INSTRUCTION MANUAL
NO. IM - 288

SHIPBOARD TYPE

MOTOR HIGH TEMPERATURE MONITOR

POWER PRODUCTS INC. DRAWING NO. AND P/N 288 TN – 2

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TABLE OF CONTENTS

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I. INTRODUCTION

Power Products P/N 288 TN-2 Motor Monitor is approved for shipboard applications by the Naval Sea System Command '(NAVSEA), with NAVSEA letter 9302 OPR: 56Z32 ser. 56Z3/154 date: 11 April 1990. It meets military specification MIL-M-24738 (SH) January 11,1990.

The Motor Monitor uses Positive Temperature Coefficient Thermistors to monitor temperatures. PTC thermistors are resistive elements which rise sharply in resistance at a specific high temperature value. The unit responses to over temperature, regardless of cause, by tripping an internal relay, instantly shutting down the motor and/or setting an indicator. It also responds to open or shorted thermistor leads.

The 288 fully conforms to National Electric Code Requirements for integral motor thermal protection.

II. CONFIGURATION

The unit is housed in a compact steel box (3x4x5) with corrosion resistant finish for mounting directly on the motor. A corrosion resistant stainless steel box is also available.
Electrical conduit fitting(s) on the box allow the entrance of leads for connection to internal terminals. Three different fitting configurations are available as shown on Power Products drawing 288 TN - 2.

User wiring consists of:

- 120 Volt AC line.
- A set of relay contacts.
- Connection of one to six pairs of thermistor sensing leads from the motor. Three of these lead pairs are inserted in the end turns or slots in each of the three stator windings of the three-phase motor. Motor winding circuits are not disturbed. Two other lead pairs are embedded in separate spring-loaded probes (bearing thermistors) which thread into the bearing housing on each end of the motor. One of the three available fitting configurations have two compression fittings which allow installation of protective tubing for the bearing thermistor leads.

The sixth set of sensing leads is optional for any other temperature monitoring. Terminals not used are bypassed internally with a small resistor. Additional thermistor terminals are available on order for simultaneous monitoring of additional system items such as pumps or components (see IV below).

III. APPLICATIONS

The following conditions cause motor over-temperature which is sensed by the monitor.

- Single phasing.
- Excessive voltage imbalance.
- Repeated overload.
- Excessive plugging/reversing/ starting.
- Locked rotor or bearing seizure/bearing rub.
- Ventilation blockage/failure.
- Excessively high ambient temperature.

IV. OTHER APPLICATIONS

In addition to motor protection, many other applications exist. These include bearing protection for any type of pump, drive or rotating machinery; heat and fire protection for general equipment enclosures; component storage areas, transformer windings, and brake or clutch overheating.

V. OPERATION

Power Products drawing No. 288TN-2, approved by NAVSEA for shipboard applications, is included with this manual. A typical thermistor curve is shown on the drawing.

A. The monitor operates in a "fail-safe" mode. That is, the relay reverts to a de-nergized condition, not only on over-temperature but also on:

1. Loss of AC power to the monitor.
2. Short circuit of any sensor leads.
3. Break in any sensor lead.

The internal transistor circuitry allows fast chatter-free relay switching. This circuitry is also designed with a hysterisis value which automatically resets the unit for operation under normal temperature condition after trip-out at high temperature.

VI. SENSOR THERMISTORS

A. The thermistors are Positive Temperature Coefficient (PTC) switching type. The basic features of the PTC thermistor is that its resistance increases sharply when its rated switch-point temperature is reached. The PTC thermistors supplied have high stability while they retain their rated switching temperatures without degradation from vibration, shock, impregnating compounds and storage.

The thermistors are connected through diode and transistor logic circuitry so that less than two milliamperes pass through each thermistor. There is no self-heating. Therefore, this low current and snap action response allows remote location from the monitor without change in switch-point calibration.

B. Thermistor types: PTC thermistor switch temperature ratings are available as required. The winding thermistors are described in MIL-M-24738(SH) as Type I, the bearing thermistors are Type II. Switch points, as described in the specification, also correspond with motor insulation class ratings of MIL-E-917; 105 C, 135 C, 200 C, or other temperatures as required.

C. To specify thermistors, specify Type I for winding or Type II for bearing probe assembly, then P/N 288PTC-( ) temperature rating in degrees C.

D. Bearing thermistors. The PTC thermistor is embedded in a stainless steel probe with high-temperature thermally conductive potting compound.

The probe is spring-loaded sliding into a stainless steel ¼ NPT external thread fitting.

The thermistor and probe are shown in MIL-M-24738 (SH), Fig, 1 and 2, and on Power Products drawing 288 TN-2

Power Products provides thermistor lead length of 4 feet of AWG 24 Teflon-insulated wire. Other lengths may be specified.

VII. SPECIFICATIONS

See Specification MIL-M-24738 (SH) for detailed specifications and requirements of the 288 TN-2 Motor Monitor.

A. Input AC (excitation power): 120 Volts nominal, 25 Milliamperes.

B. Sensor input: From one to six PTC thermistors connected to thermistor terminals. Any unused terminal is jumpered to a common terminal with a 150 OHM, ½ watt resistor.

C. Operating temperature: 0 to 50 C continuous, short-term emergency operation to 70 C. Humidity to approximately 95%.

D. Relay trip: Normally open (closed during normal energized operation). After being tripped, relay automatically resets (energizes) when thermistor temperature recovers.

E. Relay contacts: Normally open, normally closed, and common contacts are available on a terminal strip in the monitor.

F. The relay is a plug-in standard general type K-10. Contacts are rated min.7 amperes 120 VAC resistive, 5 amps 240 VAC "Form C" type used for military and commercial use. Coil is 12 Volts DC, 160 Ohms.

G. Relay sources: 1DEC, No. RH2B-U-DC-12V; Guardian Relay No. 1395P-2C-12D; Potter & Brumfield KIOPI 1D15-12VDC. Note that the catalog contact ratings are higher than as specified in paragraph above, and on the Power Products drawing. The catalog ratings are normal, and Power Product's are for absolute worst case.

H. Fail-safe operation. Controller de-energizes for any one of the following reasons:

1. Motor over-temperature (see III "Applications").
2. Open-circuit of any thermistor lead.
3. Short-circuit or very low resistance of thermistor.
4. Loss of AC input to the monitor (loss of excitation voltage).

VIII. INSTALLATION

A. Refer to Power Products drawing 288TN-2. Mount the monitor on an appropriate plate on the motor. Use a gasket on the mounting surface, as shown.

B. Input AC connection. Connect 120 Volts AC to terminal 1 and 2. Route the wires through the ½ watertight conduit connector, item 8 on the drawing. Although very low current is required, use No. AWG 16 for mechanical strength.

C. Relay Contact Connections: The relay contact leads normally connect to Terminal 4 (common) and Terminal 5 normally open, closed when energized.

Terminal 3 is normally closed, open when energized.

Relay lead wires also route through the same conduit connectors as the AC input for configuration 288 TN-2-1, or separately with configuration 288 TN-2-2.

- CAUTION -

Never apply power directly across the relay contacts without a load such as another relay coil, warning lamp, etc. in series with the contact.

D. Winding thermistor lead wires: A through-hole from inside the unit to the base of the monitor is provided as the most direct access through the monitor mounting plate to the internal motor windings.

E. Bearing thermistor leads: Two ⅜" compression-type tube fittings are provided next to the ½" AC conduit fitting. Each bearing thermistor routes through a tube into one of the fittings, thus enclosing the externally-run thermistor leads. This is configuration 288 TN-2-3.
NOTE: 2 conduit fittings, no compression fitting is 288 TN-2-2.
1 conduit fitting, no compression fitting is 288TN-2-1.

IX. TESTING

In order to test the monitor, the operator may use the thermistors or simulate the action of the thermistors.

In either case, it is advisable to test the unit when removed from the motor in order to eliminate any chance of wiring problems external to the unit, and to easily observe the action of the relay.

A. Testing with Thermistors.

When using external testing thermistors, use six of the winding, bearings, or both. Connect all six so that all inputs are connected. If six are not available, connect a 150 OHM '/2 watt resistor in place of the thermistor.

1. Connect one lead of all thermistors together and connect to terminal 6. The open end of each thermistor connects to terminal 7 to 12. There is no thermistor polarization.

2. Connect a nominal 120 Volt AC line to terminal 1 and 2 with 2 lamps as shown in Fig 1.

3. Place AC switch "ON", or plug-in to AC. The monitor relay is now energized, and the N.O. position is now closed with the green lamp on.

4. Place a jumper or small clip-lead from terminal 6 to terminal 7 to 12, in turn or randomly. When the lead is touched to the terminal, green lamp goes off, red lamp is on. This demonstrates that short-circuiting any thermistor will de-energized the monitor relay.

5. Heat any thermistor to its rated transfer point. (This is done at the factory with hot oil immersion). At this point, the relay de-energizes, green lamp off, red lamp on. After a few seconds when the thermistor's temperature goes down, the relay resets to its energized position, and green lamp goes on, red off.

6. Open any thermistor terminal 7 to 12. The relay should de-energize.

B. Simulating Thermistor Action

1. Instead of thermistors, connect (6) 150 OHM ½ watt resistors from terminal 6 to 7 through 12. Only open and short-circuit tests can be made, no temperature tests.

2. Perform the same tests as with the thermistors. That is, (a) open any resistor and the relay should de-energize; and (b) short any resistor and the relay de-energizes.

3. Power Products has a test fixture, P/N 266RT, which uses six 10 turn 5 K Potentiometers with a 3 position switch connected to each pot. The pots (a) simulate the rise on resistance of the thermistor; (b) consistency of each of the six sensors inputs to the resistance value; and (c) simulate the hysterisis return to normal temperature/resistance and resetting of the relay. The switch when in short position, simulates short-circuit de-energizing; when in open position, simulates the opening of the sensor leads.

A schematic of this test fixture is enclosed, Figure 1, so that the operator may construct this fixture, or contact Power Products for its availability.

X. PROBLEMS

If the unit does not function properly and the wiring is correct, replace the relay by unplugging the old relay and replacing it with a new one.

Make sure that all test connections are tight and the relay is firmly seated.

If the monitor still does not function, it must be replaced.