User’s Guide

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CN2110
Rev. 8-03
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**WARNING:** These products are not designed for use in, and should not be used for, patient-connected applications.
# CN 2110 Temperature Controller

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Section 1—Quick Setup

After the controller is properly wired into the system, the user only needs to verify the sensor input and control type and adjust the set point.

Setting the Sensor and Control Mode

Adjust the dip switches located on the bottom of the unit as shown in Figure 1.1. The factory settings are J, TC, °F, and PI. It is simpler to adjust the dip switch prior to mounting the CN 2110.

Adjusting the Set Point

1. Apply power to the unit.
2. To adjust the set point on the CN 2110 Temperature Controller, press and hold the Set Point button (see Figure 1.2). The Set Point light is illuminated.
3. While still pressing the Set Point button, press either the † or ‡ button to adjust the set point to the desired value (see Figure 1.3). Holding the † or ‡ button increases the speed of the set point changes.

The Controller is now operational with factory settings. For more precise control, set up of the alarm, etc., see Section 4 – Adjusting Set Point and Configuration.
Section 2—Introduction

**Description**

The CN 2110 Temperature controller offers simple setup, flexibility and control features in an attractive, compact design. The CN 2110 is housed in a rugged, plastic 1/4 DIN package that only requires four inches behind the mounting surface. Straightforward operation and easy-to-use control features are major strengths of the CN 2110 controller.

**Easy Three-Step Setup:** The CN 2110 delivers exceptional process temperature control. Your process is up and running after three easy setup steps: 1) Select the sensor and control type, 2) Hook up the system and 3) Select the desired temperature.

**NEMA 4X Front Panel**

Construction for hosedown applications

**Output LEDs**

Indicates control load ON and alarm status

**Temp and Set Point LEDs**

Indicates actual or set point temperature is displayed

**Set Point Button**

- In Operation Mode, adjusts Set Point
- In Configuration Mode with the ↑ or ↓ button, serves as "Menu" button

**Display**

(4 Green, 7-Segment LEDs)

Actual process temperature displayed

**Green LEDs**

Indicates °F or °C selected for temperature display

- In Operation Mode, pushbuttons adjust Set Point.
- In Setup Mode, pushbuttons increase/decrease MENU values.

---

**Inspection and Unpacking**

Your CN 2110 controller should arrive in good condition. Upon arrival, inspect the packaging for any visible damage.

Unpack the controller and carefully inspect for product damage that may have occurred during shipment. If the package or contents have been damaged in shipping, you must file a claim with the delivery service. The delivery service will not accept a claim from the shipper.

If not immediately installing the controller, store in a cool, dry environment in its original protective packaging. Temperature extremes and excessive moisture can damage the instrument.
Typical Application

Figure 2.2 shows the CN 2110 in a typical application.

Model Identification

Before installation, please identify your controller model number. The model number appears on a label on the side of the housing.
Section 3—Installation and Wiring

Sensor and Control
Type Selection
Switches

Set the CN 2110 controller’s configuration via mechanical dip switches, located on the bottom of the unit. Factory settings are J, TC, °F, and PI Control. Switches are easier to set before mounting.

To change the switch settings, first disconnect all wiring and power from the unit. Adjust switch settings as follows:

<table>
<thead>
<tr>
<th>Switch</th>
<th>Function</th>
<th>Setting Options</th>
<th>Factory Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Thermocouple</td>
<td>J or K</td>
<td>J</td>
</tr>
<tr>
<td>B</td>
<td>Input Type</td>
<td>TC or RTD</td>
<td>TC</td>
</tr>
<tr>
<td>C</td>
<td>Temperature Units</td>
<td>°F or °C</td>
<td>°F</td>
</tr>
<tr>
<td>D</td>
<td>Control Type</td>
<td>ON-OFF or PI</td>
<td>PI</td>
</tr>
</tbody>
</table>

If input type is thermocouple, switch A selects either thermocouple type J or K.

Switch B selects input type thermocouple or RTD (resistance temperature detector). Note: If RTD is selected, switch A is ignored.

Switch C selects temperature units °F or °C.

Switch D selects either PI (Proportional-Integral) or ON-OFF control.

Figure 3.1
Default Dip Switch Settings
CN 2110 Temperature Controller

Mounting

Two mounting collars securely hold the CN 2110 controller in the mounting hole. Remove these mounting collars before installation.

Removing Mounting Collars

1. To remove the rear collar, press the sides of the collar. This releases holding tabs on the top and bottom of the collar.
2. Slide the collar off the back of the unit.
3. Slide the front collar off the back of the unit.

Figure 3.2
Removing Mounting Collars
Mount the CN 2110

1. Cut out a 1/4 DIN, 3.6-inch (92mm) square hole in the mounting panel.
2. Insert the unit into the mounting hole as shown in Figure 3.4.
3. Slide the front mounting collar onto the back of the controller.
4. Slide the rear mounting collar onto the back of the controller until the holding tabs securely engage with the holding tab slots in the controller housing (see Figure 3.4).
5. Tighten the four rear collar mounting screws until the unit is held firmly in the panel. **CAUTION: Do not overtighten.**

The controller will now be held firmly in place.
**Good Wiring Practices**

**Separate wire into bundles**—When planning the system wiring, separate wiring into functionally similar bundles, e.g.

- Power leads
- Sensor leads (if power leads must cross sensor leads, they should cross at a 90° angle)
- Output signal lines

**Separate sources of electrical noise**—Locate all sources of electrical noise in your system, and separate these sources from the control system, e.g.

- Motors
- Contacts
- Solenoids

Electrical noise can affect the function of any control system. When driving a contactor coil or other inductive load, an appropriate rated AC snubber circuit is recommended (Omega Part No. CNQUENCHARC).

**Connect before power is applied**—Make all electrical wiring connections to the back of the controller before power is applied to the unit.

**Comply with regulations**—WARNING: All wiring practices must comply with local regulations. Failure to do so could result in damage to controller and/or personal injury or death from electrical shock.

This instrument is intended for panel mounting and the terminals must be enclosed within a panel. Use National Electric Code (NEC) Class 1 wiring for all terminals except the sensor terminals.

**Check wiring decal**—Check the wiring decal on the side of the unit to verify the model number. The wiring decal shows the wiring terminations. All wiring will be connected to the terminals on the back of the instrument case. Specific wiring instructions for different input and output types are given in this section. See also Figure 3.5.

**Additional information**—For sensor wiring practices, see “Sensor Input Wiring”. For additional information on good wiring practice, request IEEE Standard No. 518-1982 from IEEE, 345 East 47th St., New York, NY 10017 or www.ieee.org.

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![Figure 3.5 Wiring Terminal Identification](image-url)
Sensor Input Wiring

Sensor Wiring Notes

For safety and best controller performance,

- **Sensor leads** (thermocouple and RTD) should not be run in the same conduit as power wiring.
- **Twisted pair**, shielded wire is recommended for sensor connections.
- **False temperature readings** can occur if the sensor wire is exposed to electrical noise.
- **Ungrounded thermocouples** are recommended.
- **Thermocouple extension wire**, if required, must be the same type as the thermocouple (i.e. if a Type K thermocouple is used, then Type K extension wire must be used.)
- **Shielded thermocouple wire**, if used, must have the shield grounded at one end only, preferably at the shield ground terminal on the controller as shown in Figure 3.6.
- **Three-wire RTDs** are recommended for greatest accuracy.
- **Standard shielded copper wire** is recommended for RTD extensions.

Thermocouple Inputs

It is important to observe polarity (+,-) when connecting thermocouple leadwires. ANSI color coding for the thermocouples used with this instrument are:

<table>
<thead>
<tr>
<th>Thermocouple Type</th>
<th>Material</th>
<th>Polarity (+)</th>
<th>Polarity (-)</th>
</tr>
</thead>
<tbody>
<tr>
<td>J</td>
<td>iron/constantan</td>
<td>white</td>
<td>red</td>
</tr>
<tr>
<td>K</td>
<td>chromel/alumel</td>
<td>yellow</td>
<td>red</td>
</tr>
</tbody>
</table>

Make thermocouple wiring connections to terminals as shown in Figure 3.6.
CN 2110 Temperature Controller

**Sensor Input Wiring continued**

**Three-Wire RTD Inputs**

*IMPORTANT:* When making the three-wire RTD input connection, make the resistance of all three extension leadwires equal by using the same gauge and same length of wire for optimum accuracy. A three-wire RTD will generally have two wires of the same color. Connect the same colored wires to the RTDL connections. Connect the alternate colored wire to the RTDH connection.

Make three-wire RTD connections to terminals as shown in Figure 3.7.

![Figure 3.7 Three-Wire RTD Connections with Shield](image)

**Two-Wire RTD Inputs**

If using a two-wire RTD input, use heavier gauge leadwires to reduce leadwire resistance. Any leadwire resistance adds directly to sensor resistance, thus adding error to the process temperature measurement. It is also necessary to jumper the two RTDL terminals on the instrument to complete a two-wire hookup.

![Figure 3.8 Two-Wire RTD Connections](image)
The following figures show the proper control output wiring for the various CN 2110 configurations.

**R1 (1 Amp Relay) and T1 (1 Amp, Solid State Relay) Output Wiring**

When driving a contactor coil or other inductive load, an appropriately rated AC snubber circuit is recommended (Omega Part. No. CNQUENCHARC), as shown in Figure 3.9.

![Figure 3.9 Control Output Wiring–R1 and T1](image)

**R20 (20 Amp Relay) Output Wiring**

1/4” fast-on tabs are provided with the R20 output.

![Figure 3.10 Control Output Wiring–R20](image)

**DC (Solid State Relay Drive, 24Vdc, 40mA) Output Wiring**

![Figure 3.11 Control Output Wiring–DC](image)
CN 2110 Temperature Controller

Control Output Wiring

T5 (Solid State Relay, 5 Amps) and T10 (Solid State Relay, 10 Amps) Output Wiring

Note: CN 2110 model T10 has a fan. CN 2110 model T5 does not have a fan.

![Control Output Wiring-T5 and T10](image)

Instrument Power Wiring

Make 120 or 240 VAC instrument power connections to terminals as shown in Figure 3.13.

![90-260 VAC Instrument Power Connections](image)

Alarm Wiring

The Form C Relay Output is connected as shown in Figure 3.14.

![Alarm Connections](image)
Section 4—Adjusting Set Point and Configuration

Adjusting the Set Point

1. Set selection switches (see Figure 3.1).
2. Apply power to the unit.
3. To adjust the set point on the CN 2110 Temperature Controller, press and hold the Set Point button (see Figure 4.1). The Set Point light is illuminated and the set point value is displayed.
4. While still pressing the Set Point button, press either the ↑ or ↓ button to adjust the set point to the desired value (see Figure 4.2).
5. Release the Set Point button.

Configuration

While the CN 2110 default settings make it a simple setup controller for most applications, additional programmable menus can be configured through three front-panel pushbuttons.

To access the user configuration menus,
1. Press and hold the ↑ and ↓ buttons. After three seconds the display will begin to toggle between the current security code and Lock (LOCK). The Temp and Set Point LEDs will turn on. See Figure 4.3.
2. Press the ↑ or ↓ button to adjust the value to the appropriate security number (see Security Codes and Levels). Only the value is displayed during adjustment. See Figure 4.4.
3. Press and hold the Set Point (↑↓) button and press the ↑ or ↓ buttons to scroll the configuration menus. The display will show the name of the menu and then begin to toggle between the name and the current value. See Figures 4.5 and 4.6.
4. Press the ↑ or ↓ buttons to adjust the value (only the value is displayed during adjustment). See Figure 4.7. The new value is set when the ↑ or ↓ button is released.

5. Press and hold the Set Point (●) button and press the ↑ button to advance to the next menu. See Figure 4.8. (Holding the Set Point (●) button and pressing the ↓ button moves through menus in the opposite direction.)

Repeat steps 4 and 5 through the configuration menus.

Exit Configuration

To exit configuration mode, press and hold both the ↑ and ↓ buttons for three seconds to return to the operation mode.

Note: If no buttons are pressed for three minutes while in user configuration mode, then the controller will exit user configuration and return to the operation mode.
Security Codes and Levels

To limit access to the user configuration interface, security codes are assigned to different menu levels. Make security codes available to operators, maintenance crew, supervisors, etc. according to what function level you want for each group. **Security Level C is not recommended for most users.** Gain access to configuration menus using the following codes.

<table>
<thead>
<tr>
<th>Security Level</th>
<th>Security Code</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>All Values</td>
<td>Allows adjustment of the Set Point</td>
</tr>
<tr>
<td>B</td>
<td>458</td>
<td>Basic menus</td>
</tr>
<tr>
<td>C</td>
<td>736</td>
<td>Calibration menus</td>
</tr>
</tbody>
</table>

Configuration Menus

The following configuration menus can be accessed through the user interface (see *Configuration*, page 12).

<table>
<thead>
<tr>
<th>Menu Code</th>
<th>Function</th>
<th>Adjustable Range</th>
<th>Factory Default</th>
<th>Security Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>LocH</td>
<td>Security Lock</td>
<td>0-999</td>
<td>458</td>
<td>A</td>
</tr>
<tr>
<td>Proc</td>
<td>Process Variable Display</td>
<td>Read Only</td>
<td>N/A</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td>Displays the actual process temperature.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SP</td>
<td>Process Set Point Adjust</td>
<td>Sensor Range</td>
<td>0°F</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td>Adjusts the target process temperature.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pb</td>
<td>Proportional Band</td>
<td>1 to Sensor Span Maximum</td>
<td>25</td>
<td>B</td>
</tr>
<tr>
<td></td>
<td>Temperature range above/below set point where proportional control is active. Most applications require a band between 10 to 200°F. This menu is active only when the dip switch is set to “PI”</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ar-St</td>
<td>Automatic Reset</td>
<td>0.0 to 100.0 Repeats/Min.</td>
<td>0.1</td>
<td>B</td>
</tr>
<tr>
<td></td>
<td>Control feature that automatically corrects for small temperature offsets that occur in proportional control. The higher the setting, the faster the correction occurs. A high setting could cause overshoot during start-up. A low setting will not allow process temperature to reach to set point quickly enough. A setting of “0” turns off automatic reset. This menu is active only when the dip switch is set to “PI”</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## CN 2110 Temperature Controller

### Configuration Menus continued

<table>
<thead>
<tr>
<th>Menu Code</th>
<th>Function</th>
<th>Adjustable Range</th>
<th>Factory Default</th>
<th>Security Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>CYCL</td>
<td>Cycle Time</td>
<td>.1 to 60.0 Sec.</td>
<td>Output R1,</td>
<td>B</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>R20 = 30 sec.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>T1, T5, T10 DC = 1 sec.</td>
<td></td>
</tr>
<tr>
<td>dB</td>
<td>On/Off Dead Band</td>
<td>1 to 100 °F or °C</td>
<td>5 Foc</td>
<td>B</td>
</tr>
<tr>
<td>RL ly</td>
<td>Alarm Type</td>
<td>Off, Hi or Lo</td>
<td>OFF</td>
<td>B</td>
</tr>
<tr>
<td>RL 5P</td>
<td>Alarm Set Point</td>
<td>Sensor Range °F or °C</td>
<td>Span High</td>
<td>B</td>
</tr>
<tr>
<td>RL db</td>
<td>Alarm Dead Band</td>
<td>0 to 100 °F or °C</td>
<td>5</td>
<td>B</td>
</tr>
<tr>
<td>SPLL</td>
<td>Set Point Lower Limit</td>
<td>Sensor Range °F or °C</td>
<td>Span Low</td>
<td>B</td>
</tr>
<tr>
<td>SPUL</td>
<td>Set Point Upper Limit</td>
<td>Sensor Range °F or °C</td>
<td>Span High</td>
<td>B</td>
</tr>
<tr>
<td>outL</td>
<td>Output Limit</td>
<td>0 to 100%</td>
<td>100</td>
<td>B</td>
</tr>
</tbody>
</table>

For calibration menus (CoFF, dFLt, & CALS), see Section 7–Calibration
Control Operation

The CN 2110 is shipped from the factory with PI (proportional/integral) control. Proportional control actually determines the percent of heat needed to control the process. The factory setting for the Proportional Band is 25°F and the Automatic Reset (Integral) is set at 0.1 repeats/minute. These settings will control many processes without any changes to the controller. If the process is unstable or too sluggish, the Proportional Band and Automatic Reset can be changed in the menu configuration.

Tuning PI Control

Adjust Proportional Band The objective of the proportional band adjustment is to find the proportional band setting at which the process temperature stabilizes and does not oscillate. If the temperature display is oscillating, increase the Proportional Band (doubling the value) until the temperature display has stopped oscillating. To establish a quick response to control upsets, adjust for the smallest band that provides stable control (does not oscillate). Note: The temperature at this point may not be at set point, but will be stable.

Adjust Automatic Reset (Integral) The Automatic Reset (Integral) automatically removes the offset between process temperature and set point. If the process is too sluggish in approaching set point, double the automatic reset. Too much automatic reset will make a process unstable.

Cycle Time Cycle time setting determines how often to switch the output to the heater. For example, if the cycle time is 1 second and the CN 2110 needs a 75% output, the output will be on for 3/4 of a second and off 1/4 of a second. Units with relay control outputs (R1 or R20) are shipped with a 30-second cycle time. Units with solid state relays or solid state relay drives (T1, T5, T10, or DC) are shipped with a 1-second cycle time.

Alarm Operation (optional)

An alarm relay output is optional on the CN 2110. An alarm can help protect the process when a too high or too low temperature occurs.

High Alarm: This alarm is a high absolute alarm that actuates when the process temperature is equal to or greater than the alarm set point. For example, if the high alarm set point is 500°F, the alarm will always actuate when the process temperature reaches 500°F.

Low Alarm: The low absolute alarm actuates when the process temperature is equal to or less than the alarm set point. The low alarm features a power-up inhibit to prevent undesirable alarms during process start up. After the unit reaches control set point, the low alarm will respond.

Alarm Dead Band: The alarm relay de-energizes (resets) when the temperature crosses out of the alarm dead band. For example, if the high alarm is set to 500°F and the alarm dead band is 5°F, the alarm condition will not reset until the process temperature reaches 495°F.

To enable the alarm relay, select either high or low alarm type and set the alarm set point. An alarm condition is indicated when the Alarm light to the left of the display illuminates. Alarm type, set point, and dead band are selectable through the user configuration interface.
The CN 2110 Temperature Controller was shipped with the output modules installed as ordered. The 10A Solid State Relay and 20A Mechanical Relay output cards control small cartridge heater or strip heater loads directly, eliminating the need for a remote contactor or solid state relay. If a larger load is required, the CN 2110 can be configured with a 1A Pilot Duty Relay or Solid State Relay Drive.

The CN 2110 may be optionally configured with a 5A/120V Alarm Relay. Alternate modules, configured with or without alarm, can be installed as needs change.

Control and alarm outputs can be changed in the field.

### Module Option Descriptions

Output Module options are as follows

<table>
<thead>
<tr>
<th>Description</th>
<th>Load/Sourcing Specification</th>
<th>Factory Default Cycle Time</th>
<th>Part No w/o Alarm</th>
<th>Part No w/ Alarm</th>
</tr>
</thead>
<tbody>
<tr>
<td>R1 Relay</td>
<td>Form A contact, SPST, N.O. 1.0 Amp at 120/240 VAC resistive load</td>
<td>30 sec.</td>
<td>2110X-R1</td>
<td>2110X-R1-AL</td>
</tr>
<tr>
<td>R20 Relay</td>
<td>Form A contact, SPST, N.O. 20 Amp at 240 VAC, 28 VDC resistive load</td>
<td>30 sec.</td>
<td>2110X-R20</td>
<td>2110X-R20-AL</td>
</tr>
<tr>
<td>DC SSR Drive</td>
<td>24 VDC nominal at 40 mA</td>
<td>1 sec.</td>
<td>2110X-DC</td>
<td>2110X-DC-AL</td>
</tr>
<tr>
<td>T1 TRIAC</td>
<td>1 amp continuous, 10 Amp in-rush 120/240 VAC</td>
<td>1 sec.</td>
<td>2110X-T1</td>
<td>2110X-T1-AL</td>
</tr>
<tr>
<td>T5 Solid State Power Controller</td>
<td>120/240 VAC, 5 Amp @ 40°C ambient</td>
<td>1 sec.</td>
<td>2110X-T5</td>
<td>2110X-T5-AL</td>
</tr>
<tr>
<td>T10 Solid State Power Controller</td>
<td>120/240 VAC, 10 Amp @ 40°C ambient with built-in cooling fan mounted on rear of housing</td>
<td>1 sec.</td>
<td>2110X-T10 (Fan Kit)</td>
<td>2110X-T10-AL (Fan Kit)</td>
</tr>
</tbody>
</table>

### Module Installation

**WARNING:** Remove power from the controller before changing the output module. Failure to do so could cause damage to controller and/or personal injury or death from electrical shock.

When handling output modules, be careful to guard the module against static discharge. Follow the steps below to remove an existing output module and replace it with a new module.

#### Removal
1. Remove power from the controller.
2. Remove all terminal connections.

---

*continued*
Module Installation

continued

3. Remove the back cover by lifting four housing clips on the controller. This releases the back cover. Then pull cover straight off the controller.

4. Gently pry around the sides to loosen and remove the module. Pull module straight out to avoid bending pin connections.

**WARNING:** Do not remove module by the handling components on the module board. This could damage the module.

When removing an T10 output module (SSR with fan), a cable connects the fan to the far right center of the T10 board. Gently disconnect the cable from the connector on the output board. **Do not remove the fan from the back cover. This is a single assembly.**

For the T10 output module, reconnect the fan cable to the connector on the far right center of the module. Tuck the cable around the heatsink.

**Replacement**

1. Line up pins on the controller with pin connections on either side of the module and push the new module into place.

2. Reinstall the back cover.

---

**Figure 6.1**
Replacing Output Module

---

**Auto Cycle Time**

The Control Output Modules have a default cycle time of 1 second (fast switching) or 30 seconds (slow switching) (See table on page 17). After replacing a control output, the CN 2110 verifies at power up if a slow or fast cycle time output has been installed. If an output with a different default cycle time is installed, the CN 2110 will change the cycle time to the new device’s default. If the user has changed the cycle time in configuration, the CN 2110 retains this value unless an output with a different default cycle time has been installed.
Section 7—Calibration

Calibration Offset

Calibration offset offsets the displayed value. Usually, this option is used to match displays of two different instruments that are measuring the same temperature, but are displaying different temperatures due to different thermocouple accuracy or placement of the thermocouples. Caution is advised when adding an offset to the display, since the actual sensed temperature will not be displayed.

Calibration offset (coFF) is available in the configuration mode, but only displays if the security lock (LocH) is set to 736.

Factory Default Recovery

This option allows you to return the controller’s configuration parameters back to the factory default values (except for the LocH menu). This parameter could be used when moving a unit from one application to another to give the operator an easy place to begin setup of the unit.

Factory Default Recovery is performed in the Configuration Mode, menu dFLt. The security lock (LocH) must be set to 736 to perform a factory default recovery.

To reestablish the factory default values:
1. Disconnect load power.
2. In the Configuration Mode, set security level (LocH) to 736.
3. Go to menu dFLt and press \rightbutton. The controller will automatically reset the values. When the display cycles from rEdy to donE, the recovery is complete.

Calibration

The CN 2110 Temperature Controller is factory calibrated before shipment. Recalibration is not needed when you receive and install the product. Periodic calibration checks or adjustments should not be necessary under normal operating conditions. Omega recommends you recalibrate the controller if all instruments in your facility are periodically calibrated to a known standard.

The CN 2110 always retains the original factory calibration values for the J, K, and RTD inputs. In an application, only one of these sensor inputs will be used. The CN 2110 only can retain manual calibration for a single sensor.
Factory Calibration Recovery

This procedure allows you to return the controller to its factory calibration settings in the event it is severely out of calibration due to poor technique or unauthorized calibration.

1. Disconnect load power.
2. Cycle the sensor selection switch twice from its original position (TC or RTD) to the opposite position (RTD or TC) and back to its original position. This brings back the factory calibration and deletes the manual calibration settings.

Calibration Notes:

When calibrating the CN 2110

1. You must have a sensor simulator to calibrate the CN 2110 controller. Substitute a precision sensor simulator (Thermocouple simulator or resistance simulator box) for sensor inputs.
2. Disconnect load power to prevent damage to the process or load.
3. Calibrate RTD inputs using copper (Cu) wire. Calibrate thermocouple inputs using thermocouple extension wire of the same type as the thermocouple you are calibrating.
4. Allow the controller to warm up with the appropriate sensor simulator connected for at least one hour prior to calibration.
5. To access the calibration menu, you need level C (736) security.

Sensor Calibration:

1. Set the CN 2110 selection switch to RTD or TC. If TC is selected, then set the selection switch to J or K.
2. Connect the sensor simulator to the sensor input terminals.
3. Set the simulator to the low value of the sensor selected J TC (-100°F), K TC (-100°F), RTD (-200°F or 48.46Ω).
4. Go to the CALS parameter on the CN 2110. The display will toggle between CALS and inLo.
5. Wait 30 seconds for the electronics to fully stabilize. Press ↑. Dashes will appear in the display while the controller calibrates the low end of span.
6. When the controller prompts inHi in the display, adjust the sensor simulator to the high end of the selected sensor span. J TC (1400°F), K TC (2400°F), RTD (1000°F or 293.49Ω).
7. Wait 30 seconds for the electronics to fully stabilize. Press ↑. Dashes will appear in the display while the controller calibrates the high end of span. When finished, the controller will display donE.
8. Calibration is complete.

Calibration continued
Section 8—Specifications

Control Modes ........................................... ON/OFF; PI—Proportional with integral

Control Adjustments
Proportional Band .......................... 1 to sensor span maximum
Automatic Reset .......................... 0.0 to 100.0 repeats/minute
Cycle Time .......................... 0.1 to 60.0 seconds
On/Off Deadband .......................... 1" to 100°F or °C
Set Point Upper Limit .......................... sensor range °F or °C
Set Point Lower Limit .......................... sensor range °F or °C
Output Limit .......................... 0 to 100%

Alarm Adjustments
Type .......................... Absolute High or Low
Set Point .......................... Sensor range °F or °C
Alarm Dead Band .......................... 0° to 100°F or °C

Control/Alarm Outputs
Relay (R1) .......................... 1 Amp Form A, 120/240V AC
Relay (R20) .......................... Form A, 120/240V AC resistive loads at 30 sec. cycle time
20 Amps, 500,000 Operations
15 Amps, 1 Million Operations
10 Amps, 5 Million Operations
5 Amps, 5 Million Operations

Solid State Relay Drive (DC) ......... 24VDC at 40mA
Solid State Relay (T1) .......................... 1A Triac, up to 240VAC
Solid State Relay (T5) .......................... 5A, up to 240VAC at 40°C
Solid State Relay (T10) .......................... 10A, up to 240VAC at 40°C
Alarm .......................... Form C, Relay 5 Amps at 120VAC,
2.5A at 240VAC

Sensor Input .......................... Switch selectable; J,K Thermocouple; RTD

Input Update Rate .......................... Four samples per second

Input Specifications .......................... Range °F Range °C Accuracy at 77°F ambient
J TC .......................... -100 to 1400°F -73 to 760°C 0.2% Span +/-1 least significant digit
K TC .......................... -100 to 2400°F -73 to 1316°C 0.2% Span +/-1 least significant digit
100Ω Pt RTD (a=.00385) .............. -200 to 1000°F -128 to 538°C 0.2% Span +/-1 least significant digit

Readout Stability
J and K TC .......................... +/-1°F per 10°F change in ambient temperature
RTD .......................... +/-0.5°F per 10°F change in ambient temperature

Open Sensor and
Out-of-Range Conditions .............. Displays “SEnS”, Control output 0%

Instrument Power .......................... 90 to 260VAC Less than 10 VA

Operating Environment ................... 0° to 65°C (32° to 150°F)

Dimensions
Overall .......................... 4.0 x 4.0 x 4.0 inches (102 mm)
Depth Behind Display .......................... 3.6 inches (92 mm)
Front Panel Projection .......................... 0.4 inches (10 mm)
Panel Cutout .......................... 3.6 x 3.6 inches (92 mm x 92 mm)

Enclosure Material .......................... High temp ABS plastic rated for 0° to 175°F

Front Panel .......................... NEMA 4X construction, requires surface finish not rougher than 0.000032 inch

Influence of Line Voltage Variation .... +/-0.1% of sensor span per 10% change in nominal line voltage

Noise Rejection
Common Mode Noise .......................... Less than 2°F with 240 VAC, 60 Hz applied from sensor input to earth ground
Series Mode Noise .......................... Less than 2°F with 100mV, peak to peak series mode noise
RFI .......................... Typically less than 0.5% of sensor span at distance of 1 meter (3.1 feet) from a transmitter of 4W at 464MHz

Sensor Leadwire Effect
J Thermocouple .......................... +/-1°F for 1000 feet of 18 AWG thermocouple extension wire
K Thermocouple .......................... +/-2°F for 1000 feet of 18 AWG thermocouple extension wire
RTD .......................... +/-0.1% of sensor span per 20Ω balanced leadwire resistance (20Ω is the total loop resistance)
The following Troubleshooting Guide offers simple solutions to common problems and explains the CN 2110’s Error Messages. Review this section for a possible solution to your problem before contacting Omega.

*Note:* For each symptom, perform correction steps in the order listed.

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Probable Cause</th>
<th>Correction Steps</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power applied, display does not light, and controller does not function</td>
<td>1. No power applied&lt;br&gt;2. External fuse open</td>
<td>1. Check power wiring and fusing&lt;br&gt;2. Power down and repower up</td>
</tr>
<tr>
<td>Display alternates between <strong>HI</strong> and <strong>SENS</strong>, CN 2110 disables control output</td>
<td>1. Open sensor&lt;br&gt;2. Out of calibration</td>
<td>1. Check sensor wiring&lt;br&gt;2. Check selection switches&lt;br&gt;3. To verify that controller is at fault, remove the thermocouple and place a jumper across the sensor terminals of the CN 2110. If the display reads approximately ambient, then the sensor is open. Replace the thermocouple.&lt;br&gt;4. See Section 7—Calibration</td>
</tr>
<tr>
<td>Process does not heat up</td>
<td>1. No power being applied to the load&lt;br&gt;2. Load fuse open</td>
<td>1. Verify Load LED is ON&lt;br&gt;2. Verify the heater or fuse is not open&lt;br&gt;3. Verify output limit is set to 100%&lt;br&gt;4. Verify set point is greater than process temperature&lt;br&gt;5. Verify output wiring</td>
</tr>
<tr>
<td>Erratic operation</td>
<td>1. Intermittent sensor connections&lt;br&gt;2. Controller failure (internal electronics)&lt;br&gt;3. External electrical noise</td>
<td>1. Check sensor wiring or substitute sensor simulator&lt;br&gt;2. Power down and repower up&lt;br&gt;3. Contact Omega</td>
</tr>
</tbody>
</table>
## CN 2110 Temperature Controller

### Troubleshooting continued

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Probable Cause</th>
<th>Correction Steps</th>
</tr>
</thead>
<tbody>
<tr>
<td>Process not in control</td>
<td>1. Incorrect settings</td>
<td>1. Check Proportional Band setting and Automatic Reset setting</td>
</tr>
<tr>
<td></td>
<td>2. Thermocouple Wiring</td>
<td>2. Check thermocouple polarity</td>
</tr>
<tr>
<td>Instrument continually goes through</td>
<td>1. Severe electrical noise</td>
<td>1. Separate sensor wiring from other wiring</td>
</tr>
<tr>
<td>power-up reset</td>
<td></td>
<td>2. Apply power line filter</td>
</tr>
<tr>
<td>Display reads FAn FAIL, CN</td>
<td>1. Fan for T10 output has failed</td>
<td>3. Contact Omega</td>
</tr>
<tr>
<td>2110 disables control output</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1. Check for and clear any obstruction in fan, then power unit up and check display</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Discontinue operation, replace fan assembly, or return to Omega for replacement</td>
</tr>
</tbody>
</table>
OMEGA ENGINEERING, INC. warrants this unit to be free of defects in materials and workmanship for a period of 13 months from date of purchase. OMEGA’s WARRANTY adds an additional one (1) month grace period to the normal one (1) year product warranty to cover handling and shipping time. This ensures that OMEGA’s customers receive maximum coverage on each product.

If the unit malfunctions, it must be returned to the factory for evaluation. OMEGA’s Customer Service Department will issue an Authorized Return (AR) number immediately upon phone or written request. Upon examination by OMEGA, if the unit is found to be defective, it will be repaired or replaced at no charge. OMEGA’s WARRANTY does not apply to defects resulting from any action of the purchaser, including but not limited to mishandling, improper interfacing, operation outside of design limits, improper repair, or unauthorized modification. This WARRANTY is VOID if the unit shows evidence of having been tampered with or shows evidence of having been damaged as a result of excessive corrosion; or current, heat, moisture or vibration; improper specification; misuse; or other operating conditions outside of OMEGA’s control. Components which wear are not warranted, including but not limited to contact points, fuses, and triacs.

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Direct all warranty and repair requests/inquiries to the OMEGA Customer Service Department. BEFORE RETURNING ANY PRODUCT(S) TO OMEGA, PURCHASER MUST OBTAIN AN AUTHORIZED RETURN (AR) NUMBER FROM OMEGA’S CUSTOMER SERVICE DEPARTMENT (IN ORDER TO AVOID PROCESSING DELAYS). The assigned AR number should then be marked on the outside of the return package and on any correspondence.

The purchaser is responsible for shipping charges, freight, insurance and proper packaging to prevent breakage in transit.

FOR WARRANTY RETURNS, please have the following information available BEFORE contacting OMEGA:
1. Purchase Order number under which the product was PURCHASED,
2. Model and serial number of the product under warranty, and
3. Repair instructions and/or specific problems relative to the product.

OMEGA's policy is to make running changes, not model changes, whenever an improvement is possible. This affords our customers the latest in technology and engineering.

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