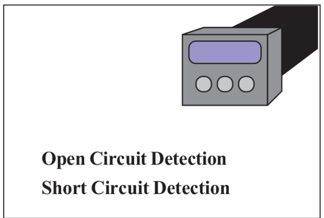
FAIL-SAFE CONTROL INSTALLATION METHODS

Although extraordinarily reliable, like any other measuring device, an IRt/c installation should be designed to "fail-safe" under all foreseeable situations. Accordingly, the possible failure modes should be considered as part of the installation design, as recommended in the *Operating Principles Manual* supplied with every IRt/c.

Open Circuit Detection



As in all thermocouple installations, a primary protection recommended is open circuit detection, which will alert if wires are broken, or if the IRt/c is physically damaged to the point of opening the electrical circuit. Standard circuit techniques involve using a small leakage current that generates negligible voltage when the circuit is closed, but drives the input amplifier into saturation if the circuit opens. Only a very small amount of current is required, ~ 1 nanoamp, which produces a negligible signal offset with the higher impedance of the IRt/c, although some devices produce far more current than required, and thus produce more offset (see Tech Notes #16, 37).

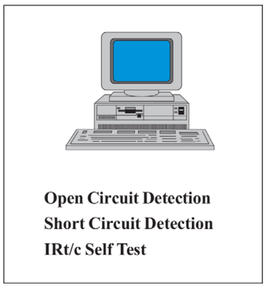
Short Circuit Detection

Also a commonly available feature of thermocouple control devices, this safety feature detects if the load is on solidly for a time that is too long for the normalprocess requirements. This would be the case if a thermocouple were shorted somewhere between the measuring junction and the controller, and thus not reporting the temperature of the process, but the temperature at the short. This safety feature in a controller is highly recommended, since it not only will protect against short circuits, but also against any other possible failure in the IRt/c which might maintain electrical continuity, but renders it blind to the process.

Calibration Drift

There are no known processes that can cause a significant calibration drift in the IRt/c. Since there are no active electrical components, the signal is generated entirely by thermoelectric effects, and the materials are kept at comfortably low temperatures. A significant feature of the IRt/c design and construction is the presence of a Xenon gas fill in the detection system, which provides an immediate and dramatic change in sensitivity (factor of ~ 3) if mechanical damage occurs sufficient to cause a leak (see Tech Note #38). A common *apparent* source of drift can be a dirty lens, since the optical signal will degrade in direct proportion to the lens area blocked. Employing the built-in air purge feature of most IRt/c's prevents this problem.

IRt/c Self-Test



A powerful method of checking an IRt/c installation is to test the response against an expected range on *every measurement cycle*. This option is highly recommended if there is computing power available, since it takes full advantage of the fact that any failure of the IRt/c will result in a dramatic change in sensitivity; and thus failure to respond to normal thermal processes will be easy to detect. Refer to Tech Note #39 for further details.

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