Transformer Temperature Monitoring – Top Oil & Hot Spot Trip operations

A.Eberle's multifunctional REG-D and REG-DA Voltage Regulator Relays (VRR's) can be equipped with a Transformer Monitoring Module (TMM) to provide temperature control of cooling fans and pumps. Using TMM the regulators can also be set to alarm and to trip the transformer when preset limits are exceeded. Please refer our website technical note (VR-007) "Transformer Temperature Control with VRR's" for more information on TMM features.

The monitoring of Transformer temperature is normally via a top oil temperature monitoring probe (with hot-spot temperature being calculated from this). A common installation involves the use of a PT100 (resistance) temperature probe being installed in the transformer top oil pocket, connecting to 4-20 mA transducer, which is used to more conveniently run the signals to the distant REG-D/DA.

Figure 1. PT 100 probe

The PT100 temperature measurement relies on a change in resistance that's proportional to a change in temperature - the hotter the temperature, the higher the resistance. Normally, this resistance is then converted to a milliamp signal by a transmitter, before being input into the REG-D(A). Since the PT100 probe itself is basically a piece of wire, and is subject to many temperature fluctuations, this wire is prone to breakages. When this happens, the measured resistance becomes infinite.

Traditional transmitters see this infinite resistance as an infinite temperature and the milliamp output signal is driven to the maximum. This can be problematic if the PT100 is being used to measure oil temperature in a transformer, particularly if trip relays are being driven from limits based on this temperature. The result can be a tripped transformer due to a broken temperature probe.

Fortunately, there are at least three solutions to this well-known problem:

1. Modern digital transmitters can be programmed to drive the milliamp output down, often below 4 mA, in the event of the resistance input becoming faulty. While this means that the temperature trips don't operate, we recommend setting up some sort of low limit monitoring to alert personnel that the PT100 has in fact failed. While this may suit new applications, changing all the existing temperature transmitters can be a costly and time-consuming exercise.
2. HV Power can provide what is fast becoming a standard H-Code solution. Known as the "PT100 Wirebreak" H-Code, it monitors the rate-of-change of the temperature signal coming from the transducer. If this rate-of-change exceeds what is expected from a real temperature rise, the trip relays are blocked, and an alarm is

HV Power Measurements and Protection Ltd Tel: +64-9- 377 2001
Unit K, 4 Gloucester Park Ave, Onehunga, Auckland
P O Box 26-074, Epsom, Auckland 1030, New Zealand Email: info@hvpower.co.nz

signalled. Once the probe has been replaced, a simple reset mechanism is provided to enable tripping from the temperature again.

3. Direct PT100 inputs are available for the REG-D(A) where wiring from the PT100 probe can be wired directly into the voltage regulator. Three or four-wire connections provide a solution to the effect of the added resistance of the wiring between the probe and the REG-D(A). With firmware 2.20, a version of the PT100 wirebreak functionality described above is built into the REG-D(A) firmware for the physical PT100 inputs. Our "PT100 Wirebreak" H-code can also be loaded if you want standardisation.

The recommendation during maintenance – reducing the risk of trip!

Where REG-D/DA Transformer Temperature Monitoring is set up to a trip the breaker due to transformer temperature (top oil and/or hot spot depending upon setup), care is needed to ensure that any maintenance work on a regulator (while transformer is in service) does not cause an inadvertent trip.

We recommend to temporarily disconnect the trip output from the REG-D/DA in such circumstances.

HV Power Measurements and Protection Ltd Tel: +64-9- 377 2001
Unit K, 4 Gloucester Park Ave, Onehunga, Auckland
P O Box 26-074, Epsom, Auckland 1030, New Zealand Email: info@hvpower.co.nz