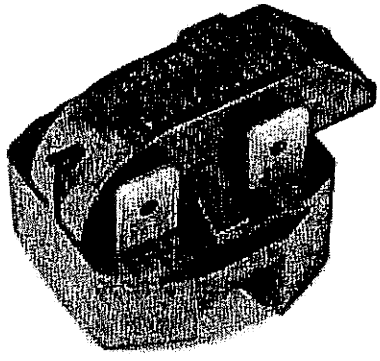
Product Bulletin

KLIXON

PTC Motor Starters
8EA Series



Features

- Solid-state PTC motor starter
- Designed for use with most split phase, capacitor run and/or start, fractional h.p. hermetic compressors
- Available for all single phase voltage applications
- Low power dissipation
- Easy installation
- Electrically (EMI) noise free
- Operating noise free
- Approved for use with explosive proof applications
- High reliability with no moving parts

Product Overview

The Texas Instruments 8EA motor starter, a low-cost alternative to electro-mechanical relays, performs the PTC (positive temperature coefficient) solid-state starter function. The 8EA is suitable for compressors used in refrigerators, freezers, water coolers, de-humidifiers, vending machines and similar refrigeration applications. It plugs directly onto the compressor terminal pins, and is frequently used with the TI 4TM plug-on motor protector.

Technical Features

- Utilizes PTC pill materials to energize / de-energize motor start windings
- Provides inherent start winding protection
- Optimal packaging approach improves efficiency
- Used in 120V or 240V applications
- Provides lowest power consumption in industry
- Wide spectrum of resistance ranges available

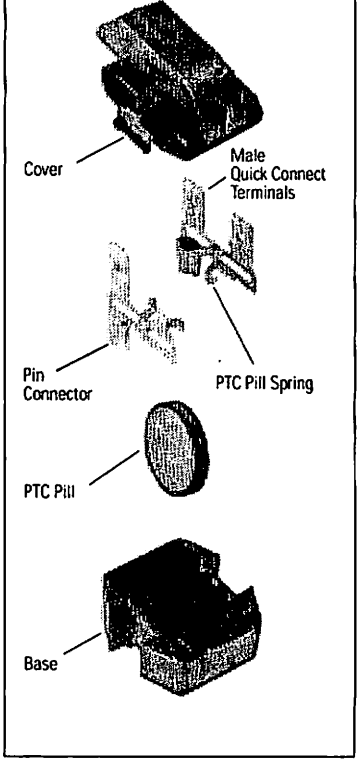
Quality and Performance

- PTC pills 100% electrically tested twice
- High reliability with no moving parts
- 500K cycles min. at max. rated condition
- Dissipates less than 2 watts under normal operating conditions
- UL and CUL Recognized Component: File SA3745
- IEC Cert. number: US/4312/UL
- Demko Cert. number: 129508-1
- CCEE number: CH003840-99
- ENEC 2018218.01

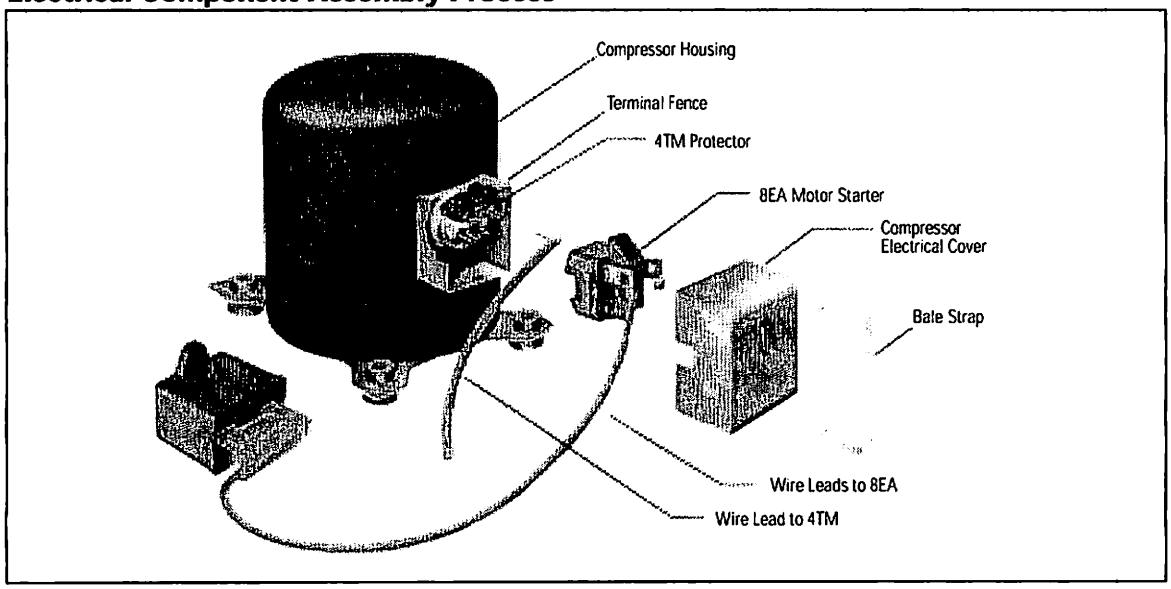
Convenience

- Fits within most existing terminal fences
- Highly legible part coding
- One rating will potentially service entire compressor voltage series
- Mounts directly to the compressor terminal pins
- Compatible with world class TI 4TM motor protection

Exploded View



Electrical Component Assembly Process



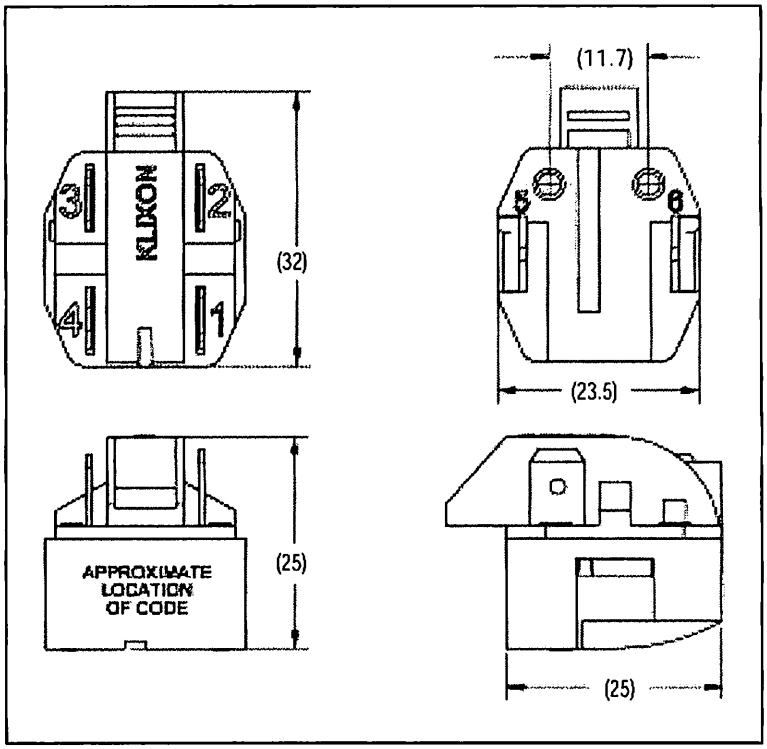
Assembly Process Description

The illustration above depicts the assembly of the 8EA onto the compressor. The 4TM motor protector is plugged onto the common pin. The 8EA plugs onto the remaining 2 pins. Female flag connectors are connected, and the electrical cover encloses the entire assembly.

8EA Coding System

8EA XXX	TI product number
XXXX	Customer part number optional
06H9R	Date Code (Typical)
Mexico	Country of Origin (Typical)

Dimensional Drawings (mm)



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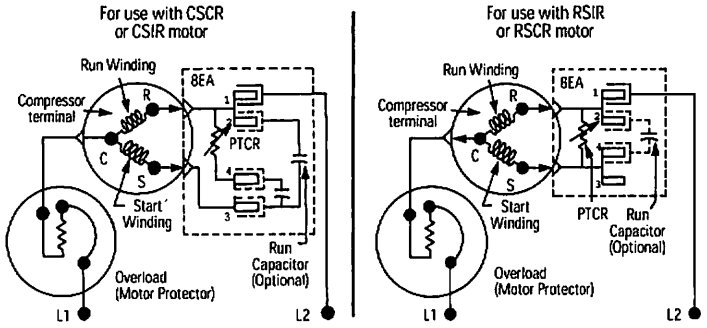
Wiring Diagrams



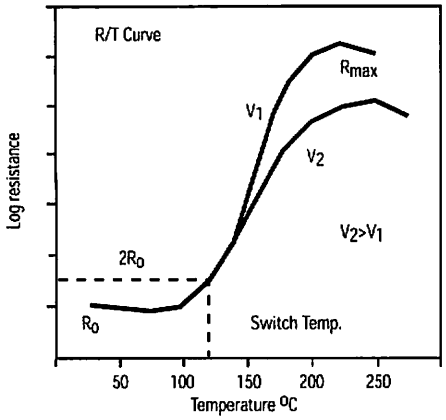
Terminal Configurations

Device	Terminal Numbers 1	2	3	4
8EAXXC1	–	M	–	–
8EAXXC2	M	M	–	–
8EAXXC3	M	M	M	–
8EAXXC4	M	M	M	M
8EAXXC5	–	M	M	–

M = 1/4"Male Quick Connect Terminal
For other configurations contact TI

PTC Performance

When power is first applied to the compressor via the 8EA, the PTC pill is in low resistance state. Current flows through the PTC pill to the start windings, causing a beneficial phase angle shift between start and main windings, and resulting in an increase in the starting torque.



8EA PTC Motor Starter Design Chart

	Independent Variable	Device Property: Switch Time	Power	Max. Voltage	Cool Rate
PTCR	Resistance ↑	↓	↓	↑	↓
PTCR	Mass ↓	↓	↓	↓	↓
PTCR	Switch Temperature ↓	↓	↓	—	↑

General trends are shown for changes in the PTCR element specifications and the corresponding 8EA device properties.

Common Electrical Rating

8EA Series	Application Voltage	V_{max}/I_{max}	Nominal Resistance (Ohms)	Heat Capacity $_{M}C_{P}$
14CX	120	180 / 12	4.7±20%	1.40
15CX	120	200 / 12	6.8±20%	1.40
16CX	120	200 / 10	10 ±20%	1.40
17CX	240	300 / 7	22 ±20%	1.40
18CX	240	355 / 6	33 ±20%	1.40
19CX	240	300 / 8	15 ±20%	1.40
20CX	240	400 / 5	47 ±20%	1.40

For other ratings contact TI.

8EA PTC Motor Starter Application Procedure

Step 1: Assemble Data Required for New Applicaions

	Example
R_0 Resistance	5.0 Ohms
Max. Volt (V_{max})	162 VAC
Max. Current (In Rush)	8 Amp
Switch Time of Motor	>0.5 Sec @ 8 Amp Ambient 25°C
Motor Type	RSCR
Reset Time	<80 Sec @ Nom. Volt Ambient 25°C
Test Requirements	•250K Cycles @ Max. Operational Conditions •300 Hrs. @ Max. Volt +10%

Step 2: Select PTC pill based on resistance and maximum operating conditions.
(See electrical rating on previous page).

Step 3: Select 8EA physical configuration based on motor type. *(See terminal configurations on previous page).*

Step 4: Switch Time Calculation
The amount of time required for PTC to switch into its high resistance state can be approximated as follows:

Equation	Example
Time (Sec) = $\frac{{}_MC_P\ (T_S-T_A)}{I^2R}$	R = 5 Ohms (R=5x.8=4)
${}_MC_P$ = Heat Capacity (Watt-Sec/°C)	I = 8 Amps
T_S = Switch Temperature (°C)	T_s = 120°C
T_A = Ambient Temperature (°C)	T_A = 25°C
I = Inrush Current (Amps-Rms)	${}_MC_P$ = 1.60
	Time (Sec) = $\frac{1.60\ (95)}{(8^2)\ (4)}$
	Switch Time = 0.59 Sec.

R = Initial Device Resistance
Under Voltage
(Use R_0 x 0.8)

Theoretical Calculated PTC Switch Time
Should Be ≥ Time Required to Start Motor

Glossary

R_0	- Measured resistance value at 25°C Max. voltage of 2.0 volts.
Cooldown Time	- Time required for the PTC resistance to return to two times the initial value (2 R_0)
Curie Point (Switch Temp.)	- Temperature obtained with a resistance value of two times ($2R_0$) the minimum resistance value (R_0)
V_{max}	- Maximum operating voltage which may be applied across the PTC continuously at the ambient temperature specified and in a steady high resistance state.
V_r	- Application rated supplied voltage/ 120 or 240 VAC (below V_{max})
I_{ss}	- Steady state current remaining at maximum operating voltage.
I_{max}	- Maximum operating current.

Application Notes

1. The surface and terminals of the 8EA device can reach high temperatures under normal running conditons. Any material in contact with the 8EA and its terminals, including wire and quick-connect receptacle plastic insulation, should have a minimum temperature rating (RTI) of 105°C. Adequate spacing should be provided to insulate lower-rated materials from this heat source.
2. The 8EA device should be protected from potential sources of liquid, such as the evaporator tray and water connections.
3. Certain materials, such as chlorine (Cl) containing gases, can degrade the characteristics of the 8EA device. The 8EA device should not be exposed to sulphur (S) or chlorine (Cl) containing gases, and must be kept away from materials that can generate them. In particular, avoid the use of polyvinyl chloride (PVC) insulation in contact with the 8EA terminals.
4. The 8EA device is designed to be used in conjunction with an electrical cover.

For further information write or call:

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