2. Temperature Verification Continued

To verify the Controller:
TURN THE POWER TO THE CONTROLLER OFF BEFORE PROCEEDING!

a) Disconnect the RTD wiring from the input terminals.
b) Connect a 100 Ω resistor across the source or sense terminal and common. Insert a jumper between the source and sense terminals.
c) Apply power to the controller. The indicated or displayed temperature should be about 32°F (0°C), depending on the actual resistance of the test resistor if RTD TYPE is set to 100Ω Platinum. Any resistor may have a +/- 10% tolerance.

3. Unstable Temperature

An erratic indication of temperature can be caused by several factors external to the controller. The controller's accuracy and resolution will result in an indicated temperature change of a couple of degrees if the measured resistance temperature falls between two discrete values (this is sometimes referred to as quantization error).

If the instability is excessive, check:

a) Wire used for extension of the RTD should be three-wire, twisted and shielded with the shield grounded at the controller only. Each of the three lead wires must be of the same gauge.
b) The ideal installation has a separate conduit for the RTD leads (if they have been extended).It is not usually a problem to run low signal levels in the same conduit as the power leads even in high power applications, as long as the RTD wire is a twisted, shielded type with an insulation rating equal to or greater than the highest voltage in the conduit. Follow the proper Electrical Code requirements for your particular installation.
c) Check the specifications for the particular cable being used to ensure that it does not have excessive capacitance when used in long lengths. This can cause a temperature offset between what the controller reads and what the RTD actually measures. This again is normally not a problem since the controller compensates for all but the worst cases of this.

3. Unstable Temperature Continued

d) Check, one by one, if the all RTD leads are connected to the connector.
e) Lastly, it is possible for the RTD itself to fail on an intermittent basis but this failure mode should be considered unusual. This kind of failure is probably the most difficult to find, but fortunately, it is also the least likely as a failure mechanism.

9.2 Ground Fault

Ground fault warning/alarms can be due to incorrect installation as well as leakage resulting from wet system components or faulted cables.

The CM2201 Controller detects ground faults by summing the outgoing and return trace currents through an internal current transformer. Under normal operating conditions (no ground fault condition), this current will be zero. When there is a flow of current from one of the trace supply wires to ground, a ground fault condition occurs.

If a ground fault alarm is present on start-up of a new installation, it is likely due to a wiring error or damaged cable. To verify this condition:

a) Check that the heating circuit neutrals return to the controller and are not connected directly to the distribution panel. This can be a common problem if the installation is a retrofit situation.
b) On paralleled circuits, be certain that ALL neutrals return. The late addition of a circuit may not be obvious.

Note: The controller monitors the integrity of the ground fault (GF) detection. If a fault is detected, the controller will generate a GFI warning/alarm, depending on the settings.

9.3 Common Warnings/Alarms - What to Look for

The CM-2201 has a wide range of warning and alarming features that may be selectively enabled or disabled to allow the monitoring and indication of trouble conditions. Described below are the different warning and alarm conditions available on the CM2201, their meanings, and possible causes. The warning settings must be below alarm settings. If an alarm is activated, the two low power SSRs will be activated.

9.3.1 High RTD 1/ RTD 2 Temperature Reading

This warning/alarm appears when the temperature exceeds the HIGH RTD WARNING/ALARM temperature setting.

Cause of Warning/Alarm:
- Warning/Alarm temperature setting too close to maintain temperature
- Flow of hot product
- Steaming out lines
- Incorrect tracer wiring

9.3.2 Low RTD 1/ RTD 2 Temperature Reading

This warning/alarm appears when the temperature decreases below the LOW RTD WARNING/ALARM temperature setting.

Cause of Warning/Alarm:
- Warning/Alarm temperature setting too close to maintain temperature
- Flow of cold product
- Empty pipe
- Damaged, wet, or missing insulation
- Heating cable not sized properly for the application

9.3.3 RTD 1/ RTD 2 Failure

This alarm indicates a sensor is not operating properly. The temperature sensor may fail due to an “open” or “shorted” condition.

Cause of Alarm:
- Incorrect or damaged field wiring - open leads or excess resistance (either intermittent or continuous) may be due to broken or damaged wires or loose terminals.
- Damaged or inoperative temperature sensors

9.3.4 High Current Warning/Alarm

This warning/alarm activates when current levels are greater than the HIGH CURRENT WARNING/ALARM setting for the application.

9.3.4 High Current Warning/Alarm Continued

Cause of Warning/Alarm:
- Warning/Alarm setting too close to normal operating current
- High in-rush current from “cold start” of self regulating cable
- Damaged or partially shorted heating cable
- “As built” cable length is greater than design value

9.3.5 Low Current Warning/Alarm

This alarms current levels which are less than the LOW CURRENT WARNING/ALARM setting.

Cause of Warnings/Alarm:
- Warning/Alarm setting too close to normal operating current
- Low source voltage
- Damaged or inoperative heating cable
- Open connection—wiring problem
- SSR or contactor failed open

9.3.6 High GFI Warning

This warns that ground fault current levels are greater than the HIGH GFI WARNING setting.

Cause of Warning:
- Warning setting too close to normal leakage current
- Damaged cable insulation and/or moisture present
- Moisture in junction box
- Poor splice or termination
- Moisture provides conductive ground path, which allows ground fault current

9.3.7 GFI Alarm

This value sets the upper limit of allowable ground fault leakage. Exceeding this limit will result in the output switch being latched off, and the alarm activated to indicate a ground fault condition.

9.3.7 GFI Alarm Continued

Cause of Alarm:
- Trip setting too close to normal leakage current
- Damaged cable insulation and/or moisture present
- Moisture in junction box
- Poor splice or termination
- Moisture provides conductive ground path, which allows ground fault current

9.3.8 High Voltage Warning/Alarm

This warning/alarms voltage levels that are greater than the HIGH VOLTAGE WARNING/ALARM setting.

Cause of Warning/Alarm:
- Warning/Alarm setting too close to normal operating voltage
- Incorrect wiring
- Power surge

9.3.9 Low Voltage Warning/Alarm

This warns/alarms of voltage levels that are less than the LOW VOLTAGE WARNING/ALARM setting.

Cause of Warning/Alarm:
- Warning/Alarm setting too close to normal operating voltage
- Damaged power cable
- Incorrect VOLTAGE TURNS RATIO
- “Brown-out” conditions
- Loss of power to the circuit

9.3.10 Overcurrent Trip

If the controller is unable to start the cable due to high current, or after attempting to soft-start it, the controller will trip its output switch off.

Cause of Alarm:
- Excessive in-rush current
- Incorrect CM-2201 settings
- Incorrect wiring
- Damaged cable

9.3.11 Switch Failure

This alarm indicates that the controller senses current flow when the output switch should be off.

Cause of Alarm
- Some other device energized heat trace
- Output switch has failed “closed”

9.3.12 Power Limiting (Current Limiting)

This alarm indicates that the solid state relay is limiting the average amount of power that is applied to the trace circuit as defined by the MAXIMUM POWER setting.

Cause of Alarm:
- Power applied to trace circuit is being limited to the MAXIMUM POWER setting

9.3.13 EEPROM Data Failure

This alarm indicates that the controller has detected a failure in its non-volatile memory (this is where all of the controller’s configuration and calibration settings are stored). This indicates an internal problem, and the CM2201 should be replaced and returned to the factory for repair.

Cause of Alarm:
- The CM-2201 cannot bypass the failed area of its memory and has loaded factory defaults into this failed area.