Product Service Bulletin
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Ask the experts

Q: My motor has a connection plate which says Dual Voltage Wye Start, Delta Run with PWS on the Low Voltage. How should I hook it up?

A: This motor has very good versatility and may be used in several power supply applications. It is a dual voltage machine and may be used on either voltage as defined on the connection plate. It is designed for use on a Wye Start, Delta Run starter. This is a special motor contactor which starts the motor on its Wye connection to limit the inrush and then switches to Delta for running. The motor must not be run on the Wye connection for more than 30 seconds as severe winding damage may occur. This motor may also be started across the line and run on the Delta connection. In addition, the motor may be used on the low voltage connection as a part-winding start motor, also to limit the inrush required. After a brief period, it is switched to the full winding.

Have a question for the experts? Contact us at jim.bryan@emotors.com

PART TWO

Winding Thermal Protection

by Ben Biondi

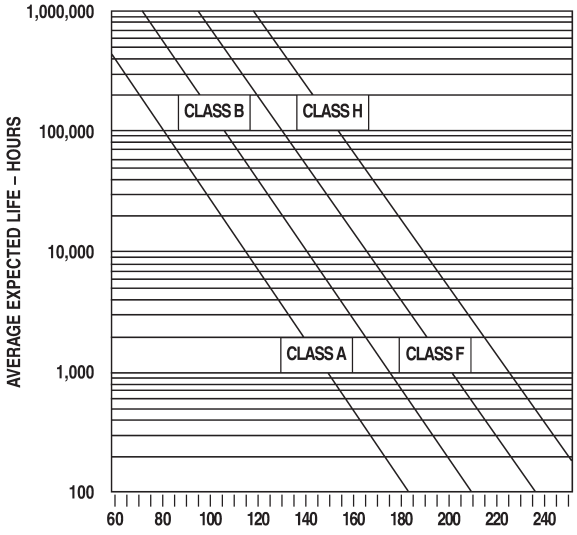
Winding Thermistors

A thermistor is a non-linear resistance temperature detector, made from semiconductor material. Each specific thermistor has its own unique resistance vs. temperature characteristic.

There are two general types of thermistors. The positive temperature coefficient (PTC) type has a resistance that increases with increasing temperature. The PTC thermistor has a sharp rise in resistance when the temperature reaches the 'knee', or switching point.

The negative temperature coefficient (NTC) type thermistor has a resistance that decreases with increasing temperature. U.S. Motors supplies the PTC-type thermistors.

TEMPERATURE VS. LIFE CURVES* FOR INSULATION SYSTEMS (PER IEEE 117 & 101)



*ASSUMES LIFE DOUBLES FOR A 10 DEGREE DECREASE IN TEMPERATURE

As with RTDs, a control module must be used with the thermistors. The control module is generally an externally excited solid-state device that senses the thermistor resistance and switches contacts when the thermistor input resistance rises above a set resistance value.

The thermistor trip temperature determines the point at which the thermistor resistance rises to a very high value, thus tripping the controller. Thermistors are available with different trip temperatures. Each thermistor has one pre-set, non-adjustable switch point.

Thermistors are normally installed in the end turns of the motor. Depending on the controller, they are either wired in series, or in a special configuration that can be referred to as a "common lead circuit" (four leads out including a common ground). The thermistors wired in series can be either wired in series internal to the motor with only two leads brought out (usually for Canadian orders), or wired in series in the outlet box so that all six leads are brought out of the motor. U.S. Motors will bring all six leads out unless specified otherwise.

Thermistors have several advantages over RTDs, thermocouples and thermostats. Like thermostats, thermistors

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have a tamper-proof pre-set switch point, with a reset only after the motor cools down. Due to their small size and heat sink construction, they have fast response times. In mush-wound motors, non-rotor limited designs, thermistors can provide locked rotor protection. Also, since the controller trips at a high resistance value, resistance variations due to long lead runs can be tolerated. This feature allows for one controller to be used for several temperature sensing locations.

Selection

Except for Therma-Sentry®, the customer must advise the exact type of thermistor required so it will match the controller. All orders that do not specify the exact type of thermistor required will be delayed. Unless specified otherwise on the face of the order, three thermistors will be supplied.

Types of Thermistors

1. Power Control Corporation (PCC) 8000 series are usually installed in the 'common lead circuit' configuration. They cannot be installed in series as false tripping will occur. PCC makes numerous controllers for customers to select from

2. Texas Instruments (TI) 4BA series thermistors are usually wired in series. Up to three thermistors may be installed in series without false tripping the controller. The U.S. Motors procedure is to bring out all six leads and make the series connection in the outlet box. The standard TI controller is a model 50AA control module.

3. Siemens Q63100-P, PTC thermistors must be wired in series. Up to six Siemens thermistors may be wired in series without false tripping the controller. U.S. Motors standard procedure is to install three thermistors in series and bring all six leads out, making the series connection in the outlet box. For Canadian orders, the three thermistors are wired in series internally in the motor, and two leads are brought out. We ask that this configuration be specified when ordering. The Siemens standard controller is a model 3UN tripping unit control module. The control module has one normally open and one normally closed contact.

Therma-Sentry®

Therma-Sentry® is a thermal protection system that is activated by excessive winding temperature. Therma-Sentry® protects against the most common causes of motor failure including: high or low supply voltage, unbalanced line voltage, single phase conditions, abnormally high ambient temperatures, blocked ventilation, starting overload and running overloads.

The system consists of three PTC thermistors embedded in the motor winding end turns, one per phase, with the leads connected to a solid state electronic controller. The solid state controller can be supplied permanently potted in the main or accessory outlet box, or as a separate module for mounting in a control panel.

Note: The Therma-Sentry® controller uses output triacs, which are specifically designed to operate directly in series with mainline contactors. If a small interpose relay must be used, the sealed VA rating of the interposing relay must be greater than 10VA. Difficulties may be encountered when interfacing with solid state motor control equipment (VFD's, Soft Start, etc.). Use with solid state starting equipment may also result in false tripping.

The leads from the three thermistors are connected internally in the 'common lead circuit' configuration.

The Therma-Sentry® system will only provide locked rotor protection for certain motors. In form-wound motors, the winding insulation is so heavy the temperature gradient across the insulation to the thermistor is too great to give the rapid response required to prevent rotor failure. Also, for mush wound motors, only motors with a winding safe stall time less than the rotor safe stall time will have locked rotor and starting overload protection.

Selection

The Therma-Sentry® controller has one normally closed (N.C.) contact with a three amp control circuit rating. Thus the Therma-Sentry® system is generally used in applications where the motor is shut down when excessive temperatures occur. On customer orders, unless the customer order specifically requires thermistors rated for alarm temperatures, thermistors for shut-down temperatures are supplied.

The Therma-Sentry® controller is supplied in one of two styles:

1. Therma-Sentry® service module - typically for NEMA frames 440 and TITAN frames 449 and larger and for remote mounting in customer panel.

2. Therma-Sentry® assembly - typically for NEMA frames 400 and smaller, or FLA under 240 amps, mounted on the motor in a special partitioned conduit box with the main motor leads in the second partition.

When specifying Therma-Sentry® at time of order entry, the mounting location of the controller must be specified. Options are: Motor mounted or separately mounted (customer control panel). The most common specification is motor mounted, separately excited (MMSE).

VOLT SOURCE: U.S. Motors only provides separately excited control modules. The control module must be separately excited by either a 115, 230, 460, or 575 volt source, or 380 volt/ 50 hertz. If not specified, 115v will be supplied. The control module must be excited before the motor can be started. Excitation voltage must be sine wave.

Winding Thermocouples

A thermocouple is a pair of dissimilar metal conductors so joined at one point that an electromotive force (EMF) is developed by the thermoelectric effects. Any given set of thermocouple wires have a known "EMF vs. Temperature" characteristic.

Thermocouples can only generate a low-voltage, low-power signal, that is in the milli-volt range. Therefore the customer must supply the electronic control equipment to translate the thermocouple voltage signal into a temperature reading, or to operate the control's alarm or shutdown devices.

There are many types of thermocouples. The U.S. Motors' standard types are copper-constantan, chromel-constantan and iron-constantan.

The standard installation procedure is to install the thermocouples in the slot portion of the winding. If required by the customer, they can also be installed in end turns of the winding. The standard quantity of thermocouples is six, installed two per phase.

Selection

The customer's choice of monitoring equipment dictates the type of thermocouples to be installed in the motor, so orders need to specify the exact type of thermocouples required. Monitoring equipment is not supplied by U.S. Motors.

For more information about winding temperature protection, contact Ben Biondi, Product Service Engineer with US Motors, at 314-553-3875 or ben.biondi@emotors.com.