surface heaters, computers and similar electronic devices where reliable performance is vital.

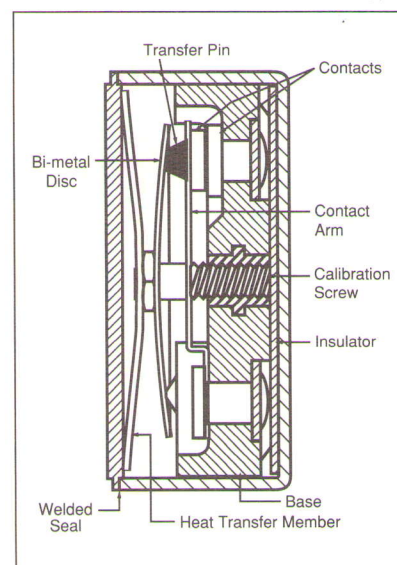
Precision temperature accuracy and long life reliability are achieved through the use of the well known Klaxon snap-acting disc. This unique mechanism multiplies the motion of the

temperature sensor and actuates a switch capable of handling high power. Welded closed after accurate calibration, the M2 is tamperproof.

The M2 is available with a variety of terminals and can be mounted in any position: through openings in metal closures, in casting wells, in ducts for control of air temperature. A surface mounting bracket or stud can be provided.

TI's years of engineering experience have yielded a wide variety of easy to use mounting means.

Typical Cross Section View



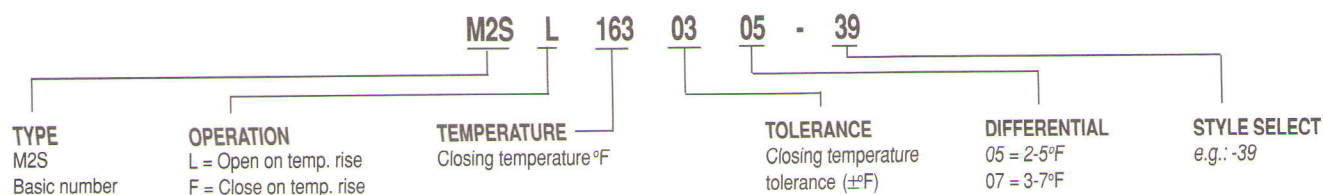
Special M2 Thermostats

Many configurations are available beyond the standard units shown above. Several varieties are shown below. The device can easily be custom designed into packages such as probe thermostats or strap mounted units.



Part Numbering System for Special M2 Thermostats

To facilitate the ordering of M2 thermostats to your specifications use the part number code below. The code permits you to call out a complete production part number at the time of component selection.



Performance Characteristics

Switch Action

SPST, normally open or normally closed

Contact Ratings (Resistive)

Voltage	30 VDC	120 VAC	Cycles
Amperes	2.0	2.0	250,000

Based on standard differential

Contact Resistance

0.050 ohms maximum,
per MIL-STD-202, Method 307

Dielectric Strength

1250 VAC, rms,
60 cycles for 1 minute,
per MIL-STD-202, Method 301

Vibration Resistance

10-2000 Hz, 10G,
per MIL-STD-202, Method 204,
Condition D, (monitored)
10 microseconds chatter, max.
50G (unmonitored)
20-2000 Hz (open contacts)

Shock Resistance

100 G, 6 milliseconds,
per MIL-STD-202, Method 213
(monitored) 10 microseconds
chatter, max.

Hermeticity

1×10^{-8} atm cc/sec. max,
per MIL-STD-202, Method 112,
Condition C

Salt Spray

per MIL-STD-202, Method 101,
Condition B, 5% solution

Weight (Average)

5.4 grams

Ambient Temperature Range

-65°F to 400°F (depending on calibrated temperature). Exposure is limited to 100°F above operating temperature for close on rise devices or 100°F below operating temperature for open on rise devices.

Temperature Settings

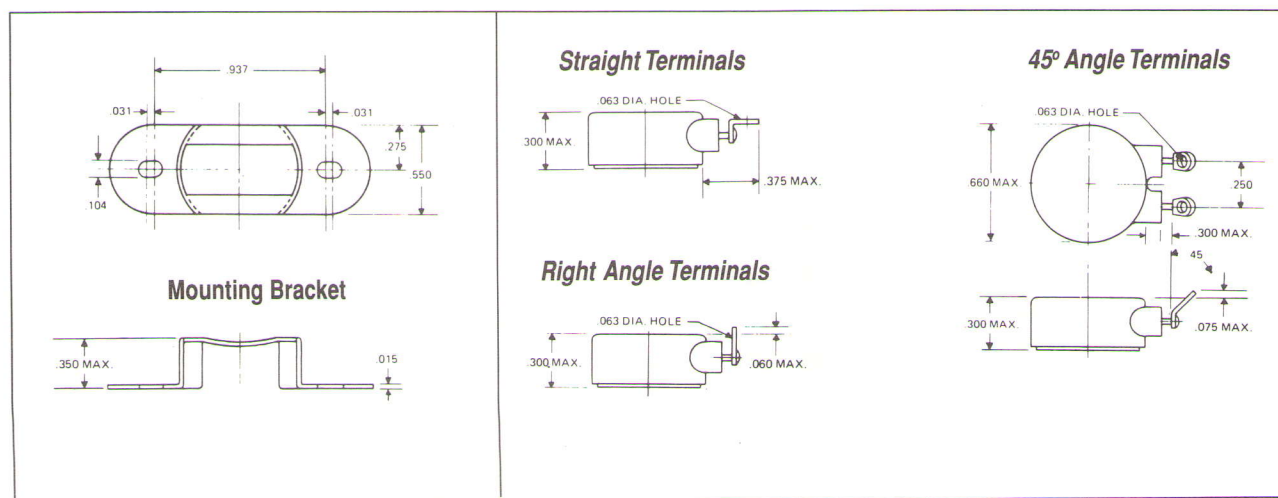
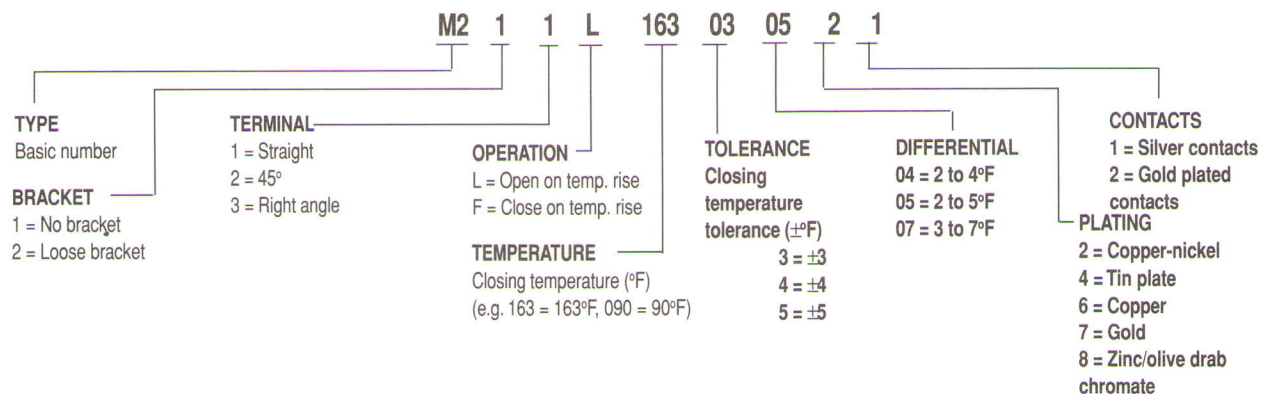
Closing Temperature Range (°F)	Opening Temperature Differential (°F)	Closing Temperature Tol. (°F)	
		Std.	Spec.
0 to 250 (-17 to 121°C)	2 - 5 (1.1 to 2.8°C)	±4 (±2.2°C)	±3 (±1.7°C)
251 to 300 (122 to 149°C)	3 - 7 (1.7 to 3.9°C)	±5 (±2.8°C)	±4 (±2.2°C)

The M2 thermostat is ordered by specifying the closing temperature with tolerance and the opening temperature in terms of a differential range, either above or below the actual closing temperature.

Example: Close at 100°F ±4, open 2-5°F above. In any one lot, the thermostats will close between 96 and 104°F. Each thermostat will open 2-5°F above the actual closing temperature of that thermostat.

Part Numbering System for Standard M2 Thermostat

To facilitate the ordering of M2 thermostats to your specifications use the part number code below. The code permits you to call out a complete production part number at the time of component selection.

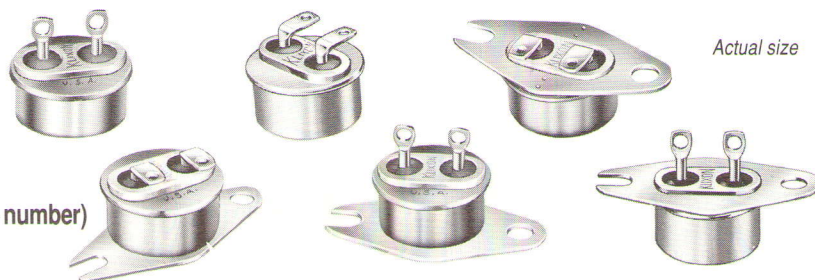


Thermostats should not be subjected to temperature overrides in excess of 100°F in the closed position.
Dimensions shown in inches.

M1/11041 Series

High Reliability, Hermetically Sealed Thermostat

- Snap-action switching
- Rapid thermal response
- Single pole, single throw
- Normally open or normally closed
- Pre-set, non-adjustable calibration
- Various mounting configurations available
- Qualified to MIL-S-24236/1 (Order by MS24236/1 - number)
- GAM-T1



Description

The Klixon M1 precision thermostat is constructed with a snap-acting bi-metal disc which serves as the actuating element. As the temperature reaches a predetermined calibration point, the disc snaps to its reverse curvature producing the crisp, positive switching action inherent to Klixon thermostats. This feature assures reliable, consistent operating temperature over long cycle life. The standard thermostat is copper-nickel plated with silver contacts. Other plating finishes are available upon request. Gold plated contacts can be furnished for the electrical loads listed in the following table to assure reliable circuit switching under low wattage conditions. Gold plated contacts are not suitable for heavier loads.

Gold Contact Ratings (Resistive)

30 VAC/DC	500 mA and below
115 VAC	200 mA and below
230 VAC	100 mA and below

Our most common mounting configurations are depicted on page 29. Many other varieties are available.

Leads can be welded to pin type terminals to form an integral unit.

The switch can be custom packaged into a probe, strap mount, or immersion thermostat. Consult the factory for special requests.

Switching Action

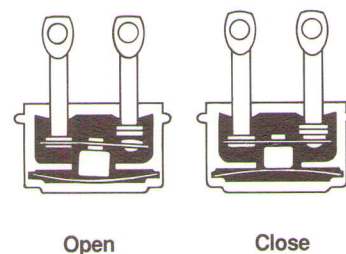
All thermostats are supplied with single pole, single throw switching. The contacts can be constructed as:

Normally closed - limit type application; contacts open on temperature rise at a pre-determined temperature to de-energize the circuit. Contacts automatically re-close as the device cools to a pre-determined temperature.

Normally open - fan type application; contacts close on temperature rise at a pre-determined temperature to energize the circuit. Contacts automatically re-open as the device cools to a pre-determined temperature.

The opening and closing temperatures are pre-set and non-adjustable.

Operation



When heated, the internal stresses of the bi-metal cause the disc to reverse its curvature with a snap-action at a fixed, preset temperature and operate the electrical contacts.

A decrease in the ambient temperature below the reset temperature of the disc relieves the internal stresses in the disc. The disc returns to its normal curvature and the contacts assume their normal operating position.

Precisely Engineered

The Klixon M1/11041 series of thermostats are carefully engineered for exceptional performance and reliability through the entire temperature range.

Features include:

Snap Action Switching -

Assures reliable, consistent operating temperature over long cycle life.

High Vibration and Shock

Resistance - A wave washer is installed to improve switching action under vibration conditions and to prevent abrasion of internal components which can create minute particles and cause contact contamination decreasing performance and life.

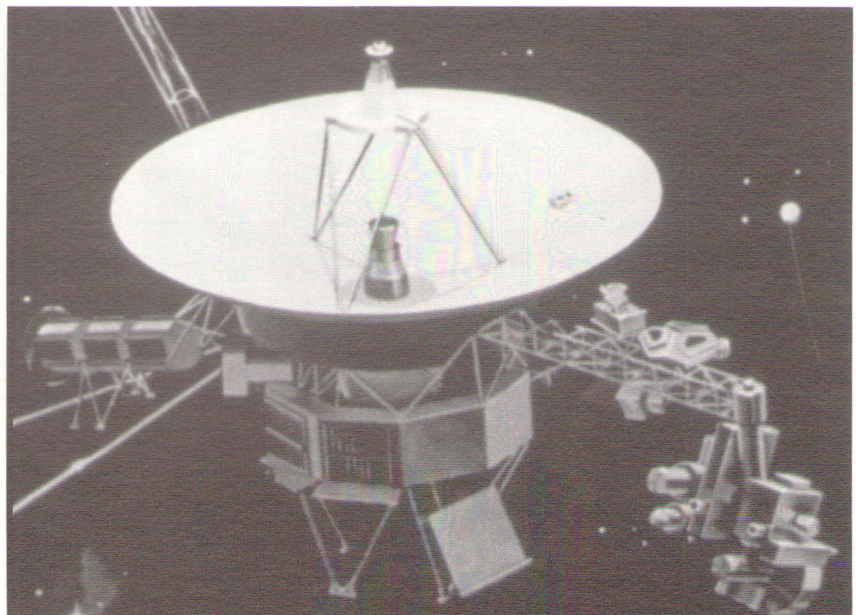
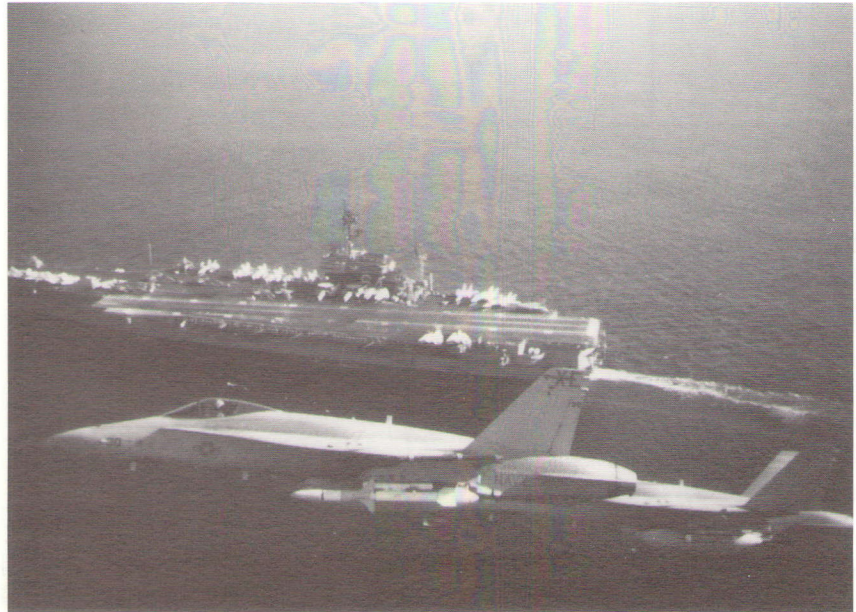
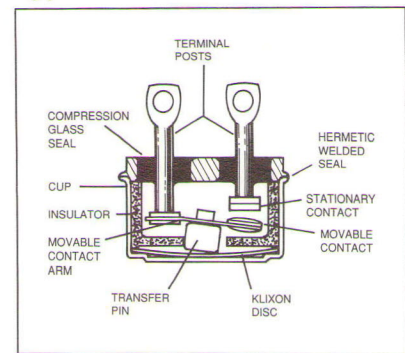
Vacuum Baking - Prior to the final weld, finished assemblies are vacuum baked to out-gas any moisture, oil, or other volatile fluids that may be present eliminating possible contact contamination at elevated temperatures.

Back Filling - Back-filling with dry nitrogen prior to the final weld excludes contamination and moisture present in the normal

atmosphere. The inert, dry back-fill eliminates moisture condensation at low temperature extremes, improves the dielectric characteristics and prevents oxidation of the contacts.

Reliability - Critical assembly steps are performed in class 100 clean rooms.

Typical Cross Section View



Common Applications

Applications for the M1 Series thermostat range from military to medical equipment and from satellites to the Space Shuttles. The M1 is the thermostat of choice where quality and reliability are paramount.

Performance Characteristics

Switch Action

SPST (snap-action)

Contact Resistance

0.050 ohms maximum

per MIL-STD-202, Method 307

Contact Ratings (Resistive)

30 VAC/DC	125 VAC	250 VAC	Life Cycles
Amperes			
5.0	2.0	1.0	100,000
5.5	3.0	1.5	50,000
6.0	4.0	2.0	25,000
6.5	5.0	2.5	10,000
7.0	6.0	3.0	5,000

Based on standard differential

Dielectric Strength

1250 VAC, rms,

60 Cycles for 1 minute,

terminal to case,

per MIL-STD-202, Method 301

Vibration Resistance

5-2000 Hz, 20G,

per MIL-STD-202, Method 204,

Condition D, (monitored)

5-1000 Hz, 100G,

Per MIL-STD-202, Method 204,

Condition D (unmonitored)

1000-2000 Hz, 50G,

per MIL-STD-202, Method 204

Condition D (unmonitored)

Shock Resistance

100 G, 6 milliseconds,

per MIL-STD-202, Method 213

Hermeticity

1 X 10⁻⁸ atm cc/sec. max,

per MIL-STD-202, Method 112,

Condition C

Salt Spray

per MIL-STD-202, Method 101,

Condition B, 5% solution

Moisture resistance

per MIL-STD-202, Method 106

Weight

Basic unit4.8 grams

with bracket5.9 grams

Temperature (Use table below for common operating temperatures).

Ambient Temperature Range:

-80°F to +550°F, (-62.2°C to 287.8°C)

Maximum ambient exposure while in the closed contact position is 200°F above contact closing temperature.

Operating temperature

Temperature at which normally closed contacts open or normally open contacts close.

Tolerance

Allowable range above and below setpoint and reset temperatures.

Differential

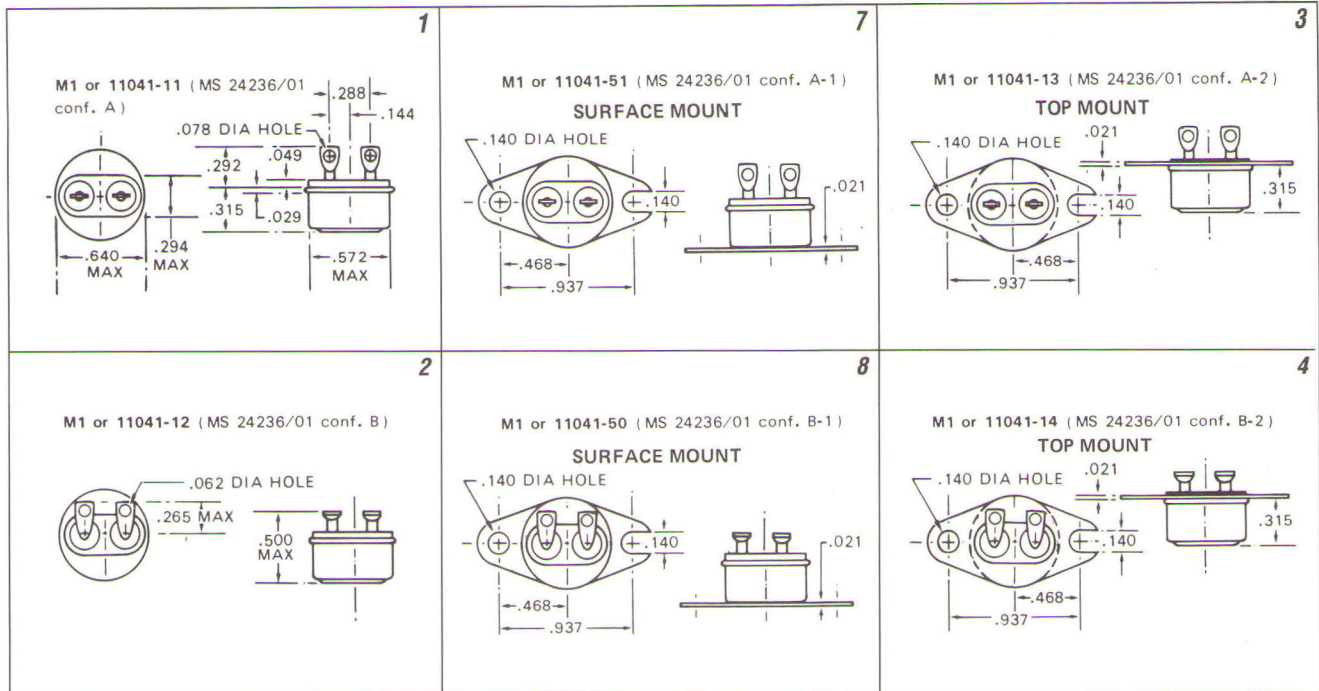
Subtract the differential from the operating temperature to determine the temperature at which the contacts will return to the normal position (reset temperature).

Operating Temperature		Differential		Tolerance	
°F	°C	°F	°C	±°F	±°C
-65	-53.9	30	16.7	10	5.6
-40	-40.0	30	16.7	10	5.6
-15	-26.1	30	16.7	10	5.6
0	-17.8	20	11.1	5	2.8
10	-12.2	20	11.1	5	2.8
20	-6.7	20	11.1	5	2.8
30	-1.1	20	11.1	5	2.8
40	4.4	20	11.1	5	2.8
50	10.0	20	11.1	5	2.8
60	15.6	20	11.1	5	2.8
70	21.1	20	11.1	5	2.8
80	26.7	20	11.1	5	2.8
90	32.2	20	11.1	5	2.8
100	37.8	20	11.1	5	2.8
110	43.3	20	11.1	5	2.8
120	48.9	20	11.1	5	2.8
130	54.4	20	11.1	5	2.8
140	60.0	20	11.1	5	2.8
150	65.6	20	11.1	5	2.8
160	71.1	20	11.1	5	2.8
170	76.7	20	11.1	5	2.8
180	82.2	20	11.1	5	2.8
190	87.8	20	11.1	5	2.8
200	93.3	20	11.1	5	2.8

Operating Temperature		Differential		Tolerance	
°F	°C	°F	°C	±°F	±°C
210	98.9	30	16.7	8	4.4
220	104.4	30	16.7	8	4.4
230	110.0	30	16.7	8	4.4
240	115.6	30	16.7	8	4.4
250	121.1	30	16.7	8	4.4
260	126.7	30	16.7	8	4.4
270	132.2	30	16.7	8	4.4
280	137.8	30	16.7	8	4.4
290	143.3	30	16.7	8	4.4
300	148.9	30	16.7	8	4.4
310	154.4	40	22.2	12	6.7
320	160.0	40	22.2	12	6.7
330	165.6	40	22.2	12	6.7
340	171.1	40	22.2	12	6.7
350	176.7	40	22.2	12	6.7
375	190.6	40	22.2	12	6.7
400	204.4	40	22.2	12	6.7
425	218.3	40	22.2	12	6.7
450	232.2	40	22.2	12	6.7
475	246.1	70	38.9	25	13.9
500	260.0	70	38.9	25	13.9
525	273.9	70	38.9	25	13.9
550	287.8	70	38.9	25	13.9

Consult factory if desired operating temperature does not appear in the table.

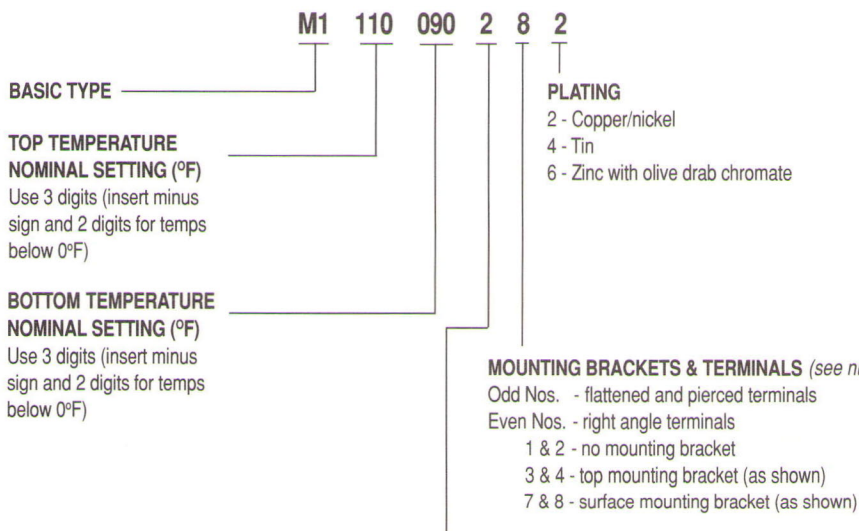
Common Configurations



All dimensions nominal/inches. Line terminal is marked for grounded AC line voltage applications.

Order by Coded Part Number

To facilitate the ordering of M1 thermostats to your specifications use the part number code below. The code permits you to call out a complete production part number at the time of component selection.



OPERATION

- 1 - Open on temp rise (fine silver contacts)
- 2 - Close on temp rise (fine silver contacts)
- 3 - Open on temp rise (gold plated contacts)
- 4 - Close on temp rise (gold plated contacts)

Standard configurations are available as the M1 series and are shown. A complete part number can be originated at the inception of an application by using the "Order By Part Number" code at left. Many other versions are available as the 11041 series. Consult the factory for the availability of different styles.

4286 Series

Narrow Differential Potted Seal

- Snap-action switching
- Epoxy sealed
- Low silhouette
- Normally open or closed
- Preset, non-adjustable calibration



Actual size

Klixon 4286 Thermostats are snap-acting, disc-type controls designed to control temperatures within narrow limits. They are used as control or warning devices for applications in guided missiles, aircraft controls,

electronic circuit components, servo-mechanisms, gyroscopes, aerial cameras, crystal ovens, surface heaters, computers, etc.

The Klixon snap-acting disc and fine silver electrical contacts are

mounted in a glass-filled alkyd base. The complete assembly is seated with epoxy into a stainless steel cup. The disc is electrically insulated and coupled with a radiating element for fast temperature response.

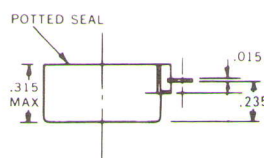
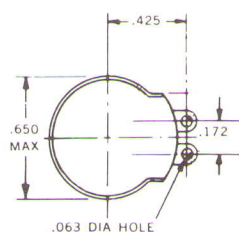
Mounting and Terminals

The unit can be mounted in any position: in casting wells, through metal enclosures and in space for control of air temperature. A surface mounting bracket can be provided at slight extra cost. Special brackets can also be supplied to meet your specifications.

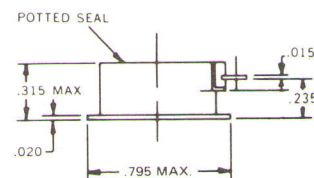
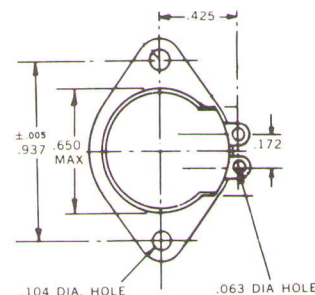
Standard contact material for the 4286 is silver (order as a 4286A1 or 4286A2). Gold contacts are available if required (order as a 4286B1 or 4286B2).

The 4286 Thermostat is available with flat terminals as shown. If other terminal configurations are desired, please call factory with detailed information.

4286-1 Style



4286-2 Style



Dimensions in inches (nominal)

Performance Characteristics

Switch Action

SPST, (snap-action)

Contact Resistance

0.050 ohms maximum

Contact Ratings (Resistive)

30 VAC/DC	125 VAC	250 VAC	Life Cycles
Amperes			
2.0	1.0	0.5	250,000

Based on standard differential

Dielectric Strength

1250 VAC, 60 cycles, 1 min.,

Vibration Resistance

5-500 Hz, 10G's

Shock Resistance

60G, impact shock (non-monitored)

Acceleration

60G (monitored)

Weight (Average)

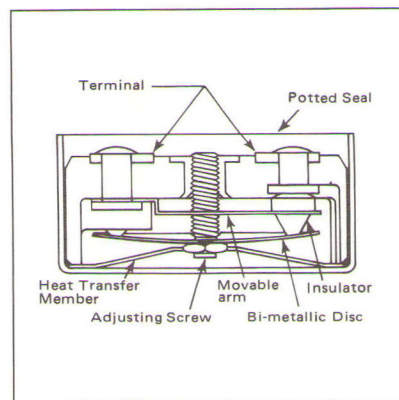
3.5 grams

***Example:** If closing temperature of 100°F is selected and close on rise operation is selected then the thermostat will close between 96° and 104°F. Each thermostat will open 2°-5°F *below* the actual closing temperature of that thermostat.

Note: If open on rise operation is selected then the thermostat will close between 96° and 104°F. Each thermostat will open 2°-5°F *above* the actual closing temperature of that thermostat.

Temperature Exposure

In general, temperature exposure limits are -65° to +275°F continuous with momentary overrides to 325°F permissible. Due to design characteristics, however, thermostats should not be subjected to temperature overrides of 100°F above operating temperature for close on rise devices or 100°F below operating temperature for open on rise devices



Calibration

Temperature settings, nominal differentials and tolerances on closing temperatures are available as shown in the table below. If settings, tolerances, or differentials other than shown are wanted, please consult factory.

Temperature (Use table below for common operating temperatures).

Ambient Temperature range:

-65°F to +275°F (-53.9°C to 135°C) continuous

Operating temperature

Temperature at which normally closed contacts open or normally open contacts close.

Tolerance

Allowable range above and below setpoint and reset temperatures.

Differential

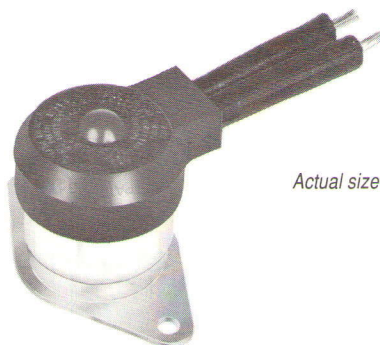
Subtract the differential from the operating temperature to determine the temperature at which the contacts will return to the normal position (reset temperature).

Closing Temperature Table*

Closing Temperature		Differential		Tolerance		Closing Temperature		Differential		Tolerance	
°F	°C	°F	°C	±°F	±°C	°F	°C	°F	°C	±°F	±°C
0	-17.8	2 to 5	1.1 to 2.8	4	2.2	140	60.0	2 to 5	1.1 to 2.8	4	2.2
10	-12.2	2 to 5	1.1 to 2.8	4	2.2	150	65.6	2 to 5	1.1 to 2.8	4	2.2
20	-6.7	2 to 5	1.1 to 2.8	4	2.2	160	71.1	2 to 5	1.1 to 2.8	4	2.2
30	-1.1	2 to 5	1.1 to 2.8	4	2.2	170	76.7	2 to 5	1.1 to 2.8	4	2.2
40	4.4	2 to 5	1.1 to 2.8	4	2.2	180	82.2	2 to 5	1.1 to 2.8	4	2.2
50	10.0	2 to 5	1.1 to 2.8	4	2.2	190	87.8	2 to 5	1.1 to 2.8	4	2.2
60	15.6	2 to 5	1.1 to 2.8	4	2.2	200	93.3	2 to 5	1.1 to 2.8	4	2.2
70	21.1	2 to 5	1.1 to 2.8	4	2.2	210	98.9	2 to 5	1.1 to 2.8	4	2.2
80	26.7	2 to 5	1.1 to 2.8	4	2.2	220	104.4	2 to 5	1.1 to 2.8	4	2.2
90	32.2	2 to 5	1.1 to 2.8	4	2.2	230	110.0	2 to 5	1.1 to 2.8	4	2.2
100	37.8	2 to 5	1.1 to 2.8	4	2.2	240	115.6	2 to 5	1.1 to 2.8	4	2.2
110	43.3	2 to 5	1.1 to 2.8	4	2.2	250	121.1	2 to 5	1.1 to 2.8	4	2.2
120	48.9	2 to 5	1.1 to 2.8	4	2.2	260	126.7	3 to 7	1.7 to 3.9	5	2.8
130	54.4	2 to 5	1.1 to 2.8	4	2.2	275	135.0	3 to 7	1.7 to 3.9	5	2.8

4391 Series Hermetically Sealed

- Snap-action switching
- Normally open or normally closed
- Automatic or manual reset
- SPST or SPDT
- Overmold optional



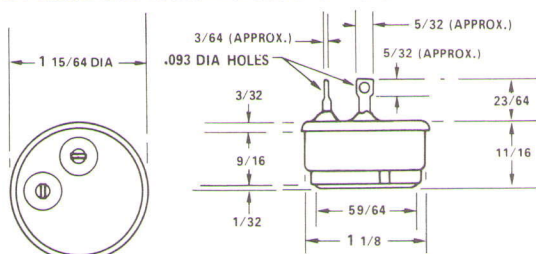
Actual size



Dimensional Drawings of Basic Design

Other variations are available - dimensions in inches

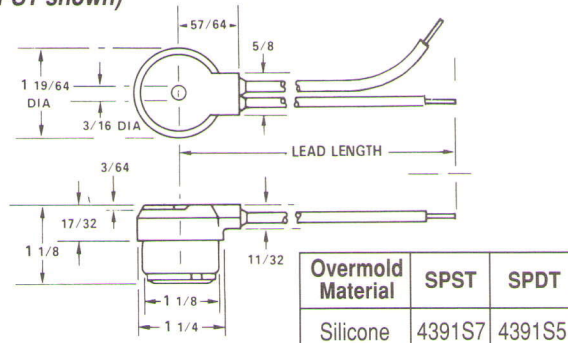
4391-8 Style SPST automatic reset without overmold



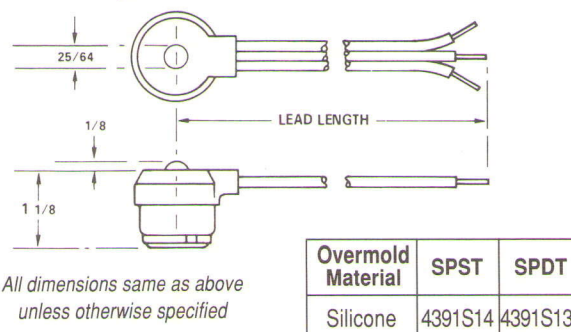
4391-6 Style SPDT automatic reset without overmold



Automatic reset with overmold (SPST shown)

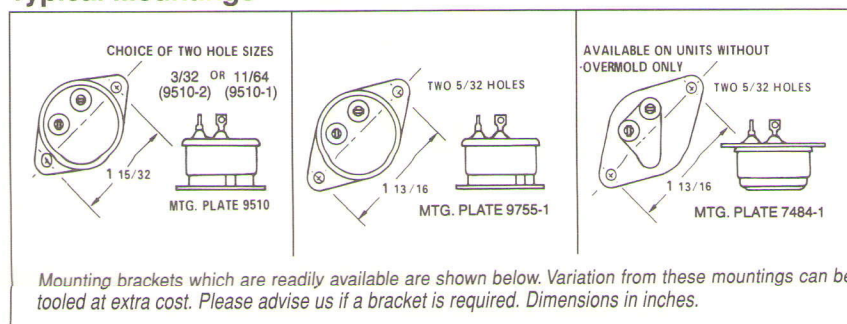


Manual reset with overmold (SPDT shown)



All dimensions same as above unless otherwise specified

Typical Mountings



Performance Characteristics

Switch Action

SPST or SPDT (snap-action)

Contact Ratings

(Resistive, Automatic Reset)

30 VAC/DC	125 VAC	250 VAC	Life Cycles
Amperes			
10	4	2	100,000
11	6	3	50,000
12	8	4	25,000
13	10	5	10,000
14	12	6	5,000

Based on standard differential

Dielectric Strength

1250 VAC, rms, 60 Cycles for 1 min.
(1500 VAC rms available on special request)

Vibration Resistance

Standard construction
5-500 Hz, 3G's
High vibration construction
5-500 Hz, 5G's

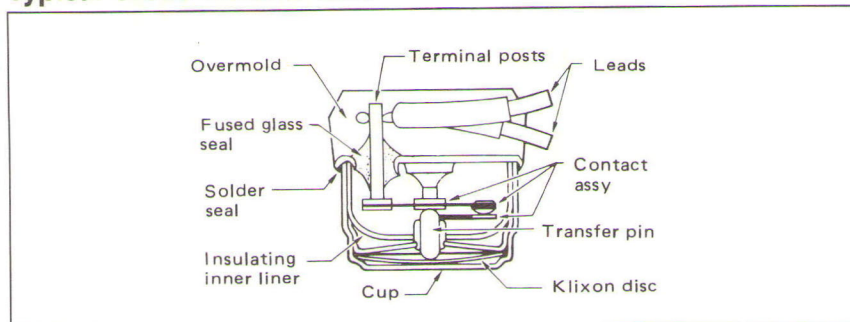
Hermeticity

1 X 10⁻⁵ atm cc/sec. max.

Weight

Without overmold..... 21 grams
With overmold 56 grams

Typical Cross Section View



Temperature (Use table below for common operating temperatures).

Ambient Temperature:

Non-overmold -65°F to +450°F

Silicone overmold -60°F to +400°F

Operating temperature

Temperature at which normally closed contacts open or normally open contacts close.

Tolerance

Allowable range above and below setpoint and reset temperatures.

Differential

Subtract the differential from the operating temperature to determine the temperature at which the contacts will return to the normal position (reset temperature).

SPST Standard Vibration Resistance

Operating Temperature		Differential		Tolerance	
°F	°C	°F	°C	±°F	±°C
0	-17.8	15	8.3	5	2.8
10	-12.2	15	8.3	5	2.8
20	-6.7	15	8.3	5	2.8
30	-1.1	15	8.3	5	2.8
40	4.4	15	8.3	5	2.8
50	10.0	15	8.3	5	2.8
60	15.6	15	8.3	5	2.8
70	21.1	15	8.3	5	2.8
80	26.7	15	8.3	5	2.8
90	32.2	15	8.3	5	2.8
100	37.8	15	8.3	5	2.8

Consult factory if desired operating temperature does not appear in the table.

Operating Temperature		Differential		Tolerance	
°F	°C	°F	°C	±°F	±°C
110	43.8	15	8.3	5	2.8
120	48.9	15	8.3	5	2.8
130	54.4	15	8.3	5	2.8
140	60.0	15	8.3	5	2.8
150	65.6	15	8.3	5	2.8
160	71.1	15	8.3	5	2.8
170	76.7	15	8.3	5	2.8
180	82.2	15	8.3	5	2.8
190	87.8	15	8.3	5	2.8
200	93.3	15	8.3	5	2.8
210	98.9	25	13.9	7	3.9

Operating Temperature		Differential		Tolerance	
°F	°C	°F	°C	±°F	±°C
220	104.4	25	13.9	7	3.9
240	115.6	25	13.9	7	3.9
260	126.7	25	13.9	7	3.9
280	137.8	25	13.9	7	3.9
300	148.9	25	13.9	7	3.9
325	162.8	45	25.0	12	6.7
350	176.7	45	25.0	12	6.7
* 375	190.6	60	33.3	15	8.3
* 400	204.4	60	33.3	15	8.3
* 425	218.3	60	33.3	15	8.3
* 450	232.2	60	33.3	15	8.3

* = Available in automatic reset only.

SPDT & High Vibration Resistance

Operating Temperature		Differential		Tolerance	
°F	°C	°F	°C	±°F	±°C
0	-17.8	25	13.9	8	4.4
10	-12.2	25	13.9	8	4.4
20	-6.7	25	13.9	8	4.4
30	-1.1	25	13.9	8	4.4
40	4.4	25	13.9	8	4.4
50	10.0	25	13.9	8	4.4
60	15.6	25	13.9	8	4.4
70	21.1	25	13.9	8	4.4
80	26.7	25	13.9	8	4.4
90	32.2	25	13.9	8	4.4
100	37.8	25	13.9	8	4.4

Consult factory if desired operating temperature does not appear in the table.

Operating Temperature		Differential		Tolerance	
°F	°C	°F	°C	±°F	±°C
110	43.8	25	13.9	8	4.4
120	48.9	25	13.9	8	4.4
130	54.4	25	13.9	8	4.4
140	60.0	25	13.9	8	4.4
150	65.6	25	13.9	8	4.4
160	71.1	25	13.9	8	4.4
170	76.7	25	13.9	8	4.4
180	82.2	25	13.9	8	4.4
190	87.8	25	13.9	8	4.4
200	93.3	25	13.9	8	4.4
210	98.9	30	16.7	10	5.6

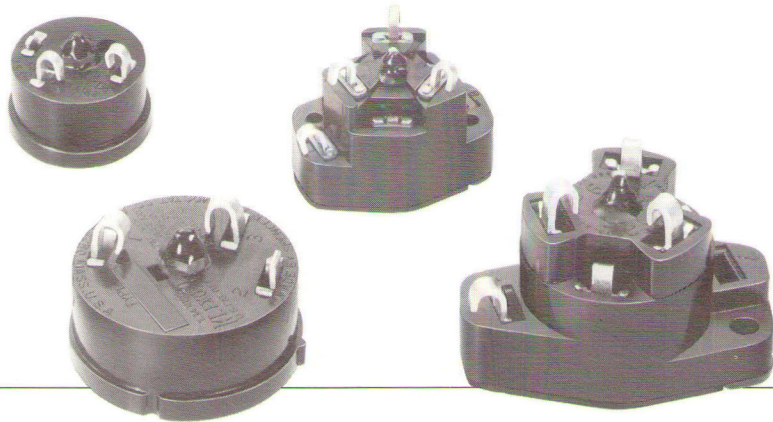
Operating Temperature		Differential		Tolerance	
°F	°C	°F	°C	±°F	±°C
220	104.4	30	16.7	10	5.6
240	115.6	30	16.7	10	5.6
260	126.7	30	16.7	10	5.6
280	137.8	30	16.7	10	5.6
300	148.9	30	16.7	10	5.6
325	162.8	45	25.0	12	6.7
350	176.7	45	25.0	12	6.7
* 375	190.6	60	33.3	15	8.3
* 400	204.4	60	33.3	15	8.3
* 425	218.3	60	33.3	15	8.3
* 450	232.2	60	33.3	15	8.3

* = Available in automatic reset only.

Motor Protectors

Aircraft Single Phase and Three Phase

- Complete motor analog
- Locked rotor protection
- Ultimate trip protection
- Neutral tap
- Meets the thermal protection requirements of MIL-M-7969, direct acting type, Method III



Klixon inherent motor protection for aircraft prevents hazards beyond the control of the manufacturer such as sustained overload and excessive temperatures. Since the protecting devices are sensitive to both temperature and current, they protect against a variety of abnormal conditions while allowing maximum motor output before shutdown. Motor life is extended by limiting damaging temperatures to the designed level.

Description

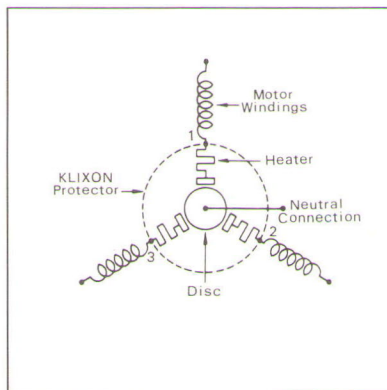
The inherent protector is basically a bimetallic thermostat with a built-in heating element, installed in series with the motor winding.

The actuating element of the protector is the Klixon snap-acting thermal disc. The built-in heaters simulate winding temperatures caused by increases in current. The protector provides crisp, positive switching when the specified trip current is sustained for a specified duration, at room temperature. The device will also actuate with an excessive ambi-

ent temperature condition. Alone, the disc protects against excessive ambient temperature and the heaters protect against excessive current increases as experienced during locked rotor conditions. Together, the heaters and disc protect against any combination of overload and ambient conditions.

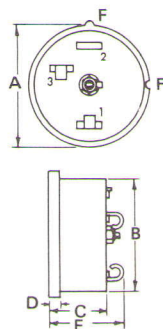
Standard ratings are available in approximately 5% current steps at ultimate trip for motors with maximum allowable temperatures of 120°C, 150°C, 175°C and 200°C. Maximum current is based on 28 VDC or 120 VAC.

A proper application can be made only by acquiring test samples from the factory.



Single Phase Motor Protectors

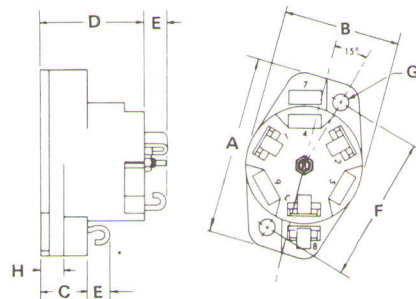
Open Type



	SKA	MKA	KA
Approx. Weight (ounces)	.125	.250	.500
Maximum Capacity	16 amps	50 amps*	100 amps*
A (max dia)	.688	.937	1.218
B (dia)	.638	.876	1.156
C	.344	.420	.500
D	.093	.093	.125
E (max)	.520	.625	.750
F (radius)	.035	.035	.035

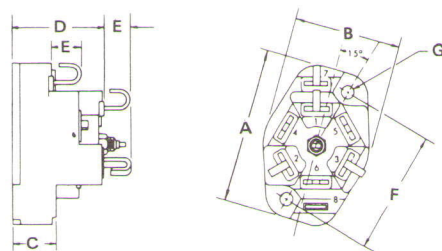
Three Phase Motor Protectors

Types BJE & MJE



	BJE	MJE
Approx. Weight (ounces)	2.750	.625
Maximum Capacity	120 amps*	60 amps*
A (max)	2.457	1.635
B (max)	1.565	.975
C	.609	.390
D (max)	1.380	.863
E (max)	.312	.188
F	1.937	1.312
G (dia)	.218	.152
H	.250	.250

Type SJE



Approx. Weight (ounces)	.375
Maximum Capacity	30 amps*
A (max)	1.072
B (max)	.735
C	.298
D	.630
E (max)	.165
F	.812
G (dia)	.090
H	—

All dimensions Nominal / in inches

*Actual device may vary. Consult factory.

CSA/UL/VDE Registered Devices

	Agency	File #	Max Voltage	Max Current (non-inductive)	Max Temperature	
					(deg-F)	(deg-C)
4344	UL	E34618	120 VAC	2.5 A	450	232.2
	UL	E34618	240 VAC	2.5 A	450	232.2
	CSA	LR24458	120 VAC	2.5 A	450*	232.2
4344 Packages	UL	E34618	120 VAC	2.5 A	392	200.0
	CSA	LR24458	120 VAC	2.5 A	392	200.0
6786	UL	E34618	120 VAC	2.5 A	302	150.0
	CSA	LR24458	120 VAC	2.5 A	302	150.0
7BT	UL	E34618	120 VAC	15 A	302	150.0
	UL	E34618	240 VAC	10 A	302	150.0
	UL	E34618	277 VAC	7.5 A	302	150.0
	CSA	LR24458	120 VAC	10 A	302	150.0
	CSA	LR24458	240 VAC	7.5 A	302	150.0
	VDE	4464.4-451-1/A-1	250 VAC	10 A	302	150.0

*450°F (No overmold)

105°F (Overmold)

Definitions

Automatic Reset

A type of thermostat that will reset itself at a specific temperature (setpoint - differential = reset temperature).

Bimetal Disc

The mechanism that opens or closes the electrical contacts. It consists of two dissimilar metals bonded together then formed with a specific curvature. When heated, the internal stresses of the bimetal cause the disc to reverse its curvature with a snap-action at a fixed, preset temperature and operate the electrical contacts.

A decrease in the ambient temperature below the reset temperature of the disc relieves the internal stresses in the disc. The disc returns to its normal curvature and the contacts assume their normal operating position.

Close on Rise

When the operating temperature is reached, electrical contacts close to complete the circuit. Also referred to as a Fan Type Device.

Contact Resistance

The electrical resistance of a pair of closed contacts, measured between switch terminals.

Dielectric Strength

Device's ability to withstand a deliberate application of a pre-determined over-voltage for a specified time.

Differential

The delta between operating temperature and reset temperature.

Insulation Resistance

Measures the resistance of the insulating member of the device to a direct voltage.

Open on Rise

When operating temperature is reached, electrical contacts open to break the circuit. Also referred to as a Limit Device.

Set Point

Operating temperature: temperature at which the disc changes its curvature ("snaps") to open or close electrical contacts.

SPDT

Single pole / double throw: an electrical switch capable of controlling two different circuits.

SPST

Single pole / single throw: an electrical switch with one set of terminals that terminate or actuate a single circuit.

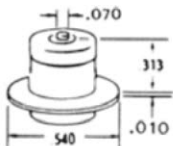
Tolerance

The allowable range above or below the set point or reset temperature.

Klixon® AT Basic Switch Package Designs

- Available in a wide variety of packaging styles
- Custom packaging is available to suit your needs, whatever they may be

Listed below is information about of our most popular device in this category.

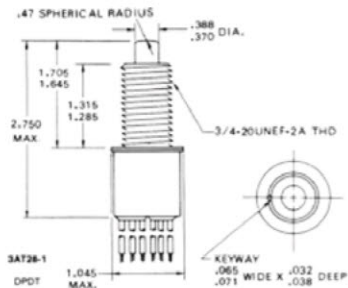


Part Numbers	Typical Actuation Characteristics
AT373	Maximum Actuating Force (STP) 30 oz.
3AT46	Minimum Release Force (STP) 4 oz.
4AT48	Plunger Seal No
10AT15	Maximum Pretravel .009 inch
AT362	Maximum Movement Differential .005 inch
3AT48	Minimum Overtravel .003 inch
4AT64	Positive Overtravel Stop No
10AT17	Maximum Force on Actuator 5 lb.
Pictured: A104 3AT47 4AT49 10AT124	

Klixon® AT High Temperature Package Designs

- Available in a wide variety of packaging styles
- Packaging options are available for one, two, or multiple poles
- Custom packaging is available to suit your needs, whatever they may be

Listed below is information about a popular device in this category.

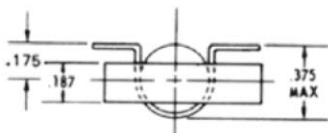
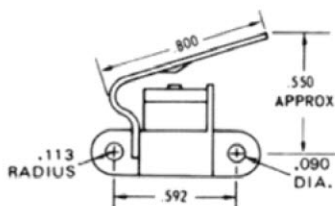


Part Numbers	Typical High Temperature Designs	
Pictured: 3AT28-1	3AT69-3	SPDT Hardware supplied: Two hex nuts only Leads: AWG #18 per MIL-W-83181
	3AT28-1 (shown)	DPDT Hardware supplied: Two hex nuts (drilled), one internal tooth washer, one keyway washer Leads: AWG #18 per MIL-C-25038
	3AT51-2	DPST Hardware supplied: Two hex nuts (drilled), one internal tooth washer, one keyway washer Leads: AWG #18 per MIL-W-25038 with TFE coated jacket Temperature range: -40°F to 500°F

Klixon® AT Leaf Actuated Package Designs

- Available in a wide variety of packaging styles
- Packaging options are available for one, two, or multiple poles
- Custom packaging is available to suit your needs, whatever they may be

Listed below is information about a popular device in this category.

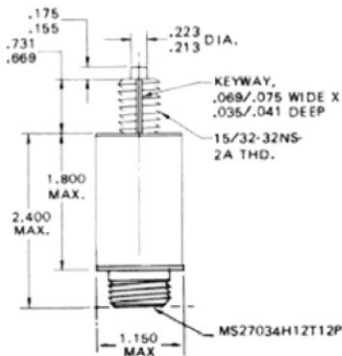


Part Numbers	Typical Actuation Characteristics
AT292	Maximum Actuating Force (STP) 24 oz.
AT290	
3AT41	Minimum Release Force (STP) 1 oz.
4AT44	
4AT46	Plunger Seal No
10AT31	
10AT28	Maximum Pretravel .250 inch
3AT43	Maximum Movement Differential .050 inch
Pictured:	
AT289	Minimum Overtravel .015 inch
AT291	Positive Overtravel Stop Yes
3AT40	
3AT42	Maximum Force on Actuator 5 lb.
3AT43	
4AT45	
10AT27	
10AT30	

Klixon® AT Two-Pole, Three-Pole, and Four-Pole Package Designs

- Available in a wide variety of packaging styles
- Packaging options are available for one, two, or multiple poles
- Custom packaging is available to suit your needs, whatever they may be

Listed below is information about a popular device in this category.

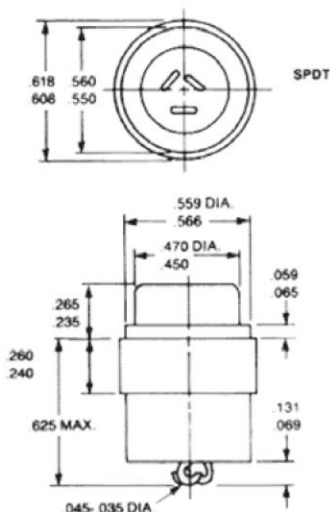


Part Numbers	Typical Actuation Characteristics			
AT409 10AT375 AT408 10AT374	Typical Actuation Characteristics	AT	10AT	
	Maximum Actuating Force (STP)	10 lb.	10 lb.	<i>Klixon can provide connectors to meet any customer application need. Contact Sensata Technologies for details to customize a switch.</i>
Pictured:	Minimum Release Force (STP)	1 lb.	1 lb.	
AT410-1	Button Seal / MIL-PLF-8805	Yes	Yes	
10AT383-1	Maximum Pretravel	.030 inch	.030 inch	
10AT453-1	Maximum Movement Differential	.020 inch	.020 inch	
	Minimum Overtravel	.200 inch	.125 inch	
	Positive Overtravel Stop	Yes	Yes	
	Maximum Force on Actuator	30 lb.	30 lb.	

Klixon® AT Pushbutton Package Designs

- Available in a wide variety of packaging styles
- Packaging options are available for one, two, or multiple poles
- Custom packaging is available to suit your needs, whatever they may be

Klixon



Part Numbers	Typical Actuation Characteristics			
AT390 10AT421	Typical Actuation Characteristics	SPDT	DPDT	These pushbutton switches are designed to be thumb or finger actuated. A variety of panel or other mounting means are available.
	Maximum Actuating Force (STP)	40 oz.	8 oz.	
	Minimum Release Force (STP)	- - -	1 lb.	
	Button Seal / MIL-PLF-8805	- - -	- - -	
	Maximum Pretravel	.040 inch	.020 inch	
	Maximum Movement Differential	- - -	.010 inch	
	Minimum Overtravel	- - -	.200 inch	
	Positive Overtravel Stop	No	No	
	Maximum Force on Actuator	25 lb.	30 lb.	

Klixon® AT One-Pole and Two-Pole Side Plate Package Designs

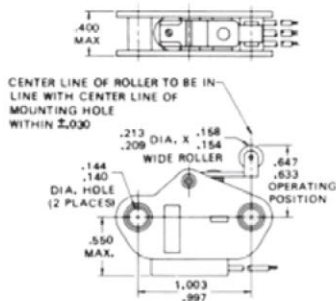
- Available in a wide variety of packaging styles
- Packaging options are available for one, two, or multiple poles
- Custom packaging is available to suit your needs, whatever they may be



Listed below is information about three popular devices in this category. *Please scroll down.*

Typical One and Two Pole Side Plate Package Designs

AT355
10AT313



Typical Actuation Characteristics

Maximum Actuating Force (STP) 24 oz.

Minimum Release Force (STP) 4 oz.

Plunger Seal - - -

Maximum Pretravel .040 inch

Maximum Movement .030 inch
Differential

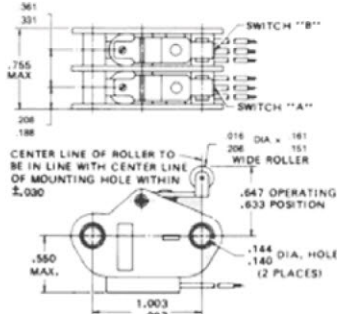
Minimum Overtravel .125 inch

Positive Overtravel Stop No

Maximum Force on Actuator 10 lb.

Leads can be configured to exit a side plate package in any direction. Contact Sensata Technologies for configurations other than those shown.

AT357
10AT315



Typical Actuation Characteristics

Maximum Actuating Force (STP) 24 oz.

Minimum Release Force (STP) 4 oz.

Plunger Seal - - -

Maximum Pretravel .040 inch

Maximum Movement Differential .030 inch

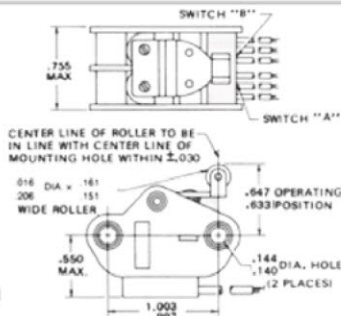
Minimum Overtravel .125 inch

Positive Overtravel Stop No

Maximum Force on Actuator 10 lb.

Leads can be configured to exit a side plate package in any direction. Contact Sensata Technologies for configurations other than those shown.

AT356
10AT314



Typical Actuation Characteristics

Maximum Actuating Force (STP) 48 oz.

Minimum Release Force (STP) 4 oz.

Plunger Seal - - -

Maximum Pretravel .040 inch

Maximum Movement Differential .040 inch

Minimum Overtravel .125 inch

Positive Overtravel Stop No

Maximum Force on Actuator 10 lb.

Leads can be configured to exit a side plate package in any direction. Contact Sensata Technologies for configurations other than those shown.

Klixon® AT Single-Pole Package Designs

- Available in a wide variety of packaging styles
- Packaging options are available for one, two, or multiple poles
- Custom packaging is available to suit your needs, whatever they may be

Listed below is information about popular devices in this category.



Single-Pole, Flange Mounted Package Designs	
10AT377 10AT378	Typical Actuation Characteristics Maximum Actuating Force (STP) 7 lb. Minimum Release Force (STP) 1 lb. Button Seal / MIL-PLF-8805 Yes Maximum Pretravel .040 inch Maximum Movement Differential .010 inch Minimum Overtravel .080 inch Positive Overtravel Stop Yes Maximum Force on Actuator 30 lb.

Single-Pole, Unsealed Button Package Designs			
<div>AT414</div> <div>AT415</div> <div>10AT384</div> <div>10AT385</div> <div>AT395</div> <div>AT396</div> <div>10AT363</div> <div>10AT364</div> <div><div>Pictured:</div><div>AT344</div><div>AT394</div><div>10AT361</div><div>10AT362</div></div>			
<div>Typical Actuation Characteristics</div>	<div>AT</div>	<div>10AT</div>	<div>All switches are hermetically sealed at the basic switch. The button assembly is not sealed.</div>
Maximum Actuating Force (STP)	20 oz.	30 oz.	
Minimum Release Force (STP)	1 oz.	4 oz.	
Plunger Seal	No	No	
Maximum Pretravel	.010 inch	.010 inch	
Maximum Movement Differential	.005 inch	.005 inch	
Minimum Overtravel	.125 inch	.125 inch	
Positive Overtravel Stop	No	No	
Maximum Force on Actuator	10 lb.	10 lb.	

Klixon® AT Typical Ordnance Package Designs



- Available in a wide variety of packaging styles
- Packaging options are available for one, two, or multiple poles
- Custom packaging is available to suit your needs, whatever they may be

Listed below is information about two popular devices in this category.

NOTE: **N.O. = Normally Open**

Part Numbers	Typical Actuation Characteristics		
10AT340-7 10AT468-1	Typical Actuation Characteristics	10AT340-7	10AT468-1
	Contact Form	SPDT	SPDT-N.O., grounded
	Lead Length	24 inches	18 inches
	Weight	3.2 oz.	2.6 oz.
	Maximum Actuating Force (STP)	5.25 lb.	6.25 lb.
	Minimum Release Force (STP)	1 lb.	1.5 lb.
	Button Seal / MIL-PLF-8805	- - -	- - -
	Maximum Pretravel	.015 inch	.020 inch
	Maximum Movement Differential	.020 inch	.010 inch
	Minimum Overtravel	.250 inch	.065 inch
	Positive Overtravel Stop	Yes	Yes
	Maximum Force on Actuator	30 lb.	30 lb.

There are numerous configurations available to suit any ordnance or safety circuit application that you may encounter. Contact Sensata Technologies for further information.

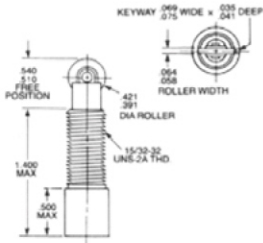
Single-Pole, Sealed Button Package Designs

AT269
10AT76
AT268
10AT7

Photo Unavailable

Single-Pole, Threaded Body, Sealed and Unsealed Button Package Designs

AT400
AT401
AT404
10AT366
10AT367
10AT369
10AT370
AT402
AT405
10AT368
10AT371



Typical Actuation Characteristics

Unsealed
AT

Sealed
AT

Unsealed
10AT

Sealed
10AT

Maximum Actuating Force (STP)

20 lb.

6.5 lb.

30 lb.

7 lb.

Minimum Release Force (STP)

1 oz.

1.5 oz.

4 oz.

1.5 oz.

Button Seal / MIL-PLF-8805

No

Yes

No

Yes

Maximum Pretravel

.010 inch

.020 inch

.010 inch

.020 inch

Maximum Movement
Differential

.005 inch

.005 inch

.005 inch

.005 inch

Minimum Overtravel

.125 inch

.125 inch

.125 inch

.125 inch

Positive Overtravel Stop

Yes

Yes

Yes

Yes

Maximum Force on Actuator

30 lb.

30 lb.

30 lb.

30 lb.

Klixon® KX Series Switch Packages

Sensata Technologies success in the switch business has been directly related to superior basic switch designs and innovative switch packaging capabilities.

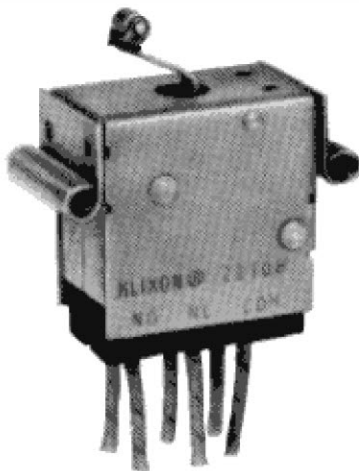
Klixon KX switches can be packaged in single- or multi-pole configurations to meet a variety of application requirements.

Sensata offers six standard actuators which can be used with any of our basic KX switches. *(Scroll down to view images of five of them.)*

All of the Klixon switches which have been commercially designed are commercially available as catalog items. Space does not permit us to show the number and variety of switches that have been designed and manufactured. We do offer a variety of custom designs which can be tailored to fit specific application requirements, including:

- Available in single- or multi-pole configurations
- Six standard actuator types
- Custom designs available for specific application requirements

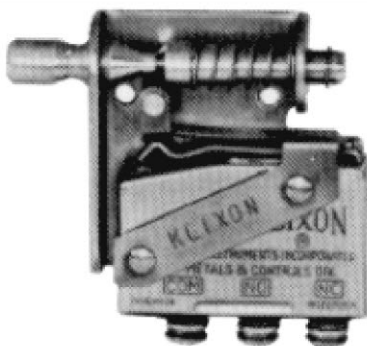
DP Roller-Leaf Side Mounted Switch Part #21682-1



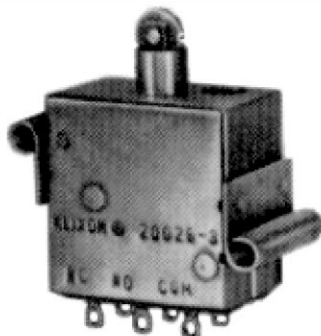
DP Plunger Actuated Switch Part #21611



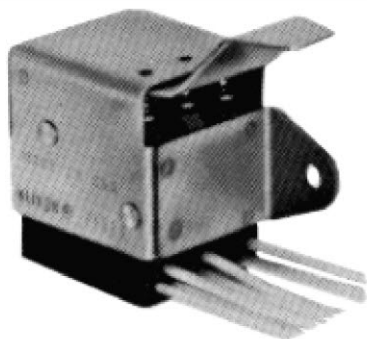
SP Panel Interlock Switch Part #21679



DP Roller-Plunger Side Mounted Switch Part #21674-1



3P Flapper Actuated Side Mounted Switch Part #21320



Actuators for the Klixon® KX Series Sine Switch

- Stainless steel
- Constructed to withstand exposure to very high temperature
- Rugged, dependable, and designed for long life
- Auxiliary roller leaf, roller, toggle, and neck mounted pushbutton actuators providing additional overtravel are available
- Potted leads can be supplied
- Six standard actuator types (*scroll to bottom for images*)

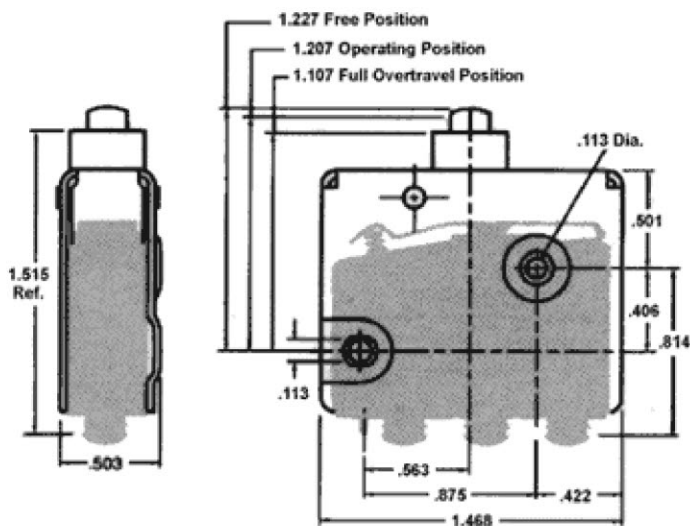
All actuators are made entirely of stainless steel and are capable of withstanding exposure to very high temperatures.

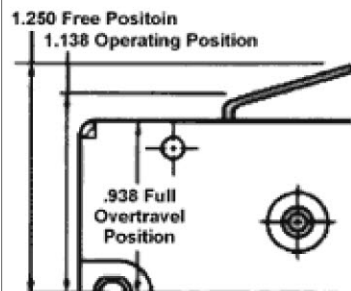
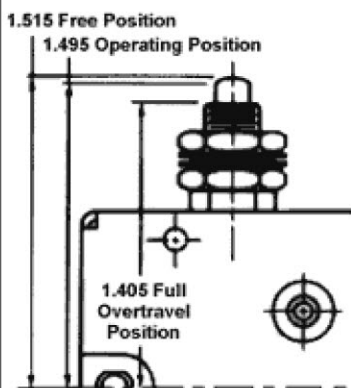
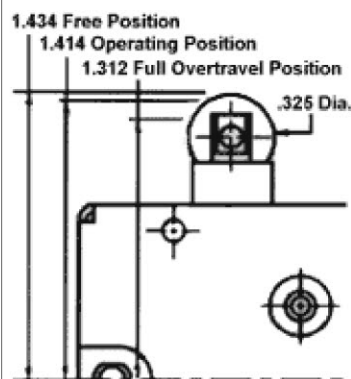
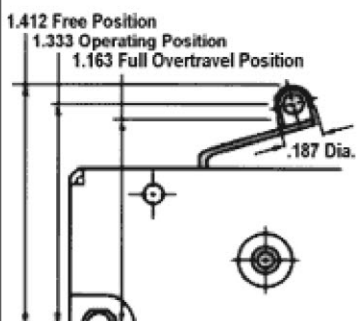
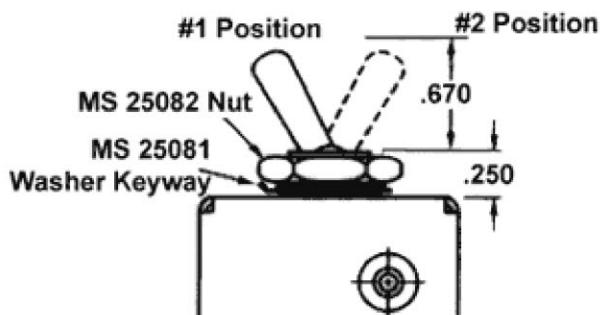
They are constructed with rugged, positive stops and dependable, long-life torsional springs. The basic design provides a stop for the actuator or plunger.

All actuators shown can be used with any KX4-1 or KX5-1 series switch. KX5-2 series switches require actuators with higher actuating force.

Important: When using one of the C9600 series actuators with a KX switch, refer to the terminal nomenclature stamped on the actuator housing.

C9614-1 Plunger Actuator



C9617-1 Leaf Actuator**C9616-2 Roller Plunger Actuator****C9616-1 Roller Leaf Actuator****C9616-1 Plunger Actuator****21100-1 Toggle Actuator**

Klixon® KX Series Sine Switch Performance Characteristics

	Resilient Standard Temp.	Hermetic Standard Temp.	Hermetic High Temp.
	KX4-1-1 KX4-1-2	KX5-1-1 KX5-1-2	KX5-2-1 KX5-2-2
Actuating Force	8 - 24 oz.	8 - 24 oz.	16 - 48 oz.
Release Force	3.0 oz. min.	3.0 oz. min.	3.0 oz. min.
Pretravel	0.025" max.	0.025" max.	0.035" max.
Movement Differential	0.020" max.	0.020" max.	0.024" max.
Overtravel	0.015" max.	0.015" max.	0.015" max.
Positive, Overtravel Stop	Yes	Yes	Yes
Max. Allowable Force on Actuator	25 lbs. max.	25 lbs. max.	25 lbs. max.
Ambient Temperature Range	-65°F to +160°F (-53.8°C to +71.1°C)	-65°F to +275°F (-53.8°C to +135°C)	-65°F to +375°F (-53.8°C to +190.5°C)
Current Rating 28 VDC 110 VAC, 60-400Hz	Res Ind. Lamp 10 5 3 10 5 3	Res Ind. Lamp 10 5 3 10 5 3	Res Ind. Lamp 5 3 2 5 3 2
Life at Rated Load	25,000 cycles	25,000 cycles	25,000 cycles
Vibration Resistance MIL-STD-202, test condition D	20 G	20 G	20 G
Shock Resistance ½ sine wave, 11ms duration	100 G w/o damage	100 G w/o damage	100 G w/o damage
Dielectric Strength	1250 VRMS	1250 VRMS	1250 VRMS
Contact Arrangement	SPDT	SPDT	SPDT
Backfill	n/a	Dry nitrogen	Dry nitrogen
Seal MIL-S-8805	Enclosure 4, *Resilient	Enclosure 5, **Hermetic	Enclosure 5, **Hermetic
Weight	1.0 oz. max.	1.1 oz. max.	1.2 oz. max.
	KX4-1-1 KX4-1-2	KX5-1-1 KX5-1-2	KX5-2-1 KX5-2-2
	Resilient Standard Temp.	Hermetic Standard Temp.	Hermetic High Temp.