

## MP-01 : TEMPERATURE SENSORS AND HOT-MOTOR COMPENSATION

### Temperature Sensors

The MPU-32 and MPS have inputs for either a positive-temperature-coefficient thermistor (PTC) or a resistance temperature detector (RTD) as well as the option of monitoring many RTD's via external modules.

A PTC sensor is a non-linear device that is not suitable for direct temperature measurement. It has a low resistance (<200 ohms) at temperatures below the nominal response temperature (NRT) and a high resistance (>3000 ohms) at temperatures above the NRT.

In contrast, RTD's have resistance values that vary in a predictable way with temperature. The most common RTD sensors for direct temperature measurement are 100-ohm platinum (Pt-100), 120-ohm nickel (Ni-120), 100-ohm nickel (Ni-100), and 10-ohm copper (Cu-10). In most industries, 100-ohm platinum (DIN 43760) is regarded as the preferred sensor.

### Hot Motor Compensation

The rate at which heat is produced in a motor is equal to the difference between the electrical power input and the shaft power output. At steady state, heat produced is equal to the heat dissipated and motor temperature will be constant. Under locked rotor, high inertia-starting, or overload conditions, the heat produced will exceed the heat dissipated and motor temperature will increase. The temperature rise in the stator will lag the temperature rise in the rotor because of the time required for heat to transfer from the rotor to the stator. If a temperature sensor is embedded in a stator winding, it will accurately indicate temperature at steady state; however, the sensor response is too slow to protect against most overload conditions.

Although the MPU-32 and MPS have programmable trip and alarm temperature set points, the most important function of an RTD sensor is to provide hot motor compensation. This function can be enabled in the settings to bias the thermal model and provide protection against loss of ventilation and high ambient temperature.

### Hot Spot and Bearing Monitoring

There is an optional MPS-RTD module which allows for monitoring of eight RTDs (or analog inputs) per module. Many modern motors have six stator RTDs and two bearing RTDs. These are useful for detecting hotspots - stator windings that are heating irregularly - that are warning signs of an eventual failure and allowing for an orderly, scheduled shut down and inspection or replacement. The bearings are also monitored, usually relative to each other, to detect impending failure, which would lead to locked rotor or jam.