



TeSys island

Application Note: Use of PTC Sensors with Analog Input module

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Background

PTC binary (thermistor) temperature sensors have a sharp resistance curve where at the temperature corresponding to the Response Value Temperature (or Rated Operating Temperature, TNF) of the thermistor the resistance rises by several magnitudes. Typically in three-phase motors the motors are built with three PTC in series. Motor protection PTCs designed as Mark A detectors per IEC 60947-8 have defined resistances relative to the operating temperature TNF.

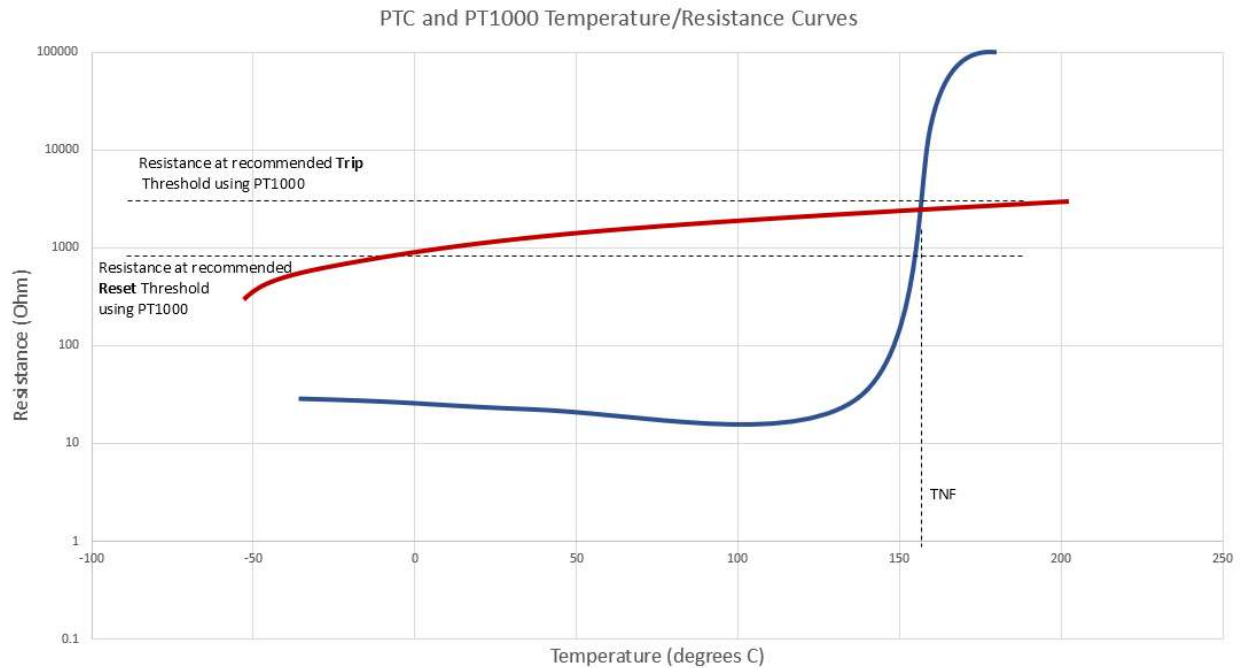
- At room temperature (TNF minus 20°K) the value of each PTC must be <250 Ω , so three in series must be <750 Ω .
- At TNF minus 5°K, the resistance must be <550 Ω per PTC or <1650 Ω overall.
- At TNF plus 5°K, the resistance must be >1330 Ω per PTC or > 4000 Ω overall
- At TNF plus 15°K, the resistance must be >4000 Ω per PTC.

Thus a motor protection algorithm per IEC 60947-8 must trigger somewhere between 1650 Ω and 4000 Ω .

PT1000 sensors provide a more linear resistance relative to the temperature they are sensing. The TeSys island Analog IO Avatar measures this resistance and relates it to a corresponding temperature. The “cold” resistance of a PTC (<750 Ω) corresponds to a temperature of ~-50°C on a PT1000 sensor. The TNF resistance of a PTC corresponds to a temperature of ~200°C (200°C is 1760 Ω on a PT1000).

The TeSys island Motor Overheat protection function, which turns off the Avatar output at a certain threshold and allows it to reset after it has cooled to a lower threshold, can have a Trip Level of up to 200°C and a minimum Reset Threshold of 0°C. This 0° corresponds to 1000 Ω and is still along the flat portion of the curve for motor protection PTC thermistors (corresponding to less than TNF temperature). Thus, if the TeSys island Avatar Motor Overheat protection function is set up to trip above 200°C and reset below 0°, it will function as a PTC relay. *See note in procedure, it may be necessary to increase the reset threshold to 50-80 degrees depending on the base resistance of the PTC circuit.*

Note that when monitoring the analog value “MotorTemperature” via fieldbus, DTM, or OMT, the temperature value will correspond to the equivalent for that resistance on a PT1000 sensor. What you will likely see is the motor at room temperature or running normally being displayed as ~-50° or lower, and once the PTC has tripped, it will display as 1000°. The PTC resistance above TNF is higher than any PT1000 would normally get and displays the maximum value for this data.



Configuration

To configure this PTC protection function using the DTM follow these steps:

1. Add Temperature Sensor to your Avatar in the DTM, MyAvatar page via the Temperature Sensor Available dropdown.

AVATAR PARAMETERS

Avatar Name: AvOneDirection02	Individual Short-Circuit Protection: Coordination Type 2
Power Supply Type: Single Phase	Load Energy Monitoring: No
Upstream Voltage: 230 V	Temperature Sensor Available: No No Yes
Rating: 0.12 kW	
Rating: 1.7 A	
Type Of Utilization: Start/Stop	

2. Enable Motor Overheat Protection. Set the Trip Level to 200°C. Set the Reset Threshold to 0°C. Select Temperature Sensor type to PT1000.

THERMAL PROTECTION

THERMAL OVERLOAD
MOTOR OVERHEAT >

Motor Overheat Trip: Enable
Trip Delay: 0 sec
Trip Level: 200 °C
Reset Threshold: 0 °C
Motor Overheat Alarm: Disable
Alarm Threshold: 0 °C
Temperature Sensor: PT1000

3. Wire Analog IO input as follows (use shielded cable to connect to the sensor) including bringing a jumper (short) between Input 0- and Input 0 Ground:

Note: with some PTC sensors, if using only 1 (instead of 3 in series) the base resistance is not enough to be detected by the module. After setting it up at room temperature in this case the system will report a temperature/resistance value of 1000 signifying out of range. If this happens, connect a 100-200 ohm resistor in series with the PTC to increase this base resistance until the temperature reported is between -200 and 50 degrees. Potentially adjust your Reset Threshold based on this value.

