![Texas Instruments logo] **TEXAS INSTRUMENTS**

KLIXON®

10BA
PTC MOTOR SENSORS

General Description

The 10BA is a Positive Temperature Coefficient (PTC) sensor with low resistance property. Once the motor winding temperature increases to a pre-determined trip temperature, the sensor resistance increases several orders of magnitude for a correspondingly small change in temperature.

This sharp increase in resistance causes the Texas Instruments control module (See table below) to de-energize an internal relay which in turn opens the contactor/starter coil circuit. Because the system places thermal sensors at the precise point where protection is needed (in the motor windings, for instance), equipment is protected against heat damage regardless of cause - including external faults such as blocked ventilation.

An advantage of the PTC type sensor is that several of them may be connected in series without a significant loss of calibration. If only one sensor reaches the trip temperature, the module will trip.

Sensor vs. Electronic Module

TI PTC Sensor	All TI PTC Sensors can be used in Conjunction with any Electronic Control Module
10BA	15AA, 30AA, 31AA, 32AA, 40AA, 41AA, 42AA, 50AA, 51AA, 2ACE

Suggested Applications

• Delta connected motor
• Motors in excess of TI line-break protector capability
• Motors employing electronic controls
• Multiple voltage motors

System Features

• Can be applied to track rates of temperature rise in excess of 20ºC/sec
• Operating range: -40ºC to 170ºC
• Can be applied to implement brown out protection
• Withstand standard varnish dip and bake operations
• Tamperproof
• Rapid responding
• UL recognized component
• Eliminates nuisance trips
• Field proven Klixon design
• Easily specified and installed
• Allows full use of motor rating
• Directly senses winding overheating
• Module independent of motor HP
• Wide trip temperature range from 80ºC to 170ºC in 5º increments
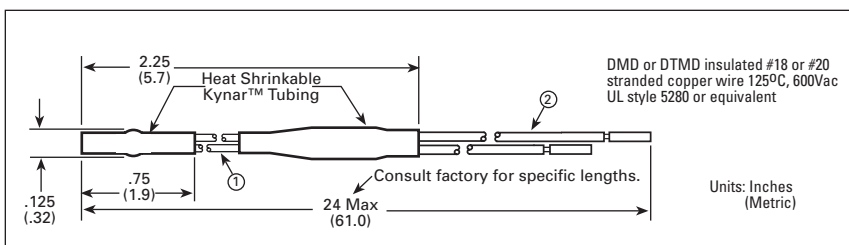• Insulation system 600V

Motor Protection

• Locked Rotor
• Running Overload
• Single Phasing
• Voltage Unbalance
• High Motor Ambient
• Blocked Ventilation
• Loss of Hermetic Compressor Charge

Sensor Nomenclature

4BA   XXX   X   XXX

10BA is the **Sensor Type:**
1. 3BA - Foil
2. 4BA - Foil
3. 7BA - Bead
4. 10BA - Bead

XXX is the **Operating Temperature:**
- Three digit trip temperature rating in 5ºC increments from 70ºC to 170ºC*

X is the **Sensor Configuration:**
1 - for Single Sensor
3 - for Three Sensor Harness

XXX is the **Wire Lead:**
- Designates wire gauge insulation and lead length.

* Range of temperature ratings varies by individual sensor type. Other temperatures available on 4BA & 7BA

2.25 (5.7)

Heat Shrinkable Kynar™ Tubing

DMD or DTMD insulated #18 or #20 stranded copper wire 125ºC, 600Vac UL style 5280 or equivalent

.125 (.32)

.75 (1.9)

①

②

Consult factory for specific lengths.

24 Max (61.0)

Units: Inches (Metric)

What is PTC?

PTC stands for *Positive Temperature Coefficient,* a conductive ceramic material used by Texas Instruments. PTC's most useful electrical property is its ability to remain at a low base resistance over a wide temperature band, and to increase its resistance abruptly at some predetermined elevated temperature. When this increase in resistance occurs, the PTC sensor acts as a solid state thermal switch and provides an input signal to the Texas Instruments electronic module which controls power to a motor starter or contactor coil.

Illustration of PTC Properties
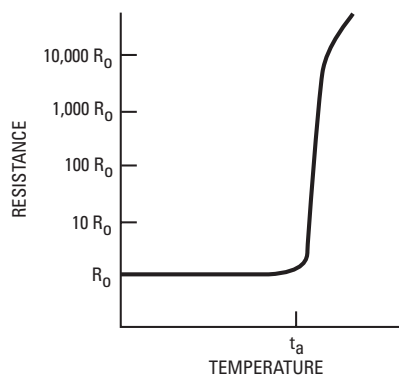
Operating Specifications

SYMBOL	PARAMETER	MIN	MAX	NOM	UNITS
Vmax	Maximum operating voltage			10	Vdc
Tc	Rated trip temperature	60			^{o}C
ΔTc	Increment		5		^{o}C
VI	Insulation rating			600	Vac
Ha	Heat absorption		25		^{o}C/Sec
T_C	Trip time response			10	Sec
	Sensor resistance at:				
Ro*	$T_A = 25^{o}$C	0.5		2.5	kΩ
Rc-5	Tc - ΔTc	$\geq$5			kΩ
Rc+5	Tc + ΔTc			$\geq$16	kΩ
Rc+15	Tc + 15°C			$\geq$42	kΩ
VH	Dielectric strength (60 Hz)			3000	Vac

*The sensor material has a non-linear voltage-current characteristic such that voltage / current applied across the sensor by the meter may influence the final result. TI recommends a voltage supply 0.8-5.0 volts to duplicate the application. Larger voltage supplies such as 9V can be used as long as a 15mA current is not exceeded.

Printed in U.S.A. 8/99 1K

## Color Coded Trip Temperatures

Temp. (^{o}C)	Insulation Color	Stripe Color
80	Orange	
85	Yellow	
90	Green	
95	Blue	
100	Purple	
105	Brown	
110	White	Orange
115	White	Red
120	White	Black
125	White	Yellow
130	White	Green
135	White	Blue
140	White	Purple
145	White	Brown
150	White	Gray
155	Red	Yellow
160	Red	White
165	Red	Black
170	Red	Orange

Sensor Selection

Motors can be secured with sensors installed from your motor manufacturer. Certain sensors can also be installed on existing motors. Sensor temperature should be selected on the basis of the design temperature rise of the motor which is usually related to the class of insulation used.

The sensor temperature elected should allow the motor to reach its normal running temperature in an industrial ambient. This places a lower limit on the sensor temperature selected. However, UL and NEMA specify maximum temperatures which may be permitted by protection devices at locked rotor and running overload conditions. These considerations place an upper limit on sensor temperatures selected.

Functional Characteristic
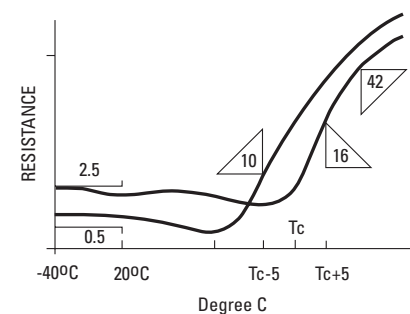
Reset Resistance Typically 3kΩ
Units: kΩ