Texas Instruments Precision Thermostats

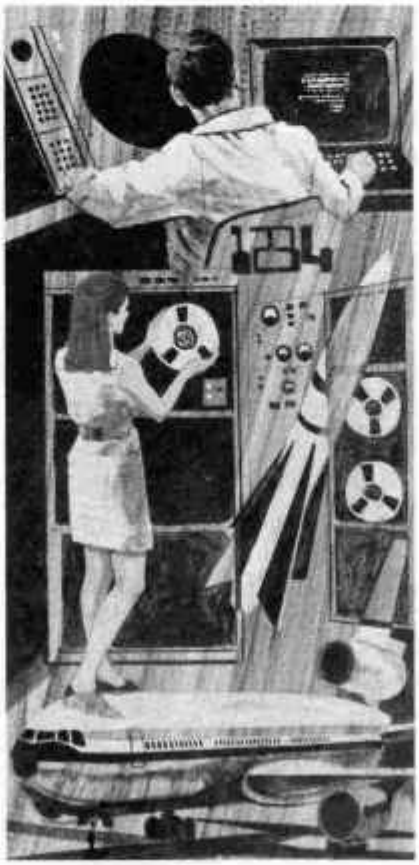
- Fast, snap-action switching
- Preset, nonadjustable calibration
- High reliability, long life
- Complete line
- In-house packaging capability

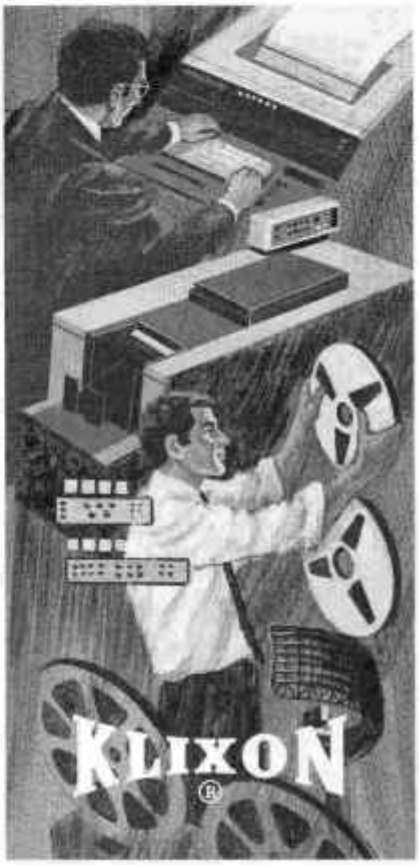
Texas Instruments line of KLIXON Precision Thermostats offers the designer a complete selection of high reliability, preset thermal switches for a wide range of temperature sensing or control applications.

The temperature sensitive element of these switches is a bimetallic, snap-acting disc. As the temperature reaches a predetermined calibration point, the disc snaps to its reverse curvature, producing the crisp, positive switching action inherent in KLIXON thermostats. This feature - - not available in slow make-and-break switches - - assures reliable, consistent operation over long cycle life, provides exceptional resistance to shock and vibration with a minimum of electromagnetic interference.

To simplify selection, the precision thermostats illustrated on the next page are grouped into categories based on temperature differentials and applications. For detailed information on a specific switch, refer to the data sheet indicated.

Texas Instruments application engineers can apply more than 50 years of precision thermostat experience to your individual thermal control needs, combining optimum performance and packaging characteristics - - standard or custom - - to meet your specific design requirements.





STANDARD DIFFERENTIAL*

M1/11041 Series
- 7 amp rating
- SPST
- Hermetically sealed
- Aerospace reliability
- Qualified to MIL-S-24236/1
- See Publication 158

4344 Series
- 7 amp rating
- SPST
- Hermetically sealed
- U/L recognized
- See publication 267

TINY STAT Series
- 1 amp rating
- SPST
- Hermetically sealed
- Subminiature size
- Extremely fast thermal response
- Qualified to MIL-S-24236/ 13, /14, & /19
- See publication 272

Insulated Version

6786 Series
- 7 amp rating
- SPST
- Environmentally sealed
- Low profile
- See publication 226

5BT Series
- 3 amp rating
- SPDT
- Hermetically sealed
- Qualified to MIL-S-24236/24
- See publication 274

7BT Series
- 15 amp rating
- SPST
- Environmentally sealed
- U/L recognized
- VDE recognized
- See publication 319

4391 Series
- 14 amp rating
- SPST or SPDT
- Hermetically sealed
- Manual reset available
- U/L recognized
- See Publication 268

NARROW DIFFERENTIAL*

M2 Series
- 4 amp rating
- SPST
- Hermetically sealed
- Aerospace reliability
- Qualified to MIL-S-24236/20
- See publication 271

4286 Series
- 4 amp rating
- SPST
- Environmentally sealed
- See publication 269

SPECIAL APPLICATIONS

2862 Series
- Three phase switching
- See publication 270

AIRCRAFT MOTOR PROTECTORS
- Single phase or three phase
- Neutral tap
- Current and/or temperature protection
- See publication 314

4PT Series
- Extremely fast response
- Up to 600° F
- See publication 275

PROBE THERMOSTATS
- Many configurations
- Qualified to MIL-S-24236
- See publication 273

CUSTOM PACKAGES
Application engineering aid is at your disposal to design and manufacture a custom package if the standard configurations do not satisfy your requirements.

* Differential is the difference between opening and closing temperatures

NOTE:
ALL PHOTOS ON THIS PAGE SHOWN ACTUAL SIZE.

For further information write or call:

TEXAS INSTRUMENTS INCORPORATED
PRECISION CONTROLS MS 12 - 33
ATTLEBORO, MASSACHUSETTS 02703
TELEPHONE (617) 222-2800

TEXAS INSTRUMENTS
INCORPORATED

Printed in U.S.A.
Reprinted 11-78 5K

KLIXON®

PRECISION THERMOSTATS

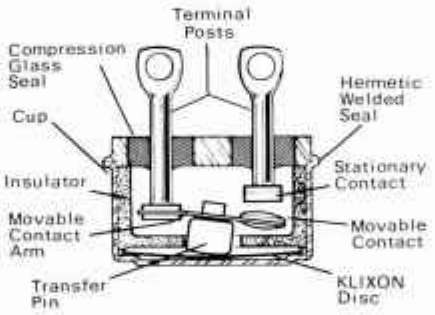
4344 SERIES
WELDED, HERMETIC SEAL

- Snap-action switching
- Single pole, single throw
- Preset, non-adjustable calibration
- Normally open or normally closed
- UL recognized file #E34618

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 platings are available, including cadmium and tin. Gold plated contacts can be supplied for low wattage conditions. The more common mounting configurations are shown. 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. Applications engineering aid is readily available.

TYPICAL CROSS SECTION VIEW



CONTACT RATINGS (Resistive)

30 v-ac/dc	125 v-ac	250 v-ac	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

Electrical loads above 5 amps produce some internal heating. The effect on temperature settings varies with the usage and should be checked on critical applications.

Actual Size

PERFORMANCE CHARACTERISTICS

Dielectric strength . . . 1250 vac, rms, 60 cycles for 1 min., terminal to case; per MIL-STD-202, Method 301

Calibration . . . See temperature settings table

Differential . . . See temperature settings table

Switch action . . . SPST, (snap-action)

Ambient temperature range . . . –80° F to +550° F

Life cycle . . . See contact ratings table

Contact resistance . . . 0.050 ohms max. per MIL-STD-202, Method 307

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

Vibration resistance . . . 5-2000 cps, 20G, per MIL-STD-202, Method 204, Condition D

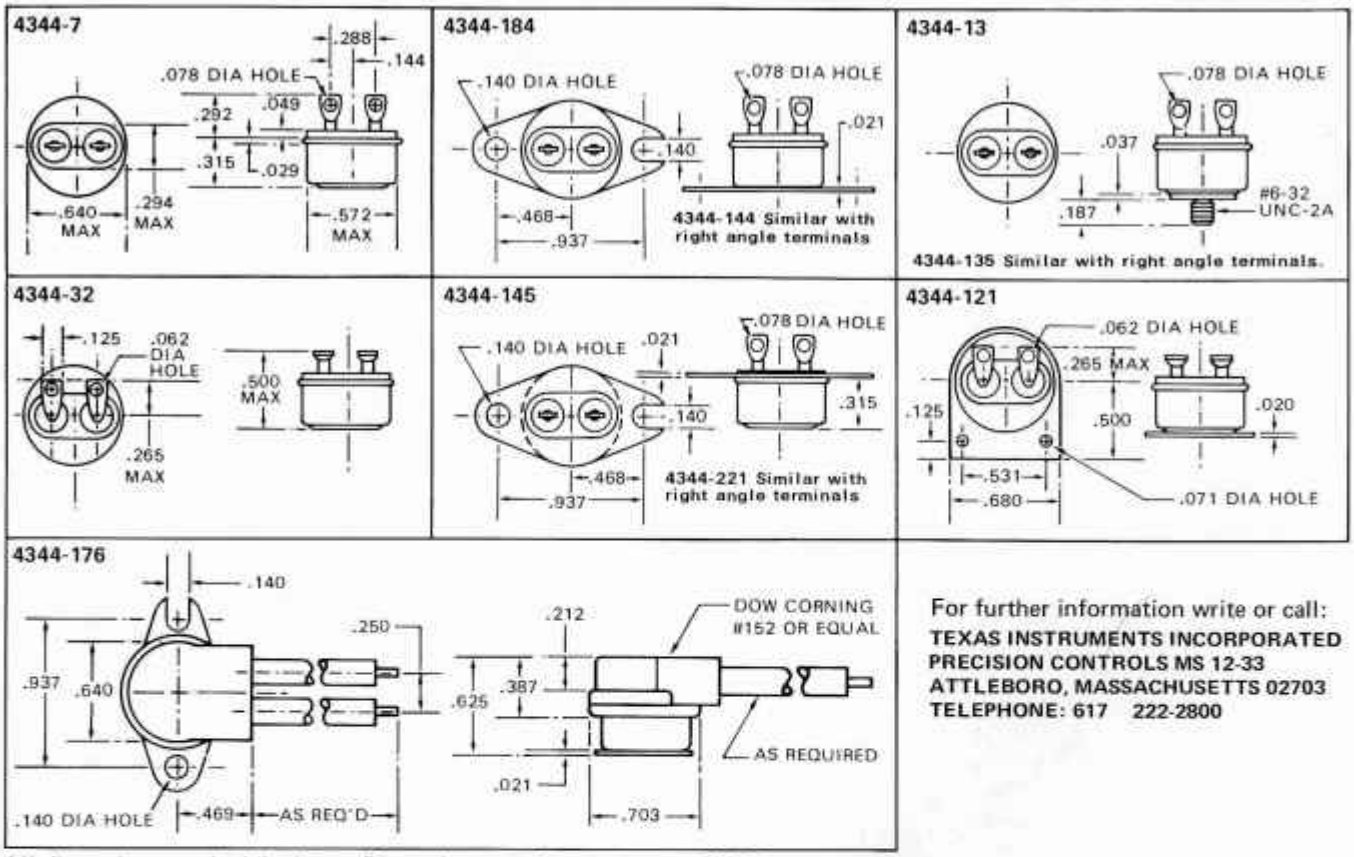
Moisture resistance . . . MIL-STD-202, Method 106C

Salt spray . . . MIL-STD-202, Method 101C, Condition B, 5% solution

Leakage . . . 1 x 10^{-8} ATM cc/sec. max., per MIL-STD-202, Method 112A, Condition C

Weight (Average) . . . Basic unit 4.8 gr., With bracket 5.9 gr., With overmold, 12" leads 23 gr.

TEXAS INSTRUMENTS
INCORPORATED



All dimensions nominal/inches -- Dimensions not shown same as 4344-7

For further information write or call:
TEXAS INSTRUMENTS INCORPORATED
PRECISION CONTROLS MS 12-33
ATTLEBORO, MASSACHUSETTS 02703
TELEPHONE: 617 222-2800

TEMPERATURE SETTINGS

Operating Temp Range °F	Available Differential Range °F			Opening Temp Tol ± °F	Closing Temp Tol ± °F
	Minimum	Standard	Maximum		
-65 to -1	25	30	200	10	8
0 to 200	9	20	200	5	5
201 to 300	20	30	200	8	6
301 to 450	30	40	200	12	12
451 to 550	60	70	200	25	25

Settings outside the ranges indicated or to closer tolerances are available on special request. Differential is the nominal difference between OP & CL temperatures.

TEXAS INSTRUMENTS
INCORPORATED

Precision Thermostat Products
Publication 267

Printed in U.S.A.
Reprinted 4-78 2K

KLIXON® PRECISION THERMOSTATS

4391 SERIES
HERMETICALLY SEALED

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

PERFORMANCE CHARACTERISTICS

Dielectric strength:
1250 VAC, RMS, 60 cycles for one minute (1500 VAC RMS available on special request)

Ambient temperature range:
Non overmold - 65°F to 450°F
Neoprene overmold - 65°F to 160°F
Silicone overmold - 65°F to 450°F

Switch action:
SPST or SPDT (snap-action)

Life cycle:
See electrical rating table

Calibration:
See temperature setting table

Differential:
See temperature setting table

Vibration:
Standard Construction 5-500 CPS, 3G's
High vibration construction 5-500 CPS, 5G's

Weight:
Without overmold 21 grams average
With overmold 56 grams average

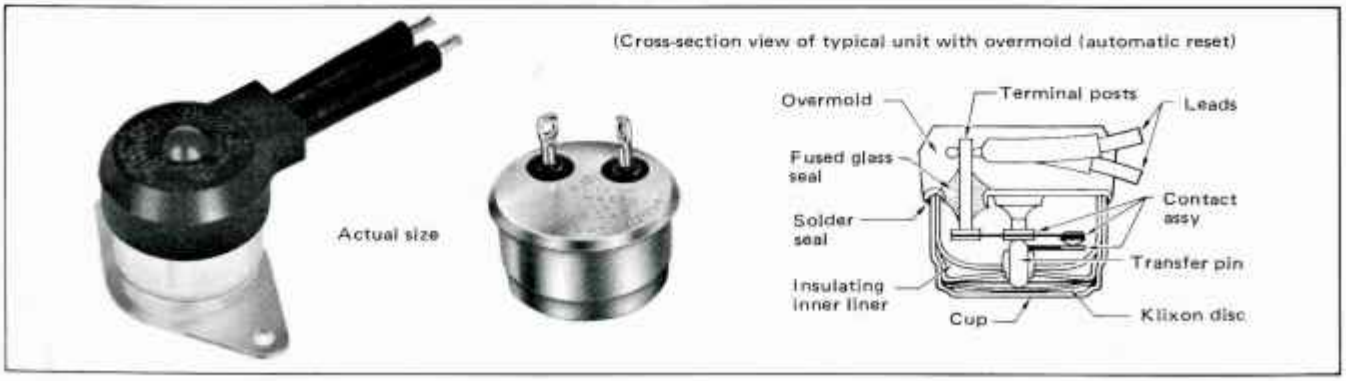
TEMPERATURE SETTING:
Single pole, single throw, standard construction

Operating temperature range °F	Available Differential °F			Open temperature tolerance °F	Close temperature tolerance °F
	Minimum	Standard	Maximum		
-65°F to -1°F	20	25	125	± 8	±10
0°F to 200°F	10	15	125	± 5	± 5
201°F to 300°F	20	25	125	± 6	± 7
301°F to 450°F	25	30	125	±10	±12

TEMPERATURE SETTING
Single pole, single throw, high vibration construction; single pole double throw

Operating temperature range °F	Available Differential °F			Open temperature tolerance °F	Close temperature tolerance °F
	Minimum	Standard	Maximum		
-65°F to -1°F	25	30	125	±10	± 7
0°F to 200°F	20	25	125	± 8	± 5
201°F to 300°F	25	30	125	±10	± 7
301°F to 450°F	30	35	125	±15	±12

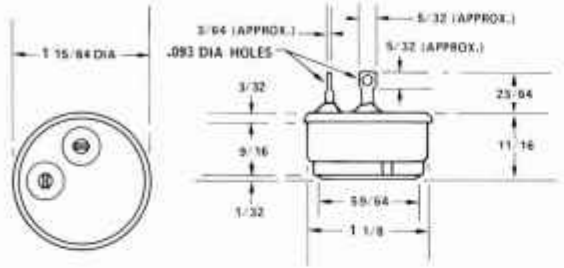
Closer settings are available on special request. Differential is the nominal difference between opening and closing temperature.



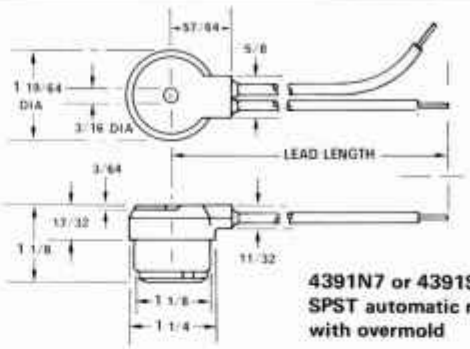
TEXAS INSTRUMENTS
INCORPORATED

DIMENSIONAL DRAWINGS OF BASIC DESIGN

Other Variations are available - dimensions in inches



4391-8 STYLE
SPST automatic reset without overmold

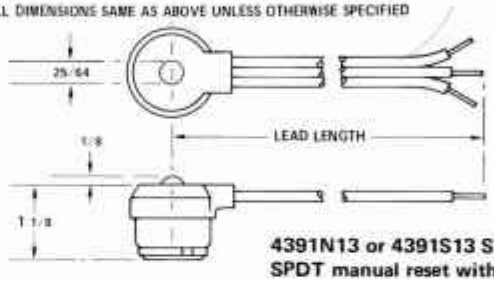


4391N7 or 4391S7 STYLE
SPST automatic reset with overmold

ALL DIMENSIONS SAME AS ABOVE UNLESS OTHERWISE SPECIFIED

4391-6 STYLE
SPDT automatic reset without overmold

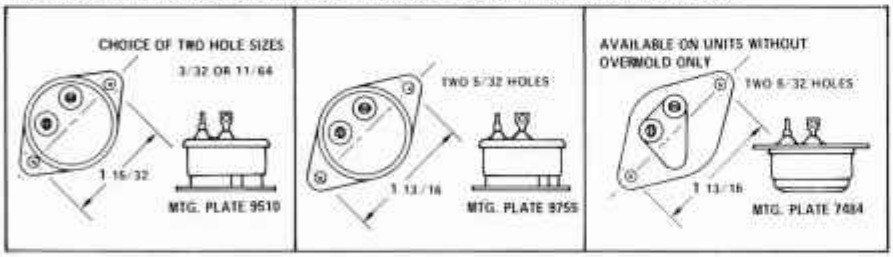
ALL DIMENSIONS SAME AS ABOVE UNLESS OTHERWISE SPECIFIED



4391N13 or 4391S13 STYLE
SPDT manual reset with overmold

TYPICAL MOUNTINGS

Mounting brackets which are readily available are shown below. Variations from these mountings can be tooled at extra cost. Please advise us if a bracket is required.



4391 STYLE NUMBERS

Overmold	Single-Pole, Single-Throw		Single-Pole, Double-Throw	
	Automatic Reset	Manual Reset	Automatic Reset	Manual Reset
Silicone	4391S7	4391S14	4391S5	4391S13
No Overmold	4391–8	Not Available	4391–6	Not Available
Neoprene	4391N7	4391N14	4391N5	4391N13

ELECTRICAL RATINGS (Resistive)

Amperes			Life cycles
30 Vac/dc	125 Vac	250 Vac	
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

For further information write or call:

TEXAS INSTRUMENTS INCORPORATED
PRECISION CONTROLS MARKETING
ATTLEBORO, MASSACHUSETTS 02703
TELEPHONE: 617 222-2800

TEXAS INSTRUMENTS
INCORPORATED

Precision Thermostat Products
Publication 268

Printed in U.S.A.
Reprinted 12-77 3K

KLIXON® MOTOR WINDING THERMOSTATS

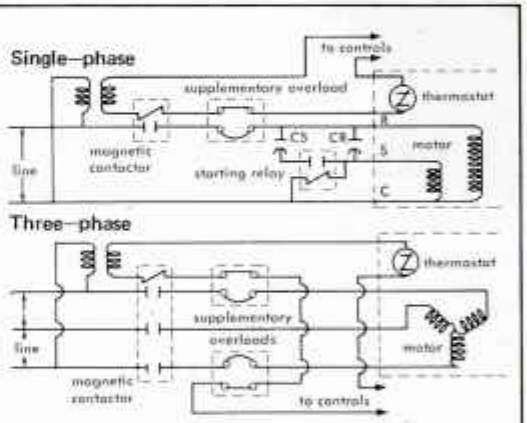
1822 SERIES

- Rapid thermal response—small mass permits close thermal coupling to motor winding
- Suitable for hermetic compressors—hermetically sealed design prevents arcing
- Assured reliability—designed, produced and inspected to assure a low leakage rate. Thermostat can pass through dipping and baking operations on the windings
- Easy to mount—variety of standard mounting brackets available
- Close temperature control—wide range of standard temperature settings available
- Long life—minimum contact wear since the disc does not break line current
- Resists vibration—thermally responsive element is positive snap-action disc

Actual size

The Klixon 1822 Motor Winding Thermostat is a small, hermetically-sealed, snap-acting device which is actuated by the thermally responsive Klixon bimetallic disc. The thermostat is designed for use on single and three-phase motors and is suitable for hermetic refrigeration compressors. It provides positive protection against overheating from all running conditions including: • Running overloads • Increased ambient temperatures • Blocked motor ventilation • Line voltage fluctuation • Any overheat conditions where the temperature rise is gradual

The thermostat should be used in conjunction with a Klixon Supplementary Overload (refer to Motor Protection Products Publication no. 180 and schematic diagram) or a remote thermal relay since the thermostat is responsive to motor winding temperature only. The overload is necessary to protect such conditions as stalling, locked rotor, single-phasing and heavy external overloads.

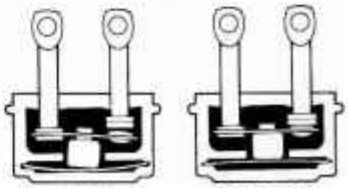


All thermostats are supplied with single-pole, single throw switching action in either of two contact structures. These contact structures are identified by a letter following the basic series number. When the letter "F" is added to the series number, the thermostat closes on temperature rise. When the letter "L" is added to the series number, the thermostat opens on temperature rise.

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.

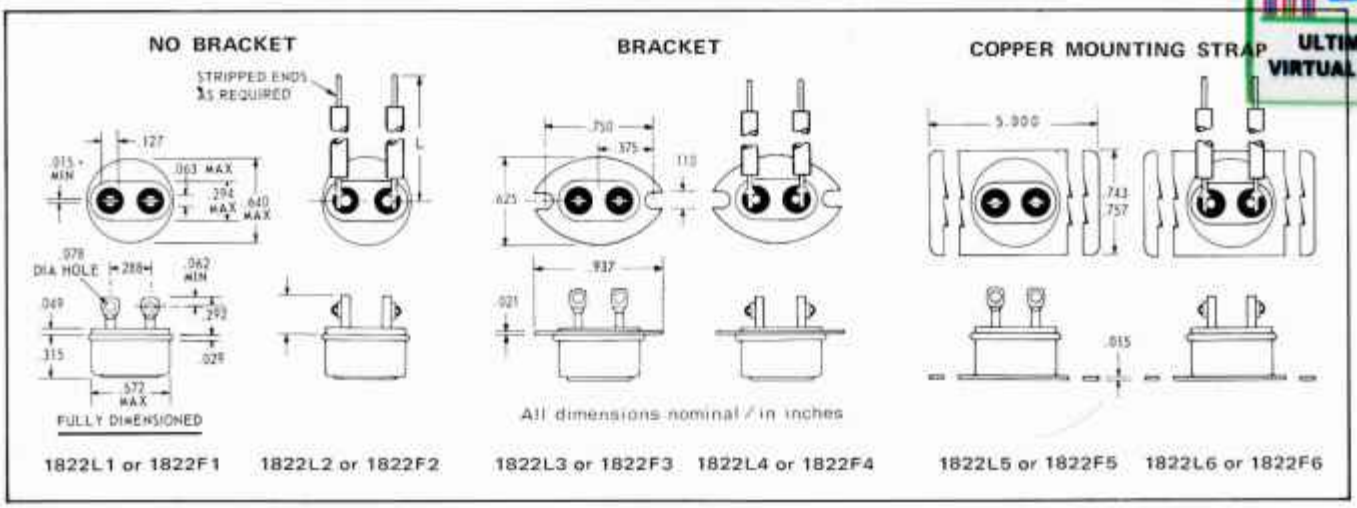
A decrease in the ambient temperature below the reset temperature of the disc relieves the internal stresses in the disc. The disc returns to its normal curvature and the contacts assume their normal operating position.

OPERATION



OPEN CLOSED

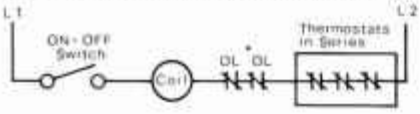
TEXAS INSTRUMENTS
INCORPORATED



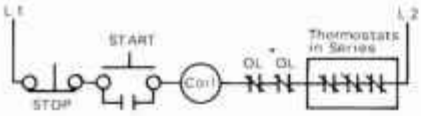
AUTOMATIC & MANUAL RESET

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 until the winding temperature returns to safe limits. Shown below are typical wiring diagrams for an automatic as well as a 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.

MOUNTING

The small size of the device enables it to be mounted conveniently on the end turns of the motor windings. Several mounting brackets are available to afford flexibility in the method of attaching the thermostat.

Additional insulation in the form of Mylar* or Fish Paper should be used, if required by the particular motor voltage, between the thermostat and ground. Full running motor protection is obtained by using one thermostat on each winding and in the case of three-phase motors, on each of the three phases.

L SERIES STANDARD TEMPERATURE SETTINGS

Temperature Dash Number	Normally Closed Contacts Open ± 5° C	Close ± 5° C
–1	70°C	60°C
–2	80	70
–3	90	80
–4	100	90
–5	105	95
–6	110	95
–7	115	100
–8	120	105
–9	130	115
–10	140	125
–11	150	135

F SERIES STANDARD TEMPERATURE SETTINGS

Temperature Dash Number	Normally Open Contacts Open ± 5° C	Close ± 5° C
–1	60°C	70°C
–2	70	80
–3	80	90
–4	90	100
–5	95	105
–6	95	110
–7	100	115
–8	105	120
–9	115	130
–10	125	140
–11	135	150

Special temperature settings other than those specified above are available at additional cost.

LEAD CONNECTIONS

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

ELECTRICAL RATINGS

The 1822 series thermostats are capable of handling the currents found in motor starters up through NEMA Size 5 ratings. The live electrical parts have sufficient insulation to carry 600 volts, which enables the control circuit to be of different voltages when the thermostat is properly insulated from ground.

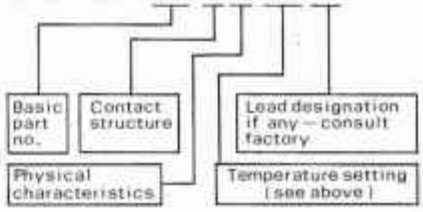
UL-CSA RECOGNITION

24 Volts AC–125 Volt-Amperes
UL File #E34618, dated 2-20-57

120-600 Volts AC–345 Volt-Amperes
CSA File #11372C, dated 7-25-65

SAMPLE CODE

Part number: 1822 L 4 –10 –5



HOW TO ORDER

Specify:

1. Klixon part number – 1822F or 1822L
2. Temperature setting (select from table)
3. Quantity
4. Terminations or lead connections
5. Mounting bracket

For further information write or call:
TEXAS INSTRUMENTS INCORPORATED
MOTOR CONTROLS MARKETING
ATTLEBORO, MASSACHUSETTS 02703
TELEPHONE: 617 222-2800

TEXAS INSTRUMENTS
INCORPORATED

Motor Protection Products
Publication 235

Printed in U.S.A.
Reprinted 5-75 2.5K

KLIXON® PRECISION THERMOSTATS

M1/11041 SERIES

HIGH RELIABILITY

- Snap action switching
- Single pole, single throw
- Preset, non-adjustable calibration
- Normally open or normally closed
- Welded, hermetic seal
- Qualified to MIL-S-24236/1

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.

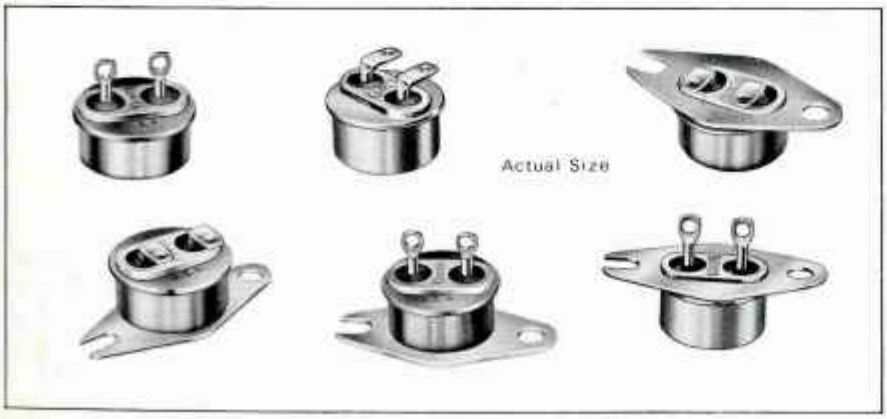
Welded Construction—Final assembly process heliarc welds the thermostat in a dry nitrogen atmosphere for a true hermetic seal.

EXCEPTIONALLY RELIABLE

Very high reliability is maintained through a stringent quality assurance program. All M1/11041 thermostats are tested on a 100% basis for the following parameters . . . . .

Operating Temperature—Opening and closing temperatures are checked on a go/no-go basis in agitated liquid baths.

Dielectric Strength—Tested for breakdown or current leakage in excess of 1 milliamp. Test voltage is 1250 v-ac for 1 minute or 1550 v-ac for 1 second.



Insulation Resistance—Terminal to case insulation is checked for 500 megohm minimum at 500 v-dc.

Creepage—Arc duration is measured during the make and break action and those units with a duration longer than 10 milliseconds are rejected.

Contact Resistance—Assures a maximum contact resistance of 0.015 ohms.

Leakage—All units are checked for leaks using the vacuum over water or hot liquid immersion method.

PERFORMANCE CHARACTERISTICS

Dielectric Strength
1250 v-ac, rms, 60 cycles for 1 min., terminal to case; per MIL-STD-202, Method 301

Calibration
See temperature settings table

Differential
See temperature settings table

Switch Action
SPST, (snap-action)

Ambient Temperature Range
-80°F. to +550°F. (non-overmolded units available for exposure to -320°F. when required)

Life Cycle
See contact ratings table

Contact Resistance
0.015 ohms max, per MIL-STD-202, Method 307

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

Vibration Resistance
5-2000 cps, 20 G per MIL-STD-202, Method 204, Condition D

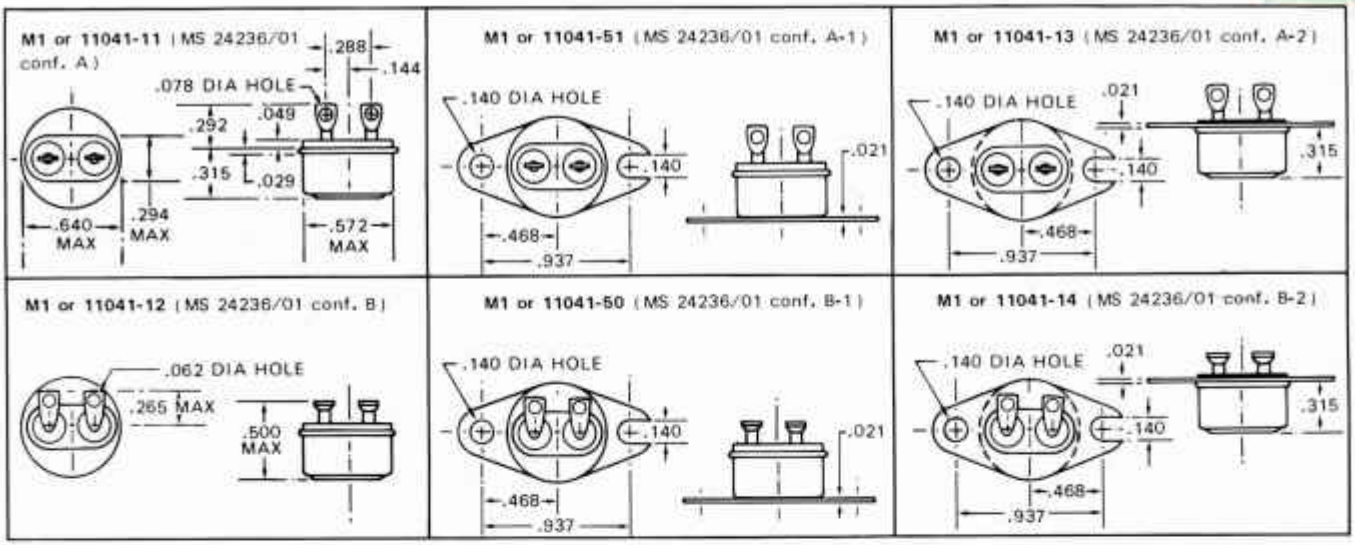
Moisture Resistance
MIL-STD-202, Method 106C

Salt Spray
MIL-STD-202, Method 101C, Condition B, 5% solution

Leakage
1×10^{-8} ATM cc/sec. Max. per MIL-STD-202, Method 112A, Cond. C

Weight (average)
Basic Unit . . . . . 4.8 gr
With Bracket. . . . . 5.9 gr
With Overmold, 12" leads . . . . . .23 gr

TEXAS INSTRUMENTS
INCORPORATED



All dimensions nominal / inches

TEMPERATURE SETTINGS

Operating Temp Range °F	Available Differential Range °F			Opening Temp Tol ± °F	Closing Temp Tol ± °F
	Minimum	Standard	Maximum		
-65 to -1	25	30	200	10	8
0 to 200	9	20	200	5	5
201 to 300	20	30	200	8	6
301 to 450	30	40	200	12	12
451 to 550	60	70	200	25	25

Settings outside the ranges indicated or to closer tolerances are available on special request. Differential is the nominal difference between OP & CL temperatures.

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.

M1 110 090 2 8 2

BASIC TYPE

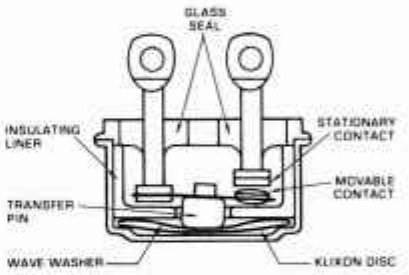
TOP TEMPERATURE NOMINAL SETTING (°F)
Use 3 digits (insert minus sign and 2 digits for temps below 0°F)

BOTTOM TEMPERATURE NOMINAL SETTING (°F)
Use 3 digits (insert minus sign and 2 digits for temps below 0°F)

PLATING
1 — Cadmium
2 — Copper/nickel
3 — Cadmium & black chromote
4 — Tin
5 — Cadmium & Cronak Dip

MOUNTING BRACKETS & TERMINALS
Odd Nos. — flattened and pierced terminals
Even Nos. — right angle terminals
1 & 2 — no mounting bracket
3 & 4 — top mounting bracket (as shown)
7 & 8 — bottom mounting bracket (as shown)

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)



CONTACT RATINGS (Resistive)

30 v-ac/dc	125 v-ac	250 v-ac	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

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 and complete part numbers are assigned by the factory.

For further information write or call:

TEXAS INSTRUMENTS INCORPORATED
COMMERCIAL CONTROLS MARKETING
ATTLEBORO, MASSACHUSETTS 02703
TELEPHONE: 617 222-2800

TEXAS INSTRUMENTS
INCORPORATED

Precision Thermostat Products
Publication 158

Printed in U.S.A.
Reprinted 6-78 2K

KLIXON® PRECISION THERMOSTATS

C6786 SERIES
FIXED TEMPERATURE

- Low silhouette - only 0 .295" high
- Lightweight - only 0.09 oz. (2.5 gram)
- Available to open or close on temperature rise
- Tamperproof, pre-set temperature calibration
- Low cost

The Klixon C6786 thermostat is a snap-acting disc type control designed for applications where maximum shock and vibration resistance is required. Typical applications include: aircraft controls, heaters, mobile communications equipment, electronic circuits and components, servo mechanisms, gyroscopes, aerial cameras, guided missiles and gun mounts.

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 C6786 makes it particularly suitable where space and weight accommodations are limited.

Actual size
6786-1 STYLE

TEMPERATURE SETTINGS, NOMINAL DIFFERENTIALS AND TOLERANCES

Operating Temperatures (°F)	Available Nominal Differential Range			Opening Temperature Tolerance* (°F)	Closing Temperature Tolerance* (°F)
	Minimum (°F)	Standard (°F)	Maximum (°F)		
−20 to 10	–	30	125	±10	±8
11 to 200	9	20	125	±8	±5
201 to 300	20	30	125	±10	±8
301 to 350	30	40	125	±12	±10
351 to 400	40	50	125	±15	±15

*These tolerances are based on precision factory calibration and test equipment. Customers' checking tolerances should allow for differences in test equipment. A "funnel" of ±1° F is recommended.

TERMINALS

The C6786 thermostat is available with solder type terminals in either the parallel or opposed alignments as shown in the drawings. If other terminal configurations are desired, write factory with detailed information.

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. Special brackets can be custom designed for your requirements.

PERFORMANCE CHARACTERISTICS

Ambient temperature range . . . . . −65°F to +400°F

Vibration resistance . . . MIL-STD-202 Method 204, Condition A

Switch action . . . . SPST, (snap-action)

Shock resistance . . . . . 30G 11 milliseconds

Weight . . . . . 0.09 oz. (2.5 gr.)

ELECTRICAL RATINGS

On electrical loads higher than 3 amperes, the self-heating effect is sufficient to influence the thermostat operating temperature. The operating temperature must be determined to compensate for the self-heating.

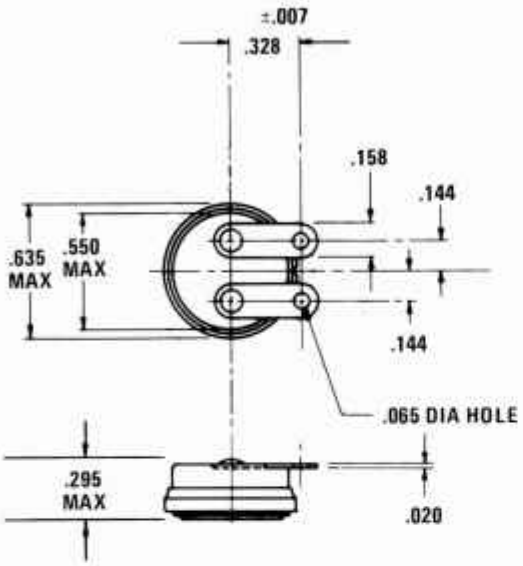
Gold plated contacts can be furnished for the electrical loads listed in the following table to assure reliable circuit making under low wattage conditions. GOLD PLATED CONTACTS ARE NOT SUITABLE FOR HEAVIER LOADS.

30 vac/dc	500 ma and below
115 vac	200 ma and below
230 vac	100 ma and below

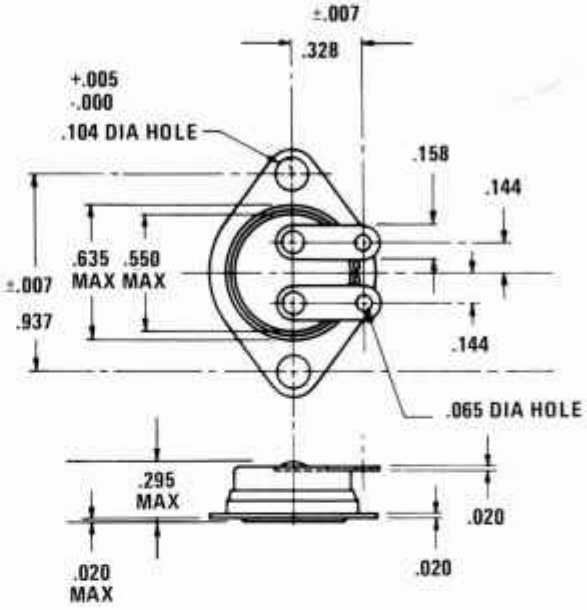
30 vac/dc	125 vac	250 vac	Cycles
Amperes			
5.0	2.0	1.0	100,000
5.5	3.0	1.5	50,000
6.0	4.0	2.0	25,000
6.5	5.0	2.5	10,000
7.0	6.0	3.0	5,000

TEXAS INSTRUMENTS
INCORPORATED

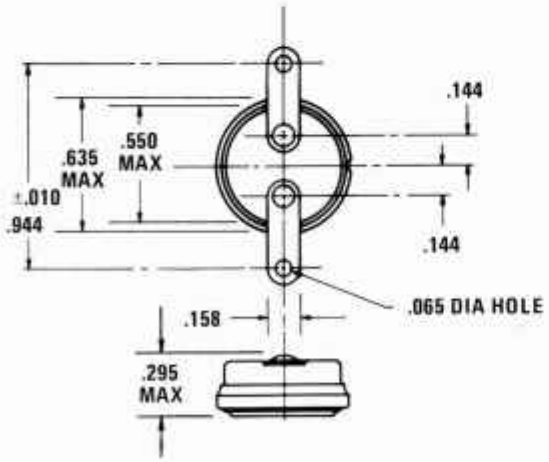
6786-1 STYLE



6786-2 STYLE



6786-3 STYLE



DIMENSION IN INCHES

For further information write or call:
TEXAS INSTRUMENTS INCORPORATED
PRECISION CONTROLS MS 12-33
ATTLEBORO, MASSACHUSETTS 02703
TELEPHONE: 617 222-2800

TEXAS INSTRUMENTS
INCORPORATED

Precision Thermostat Products
Publication 226

Printed in U.S.A.
Reprinted 6-78 2K

KLIXON® PRECISION THERMOSTAT

M2 SERIES
NARROW DIFFERENTIAL

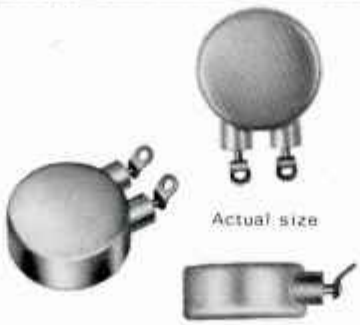
- Snap action switching
- Single pole, single throw
- Preset, nonadjustable calibration
- Welded, hermetic seal
- Normally open or normally closed
- Qualified to MIL-S-24236/20

M2 thermostats are recommended for use as controls and warning devices in guided missiles, aircraft controls, heating blankets, electronic circuit components, servo mechanisms, 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 KLIXON 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 application engineering experience have yielded a wide variety of easy to use mounting means. Availability of historical test data also makes the specification writer's job easier. Call your TI product specialist or field engineer for assistance.



Actual size

PERFORMANCE CHARACTERISTICS

Calibration: See temperature setting table

Life cycle: 250,000 cycles at 2 amps resistive, 30Vdc/120Vac. 50,000 cycles at 3 amps resistive, 30Vdc/120Vac

Dielectric strength: 1250Vac RMS, 60 hertz for 1 minute per MIL-STD-202, method 301

Contact resistance: .050 ohms maximum per MIL-STD-202, method 307

Switch action: SPST, normally open or normally closed

Vibration: 5-2000 CPS at 10g per MIL-STD-202, method 204, condition D

Shock: 100g, 6 milliseconds per MIL-STD-202, method 213

Ambient temperature: −65°F to 450°F (depending on calibrated temperature)

Leakage: 1×10^{-8} ATM cc/sec maximum per MIL-STD-202, method 112A, condition C

Salt spray: MIL-STD-202, method 101C, condition B, 5% solution

Moisture resistance: MIL-STD-202, method 106C

Weight: 5.4 grams (average)

TEMPERATURE SETTING

Closing temperature range	Opening temperature differential	Closing temperature tolerance	
		std.	spec.
0° to 250°F	2° - 5°F	±4°F	±3°F
251° to 400°F	3° - 7°F	±5°F	±4°F

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.

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

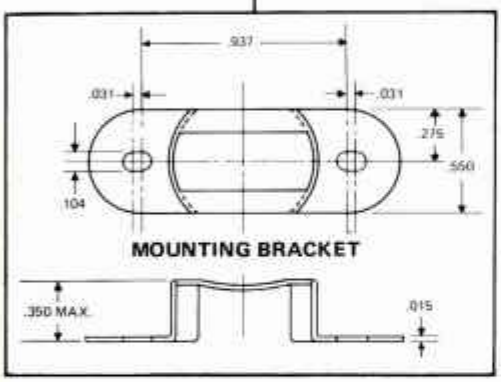
TEXAS INSTRUMENTS
INCORPORATED

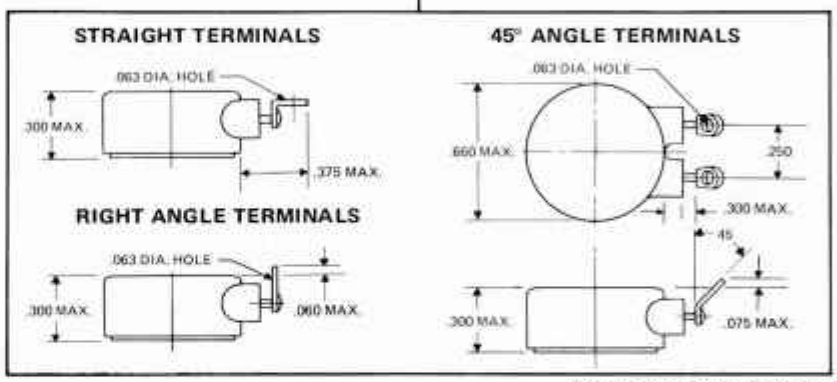
PART NUMBERING SYSTEM FOR STANDARD M2 THERMOSTATS

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.

M2 1 1 L 163 03 05 1 1

TYPE	BRACKET	TERMINAL	OPERATION	TEMPERATURE	TOLERANCE	DIFFERENTIAL	PLATING	CONTACTS
basic number	1 = no bracket 2 = loose bracket	1 = straight 2 = 45° 3 = right angle	L = open on temp. rise F = close on temp. rise	closing temperature °F	closing temperature tolerance (± °F)	05 = 2°–5° F 07 = 3°–7° F	0 = none 1 = cadmium 2 = copper — nickel 3 = black chromate 4 = tin plate 5 = chromate dip	1 = silver contacts 2 = gold plated contacts





Dimensions shown in inches

Due to design characteristics, thermostats that close on temperature should not be subjected to temperature overides in excess of 100° F.

SPECIAL M2 THERMOSTATS

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

TEXAS INSTRUMENTS INCORPORATED, PRECISION CONTROLS MS 12-33, ATTLEBORO, MASS. 02703, 617-222-2800

TEXAS INSTRUMENTS
INCORPORATED

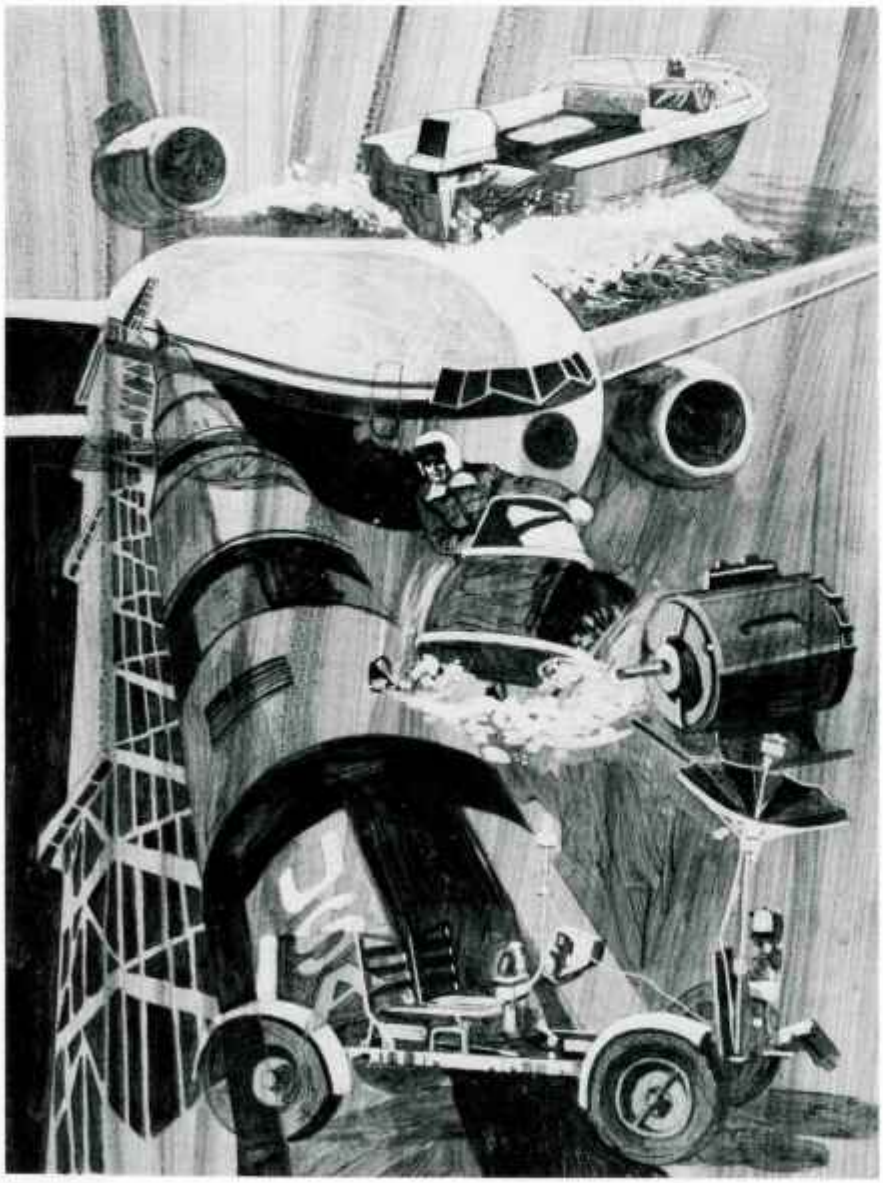
Precision Thermostat Products
Publication 271

Printed in U.S.A.
Reprinted 6-78 2K

KLIXON®

PRECISION THERMOSTATS

3BT & 4BT SERIES
TINY-STAT
MINIATURE THERMOSTATS



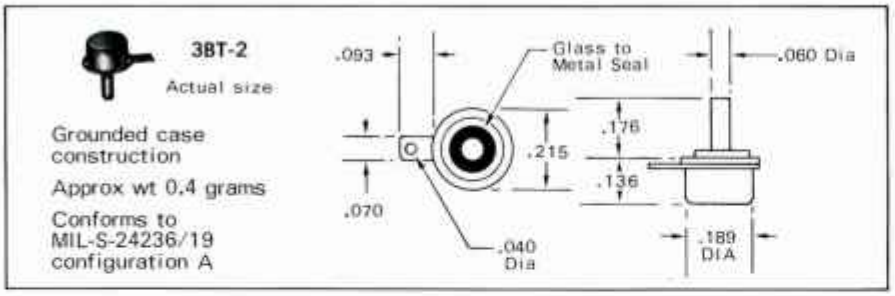
- Smallest snap-acting thermal switches ever made
- Qualified to MIL-S-24236
- Extremely fast response
- Hermetically sealed
- Tamperproof calibration – preset at factory
- Grounded case construction

Tiny-Stat miniature thermostats combine an impressive list of superlatives in a reliable, hermetically-sealed, snap-acting KLIXON 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.

STANDARD CONFIGURATIONS

Many standard configurations are available including pin type terminals for quick assembly to printed circuit boards (3BT-2), 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.

TEXAS INSTRUMENTS
INCORPORATED



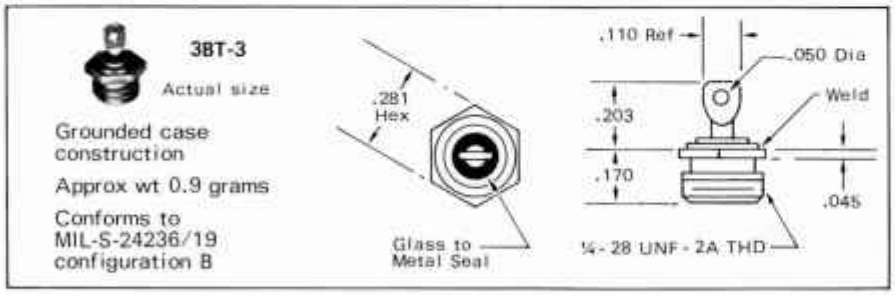
3BT-2

Actual size

Grounded case construction

Approx wt 0.4 grams

Conforms to MIL-S-24236/19 configuration A



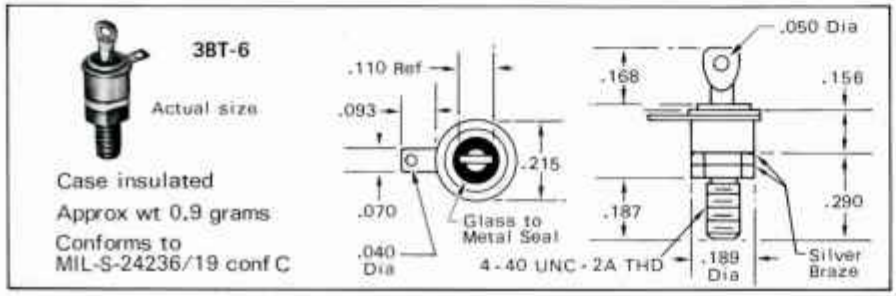
3BT-3

Actual size

Grounded case construction

Approx wt 0.9 grams

Conforms to MIL-S-24236/19 configuration B



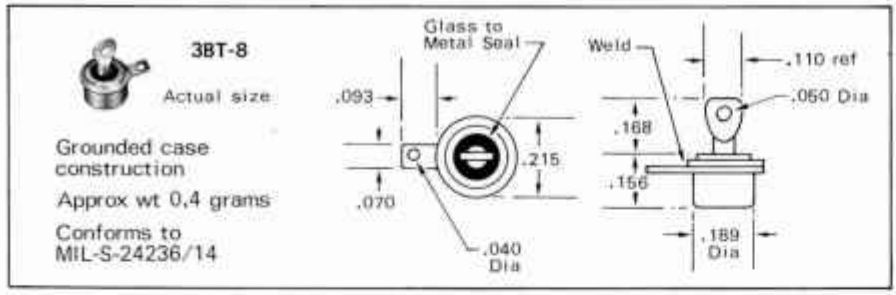
3BT-6

Actual size

Case insulated

Approx wt 0.9 grams

Conforms to MIL-S-24236/19 conf C



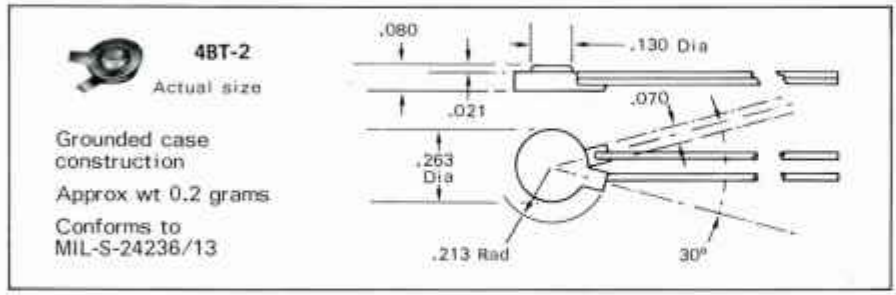
3BT-8

Actual size

Grounded case construction

Approx wt 0.4 grams

Conforms to MIL-S-24236/14



4BT-2

Actual size

Grounded case construction

Approx wt 0.2 grams

Conforms to MIL-S-24236/13

NOTES:

All dimensions nominal, in inches.

Optional leads available (6 inch increments) AWG#24, single conductor stranded wire, Teflon* insulated, white. Conforms to MIL-W-16878 type EE (1,000 volts).

PERFORMANCE CHARACTERISTICS

Operation
SPST, open or close on temperature

Operating temperature range
0° F to 350° F (specials to 400° F)

Differential
30° F nominal

Operating temperature tolerances
±8° F

Voltage
115 v-ac / 30 v-dc

Maximum current
1 amp resistive (silver contacts)
.5 amp resistive (gold contacts)

Dielectric strength
500 v-ac rms 60 cycle across open contacts

Vibration (operating)
30G, 5-2000 cps MIL-S-24236

Shock
100G MIL-S-24236

Acceleration
200G MIL-S-24236

Salt spray
MIL-S-24236 (48 hours, 5% solution)

Endurance
10,000 cycles minimum

Temperature exposure
−80° F to 400° F

For further information write or call:
TEXAS INSTRUMENTS INCORPORATED
PRECISION CONTROLS MS 12-33
ATTLEBORO, MASSACHUSETTS 02703
TELEPHONE: 617 222-2800

*TM of E. I du Pont deNemours & Co. (Inc.)

TEXAS INSTRUMENTS
INCORPORATED

Precision Thermostat Products
Publication 272

Printed in U.S.A.
Reprinted 9/78 2K

KLIXON® SEALED THERMOSTAT

4286 SERIES NARROW DIFFERENTIAL FIXED TEMPERATURE

- Narrow differential provides close temperature control
- Epoxy sealed for moisture resistance
- Side mounted terminals for low silhouette
- Available to open or close on temperature rise
- Temperature calibration is preset at factory — tamperproof

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, servomechanisms, 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 sealed with epoxy into a stainless steel cup. The disc is electrically insulated and coupled with a radiating element for fast temperature response.

Actual size

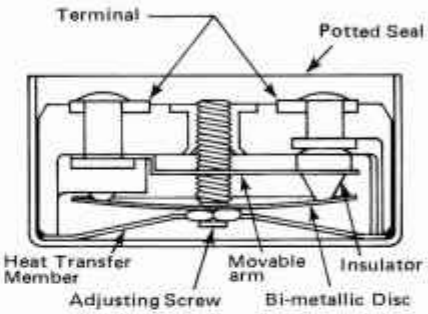
TEMPERATURE EXPOSURE

In general, temperature exposure limits are -65° to +275°F continuous with momentary overrides to 325°F permissible. Due to design characteristics, however, thermostats that close on temperature rise should not be subjected to temperature overrides in excess of 100°F.

ELECTRICAL RATINGS

As current increases, it tends to heat any small thermostat. The operating temperature must be determined to compensate for self-heating.

30 Vac/dc	125 Vac	250 Vac	CYCLES
AMPS, RESISTIVE			
3.0	1.0	0.5	250,000
4.0	2.0	1.0	100,000
4.0	3.0	1.5	50,000



SPECIAL CONTACTS

Gold plated contacts can be furnished for electrical loads in the following table to insure reliable circuit continuity under low wattage conditions.

30Vac/dc	500 milliamps & below
115 Vac	200 milliamps & below
230 Vac	100 milliamps & below

Gold Plated Contacts are not suitable for heavier loads.

PERFORMANCE CHARACTERISTICS

Electrical ratings . . . See chart
Dielectric strength . . . 1250 vac, 60 cycles, 1 min.
Calibration . . . See table
Differentials . . . See table
Switch action . . . SPST, opens or closes on temperature rise
Ambient temperature range . . . –65° F to +275° F continuous
Life cycle . . . See table
Millivolt drop terminal to terminal . . . 100 mv max. at 2 amps, 6V
Acceleration . . . 60 G (operating)
Shock resistance . . . 60 G impact shock (non-operating)
Vibration resistance . . . 5-500 cps at 0.036 in double amplitude or 10 G acceleration (operating)
Leakage . . . Immersion test per MIL-E-5272C
Approximate weight . . . 3.5 grams

TEXAS INSTRUMENTS
INCORPORATED

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, send us details for special consideration.

TEMPERATURE SETTING RANGE	DIFFERENTIAL RANGE	CLOSING TEMPERATURE TOLERANCES*	
		STD.	SPECIAL
0° to 250°F	2° to 5°F	±4°F	±3°F
251° to 270°F	3° to 7°F	±5°F	±4°F

*These tolerances are based on precision factory calibration and test equipment. Customers checking tolerances should allow a "funnel" of ±1°F for differentials in test equipment.

MOUNTING AND TERMINALS

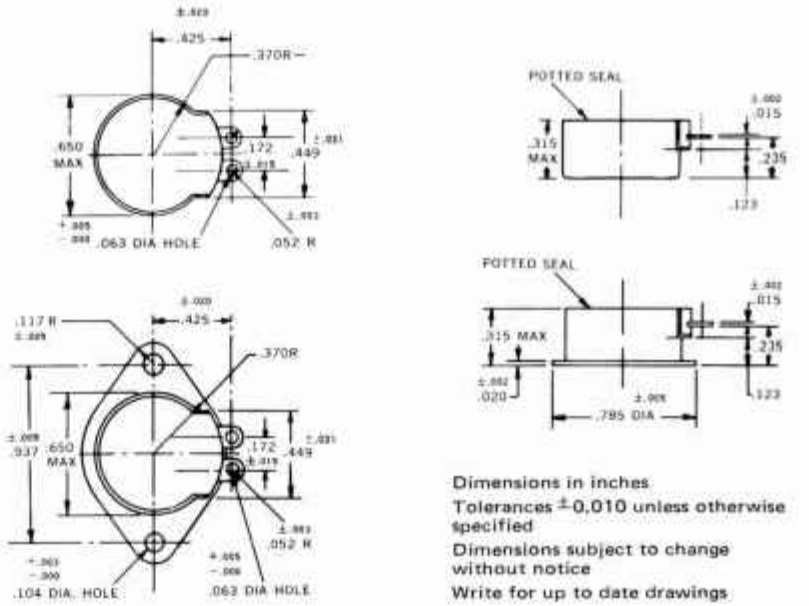
The unit can be mounted in any position: in casting wells, through metal enclosures and in space for control of air temperature. A surface mounting bracket can be provided at slight extra cost. Special brackets can also be supplied to meet your specifications.

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

For further information write or call:

TEXAS INSTRUMENTS INCORPORATED
PRECISION CONTROLS MS 12-33
ATTLEBORO, MASSACHUSETTS 02703
TELEPHONE: 617 222-2800

4286A2 (Silver Contacts)
4286B2 (Gold Plate Contacts)



Dimensions in inches
Tolerances ±0,010 unless otherwise specified
Dimensions subject to change without notice
Write for up to date drawings

TEXAS INSTRUMENTS
INCORPORATED

Precision Thermostat Products
Publication 269

Printed in U.S.A.
Reprinted 9-77 2K

KLIXON® THERMOSTATS

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
- Qualified to MIL-S-24236/24

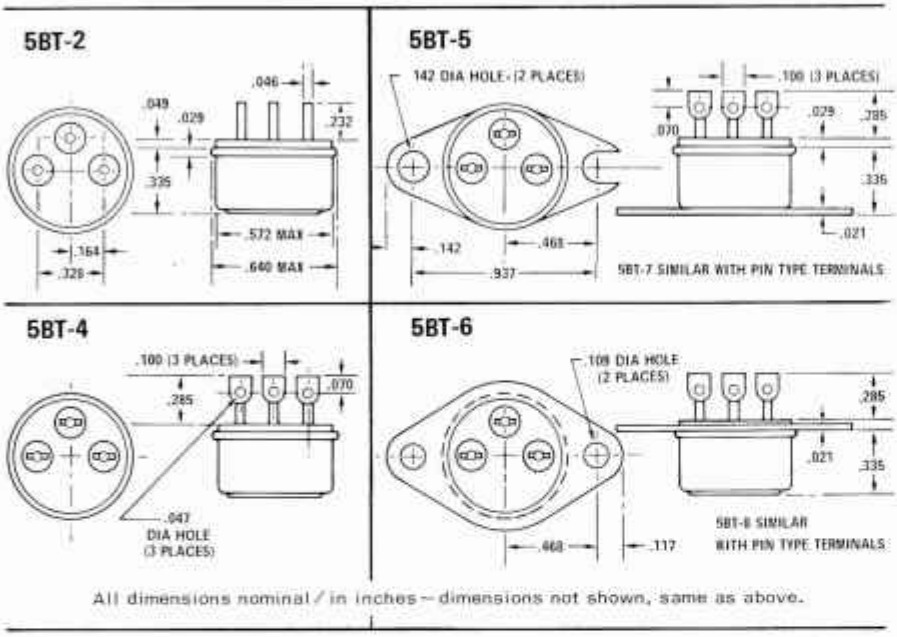
The KLIXON 5BT series thermostat is a high reliability, hermetically sealed thermal switch. The single pole, double throw design allows versatility and economy in providing two functions within the same device. Typically these KLIXON switches are used to control and indicate at a preset temperature. 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.

TEXAS INSTRUMENTS
INCORPORATED

TEMPERATURE SETTINGS

Operating temp. Range °F	Available Differential Range °F			High Temp Tol ± °F	Low Temp Tol ± °F
	Minimum	Standard	Maximum		
-65 to -1	25	30	200	10	8
0 to 300	15	20	200	8	6
301 to 350	15	25	200	10	8
351 to 400	25	35	200	12	12

Settings outside the ranges indicated or to closer tolerances are available on special request. Differential is the nominal difference between OP & CL temperatures.



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

PERFORMANCE CHARACTERISTICS

Dielectric strength (without breakdown or current leakage in excess of one milliampere) . . . 1250 v-ac, rms, 60 cycles for 1 min, terminal to case. Per MIL-STD-202, Method 301

Calibration . . . . . See temperature settings table

Differential . . . . . See temperature settings table

Switch action . . . . . SPDT, (snap action)

Ambient temperature range . . . . . -65 °F to +450 °F continuous

Life Cycle . . . . . See contact ratings table

Insulation resistance . . . . . 100 megohms min. at 500 v-dc

Acceleration . . . . . 60 G

Shock resistance . . . . . 60 G, 11 milliseconds

Vibration resistance . . . . . 5-2000 CPS, 10G

Sand and dust . . . . . MIL-STD-202, Method 110, Test Condition A

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

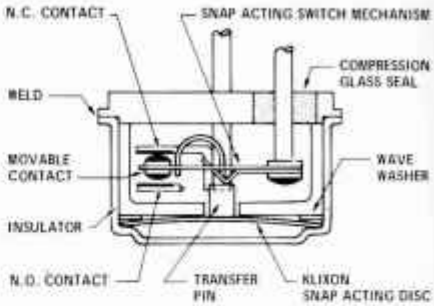
Salt spray . . . . . MIL-STD-202, Method 101A, 168 hrs

Leakage (seal) . . . . . 10^{-8} cc helium/sec per MIL-STD-202, Test Condition C, Procedure IV

Weight (avg) . . . . . Basic unit . . . . . 6 gr
Basic unit with bracket . . . . . 7 gr

CONTACT RATINGS (Resistive)

30v-dc/125v-ac	Life
Amperes	Cycles
2.0	100,000
3.0	50,000



TYPICAL CROSS SECTION VIEW

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 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 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 mountingflanges 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. Application Engineering aid is readily available.

For further information write or call:
TEXAS INSTRUMENTS INCORPORATED
PRECISION CONTROLS MS 12-33
ATTLEBORO, MASSACHUSETTS 02703
TELEPHONE: 617 222-2800

TEXAS INSTRUMENTS
INCORPORATED

Printed in U.S.A.
Reprinted 1-79 1K

KLIXON® PRECISION THERMOSTATS

7BT SERIES
HIGH CAPACITY

- Reliable, snap-action switching
- Tamperproof, preset calibration
- Normally open or normally closed
- UL recognized file #E34618
- CSA recognized file #LR24458-4
- VDE recognized file #4464.4-451-1/A-1

PERFORMANCE CHARACTERISTICS

Dielectric strength
1250 v-ac, RMS 60 cycles, for 1 minute

Ambient temperature range:
−20°F to 350°F

Switch action:
SPST (snap-action)

Calibration
See temperature settings table

Differential:
See temperature settings table

Life cycle:
100,000 cycles, see table

Weight: 4 grams

CONTACT RATINGS (resistive) 100,000 CYCLES

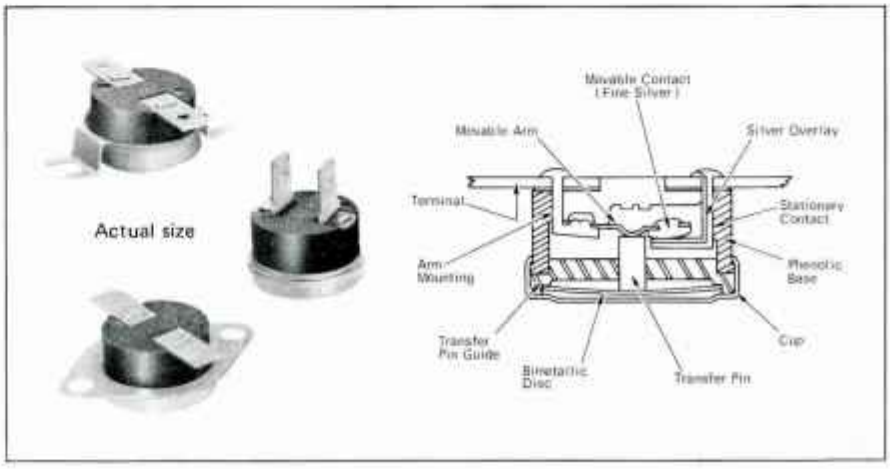
Voltage	120 v-ac	240 v-ac
Amperes	15	10

For DC applications information, please contact our marketing department.

TEMPERATURE SETTINGS

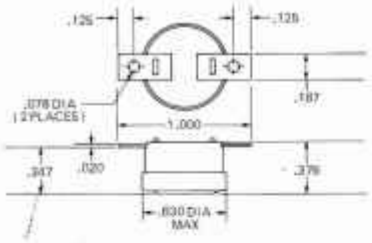
Operating temperature range °F		100° to 200°	201° to 300°	301° to 350°
Available differential range °F	Min.	10°	20°	30°
	Std.	20°	30°	40°
	Max.	100°	100°	100°
Opening temp. tol ± °F		±5°	±8°	±12°
Closing temp. tol ± °F		±5°	±8°	±12°

Settings outside the ranges indicated, or closer tolerances, are available on special request. Differential is the nominal difference between opening and closing temperatures.

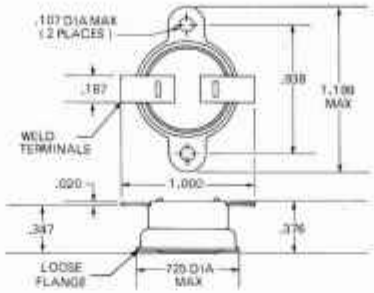


TEXAS INSTRUMENTS
INCORPORATED

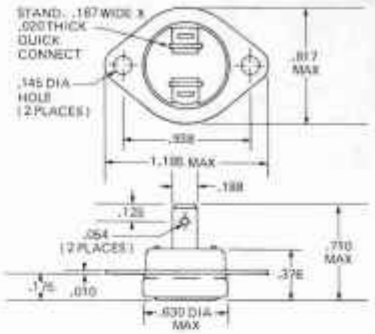
7BT 2A



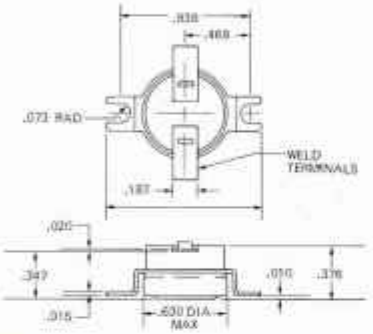
7BT 3C



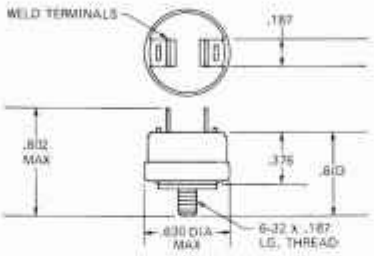
7BT 4B



7BT 5C



7BT 6D



ALL DIMENSION NOMINAL / IN INCHES

TERMINALS:

All spade type quick-connect terminals are .187 wide x .020 thick. Mate with any standard female terminals.

All dimensions are nominal and in inches.

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.

7BT L 3 D – 36 – 2

Type					
Basic number	L=Open on rise silver contacts F=Close on rise silver contacts	Style 2=No mounting 3=Loose bottom bracket 4=Fixed top flange 5=Fixed bottom flange 6=6-32 x .0187 stud	Terminals A=Solder flat .078" hole B=3/16 Q.C. 90° inset C=3/16 weld flat D=3/16 weld inset 90°	Operating temps 1-47 Standard temp. settings 120°F to 350°F in 5° increments (Non-standard increments available upon request)	Wire leads 1=6" 2=12" 3=18" 4=24" Standard wire is AWG #18 stranded, tinned copper wire 600v 105°C, .031" PVC insul., black, UL & CSA approved

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.

For further information write or call:

TEXAS INSTRUMENTS INCORPORATED
PRECISION CONTROLS MS 12-33
ATTLEBORO, MASSACHUSETTS 02703
TELEPHONE: 617 222-2800

TEXAS INSTRUMENTS
INCORPORATED

Precision Thermostat Products
Publication 319

Printed in U.S.A.
Reprinted 1-79 2K