System 450™ Series Control Module with Ethernet Communications

Installation Instructions

C450CEN-x

Refer to the QuickLIT website for the most up-to-date version of this document.

Application

> **IMPORTANT:** Use this System 450™ Series Control Module only as an operating control. Where failure or malfunction of the System 450 control module could lead to personal injury or property damage to the controlled equipment or other property, additional precautions must be designed into the control system. Incorporate and maintain other devices, such as supervisory or alarm systems or safety or limit controls, intended to warn of or protect against failure or malfunction of the System 450 control module.

System 450™ is a family of modular, digital electronic controls that is easily assembled and set up to provide reliable temperature, pressure, and humidity control for a wide variety of HVACR and commercial and industrial process applications.

The System 450 control modules allow you to configure custom application-specific control systems with up to three input sensors and ten (relay or analog) outputs, including control systems that can monitor and control temperature, pressure, and humidity applications simultaneously.

C450CEN-x control modules feature an LCD and four-button touch pad UI that allows you to set up a System 450 control system, and an RJ45 Ethernet network port that enables you to connect your control system to and communicate across an Ethernet network.

The System 450 control module with Ethernet communications has an integral web server that supports browser access. The web server can be configured to deliver System 450 web pages to client browsers and allows you to monitor your control system status and change your control system configuration in simple, user-friendly web pages.

Refer to the *System 450 Series Control Systems with Network Communications Technical Bulletin (LIT-12011826)* for detailed information on designing, installing, setting up, and troubleshooting System 450 Series control systems with network communications. The technical bulletin can be accessed and downloaded on the Johnson Controls® Online Product Literature website at the following web address: *http://cgproducts.johnsoncontrols.com/default.aspx*

System 450 control modules with network communications also include the High Input-Signal Selection, Differential Control, Output Signal Update Rate, and Output Signal Dead Band features.
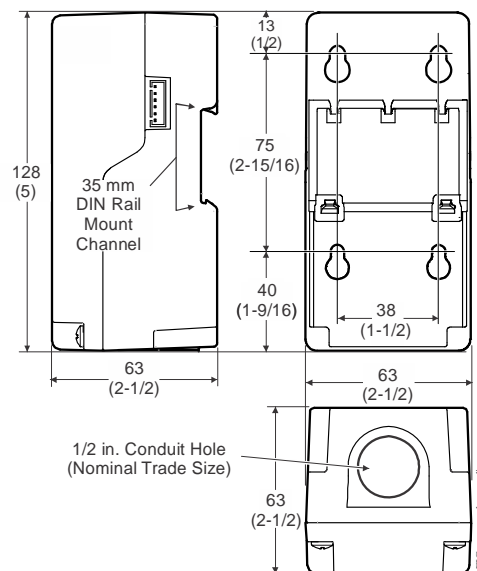
Installation

Figure 1: System 450 Module Dimensions, mm (in.)

Location Considerations

Observe the following System 450 location guidelines:

- Ensure that the mounting surface can support the module assembly, mounting hardware, and any (user-supplied) panel or enclosure.

- Mount the modules upright and plugged together in a horizontal row where possible (Figure 3). DIN rail mounting is highly recommended.

- Mount modules on flat even surfaces.

- Allow sufficient space for wires and connections.

- Mount the modules in locations free of corrosive vapors and observe the ambient operating conditions listed in the *Technical Specifications*.

- Do not mount the modules on surfaces that are prone to vibration or in locations where radio frequency or electromagnetic emissions may cause interference.

- Do not install the modules in airtight enclosures.

Do not install the modules in an enclosure with heat-generating devices that may cause the temperature to exceed the ambient operating limit.

Mounting

You can mount System 450 modules on 35 mm DIN rail (recommended) or directly to an even wall surface. To mount modules on DIN rail:

1. Provide a section of 35 mm DIN rail that is longer than the module assembly width, and mount the DIN rail horizontally in a suitable location using the appropriate mounting hardware.

2. Clip the control module on the rail, position the upper DIN rail clips on the top rail, and gently snap the lower clips onto the rail.

3. Clip the remaining modules to the right of the control module on to the DIN rail and plug the 6-pin module connectors together (Figure 3).

   Note: If your System 450 control system uses a power module, the power module **must** be plugged into the right side of the control module.

To direct-mount modules to walls and other flat surfaces using the four keyhole slots:

1. Plug the modules together, remove the module covers, place the module assembly horizontally against the wall surface in a suitable location, and mark the mount hole locations on the mounting surface (Figure 1).

   Note: The four keyhole slots on the communications control module are not accessible from the front (even with the cover removed). Use another System 450 module to mark the communications module mounting hole locations on the mounting surface.

2. Install appropriate screws or fasteners, leaving the screw heads approximately one to two turns away from flush to the surface.

3. Position the assembly mounting slots over the screw heads, and then **carefully** tighten the mounting screws to secure the assembly to the surface.

   Note: The mounting screws on a communications module cannot be accessed or tightened after the module is attached to the screws. The enclosure has a ramp molded into the keyhole slots, which allows you to mount the module on the screw heads.

   Note: If you mount the modules on an uneven surface, use shims or washers to mount module assembly evenly on the surface.

Refer to the input sensor installation instructions for information on locating and mounting control sensors.

Wiring

See Figure 2 and Table 1 for electrical termination locations and wiring information. See *Technical Specifications* on page 46 for electrical ratings.

> ⚠ **WARNING: Risk of Electric Shock.**
> Disconnect or isolate all power supplies before making electrical connections. More than one disconnect or isolation may be required to completely de-energize equipment. Contact with components carrying hazardous voltage can cause electric shock and may result in severe personal injury or death.

IMPORTANT: Use copper conductors only. Make all wiring in accordance with local, national, and regional regulations.

IMPORTANT: Do not exceed the System 450 module electrical ratings. Exceeding module electrical ratings can result in permanent damage to the modules and void any warranty.

IMPORTANT: Run all low-voltage wiring and cables separate from all high-voltage wiring. Shielded cable is strongly recommended for input (sensor) and analog output cables that are exposed to high electromagnetic or radio frequency noise.

IMPORTANT: Electrostatic discharge can damage System 450 modules. Use proper Electrostatic Discharge (ESD) precautions during installation and servicing to avoid damaging System 450 modules.

IMPORTANT: Do not connect 24 VAC supply power to the System 450 modules before finishing wiring and checking all wiring connections. Short circuits or improperly connected wires can result in damage to the modules and void any warranty.

IMPORTANT: A System 450 control module and module assembly can be connected to an internal power source (a System 450 power module) **or** an external power source (24 V power connected to the 24V and COM terminals on the control module), but must **not** be connected to both power sources simultaneously. Connecting a control module to both internal and external power sources can damage the modules and void any warranty.

IMPORTANT: When connecting System 450 compatible sensors with shielded cable to a System 450 control module, connect the cable shield drain lead to one of the C (common) terminals on the input sensor terminal block. Do not connect the shield at any other point along the cable. Isolate and insulate the shield drain at the sensor end of the cable. Connecting a cable shield at more than one point can enable transient currents to flow through the sensor cable shield, which can cause erratic control operation.
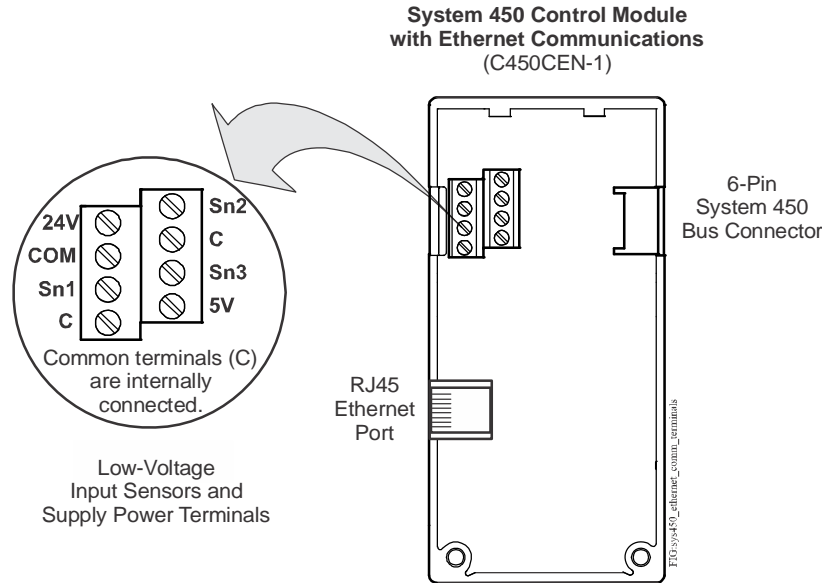
**System 450 Control Module
with Ethernet Communications**
(C450CEN-1)

24V
COM
Sn1
C

Sn2
C
Sn3
5V

Common terminals (C)
are internally
connected.

Low-Voltage
Input Sensors and
Supply Power Terminals

6-Pin
System 450
Bus Connector

RJ45
Ethernet
Port

**Figure 2: C450CEN-x Control Module with Ethernet Communications
Showing Wiring Terminals**

Table 1: System 450 Control Module with Ethernet Communications Wiring Information

Terminal Block	Label	Function, Electrical Ratings, and Requirements	Recommended Cable Type and Wire Sizes
Low-Voltage and Input Sensors Terminal Block	**24V**	Provides internal 24 VAC power at terminals for (humidity) sensors when a C450YNN power module **is** connected in the control system module assembly. **or** Accepts external 24 VAC (20–30 VAC) supply power for the control system when a C450YNN power module is **not** connected in the control system module assembly.	0.08 mm^2 to 1.5 mm^2 28 AWG to 16 AWG
	COM	Provides the common connection for 24 VAC power terminal for either internally or externally supplied 24 VAC power (only).	
	S1, S2, S3	Accepts passive or active (0–5 VDC) input signals from control sensors[1].	0.08 mm^2 to 1.5 mm^2 28 AWG to 16 AWG
	C, C	Provide low-voltage common connections for the sensors connected to the 5V, Sn1, Sn2, or Sn3 terminals (only). **Note:** The two **C** terminals are use for sensor common connections only. The two **C** terminals are connected internally.	
	5V	Provides 5 VDC power for active sensors.	
Ethernet Port		Provides 8-Pin RJ45 modular jack for connecting to an Ethernet network.	CAT 5 Straight-Through or Crossover Cable

1. For sensor wire runs greater than 50 ft or where the sensor wiring is exposed to electromagnetic or radio frequency interference, use shielded cable and connect the shield to a C (common) terminal on the control module.
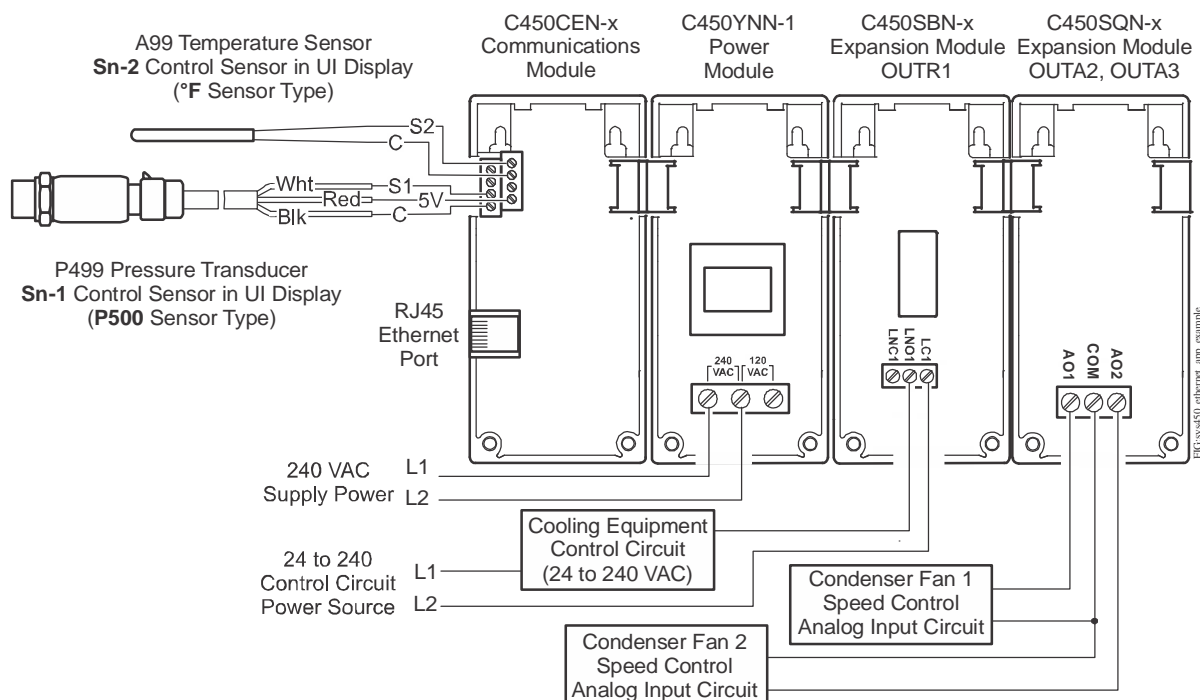
Figure 3: Example System 450 Control System with an Ethernet Communications Module Controlling a Cooling System with Condenser Fan Speed Control

Setup and Adjustments

System 450 Component Requirements

A System 450 control system consists of one control module, one to three control sensor inputs, and one to ten outputs that provide on/off control or analog control. Figure 3 shows an example System 450 control system module assembly, with two sensors and three outputs, connected to an Ethernet network.

Building a System 450 Module Assembly

To set up a System 450 module assembly:

1. Determine the controlled conditions, sensor types, and value ranges required for your application, and select the appropriate System 450 sensor types.

2. Determine the number and type (relay or analog) of outputs required to control your application, and select the appropriate System 450 control module and expansion modules to provide the outputs.

3. Assemble the control and expansion modules in the proper order, starting with the control module on the left.

   Note: If you use a C450YNN-1C power module, it must be plugged into the control module. Plug in any expansion modules to the right of the power module.

4. Apply supply power to the module assembly.

Note: After you power on your module assembly, you can set up your control system in the control module UI before wiring the sensors or outputs to your assembly.

Setting Up the Control System in the UI

System 450 control modules have a backlit LCD and a four-button touch pad UI (Figure 4) that enable you to set up your control system. To set up a control system in the System 450 UI:

1. Build your control system module assembly and connect it to power. See *Building a System 450 Module Assembly* on page 5.

   Note: Every time a module assembly is powered On, the control module polls all of the modules to identify output type (relay or analog) and assigns a sequential output number (1 to 9 [0 = 10]) to each output starting with the control module output on the left. The output numbers identify each output's setup screens in the UI. (See Figure 4.)

2. Access the System 450 setup screens in the UI. See *Accessing the System 450 Setup Start Screens* on page 6.

3. Set up the control system inputs in the UI. See *Setting Up System 450 Sensors* on page 8.

Status or Setup Value: Displays the current input status, output status **or** setup parameter value for the displayed input sensor, output or setup parameter. Press ▲ or ▼ to select a different parameter value when the value is flashing. (Here, 100 = 100%.)

Status or Setup Identifier: Displays the unit of measurement, output, sensor number, **or** setup parameter for the displayed status or setup value. (Here, the setup identifier **OSP** represents % output signal strength at setpoint.)

Menu Button: Press Ⓜ to move through the sensor and output setup start screens. When moving through the status or setup screens, press Ⓜ to return to the status start screen or setup start screen.

Up and Down Buttons: Press ▲ or ▼ to select a different flashing value for any flashing value in the setup value field. In the Main (sensor status) screens, press and hold both ▲ and ▼ for 5 seconds to access the Setup Start screens.
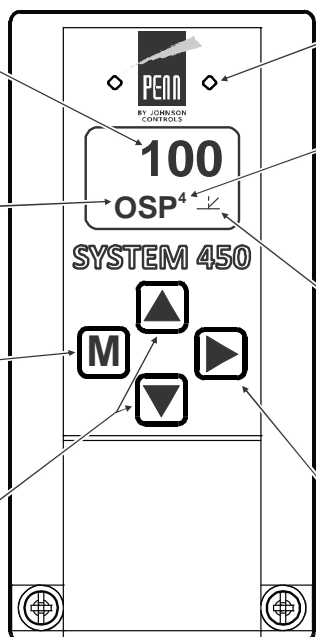
LED: The green LEDs on the Comm Module indicate Ethernet communications performance on the Ethernet network. Blinking Right LED = proper receive activity Blinking Left LED = proper transmit activity

Output Number: Displays a numerical value that identifies the output associated with the status or setup value shown on the screen. Output numbers are automatically determined by the outputs' physical positions (left to right) in the module assembly. (Here, 4 = Output 4.)

Control Ramp Icon: Displays whether an analog output (only) is set as direct acting or reverse acting, and whether the output signal strength is at minimum or maximum when the sensed property is at Setpoint. The control ramp icon displayed is determined by the output's SP, EP, OSP, and OEP setup values.

Next Button: In the Main screens, press ▶ to scroll through the system status screens. In a setup screen, press ▶ to save the (flashing) setup value and go to the next setup screen.

Figure 4: System 450 Communications Module LEDs, LCD, Four-Button Touch Pad User Interface

4. Set up the control system outputs in the UI. See *Setting Up System 450 Outputs* on page 12.

IMPORTANT: Do not change the module positions after a System 450 control system is set up in the UI. System 450 control logic is set up in the UI according to the Sensor Types, the output types, and the output numbers. Changing modules or module positions in a module assembly that is already set up in the UI can change the output numbers, output types, and the setup values of the assembly outputs, which requires setting up the outputs again.

Viewing the Startup, Main, and System Status Screens

Every time you connect power to a System 450 control module, the Startup screen appears for several seconds before the Main screens appear. The Startup screen displays the current firmware version for the module. See Table 2 and *System 450 Firmware Versions* for more information.

After you install, wire, power on, and set up your control system in the UI, the Main screens appear on the LCD, immediately after the Startup screen. During normal operation, the Main screens automatically scroll through the current status of each sensor in your control system. See Table 2 for more information.

The System Status screens display the current status of each input and output in your control system. With the Main screen displayed, press ▶ repeatedly to scroll through and view all of the status screens in your control system. See Table 2 for more information about the System Status screens.

System 450 Firmware Versions

System 450 firmware versions identify the features available on System 450 modules. System 450 control modules with network communications have the High Input-Signal Selection and Differential Control features. See *High Input-Signal Selection* and *Differential Control* on page 11 for more information.

Accessing the System 450 Setup Start Screens

Access the System 450 Setup Start screens from the Main screen. See Table 2 for more information about the Setup Start screens.

To access the System 450 setup screens:

1. Apply power to your module assembly. After the Startup screen appears briefly (displaying the control module firmware version), the Main screen appears on the LCD.

2. In the Main screen, press and hold ▲ and ▼ simultaneously for 5 seconds to access the setup screens and go to the Sensor Setup Start screen.

3. Press Ⓜ repeatedly to scroll through the Output Setup Start screens. See Figure 6.

   Note: The UI returns to the Main screens after 2 minutes of inactivity in any screen in the UI.

Table 2: System 450 Startup Screen, Main Screens, Status Screens, and Setup Start Screens Information and Procedures (Part 1 of 2)
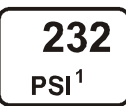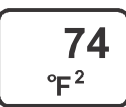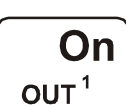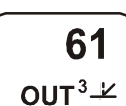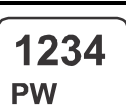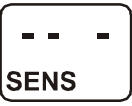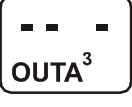
LCD Screen	Name, Description or Function, User Action, and Example
2.00 *xxxx*	**Startup Screen:** When you power a System 450 control module, the LCD displays the control module's current firmware version for approximately five seconds before it displays the Main (Input Status) screen. The screen example shows System 450 firmware version number **2.00** on the top of the screen. The number on the bottom of the screen (indicated in this example with xxxx) identifies the Johnson Controls firmware.
232 PSI^1 **74** °F ^{2} **-4** dIFT **OPEn** bin^3	**Main (Input Status) Screens:** During normal operation, the Main screens automatically scroll through the current status of each input sensor in your control system and display the sensor number, the unit of measurement, and the sensed condition value. See Figure 6 for an example of the Main screens. **Note:** Main screens are view-only; selections are not made in Main screens. The Main screens are the System 450 default screens. After 2 minutes of inactivity in any screen, the UI reverts to the Main screens. **While the Main screens are scrolling, you can press ▷ repeatedly to scroll through and view the System Status screens for all inputs and outputs in your control system.** **While the Main Screens are scrolling, you can press and hold ▲ and ▼ for 5 seconds to access your control system's Setup Start screens. But, if the System 450 User password is set to a value other than factory-default value of 0000, the Password Protected Access screen appears and requires you to enter either the valid User password or valid Admin password to proceed to the Sensor Setup Start screen and the rest of the System 450 setup screens.** The top two screen examples show **Sensor 1** sensing **232 psi** and **Sensor 2** sensing **74°F.** The third screen example shows a **Temperature Differential Sensor** sensing a **-4** degree differential. The bottom screen shows **Sensor 3** set up as a **Binary Input** and the input is **open**.
On OUT ^{1} **61** OUT^3 ↙	**System Status Screens:** The System Status screens display current status of all inputs **and** outputs in your control system. System Status screens are view-only; selections are not made in Status screens. Relay output status screens display output number and relay status (On/Off). Analog output status screens display output number, output signal strength (as a percentage of the total signal strength), and a control ramp icon, which indicates the output's control action. **Press ▷ repeatedly to scroll and view the System Status screens for the inputs and outputs in your control system. When you stop pressing ▷, the displayed Status screen refreshes its value and remains displayed for 2 minutes before returning to the Main Screens.** The screen examples show **Output 1** relay is **On** and **Output 3** signal strength is **61**% of the total signal strength. The control ramp icon in the bottom screen example indicates that the analog output is set up with SP<EP and OSP<OEP. See *Setting Up an Analog Output* for information about ramp icons.
1234 PW	**Password Protected Access Screen:** When Password Protection is enabled, the Password Protected Access screen appears after you press and hold ▲ and ▼ for 5 seconds to access your control system's Setup Start screens. If the User password is set to the factory-default value of 0000, password protection is disabled, and the Password Protected Access screen does not appear; the Sensor Setup Start screen appears. See *Setting Up Password Protection* on page 21 for more information on System 450 password protection.

Table 2: System 450 Startup Screen, Main Screens, Status Screens, and Setup Start Screens Information and Procedures (Part 2 of 2)

LCD Screen	Name, Description or Function, User Action, and Example
SENS / OUTR[1] / OUTA[3] / COMM / USER / AdMN	**Setup Start Screens:** Setup Start screens are view-only screens, from which you can access the setup screens for the sensors or the displayed output; selections are not made in Setup Start screens. The Sensor Setup Start screen is the first screen displayed when you access the System 450 setup screens. **Note:** The numerical order and type of Output Setup Start screens are determined by the modules selected for your System 450 control system and their physical order in the control system module assembly. See *Setting Up the Control System in the UI* on page 5 for more information. **From the Sensor Setup Start screen, press Ⓜ repeatedly to scroll through the Output Setup Start screens for all of the outputs in your control system. When a Setup Start screen appears, press ▶ to go to the setup screens for the sensors or the output displayed in the screen.** **Note:** In any Setup Start screen, you can return to the Main screens by pressing both ▲ and ▼ simultaneously. Also, the UI returns to the Main screen after 2 minutes of inactivity in any screen. The screen examples show the **Sensor**, **Relay Output 1**, **Analog Output 3**, **Communications**, **User Password**, and **Administrator Password Setup Start** screens.

Setting Up System 450 Sensors

You must set up the input sensors for your control system before you can set up any of outputs. To set up the input sensors you must access the setup screens. See *Accessing the System 450 Setup Start Screens*.

The Sensor Setup Start screen is the first screen displayed when you access the system setup screens.

Table 3 provides information about System 450 sensors, Sensor Types, parameter values, and specified sensor or transducer product code numbers.

Table 3: System 450 Sensor Types, Setup Values, and Sensor or Transducer Product Codes (Part 1 of 2)

Sensor Type	Unit of Measurement Value (Condition/Units)	Effective Sensing Range	Range of Usable Values[1]	Resolution Increment Value	Minimum Proportional or Control Band	Sensor Product Type Number[2]
°F	°F (Temperature/degrees)	-46 to 255	-40 to 250	1	1	A99B-xxx
°C	°C (Temperature/degrees)	-43 to 124	-40 to 121	0.5	0.5	A99B-xxx
rH	% (Humidity/%RH)	1 to 100	10 to 95	1	2	HE-67Sx-xxxxx HE-67Nx-xxxxx HE-68Nx-0N00WS
P 0.25	INWC (Pressure/in. W.C.)	-0.250 to 0.250	-0.225 to 0.250	0.005	0.01	DPT2650-R25B-AB
P 0.5	INWC (Pressure/in. W.C.)	0 to 0.5	0.025 to 0.5	0.005	0.01	DPT2650-0R5D-AB
P 2.5	INWC (Pressure/in. W.C.)	0 to 2.5	0.1 to 2.5	0.02	0.1	DPT2650-2R5D-AB
P 5	INWC (Pressure/in. W.C.)	0 to 5.0	0.25 to 5.0	0.05	0.25	DPT2650-005D-AB
P 8	bAR (Pressure/bar)	-1 to 8	-1 to 8	0.05	0.1	P499Rxx-401C
P 10	INWC (Pressure/in. W.C.)	0 to 10	0.5 to 10	0.05	0.2	DPT2650-10D-AB
P 15	bAR (Pressure/bar)	-1 to 15	-1 to 15	0.1	0.2	P499Rxx-402C

Table 3: System 450 Sensor Types, Setup Values, and Sensor or Transducer Product Codes (Part 2 of 2)

Sensor Type	Unit of Measurement Value (Condition/Units)	Effective Sensing Range	Range of Usable Values[1]	Resolution Increment Value	Minimum Proportional or Control Band	Sensor Product Type Number[2]
P 30	**bAR** (Pressure/bar)	0 to 30	0 to 30	0.1	0.4	P499Rxx-404C
P 50	**bAR** (Pressure/bar)	0 to 50	0 to 50	0.2	0.4	P499Rxx-405C
P 100	**PSI** (Pressure/psi)	0 to 100	0 to 100	0.5	1	P499Rxxx101C
P 110[3]	**Hg/PSI** (Pressure/Hg-psi)	-10 to 100	-10 to 100	0.5	1	P499Rxxx100C
P 200	**PSI** (Pressure/psi)	0 to 200	0 to 200	1	1	P499Rxxx102C
P 500	**PSI** (Pressure/psi)	0 to 500	90 to 500	1	5	P499Rxx-105C
P 750	**PSI** (Pressure/psi)	0 to 750	150 to 750	2	6	P499Rxx-107C
HI°F	°**F** (Temperature/degrees)	-50 to 360	-40 to 350[4]	1	1	TE-631x, TE-6000-x TE-68NT-0N00S
HI°C	°**C** (Temperature/degrees)	-45.5 to 182	-40 to 176[4]	0.5	0.5	TE-631x, TE-6000-x TE-68NT-0N00S
bin	Open or Closed[5] (Dry Contacts)	N/A	N/A	N/A	N/A	N/A

1. Because of the way that the System 450 Differential Sensor (Sn-d) is set up and calculated with two identical sensors (Sn-1 and Sn-2), the range of usable values is twice as large as a single sensor. Each Sensor Type has an equal number of positive and negative values. See Table 9 for the range of usable values when an output references Sn-d.
2. Refer to the *System 450 Series Modular Controls Product Bulletin (LIT-12011458)*, *Catalog Page (LIT-1900549)*, or the *System 450 Series Controls Systems with Communications Technical Bulletin (LIT-12011826)* for additional ordering information for System 450 compatible sensors and transducers.
3. See *Setting Up Outputs That Reference a P 110 Sensor* on page 10 for information on setting up System 450 outputs that reference the P 110 Sensor Type.
4. Many of the temperature sensors that can be set up as HI°F or HI°C Sensor Types are not designed for use across the entire range of usable values for HI°F and HI°C Sensor Types. Refer to the Technical Specifications for the sensor you intend to use to determine the ambient temperature range that the sensor is specified to operate in. The TE-6000-6 Nickel Sensor is the only sensor designed for use over the entire temperature range.
5. Selecting the **bin** Sensor Type for a sensor (Sn-1, Sn-2, or Sn-3) sets up the input to control relay outputs (only) based on the state of the binary input contacts (open or closed) connected to the sensor input (Sn1, Sn2, or Sn3). See *Binary Input Control for Relay Outputs* on page 11 for more information.

Table 4 provides sensor setup information, procedures, and example screens. Figure 6 on page 25 provides a System 450 UI setup example.

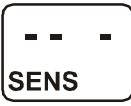**Table 4: System 450 Sensor Setup Screen Information and Procedures (Part 1 of 2)**

LCD Screen	Name, Description or Function, User Action, and Example
`- - -` `SENS`	**Sensor Setup Start Screen:** The Sensor Setup Start screen is the first screen displayed when you access the System 450 setup screens. From the Sensor Setup Start screen you can navigate to the Output Setup Start screens or the Sensor Setup screens. See Figure 6. **Note:** You must set up the input sensors before you can set up the control system outputs. The Sensor Setup Start screen is view-only; selections are not made in Setup Start screens. **1. In the Sensor Setup Start screen, press ▶ to go to the first Sensor Type Selection screen (Sn-1) and begin setting up the sensors in your control system.** The screen example shows the **Sensors** Setup Start screen with flashing dashes.

Table 4:   System 450 Sensor Setup Screen Information and Procedures (Part 2 of 2)

LCD Screen	Name, Description or Function, User Action, and Example
P500 Sn-1 **°F** Sn-2 **- -** Sn-3	**Sensor Type Selection Screens:** The Sensor Type you select for an input sensor automatically determines the setup parameters and values for each output that is set up to reference that sensor. See Table 3 for information about System 450 sensors or transducers, Sensor Types, condition type, units of measurement, minimum control band or proportional band, setup values, value ranges, and product code numbers. **Note:** For outputs to operate properly, the selected Sensor Type must match the sensor or transducer model wired to the control module, and the sensor or transducer must be wired to the proper control module input terminals. **2. In the Sn-1 Sensor Type Selection screen, press ▲ or ▼ to select the desired Sensor Type. Press ▶ to save your selection and go to the Sn-2 Sensor Type Selection screen.** **3. In the Sn-2 Sensor Type Selection screen, press ▲ or ▼ to select the desired Sensor Type. Press ▶ to save your selection and go to the Sn-3 Sensor Type Selection screen.** **Note:** If your control system does not use three input sensors, simply press ▶ while the two dashes are flashing in a Sensor Type Selection screen to save **no** Sensor Type and go to the next setup screen. **4. In the Sn-3 Sensor Type Selection screen, press ▲ or ▼ to select the desired Sensor Type. Press ▶ to save your selection and either:** • **go to the Temperature Offset Setup screen for the first temperature sensor in your system.** • **return to the Sensor Setup Start Screen, if your control system has no temperature sensors.** **Note:** On System 450 control modules with network communications, if you select the same Sensor Type for Sn-1 and Sn-2, two additional functional sensors (Sn-d and HI-2) are available for selection when you set up the control system outputs. If you select the same Sensor Type for Sn-1, Sn-2 and Sn-3, then functional sensor HI-3 is also available for selection when you set up outputs. See _High Input-Signal Selection_ on page 11 and _Differential Control_ on page 11 for more information. The screen examples show **Sn-1** with the **P 500** Sensor Type selected; **Sn-2** with the **°F** Sensor Type selected; and **Sn-3** with the **no** Sensor Type selected.
- 3 OFFS ²	**Temperature Offset Selection Screens:** Select a temperature offset for the temperature inputs (only) in your control system. Sensor Type **°F** enables an offset of +/- 5°F in 1 degree increments. Sensor Type **°C** enables an offset of +/- 2.5°C in 0.5 degree increments. **Note:** The temperature offset changes the displayed temperature value by the selected offset value. **5. Press ▲ or ▼ to select the desired temperature offset value. Press ▶:** • **to go to the next Temperature Offset Selection screen (if there are additional temperature sensors in your control system) and repeat this step for each temperature sensor.** • **to return to the Sensor Setup Start screen.** The screen example shows an **OFFS** value of **-3** (°F) for Sensor **2**. Therefore a sensed temperature value of 75 (°F) at Sensor 2 is displayed as 72 (°F).
- - - SENS	**Sensor Setup Start Screen:** When you have finished setting up all of the sensors for your control system, the display returns to the Sensor Setup Start screen. **Note:** You can edit the sensor setup values at any time, if required. However, changing the Sensor Type for a sensor that is referenced by an output requires setting up the output again to the new Sensor Type values. **After the sensors are set up for your control system, you can:** • **Press Ⓜ to scroll through the Output Setup Start screens and begin setting up your system outputs.** • **Press ▲ and ▼ simultaneously to return to the Main screens.** The screen example shows **Sensors** Setup Start screen with flashing dashes.

Setting Up Outputs That Reference a P 110 Sensor

The P 110 Sensor Type can monitor negative pressure down to 20 InHg (-10 psi). When referencing a P 110 sensor, System 450 displays negative pressure values in InHg on the Main and System Status screens.

But when you set up an output that references a P 110 sensor and the setup value is a negative pressure value, you must select a pressure value in negative psi.

Use Table 5 to determine the negative PSI setup value that corresponds to your InHg target value. For example, if you want a relay output to go off when the sensed pressure reaches 7 InHg, you select the value -3.5 (psi) in the output's Relay OFF Selection screen.

Table 5: InHg Target Values and PSI Setup Values

InHg Value	psi Setup Value	InHg Value	psi Setup Value
1	-0.5	11	-5.5
2	-1.0	12	-6.0
3	-1.5	13	-6.5
4	-2.0	14	-7.0
5	-2.5	15	-7.5
6	-3.0	16	-8.0
7	-3.5	17	-8.5
8	-4.0	18	-9.0
9	-4.5	19	-9.5
10	-5.0	20	-10.0

Note: When an output references the P 110 Sensor Type and the output is set up for Differential Control (Sn-1 and Sn-2 are P 110 Sensor Type), the negative pressure values displayed in the differential pressure System Status screen (dIFP) appear as negative psi values, not InHg values. See *Differential Control* for more information.

Binary Input Control for Relay Outputs

You can connect a binary input (dry contacts) to any of the three System 450 communications control module inputs (Sn1, Sn2, or Sn3) and control the output relays in your control system based on the binary input's state (open or closed).

A sensor (Sn-1, Sn-2, or Sn-3) set up as a binary input can only be referenced by a relay output. Sensors set up as binary inputs are not available for selection on analog outputs.

When a relay output references a sensor that is set up as a binary input, the **On** and **OFF** parameter screens are not available as you set up the output. The relay output's On/Off state is controlled by the binary input's Closed/Open state **and** any of the timer parameters (ONT, OFFT, ONd, or OFFd) that you set up for the relay output. Refer to the Binary Input Control for Relay Outputs section on page18 of the *System 450 Series Modular Control Systems with Communications Control Modules Technical Bulletin (LIT-12011826)* for more information.

High Input-Signal Selection

System 450 control modules with communications include the High Input-Signal Selection control feature.

The High Input-Signal Selection feature enables a System 450 control system to monitor a condition (temperature, pressure, or humidity) with two or three sensors (of the same type) and control relay and/or analog outputs based on the highest condition value sensed by the two or three referenced sensors.

In two sensor applications (HI-2), Sn-1 and Sn-2 must be the same Sensor Type. In three sensor applications (HI-3), Sn-1, Sn-2, and Sn-3 must be the same Sensor Type.

A System 450 control system, using High Input-Signal Selection, can monitor the outlet pressures of two condenser coils in a multi-circuit condensing unit using two pressure sensors of the same type; one connected to each coil outlet.

Differential Control

System 450 control modules with communications include the Differential Control feature. Differential control is used to monitor and maintain a given difference in a condition (temperature, pressure, or humidity) between two sensor points within a system, process, or space.

The Differential Control feature enables a System 450 control system to monitor the temperature, pressure, or humidity differential between two sensors of the same type (Sn-1 and Sn-2) and control relay and/or analog outputs based on the sensed differential value relative to user-selected differential values (dON, dOFF, dSP, and dEP).

When a Differential Control sensor (Sn-d) is set up, the displayed differential sensor value is a calculated variable value: (Sn-d) = (Sn-1) – (Sn-2).

The Sn-d value appears in the System Status screens as either a temperature differential value (dIFT), pressure differential value (dIFP), or humidity differential value (dIFH). The unit of measurement associated with the displayed differential value is determined by the Sn-1 and Sn-2 Sensor Type. See Table 3 on page 8 for Sensor Types and their units of measurement.

The relay output setup values dON and dOFF are condition differential values. When a relay output is set up for differential control, System 450 controls the relay state (On or Off) based on the difference between Sn-1 and Sn-2 (Sn-d) relative to the user-selected differential On (dON) and differential Off (dOFF) values.

When an analog output is set up for differential control, System 450 controls the analog signal strength based on the difference between Sn-1 and Sn-2 (Sn-d) relative to the user-selected differential setpoint (dSP) and differential endpoint (dEP) values.

Differential Sensor Range of Usable Values

The System 450 Differential Control sensor (Sn-d) value is always equal to Sn-1 minus Sn-2. Depending on the intended control action of the output, the differential value may be either a positive or negative value. Therefore, the range of usable values is twice as large as a single sensor, and each Sensor Type has an equal number of positive and negative values. See Table 6 for the range of usable values when an output references Sn-d.

Note: Binary Inputs cannot be set up to as a Differential Sensor.

Table 6: Ranges of Usable Values for Sensor Types in Differential Control Applications

Sensor Type	Sn-d Range of Usable Values	Sensor Type	Sn-d Range of Usable Values
°F	-290 to 290	P 30	-30.0 to 30.0
°C	-161.0 to 161.0	P 50	-50.0 to 50.0
rH	-95 to 95	P 100	-100.0 to 100.0
P0.25	-0.500 to 0.500	P 110	-110.0 to 110.0
P 0.5	-0.500 to 0.500	P 200	-200 to 200
P 2.5	-2.50 to 2.50	P 500	-500 to 500
P 5	-5.00 to 5.00	P 750	-750 to 750
P 8	-9.00 to 9.00	HI°F	-380 to 380
P 10	-10.00 to 10.00	HI°C	-210.0 to 210.0
P 15	-16.0 to 16.0	--	--

Setting Up System 450 Outputs

After you build and connect power to your control system module assembly, the output numbers and output types for your control system are automatically assigned in the UI.

Note: You must set up the input sensors for your control system before you can set up the outputs. See *Setting Up System 450 Sensors* on page 8 for more information.

To set up System 450 outputs in the UI:

1. Apply power to your module assembly. After the **Startup** screen appears briefly (displaying the control module firmware version), the **Main** screen appears on the LCD.

2. In the **Main** screen, press and hold ▲ and ▼ simultaneously for 5 seconds to access the setup screens and to go to the **Sensor Setup Start** screen.

3. At the **Sensor Setup Start** screen, press Ⓜ repeatedly to scroll through and select the desired **Output Setup Start** screen. The Output Setup Start screen indicates the output number and the output type for the selected output.

4. To set up relay outputs, see *Setting Up a Relay Output* and Table 7 for setup information and procedures.

5. To set up analog outputs, see *Setting Up an Analog Output* and Table 9 for setup information and procedures.

Setting Up a Relay Output

Table 7 provides information, procedures, guidelines, and screen examples for setting up relay outputs on System 450 control modules with communications. See Figure 6 on page 25 for example menu flow of the Relay Output 1 set up in Table 7.

Note: The differential sensor, Sn-d, is used to set up analog and relay outputs for Differential Control. See *Differential Control* on page 11 for more information.

Table 7: System 450 Setup Screen Information and Procedures for Relay Outputs (Part 1 of 4)

LCD Screen	Name, Description or Function, User Action, Example
⌐ - - - ⌐ OUTR¹	**Relay Output Setup Start Screen:** The output numbers and the output type (relay or analog) are determined by the module types and configuration of your control system's module assembly and are automatically assigned when you connect power to the module assembly. (See *Setting Up the Control System in the UI* on page 5.) **Note:** You must set up the control system input sensors before you can set up the outputs. **1. In the Relay Output Setup Start screen, press ▶ to go to the output's Sensor Selection screen.** The screen example shows a **Relay** Output Setup Start screen for **Output 1**.

Table 7: System 450 Setup Screen Information and Procedures for Relay Outputs (Part 2 of 4)

LCD Screen	Name, Description or Function, User Action, Example
- - SENS[1] **Sn-2** SENS[1] **HI-2** SENS[1] **Sn-d** SENS[1] **bin** SENS[1]	**Sensor Selection Screen:** The sensor you select here determines the output's setup parameters and values, including condition type, unit of measurement, minimum control band, default setup values, and setup value ranges for several of the remaining output setup screens. If a sensor is not selected, the remaining output setup screens do not appear. If a sensor is already selected for this output, the Sensor Selection screen does not appear here and the Relay ON Selection (ON or dON) screen appears instead. **Note:** You must select a sensor in this Sensor Selection screen **and** the selected sensor must be already set up in the System 450 UI. (See *Setting Up System 450 Sensors*.) **Note:** On System 450 control modules with network communications, the functional sensors Sn-d and HI-2 are available, if Sn-1 and Sn-2 are the same Sensor Type. If Sn-1, Sn-2, and Sn-3 are the same Sensor Type, the functional sensor HI-3 is also available. 2. **Press ▲ or ▼ to select the sensor that this output references:** • **For standard control action, select Sn-1, Sn-2, or Sn-3.** • **For standard control action with High Input-Signal Selection, select HI-2 or HI-3.** • **For differential control action, select Sn-d.** • **For binary input control of Relay Outputs, select bln.** **Then, press ▶ to save your sensor selection and go to the Standard Relay ON Selection screen or the Relay dON Selection.** The top screen example shows the initial **Sensor** Selection screen for Relay Output **1** before a sensor is selected. The remaining screen examples show some of the sensors that may be available for selection. For the Output Relay example, **Sn-2** is selected as the **Sensor** for Output **1** as shown in the second screen.
78 ON[1] OR **30.0** dON[1]	*When a Relay Output references Sn-1, Sn-2, Sn-3, HI-2, or HI-3, the Standard Relay ON Selection screen appears.* **Standard Relay ON Selection Screen:** Select the value at which the relay turns on. Relay **ON** is defined as relay LED On (lit), relay contacts N.O. to C are closed, and N.C. to C contacts are open. **Note:** The value ranges and minimum control band are determined by the Sensor Type selected for the sensor that the output references and are enforced in the Relay ON and Relay OFF Selection screens. 3. **Press ▲ or ▼ to select the value at which the output relay turns on, then press ▶ to save your selection and go to Relay OFF Selection screen.** The screen example shows an **ON** value of **78** (°F) selected for Relay Output **1**.
	When a Relay Output References Sn-d, the Differential Relay dON Selection screen appears. **Differential Relay dON Selection Screen:** Select the dON value at which the relay turns on. The dON value is a differential value that represents the intended difference in the condition (temperature, pressure, or humidity) between Sn-1 and Sn-2 (Sn-1 minus Sn-2) at which the relay is turned on. Depending on the intended control action and the physical location of Sn-1 and Sn-2 sensors in the condition process, dON may be a positive or negative value. **Note:** The unit of measurement, resolution increment, minimum control band, and range of usable values for dON and dOFF are determined by the Sensor Type selected for Sn-1 and Sn-2. (See Table 3 and Table 6 for more information.) 3. **Press ▲ or ▼ to select the differential value at which the output relay turns on. Press ▶ to save your selection and go to Relay dOFF Selection Screen.** The screen example shows a **dON** value of **30** (psi) selected for Relay Output **1**.
	When a Relay Output references a hard-wire sensor (Sn-1, Sn-2, or Sn-3) that is set up with the bin (binary input) Sensor Type, the ON and OFF screens are not available. If you select and save a sensor set up as a binary input in Step 2, the ON Delay (ONd) screen appears. Go to Step 5. **Binary Input Control:** Relay outputs that reference a sensor set up with the **bin** Sensor Type are controlled by the binary input contacts state (open or closed). The ON and OFF values are not used to control relay outputs that reference a binary input sensor.

Table 7: System 450 Setup Screen Information and Procedures for Relay Outputs (Part 3 of 4)
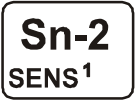
LCD Screen	Name, Description or Function, User Action, Example
75 OFF [1] OR **32.0** dOFF [1]	***When a relay output references Sn-1, Sn-2, Sn-3, HI-2, or HI-3, the Standard Relay OFF Selection screen appears.*** **Standard Relay OFF Selection Screen:** Select the value at which the relay turns off. Relay **OFF** is defined as relay LED Off, relay contacts N.C. to C are closed, and N.O. to C contacts are open. **Note:** The value ranges and minimum control band are determined by the Sensor Type selected for the sensor that the output references and are enforced in the Relay ON and Relay OFF Selection screens. **4. Press ▲ or ▼ to select the value at which output relay turns off, then press ▶ to save your selection and go to Relay-ON Delay Time Selection screen.** The screen example shows an **OFF** value of **75** (°F) selected for Relay Output **1**.
	When a relay output references Sn-d, the Differential Relay dOFF Selection screen appears. **Differential Relay dOFF Selection Screen:** Select the dOFF value at which the relay turns on. The dOFF value is a differential value that represents the intended difference in the condition (temperature, pressure, or humidity) between Sn-1 and Sn-2 (Sn-1 minus Sn-2) at which the relay is turned off. Depending on the intended control action and the physical location of Sn-1 and Sn-2 sensors in the condition process, dOFF may be a positive or negative value. **dOFF** is defined as relay LED Off, relay contacts N.C. to C are closed, and N.O. to C contacts are open. **Note:** The unit of measurement, resolution increment, minimum control band, and range of usable values for dON and dOFF are determined by the Sensor Type selected for Sn-1 and Sn-2. (See Table 3 and Table 6 for more information.) **4. Press ▲ or ▼ to select the differential value at which output relay turns off. Press ▶ to save your selection and go to the Relay-ON Delay Time Selection Screen.** The screen example shows a **dOFF** value of **32** (psi) selected for Relay Output **1**.
	When a Relay Output references a hard-wire sensor (Sn-1, Sn-2, or Sn-3) that is set up with the bin (binary input) Sensor Type, the ON and OFF screens are not available. If you select and save a sensor set up as a binary input in Step 2, the ON Delay (ONd) screen appears. Go to Step 5. **Binary Input Control:** Relay outputs that reference a sensor set up with the **bin** Sensor Type are controlled by the binary input contacts state (open or closed). The ON and OFF values are not used to control relay outputs that reference a binary input sensor.
30 ONd [1]	**Relay-On Delay Time Selection Screen:** Select the value (in seconds) that you want output relay to delay turning ON after the condition reaches and maintains the Relay On value. The Relay-On Delay time range is 0 to 300 seconds. **Note:** The Relay-On Delay feature can be used to delay the output relay from going to the On state after the On value is reached at the referenced input sensor. The condition change must reach or exceed the output's Relay On value for the entire duration of the Relay-On Delay, before the output relay goes On. This feature can be used to prevent controlled equipment such as actuators from being exercised every time the condition momentarily spikes to the Relay-On value, reducing wear on the controlled equipment. **5. Press ▲ or ▼ to select the time value (in seconds) that the output relay delays turning on after the process condition reaches the Relay-On value, then press ▶ to save your selection and go to the Relay-On Delay Time Selection Screen.** The screen example shows an **ONd** value of **30** (seconds) selected for Output **1**.
0 OFFd [1]	**Relay-Off Delay Time Selection Screen:** Select the value (in seconds) that you want output relay to delay turning Off after the condition reaches and maintains the Relay Off value. The Relay-Off Delay time range is 0 to 300 seconds. **Note:** The Relay-Off Delay feature can be used to delay the output relay from going to the Off state after the Off value is reached at the referenced input sensor. The condition change must reach or exceed the output's Relay Off value for the entire duration of the Relay-Off Delay, before the output relay goes Off. This feature is used to prevent controlled equipment such as actuators from being exercised every time the condition momentarily spikes to the Relay Off value, reducing wear on the controlled equipment. **6. Press ▲ or ▼ to select the time value (in seconds) that the output relay delays turning off after the process condition reaches the Relay Off value, then press ▶ to save your selection and go to the Relay-Off Delay Time Selection Screen.** The screen example shows an **OFFd** value of **0** (seconds) selected for Output **1**.

Table 7:   System 450 Setup Screen Information and Procedures for Relay Outputs (Part 4 of 4)

LCD Screen	Name, Description or Function, User Action, Example
0 ONT[1]	**Minimum Relay ON Time Selection Screen:** Select the minimum time that the output relay is required to stay on after it turns on. The minimum ON Time range is **0** to **300** seconds. 7. Press ▲ or ▼ to select the minimum time that the output relay remains on after reaching the Relay ON value, then press ▶ to save your selection and go to the Minimum Relay OFF Time Selection screen. The screen example shows an **ONT** value of **0** (seconds) selected for Output **1**.
120 OFFT[1]	**Minimum Relay OFF Time Selection Screen:** Select the minimum time that the output relay is required to stay Off after it turns Off. Minimum OFF Time range is **0** to **300** seconds. 8. Press ▲ or ▼ to select the minimum time that this output relay remains off after reaching the Relay OFF value. Press ▶ to save your selection and go to the Sensor Failure Mode Selection screen. The screen example shows an **OFFT** value of **120** (seconds) selected for Output **1**.
OFF SNF[1]	**Sensor Failure Mode Selection Screen:** Select the output's mode of operation if a referenced sensor or sensor wiring fails. For outputs that reference functional sensors HI-2, HI-3, or Sn-d, the failure of any of the referenced hard-wired sensors results in a functional sensor failure condition. The output operates in the selected Sensor Failure mode until the failure is remedied. Sensor Failure mode selections for relay outputs include: • **ON** = Output relay remains on during sensor failure. • **OFF** = Output relay remains off during sensor failure. 9. Press ▲ or ▼ to select this output's mode of operation if the sensor or sensor wiring fails. Press ▶ to save your sensor failure mode selection and go to the Edit Sensor screen. The screen example shows **OFF** selected as the **Sensor Failure** mode for Output **1**.
Sn-2 SENS[1]	**Edit Sensor Screen:** This screen displays the sensor that this output currently references. Typically, no action is taken in this screen. But if you need to change the sensor that this output references, you can select a different sensor for this output in this screen. **Note:** If you change the sensor that an output references to a sensor with a different Sensor Type, the default setup values for the output change, and you must set the output up again. 10. If you do not need to change this output's sensor, simply press ▶ to save the current sensor selection and return to the Relay Output Setup Start screen. To change the sensor this output references, press ▲ or ▼ to select the new sensor that this output references. Then press ▶ to save the new sensor selection and return to the Relay ON Selection screen (ON or dON). If the new sensor has a different Sensor Type from the previously referenced sensor, repeat the output setup procedure for this output. This relay output is now set up in the System 450 UI. The screen example shows **Sn-2** is selected **Sensor** for Output **1**.
– – – OUTR[1]	**Relay Output Setup Start Screen** After you have set up this relay output, you can go to another Output Setup Start screen, the Sensor Setup Start screen, or return to the Main screens. 11. Press Ⓜ to scroll through the remaining Output Setup Start screens and return to the Sensor Setup Start screen, or press ▲ and ▼ simultaneously to return to the System 450 Main screens. The screen example shows a **Relay** Output Setup Start screen for **Output 1**.

Setting Up an Analog Output

Analog outputs provide an analog signal to control equipment in you application based on the input from a standard fixed setpoint sensor (Sn-1, Sn-2, or Sn-3) or a High Input Signal Selection sensor (HI-2 or HI-3).

Note: The differential sensor, Sn-d, is used to set up analog and relay outputs for Differential Control. See *Differential Control* on page 11 for more information.

Analog outputs provide an auto-selecting analog signal that is proportional to the sensed input condition. The System 450 analog output senses the impedance of the controlled equipment's analog input circuit and automatically delivers either a 0–10 VDC or 4–20 mA signal to the controlled equipment.

Figure 5 shows an example of the analog output setup values and the resulting output signal in a typical space heating application (SP > EP and OSP < OEP).
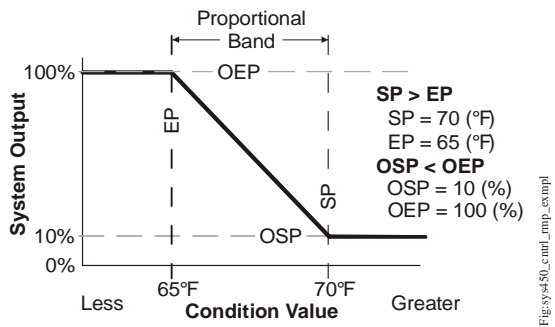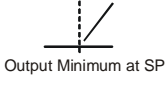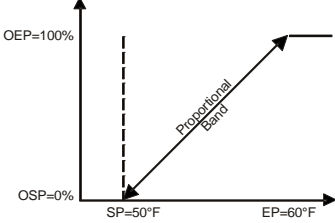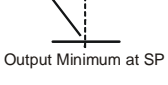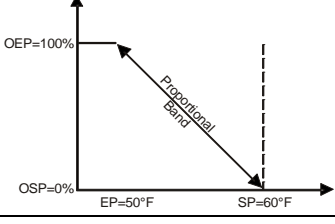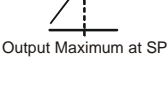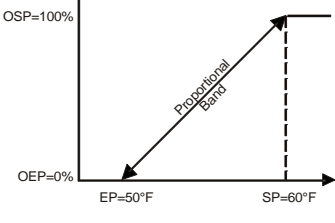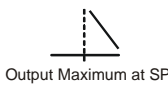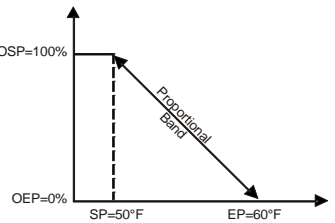
Figure 5: Control Ramp Example for a Typical Heating Application (SP > EP and OSP < OEP)

The control action between the input signal and the output signal can be set up four ways, depending on the values selected for the Setpoint (SP), End Point (EP), Percent Output Signal Strength at Setpoint (OSP), and Percent Output Signal Strength at End Point (OEP). The LCD displays different Control Ramp icons for the four control actions.

Table 8 shows the four Control Ramp icons and the associated analog output setup value relationships.

Table 8:   Analog Output Control Ramp Icons

Control Ramp Displayed on LCD	Control Action	Set the Analog Output Value Relationships for the Desired Control Action and Control Ramp
Output Minimum at SP		**SP < EP** **OSP < OEP**
Output Minimum at SP		**SP > EP** **OSP < OEP**
Output Maximum at SP		**SP > EP** **OSP > OEP**
Output Maximum at SP		**SP < EP** **OSP > OEP**

Setting Up the Integration Constant, Update Rate, and Output Deadband

The System 450 Integration Constant (I-C), the Update Output Signal Rate (UP-R), and the Output Signal Strength Deadband (bNd) are powerful tools for controlling the analog outputs and your application's process loops.

Depending on your control system application, setting up the I-C, UP-R, or bNd values to values other than the factory-default values can significantly change the behavior of an analog output. Refer to the *System 450 Series Modular Control Systems with Communications Control Modules Technical Bulletin (LIT-12011826)* for more information.

> **IMPORTANT:** If you set the I-C, UP-R, or bNd values to values other than the default value, you should operate and observe the affected analog outputs and process loops through the entire range of control. Failure to observe and adjust an analog output set up to use the I-C, UP-R, or bNd features can result in unexpected behavior and out of range conditions in the affected process loops.

Table 9 provides information, procedures, guidelines, and screen examples for setting up analog outputs on System 450 control modules with communications.

See Figure 6 on page 25 for example menu flow of the Analog Output 3 set up in Table 9.

Table 9: System 450 Setup Screen Information and Procedures for Analog Output (Part 1 of 4)

LCD Screen	Name, Description or Function, User Action, Example
- - - **OUTA**[3]	**Analog Output Setup Start Screen:** The output numbers and the output type (relay or analog) are determined by the module types and configuration of your control system's module assembly and are automatically assigned when you connect power to the module assembly. (See *Setting Up the Control System in the UI* on page 5.) **Note:** You must set up the system's sensors before you can set up the outputs. **1. Press ▷ to go to this output's Sensor Selection screen.** The screen example shows the **Analog** Output Setup Start screen for **Output 3**.
- - **SENS**[3] **Sn-1** **SENS**[3] **HI-2** **SENS**[3] **Sn-d** **SENS**[3]	**Sensor Selection Screen:** The sensor you select here determines this output's setup parameters and values, including condition type, unit of measurement, minimum proportional band, default setup values, and setup value ranges for several of the remaining output setup screens. If a sensor is not selected here, this output's remaining setup screens do not appear. If a sensor is already selected for this output, the Sensor Selection screen does not appear here, and the Setpoint Selection (SP or dSP) screen appears instead. **Note:** You must select a sensor in this Sensor Selection screen **and** the selected sensor must be already set up in the System 450 UI. (See *Setting Up System 450 Sensors*.) **Note:** On System 450 control modules with network communications, the functional sensors Sn-d and HI-2 are available if Sn-1 and Sn-2 are the same Sensor Type. If Sn-1, Sn-2, and Sn-3 are the same Sensor Type, the functional sensor HI-3 is also available. The Binary Input sensor is not available for analog outputs. **2. Press ▲ or ▼ to select the sensor that this output references:** • **For standard control action, select Sn-1, Sn-2, or Sn-3.** • **For standard control action with High Input-Signal Selection, select HI-2 or HI-3.** • **For differential control action, select Sn-d.** **Then press ▷ to save your sensor selection and go to the Setpoint Selection screen.** The top screen example shows the initial **Sensor** Selection screen for Analog Output **3** before a sensor is selected. The remaining screen examples show some of the sensors that may be available for selection. For the analog output example, **Sn-1** is the selected **Sensor** for Output **3** as shown in the second screen.

Table 9:   System 450 Setup Screen Information and Procedures for Analog Output (Part 2 of 4)

LCD Screen	Name, Description or Function, User Action, Example
225 SP³ Or **30.0** dSP³	***When an analog output references Sn-1, Sn-2, Sn-3, HI-2, or HI-3, the Standard Setpoint Selection screen appears.*** **Setpoint Selection Screen:** Setpoint is the target value that the controlled system drives towards and along with End Point, defines this output's proportional band. **Note:** An output's minimum proportional band (between Setpoint and End Point) is automatically enforced in the output's Setpoint and End Point Selection screens. **3. Press ▲ or ▼ to select this output's Setpoint value. Press ▶ to save your Setpoint value selection and go to the End Point Selection screen.** The screen example shows a **Setpoint** value of **225** (psi) selected for Output **3**.
	When an analog output references Sn-d, the Differential Setpoint Selection screen appears. **Differential Setpoint Selection Screen:** Differential Setpoint (dSP) is the target value that the controlled system drives towards and along with Differential End Point (dEP), defines this output's proportional band. The dSP value is a differential value that represents a (selected) difference in the condition (temperature, pressure, or humidity) between Sn-1 and Sn-2 (Sn-1 minus Sn-2). Depending on the intended proportional control action and the physical location of Sn-1 and Sn-2 sensors in the condition process, dSP may be a positive or negative value. **Note:** The unit of measurement, resolution increment, minimum proportional band, and range of usable values for dSP and dEP are determined by the Sensor Type selected for Sn-1 and Sn-2. (See Table 3 and Table 6 for more information.) The output's minimum proportional band (between dSP and dEP) is automatically enforced in the output's Setpoint and End Point Selection screens. **3. Press ▲ or ▼ to select this output's Differential Setpoint value. Press ▶ to save your Differential Setpoint value selection and go to the End Point Selection screen.** The screen example shows a **dSP** value of **30** (psi) selected for Output **3**.
250 EP³ Or **25.0** dEP³	***When the output references Sn-1, Sn-2, Sn-3, HI-2, or HI-3, the Standard End Point Selection screen appears.*** **End Point Selection Screen:** End Point is the value that the controlled system drives away from (towards Setpoint) and, along with Setpoint, defines this output's proportional band. **Note:** An output's minimum proportional band (between Setpoint and End Point) is automatically enforced in the output's Setpoint and End Point Selection screens. **4. Press ▲ or ▼ to select this output's End Point value. Press ▶ to save your End Point value selection and go to the %Output Signal Strength at Setpoint Selection screen.** The screen example shows an **End Point** value of **250** (psi) selected for Output **3**.
	When the Output references Sn-d, the Differential End Point Selection screen appears. **Differential End Point Selection Screen:** Differential End Point (dEP) is the target value that the controlled system drives away from (towards Differential Setpoint) and along with Differential Setpoint (dSP), defines this output's proportional band. The dEP value is a differential value that represents a (selected) difference in the condition (temperature, pressure, or humidity) between Sn-1 and Sn-2 (Sn-1 minus Sn-2). Depending on the intended proportional control action and the physical location of Sn-1 and Sn-2 sensors in the condition process, dEP may be a positive or negative value. **Note:** The unit of measurement, resolution increment, minimum proportional band, and range of usable values for dSP and dEP are determined by the Sensor Type selected for Sn-1 and Sn-2. (See Table 3 and Table 6 for more information.) The output's minimum proportional band (between dSP and dEP) is automatically enforced in the output's Setpoint and End Point Selection screens. **4. Press ▲ or ▼ to select this output's Differential End Point value. Press ▶ to save your Differential End Point value selection and go to the %Output Signal Strength at Setpoint Selection screen.** The screen example shows a **dEP** value of **25** (psi) selected for Output **3**.
10 OSP³	**Output Signal Strength at Setpoint Selection Screen:** Select the strength of the signal that this output generates when the sensed condition is at the Setpoint value. The signal strength range is **0** to **100** (%). **5. Press ▲ or ▼ to select this output's %Output Signal Strength at Setpoint (OSP) value. Press ▶ to save your selection and go to the %Output Signal Strength at End Point Selection screen.** The screen example shows an **OSP** value of **10** (%) selected for Output **3.** Therefore Output 3 generates 10% of the total signal strength (1 V or 5.6 mA) when the input is at the Setpoint value of 200 (psi).

Table 9: System 450 Setup Screen Information and Procedures for Analog Output (Part 3 of 4)

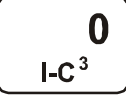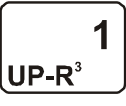| LCD Screen	Name, Description or Function, User Action, Example
90 OEP [3]	**Output Signal Strength at End Point Selection Screen:** Select the strength of the signal that this output generates when the sensed condition is at the End Point value. The signal strength range is **0** to **100** (%). **6. Press ▲ or ▼ to select this output's %Output Signal Strength at End Point value. Press ▶ to save your selection and go to the Integration Constant Selection screen.** The screen example shows an **OEP** value of **90** (%) selected for Output **3.** Therefore Output 3 generates 90% of the total signal strength (9 V or 18.4 mA) when the input is at the End Point value of 250 (psi).
0 I-C [3]	**Integration Constant Selection Screen:** An integration constant allows you to set up proportional plus integral control for this analog output. proportional plus integral control can drive the load closer to Setpoint than proportional only control. **Note:** Initially, you should select the I-C value of **0** (zero) for no integration constant. Refer to the *System 450 Series Technical Bulletin (LIT-12011459)* for more information on proportional plus integral control and setting an integration constant in the System 450 UI. **7. Press ▲ or ▼ to select this output's Integration Constant for proportional plus integral control. Press ▶ to save your selection and go to the Output Update Rate Selection screen.** The screen example shows an **I-C** value of **0** (zero) selected for Output **3**.
1 UP-R [3]	**Output Signal Update Rate Selection Screen:** Select the time interval in seconds at which the output updates the output signal strength. The selected Output Signal Update Rate is the minimum time that the output maintains a constant signal strength (regardless of the input signal) before updating the output signal in response to the referenced input signal. The Output Signal Update Rate value range is 1 to 240 (seconds). **Note:** The Output Update Rate is used to reduce excessive cycling or repositioning of controlled equipment, such as valve and damper actuators. The Output Signal Update Rate feature can be used in conjunction with the Output Signal Dead Band feature. **8. Press ▲ or ▼ to select this output's Output Signal Update Rate. Press ▶ to save your selection and go to the Output Signal Dead Band Selection screen.** The screen example shows an Output Update Rate value of 1 (second), which is the default and lowest update rate you can select.
0 bNd [3]	**Output Signal Dead Band Selection Screen:** Select the Output Signal Dead Band value (as a percent of the output signal strength range) to establish a dead band around the analog output signal strength. The analog output responds to a changing input signal and updates the output signal strength whenever the input signal moves outside of the selected Output Signal Deadband. At each update of the output signal, the control determines if the calculated (input-induced) output signal strength is within the selected Output Signal Dead Band or not. If the input-induced change of the output signal strength is within the selected Output Signal Dead Band, the output signal strength is not updated and remains unchanged. If the input-induced change of the output signal falls outside the Output Signal Dead Band, the output signal strength is updated to the new signal strength value and the selected Output Signal Dead Band is applied to the new signal strength value. The Output Signal Dead Band range is 0 to 50% of the OSP to OEP range. **Note:** The Output Signal Dead Band is used to reduce excessive cycling or repositioning of controlled equipment, such as valve and damper actuators.The Output Signal Dead Band feature can be used in conjunction with the Output Signal Update Rate feature. **9. Press ▲ or ▼ to select this output's Output Signal Dead Band. Press ▶ to save your selection and go to the Sensor Failure Mode Selection screen.** The screen example shows an Output Dead Band value of 0 (%), which is the default value and disables the Output Dead Band feature.
OFF SNF [3]	**Sensor Failure Mode Selection Screen:** Select the output's mode of operation if a referenced sensor or sensor wiring fails. For outputs that reference functional sensors HI-2, HI-3, or Sn-d, the failure of any of the referenced hard-wired sensors results in a functional sensor failure condition. The output operates in the selected Sensor Failure mode until the failure is remedied. Sensor Failure mode selections for analog outputs include: • **ON** = Output generates the selected OEP signal strength during sensor failure. • **OFF** = Output generates the selected OSP signal strength during sensor failure. **10. Press ▲ or ▼ to select this output's mode of operation if the sensor or sensor wiring fails. Press ▶ to save your selection and go to the Edit Sensor Selection screen.** The screen example shows **OFF** selected as the **Sensor Failure** mode for Output **3**.

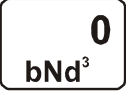**Table 9: System 450 Setup Screen Information and Procedures for Analog Output (Part 4 of 4)**

LCD Screen	Name, Description or Function, User Action, Example
Sn-2 SENS [3]	**Edit Sensor Selection Screen:** This screen displays the sensor that this output currently references. Typically, no action is taken in this screen. But if you need to change the sensor that this output references, you can select a different sensor for this output in this screen. **Note:** If you change the sensor that an output references to a sensor with a different Sensor Type, the default setup values for the output change, and you must set the output up again. 11. **If you are not changing this output's sensor, simply press ▶ to save the current sensor selection and return to the Analog Output Setup Start screen.** **To change the sensor this output references, press ▲ or ▼ to select the new sensor that this output references. Then press ▶ to save the new sensor selection and return to the Setpoint Selection screen (SP or dSP). If the new sensor has a different Sensor Type from the previously referenced sensor, repeat the output setup procedure for this output.** The screen example shows **Sn-2** as the selected Sensor for Output 3.
– – – OUTA [3]	**Analog Output Setup Start Screen** After you have set up this analog output, you can go to another Output Setup Start screen, the Sensor Setup Start screen, or return to the Main screens. 12. **Press Ⓜ to scroll through the remaining Output Setup Start screens and return to the Sensor Setup Start screen, or press ▲ and ▼ simultaneously to return to the System 450 Main screens.** The screen example shows the Analog Output Setup Start screen for Output 3.

Viewing Network Settings, Setting the Remote Network UI Access Lock, and Resetting the Network Settings

In the Communications View and Setup Start screens, you can set up the Ethernet communications parameters for the System 450 control module. You must use a web browser on a computer that is connected to the control module.

Refer to the *System 450 Series Modular Control Systems with Network Communications Technical Bulletin (LIT-12011826)* for more information and procedures for setting up a System 450 control module with Ethernet communications.

Table 10 provides procedures, screen examples, and general information for setting up a System 450 control module with communications on an Ethernet network.

You can use an Ethernet patch cable to connect your computer or laptop directly to the System 450 control module with Ethernet communications.

The default (factory set) Ethernet IP address for a System 450 control module with Ethernet communications is 169.254.1.1.

Table 10: System 450 Ethernet Network Setup Screen Information and Procedures (Part 1 of 2)
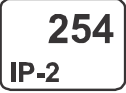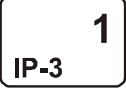
LCD Screen	Name, Description or Function, User Action, and Example
– – – COMM	**Communications View and Setup Start Screen:** From the Communications Setup Start screen, you can access the communications screens for the control module with Ethernet communications. 1. **In the Communications Setup Start screen, press ▶ to go to the Remote Network Access Lock screen.** The screen example show the Communications Setup Start screen.
OFF RLCK	**Remote Network Access Lock Screen:** You can lock or unlock remote access (via Ethernet) to the System, Sensor, and Network web pages in the control module's web UI. When On is selected, the login fields on the Home page are not available; remote users can access only the System 450 Home page and view the system status. Select OFF to enable the login fields, which allow web users to log into the UI and access the setup screens. 2. **Select On or OFF and press ▶ to save the selection and go to the next screen.** The screen example shows the Remote Network Access Lock is set to OFF, indicating that remote access is permitted. Remote Access refers to the ability to make configuration changes to the device through the Ethernet connection.

Table 10: System 450 Ethernet Network Setup Screen Information and Procedures (Part 2 of 2)

LCD Screen	Name, Description or Function, User Action, and Example
169 IP-1	**First IP-Address Octet Display Screen:** Displays the first octet (one to three numerals) of the control module IP address. This is a view-only screen. The control module's IP address is set up using a client computer connected to the control module. **3. Press ▷ to go to the next screen.** The screen example shows the first IP address octet value **169** for the complete example IP address of **169**.254.1.1, which is the factory-default IP address.
254 IP-2	**Second IP-Address Octet Display Screen:** Displays the second octet (one to three numerals) of the control module IP address. This is a view only screen. The control module's IP address is set up using a client computer connected to the control module. **4. Press ▷ to go to the next screen.** The screen example shows the second IP address octet value **254** for the complete example IP address of 169.**254**.1.1, which is the factory-default IP address.
1 IP-3	**Third IP-Address Octet Display Screen:** Displays the third octet (one to three numerals) of the control module IP address. This is a view only screen. The control module's IP address is set up using a client computer connected to the control module. **5. Press ▷ to go to the next screen.** The screen example shows the third IP address octet value **1** for the complete example IP address of 169.254.**1**.1, which is the factory-default IP address.
1 IP-4	**Fourth IP-Address Octet Display Screen:** Displays the fourth octet (one to three numerals) of the control module IP address. This is a view-only screen. The control module's IP address is set up using a client computer connected to the control module. **6. Press ▷ to go to the next screen.** The screen example shows the fourth IP address octet value **1** for the complete example IP address of 169.254.1.**1**, which is the factory-default IP address.
drct ModE	**Network Address Mode Status Screen:** Displays the Network Address mode that control module is configured to operate in. This is a view only screen. The three available modes are: • **drct ModE** (Direct Connection mode) • **StAt ModE** (Static IP Connection mode) • **Auto ModE** (Automatically Obtain IP Address mode) After you configure the network parameters for your control module in the web UI and reset the control to implement your network settings, this screen displays the network address mode. **7. Press ▷ to go to the next screen.** This screen example shows that the communications control module is in the Direct Connection mode.
rSEt IP	**Reset Default Network Configuration Screen:** Allows you to restore all of the network configuration parameters to their default values, and places the communications control module in the Direct Connection mode. **8. While rSEt is blinking, press and hold ▽ for 5 seconds to restore the control module's network configuration values to the original default values. When rSEt stops blinking, the reset is complete. Press ▷ to go to the next screen.** This screen example shows the Reset Network Configuration screen.
- - - - COMM	**Communications Setup Start Screen:** From the Communications Setup Start screen, you can access the communications screens for the control module with Ethernet communications. **9. Press ▷ to go to the Remote Network Access Lock screen, or press Ⓜ to scroll through the System Setup Start screens, or press and hold ▽ and △ simultaneously to return to the Main screens.** This screen example show the Communications Setup Start screen.

Setting Up Password Protection

System 450 communications control modules provide password-protected access to your System 450 control systems. You can operate your control system with or without password protection.

There are two password types for accessing the local (touchpad) System 450 UI – a User level password and an Administrator (Admin) level password. Both local UI passwords are four-digit values (0000 to 9999).

The User password allows you to access the System Setup screens from the System Status screens (Figure 6).

When the User password is set to the factory-default value of 0000, password-protected access is disabled, and a password is not required to access the System Setup screens and change control system parameters and values. Changing the User password to a value other than 0000 enables password-protected access.

The Admin password allows you access to the System Setup screens just like the User password. The Admin password also provides access to the User Password Setup screens (Table 11) and the Administrator Password Setup screens (Table 12), and change the password values. The factory-default Admin password is 1234.

The User and Admin Password Setup screens behave differently than the other System Setup screens. In the System Setup screens, the entire parameter value blinks and you enter an entire new value, then press ▶ to save the entire value and go to the next screen.

In the User and Admin Password Setup screens, you must enter each digit in a screen individually and press ▶ to save the single-digit value and go to the next digit in the four-digit password string.

When you press ▶ to save the last digit in the Change User Password or Change Admin Password screens, the password is saved and the UI displays the next screen. When you press ▶ to save the last digit in the Confirm Admin Password screen, the password is confirmed and the UI displays the Validate Admin Password Change screen.

Note: After you have selected and saved a digit, you cannot go back and change the digit. You must navigate to the change password screen and re-enter the entire four-digit password with the correct digits.

Note: If you change the Admin password, be sure to record and store the password. If you do not recall the Admin password in the future, you cannot access the System Password Setup screens. If you do not recall the User password (after it is changed from the default 0000), you cannot access the System Setup screens.

Table 11 provides procedures for and information on changing the System 450 User password.

Table 11: System 450 User Password Setup Screen Information and Procedures (Part 1 of 2)

LCD Screen	Name, Description or Function, User Action, and Example
_ _ _ **USER**	**User Password Setup Start Screen:** From the User Password Setup Start screen, you can access the User password setup screens and change the User password. 1. **In the User Password Setup Start screen, press ▶ to go to the User Password Setup Access screen.** The screen example shows the User Password Setup Start screen.
1234 **AdPW**	**User Password Setup Access Screen:** Provides password-protected access to the Change User Password screen. You must know the control system's Admin password to access the Change User Password screen. The factory-set default Admin password is 1234. 2. **Press ▲ or ▼ to select the first digit of the Admin password, then press ▶ to save the selected first digit and go to the second digit of the Admin password. Press ▲ or ▼ to select the second digit of the Admin password, then press ▶ to save the selected second digit and go to the third digit of the Admin password. Repeat for the third and fourth digit of the Admin password.** • **If the correct Admin password is entered, the Change User Password screen appears. Go to Step 3.** • **If an invalid Admin password is entered, the Main screen appears and you must repeat the access sequence and enter the correct digits for the Admin password to access the Change User Password screen.** The screen example shows the User Password Setup Access screen with the default Admin password entered.

Table 11: System 450 User Password Setup Screen Information and Procedures (Part 2 of 2)

LCD Screen	Name, Description or Function, User Action, and Example
00- - **USER[1]**	**Change User Password Screen:** Allows you to change the User password. **Note:** The factory-set default User Password is 0000. When the User password is set to 0000, the System 450 local (touchpad) password feature is disabled, and the password challenge screen does not appear when you access the System Setup screens. After you change User password to a value other than 0000, the password challenge screen appears and you must enter the new User password value (or the Admin password value) to access the control system setup menus and change parameters values. See Figure 6 on page 25 for an example of the password challenge screen in the UI menu flow. 3. **Press ▲ or ▼ to select the first digit of your new User password, then press ▶ to save the selected first digit and go to the second digit of the User password. Press ▲ or ▼ to select the second digit of the User password, then press ▶ to save the selected second digit and go to the third digit of the User password. Repeat for the third and fourth digit of the User password. Then press ▶ to save your new User password.** This screen example shows the Change User Password screen with the default password ready to be changed in the screen.

Table 12 provides procedures for and information on changing the System 450 Administrator (Admin) password.

Table 12: System 450 Administrator Password Setup Screen Information and Procedures (Part 1 of 2)
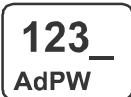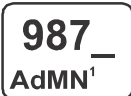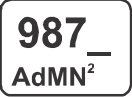
LCD Screen	Name, Description or Function, User Action, and Example
‒ ‒ ‒ **AdMN**	**Admin Password Setup Start Screen:** From the Admin Password Setup Start screen, you can access Admin Password setup screens and change the Admin password for your control system. 1. **In the Admin Password Setup Start screen, press ▶ to go to the Admin Password Setup Access Setup screen.** The screen example shows the Communications Setup Start screen.
123_ **AdPW**	**Admin Password Setup Access Screen:** Provides password-protected access to the Change Admin password screens. You must know the Admin password to access the change password screens. The factory-set default Admin password is 1234. 2. **Press ▲ or ▼ to select the first digit of the Admin password, then press ▶ to save the selected first digit and go to the second digit of the Admin password. Press ▲ or ▼ to select the second digit of the Admin password, then press ▶ to save the selected second digit and go to the third digit of the Admin password. Repeat for the third and fourth digit of the Admin password.** • **If the correct Admin password is entered, the Change Admin Password screen appears. Go to Step 3.** • **If an invalid Admin password is entered, the Main screen appears and you must repeat the sequence and enter the correct digits for the Admin password.** The screen example shows the default Admin password being enter in the Admin Password Setup Access screen.
987_ **AdMN[1]**	**Change Admin Password Screen:** Allows you to change the Admin password. Enter your new Admin password here. The Change Admin Password screen is identified by a 1 in superscript following **AdMN**. **Note:** The factory-set default Admin Password is 1234. If you change the Admin password, record and store the new password appropriately. If you do not recall the changed Admin password, you cannot change the User or Admin passwords. 3. **Press ▲ or ▼ to select the first digit of the new Admin password, then press ▶ to save the selected first digit and go to the second digit of the Admin password. Press ▲ or ▼ to select the second digit of the Admin password, then press ▶ to save the selected second digit and go to the third digit of the Admin password. Repeat for the third and fourth digit of the Admin password. Then press ▶ to save the complete new Admin password.** This screen example shows the Admin password being changed to a new password.

Table 12: System 450 Administrator Password Setup Screen Information and Procedures (Part 2 of 2)

LCD Screen	Name, Description or Function, User Action, and Example
987_ AdMN²	**Confirm New Admin Password Screen:** Confirms the new Admin password entered in the previous (Change Admin Password) screen. The Confirm Admin Password screen is identified by a 2 in the superscript following **AdMN**. 4. **Press ▲ or ▼ to select the first digit of the new Admin password, then press ▶ to save the selected first digit and go to the second digit of the Admin password. Press ▲ or ▼ to select the second digit of the Admin password, then press ▶ to save the selected second digit and go to the third digit of the Admin password. Repeat for the third and fourth digit of the Admin password. Then press ▶ to save the complete new Admin password.** The screen example shows the new Admin password being entered in the Confirm Admin Password screen.
‒‒‒‒ OK **‒‒‒‒** FAIL	**Validate Admin Password Change Screen:** Validates that the Admin Password was successfully changed (OK). 5. **Press ▶ to return to the Main screens** **Note:** If the value entered in the Confirm Admin Password screen does not match the value entered in the Change Admin Password screen, validation fails (FAIL) and the Admin Password Setup Start appears. The top screen example shows the Admin password change is successful (OK). The bottom screen example shows the Admin password change failed (FAIL).

Figure 6 content:

When User Password is 0000
No Password Access Screen

Password Access Screen

Press and hold ◄ + ► for 5 seconds to go to the Setup Start screens.

After a 2 minute pause in any setup or status screen (below), the display returns to the Main (Sensor Status) screens

Press Ⓜ in any Setup screen to go to the associated Setup Start screen.

Press ◄ + ► simultaneously in any Setup Start screen to return to the Main screen.

Sensor status screens auto scroll during normal operation.

Press ▲ to scroll through Sensor Status screens and Output Status screens.

Up to ten outputs can be set up and displayed.

Up to ten outputs can be connected and set up.

System Status Screens

Sensor Screens

Relay Output 1 Screens

Relay Output 2 Screens

Relay Output 3 Screens

Network Communications Screens

User Password Setup Screens

System Password Setup Screens

Screen boxes:

1234 PW

74 °F[2]

232 PSI[1]

232 PSI[1]

- - - SENS Ⓜ

P500 Sn-1 | °F Sn-2 | - - Sn-3 | -1 OFFS[2]

74 °F[2] | - - - [3] | OFF OUT[1] | OFF OUT[2] | 32 OUT[3] ⊥

- - OUTR[1] ▲ | Sn-2 SENS[1] | 78 ON[1] | 75 OFF[1] | 30 ONd[1] | 0 OFFd[1] | 0 ONT[1] | 120 OFFT[1] | OFF SNF[1] | Sn-2 SENS[1]

- - OUTR[2] ▲ | Sn-2 SENS[2] | 68 ON[2] | 71 OFF[2] | 0 ONd[2] | 0 OFFd[2] | 0 ONT[2] | 0 OFFT[2] | OFF SNF[2] | Sn-2 SENS[2]

- - OUTA[3] ▲ | Sn-1 SENS[3] | 225 SP[3] | 250 EP[3] | 10 OSP[3] | 90 OEP[3] | 0 I-C[3] | 1 UP-R[3] | 0 bNd[3] | OFF SNF[3] | Sn-1 SENS[3]

- - COMM ▲ | OFF RLCK | 169 IP-1 | 254 IP-2 | 1 IP-3 | 1 IP-4 | drct ModE | rSEt IP

- - USER ▲ | 1234 AdPW | 0000 USER[1]

- - AdMN ▲ | 1234 AdPW | 9876 AdMN[1] | 9876 AdMN[2]

- - - OK | - - - FAIL

FIG:ethernet_menu_flw_chrt

Figure 6: System 450 Status Screens, Setup Screens, and Menu Flow Example

Setting Up Ethernet Communications

Obtain the information in this section and record the values in the fields provided. Your network administrator may be able to provide most, if not all, of this Ethernet setup information. Use the following steps to connect your computer to the router using a wired port or Wi-Fi:

1. Consult the user manual for the router or see your Network Administrator to obtain the router IP address, user name, and password.

   - Record the router's Internal LAN IP address (_____._____._____._____).

   - Record the user name (_____) and password (_____).

2. Log in to the router using the router's IP address and login credentials from Step 1. Access the configuration and setup pages within the router.

3. Locate the router's LAN setup screen to view the router's subnet mask.

Note: The subnet mask is usually 255.255.255.0.

   - Record the router's subnet mask (_____._____._____._____).

4. Determine the DHCP client address range used by the router. You can use addresses outside this DHCP address range for static addressing.

Note: If the DHCP client address range does not provide space for the devices you need to add to the network, reduce the DHCP client address range.

   - Record the DHCP client address range (_____._____._____._____ to _____._____._____._____).

5. Determine if there are any existing devices on the network that use a static IP address. Examples might include printers, cameras, or other special equipment.

6. Determine the static address range. The static address range does not fall within the DHCP client address range and does not conflict with any existing devices that use a static IP address. For example, if the DHCP client address range is 192.168.1.2 to 192.168.1.100, the space available for static IP addressing would be 192.168.1.101 to 192.168.1.255.

   - Record the static address range (_____._____._____._____ to _____._____._____._____).

Establishing a Direct Connection

The Ethernet control module is shipped with the Direct Connect addressing mode enabled. When operating in Direct Connect mode, the control module uses an integral DHCP server to provide an IP address to your computer and enables communications between your computer and the control module.

After you have established a direct connection between your computer and the Ethernet control module (Figure 7), you can use a web browser on your computer to browse to the Ethernet control module and set up the Ethernet control module's network configuration before connecting it to an existing local network.
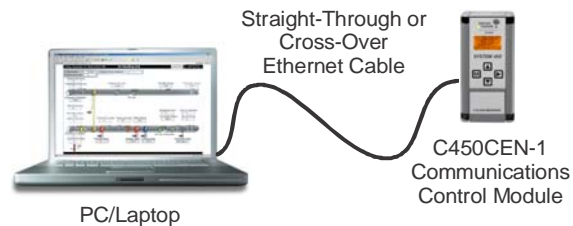
Figure 7: Direct Connection Between a Laptop and a System 450 Communications Control Module

You can also use the Direct Connection mode to connect and browse to System 450 communications control systems that are not permanently connected to a network.

Note: The control module's network settings, with the exception of resetting the network configuration to its default state, cannot be set up or changed via the local user interface.

To establish a direct connection between a computer and a Ethernet control module:

1. Start your computer and disable the wireless networking feature (Wi-Fi) on the computer.

2. Connect an Ethernet cable (straight-through or crossover) between your computer's RJ-45 Ethernet port and the Ethernet control module's RJ-45 Ethernet port.

3. Connect power to the Ethernet control module. Using the local UI, navigate to the Communications Setup screen and verify that the address mode is set to Direct (drct). If it is not, navigate to the Reset Default Network Configuration screen and restore the network configuration to its default state. See Table 10 on page 20 for information on navigating to and through the Communications Setup screen.

4. Open the Windows® Internet Explorer® web browser on your computer. The Internet Explorer browser at version 9 or later is recommended and supported.

5. Type the IP address 169.254.1.1 into the browser's address bar and press Enter. The System 450 Overview and Login page should appear (Figure 8).

Note: If the Ethernet control module does not respond, close the browser, wait for 1 to 2 minutes, and try again. It may take some time for the control module to assign an IP address to your computer. If the control module still does not respond, you may need to turn the power off and on.

6. Enter the System 450 web server user name and password to log in. On your initial login to the communications control module's web UI, enter **System450User1** into the Web User Name field and **Wx9jc3** into the Web Password field.

After you log in, you can set up your control system parameters and configure the Ethernet control module with a static IP address for connection to a local network. Refer to the *System 450 Series Control Modules with Communications Technical Bulletin (LIT-12011826)* for information on accessing Ethernet control systems from the Internet.

Setting Up a Static IP Address

To configure your Ethernet control module for a local network using a static IP address, you must determine the default gateway (router) address and subnet mask on your local network and a static IP address for the control module.

Note: Your network administrator may be able to provide most or all of this network setup information.

Use the following steps to configure the Ethernet control module to use a static address:

1. See *Establishing a Direct Connection* for instructions about how to connect a computer directly to the Ethernet control. Log in to the System 450 web UI and go to the Network Configuration page (Figure 13).

2. In the IP Address section on the Network Configuration page, click the Static IP Address option in the IP Address section. Use a value from the static address range determined in Step 6 of *Setting Up Ethernet Communications*.

3. In the IP Address section on the Network Configuration page, enter the assigned subnet mask in the Subnet Mask field. Use the value recorded in Step 3 of *Setting Up Ethernet Communications*.

4. In the IP Address section on the Network Configuration page, enter the router internal IP address in the Default Gateway field. Use the value recorded in Step 1 of *Setting Up Ethernet Communications*.

5. In the Web Server section of the Network Configuration page, enter a Site Name and a new web password. This is **strongly** recommended for security reasons. The new password must have at least six digits with a minimum of one uppercase letter, one lowercase letter, and one number.

Note: The default web password can be restored through the **rSEt** (Reset to Default Network Configuration) feature in the local UI. When the default password is restored using the rSEt feature, the entire network configuration reverts to the direct connect default state.

6. Click OK to save the new settings.

Note: Clicking OK on the Network Configuration page after changing network setup values initiates a reset of the Ethernet control module. After the reset, the new network settings take effect and the direct connection is no longer functional.

7. Remove the Ethernet cable from the computer and connect the Ethernet control module to the router on the local network you specified.

8. Enable the wireless networking feature on your computer again so it can connect to the router local network. Type the static IP address assigned to the Ethernet control module in the address bar of the web browser to open the web UI and verify it connects to the network. You entered this IP address into the Ethernet control module's IP address field in Step 2.

System 450 Web User Interface

System 450 control modules with Ethernet communications have an integral web server. The web server delivers web pages to client browsers on desktop and laptop computers. The System 450 web UI allows you to monitor your control system status and change the configuration in simple, user-friendly web pages delivered to your computer via a direct connection, connection through a LAN, or over the Internet.

Note: You can monitor control system status and configure the control system parameters in both the local UI (LCD and four-button touch pad) and the web UI. But you can only configure the control system's network settings in the web UI.

See _Viewing Network Settings, Setting the Remote Network UI Access Lock, and Resetting the Network Settings_ on page 20 for the procedures on establishing a direct connection between a computer and the communications control module.

Refer to the _System 450 Series Modular Control Systems with Communications Control Modules Technical Bulletin (LIT-12011826)_ for more detailed information on connecting to your System 450 communications control system to a local network and the Internet.

System Overview Page

Figure 8 shows an example System Overview page for a System 450 control system that is set up and operating. In the System Overview, you can view the system status, system setup parameters, and values, and you can log in to the control system's web UI.

Note: You cannot make any changes to the system configurations on the System Overview page. You must log in to the web UI with the assigned user name and password and then go to the sensor and output configuration pages to change your control system parameters and values.

This control system example uses the following input sensors and outputs:

- a pressure sensor (Sn-1) to control the motor speed of two condenser fans with analog outputs (OUTA1 and OUTA2)

- a temperature sensor (Sn-2) to control the cooling equipment (via Relay Output OUTR3) that maintains room temperature

- a humidity sensor (Sn-3) to control the humidification equipment (via Relay Output OUTR4) to maintain the room humidity

Table 13 provides descriptions, user actions, and references for the items called out in Figure 8.
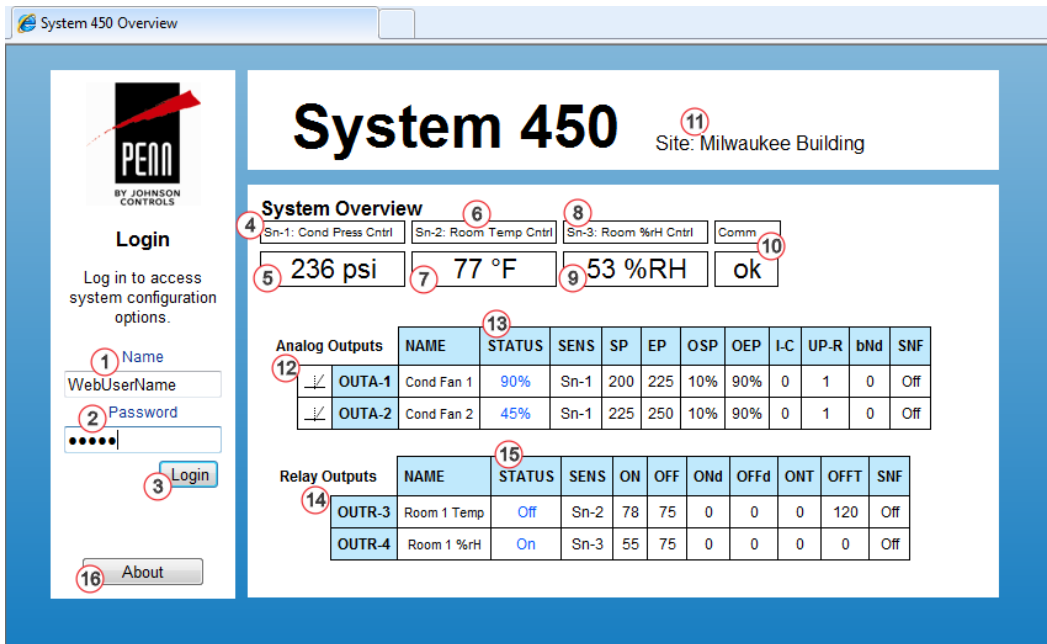
Figure 8: System 450 System Overview Page Example

Table 13: System 450 Web UI Overview Page Descriptions, User Actions, and References (Part 1 of 2)

Callout Number	Identifier *Item Name*	User Actions, Descriptions, References
1	**Name** *Login Field*	Enter the assigned System 450 web user **name** here. **Note:** You can assign a web user name in the *Web User Name:* field in the W*eb Server* section on the *Network Configuration* page. See <u>Network Configuration Page</u> on page 41 for more information about assigning a user name. In this example, *WebUserName* is entered as the assigned login name. The default web user name is **System450User1**.
2	**Password** *Login Field*	Enter the assigned System 450 web **password** here. **Note:** You can assign a web password in the *Web Password:* field in the *Web Server* section on the *Network Configuration* page. See <u>Network Configuration Page</u> on page 41. In this example, a password is entered. The default web password is **Wx9jc3**.
3	**Login** *Button*	After entering the assigned web user name and web password, click **Login** to log in to the System 450 web UI. The System Configuration page appears. See <u>System Configuration Page</u> on page 31 for more information.
4	**Sn-1:** *Sensor 1 Name*	Identifies the Sn-1 (Sensor 1) and displays the assigned Sn-1 name. **Note:** You have the option to assign a sensor name for Sn-1 in the *Name* field in the *Sn-1: Sensor 1* section on the <u>Sensor Configuration Page</u>. In this example, the assigned sensor name for Sn-1 is **Cond Press Cntrl**.
5	*Sn-1 Status*	Displays the current condition status sensed at Sn-1.
6	**Sn-2:** *Sensor 2 Name*	Identifies the Sn-2 (Sensor 2) and displays the assigned Sn-2 name. **Note:** You have the option to assign a sensor name for Sn-2 in the *Name* field in the *Sn-2: Sensor 2* section on the <u>Sensor Configuration Page</u>. In this example, the assigned sensor name for Sn-2 is **Room Temp Cntrl**.
7	*Sn-2 Status*	Displays the current condition status sensed at Sn-2.
8	*Sn-3 Sensor 3 Name*	Identifies the Sn-3 (Sensor 3) and displays the assigned Sn-3 name. **Note:** You have the option to assign a sensor name for Sn-3 in the *Name* field in the *Sn-3: Sensor 3* section on the <u>Sensor Configuration Page</u> In this example, the assigned sensor name for Sn-3 is **%rH Cntrl**.
9	**Sn-3:** *Status*	Displays the current condition status sensed at Sn-3.
10	*Communications Status*	Displays the current status of communication between your System 450 communications control module and the connected LAN, WAN, or Internet. Communications status is defined as OK or FAIL.
11	**Site** *Name Field*	Displays the assigned **site** name. **Note:** You have the option to assign a site name for your System 450 control system in the *Site Name:* field in the *Web Server* section on the *Network Configuration* page. See <u>Network Configuration Page</u> on page 41 for more information.

Table 13: System 450 Web UI Overview Page Descriptions, User Actions, and References (Part 2 of 2)

Callout Number	Identifier *Item Name*	User Actions, Descriptions, References
12	**Analog Outputs** *Status Section*	Displays the setup values for each analog output in your control system, including the configured control ramp icon, analog output name (NAME), output signal status (STATUS), referenced sensor (SENS), setpoint (SP), end point (EP), output signal strength at setpoint (OSP), output signal strength at end point (OEP), integration constant (I-C), output signal update rate (UP-R), output signal dead band (bNd), and sensor failure mode (SNF). See *Analog Output Configuration Page* on page 36 for more information on setting up analog outputs in the System 450 web UI.
13	**STATUS** *of Analog Output Signal*	Displays the current status of each analog output in your control system as a percentage of the total output signal strength range. In this example, OUTA-1 (Analog Output 1) is providing an output signal that is 90% of the full signal strength, and OUTA-2 (Analog Output 2) is providing an output signal that is 45% of the full signal strength.
14	**Relay Outputs** *Status Section*	Displays the setup values for each relay output in your control system, including relay name (NAME), relay output status (STATUS), referenced sensor (SENS), relay on value (ON), relay off value (OFF), on-delay value (ONd), off-delay value (OFFd), minimum on time (ONT), minimum off time (OFFT) and sensor failure mode (SNF). See *Relay Output Configuration Page* on page 39 for more information on setting up relay outputs in the System 450 web UI.
15	**STATUS** *of Relay Output*	Displays the current status of each relay output in your control system as either **On** or **Off**. In this example, OUTR-3 (Relay Output 3) is off, and OUTR-4 (Relay Output 4) is on.
16	**About** *Button*	Click **About** to display the System 450 Control Firmware ssm number and version, the Control CPU type, the Terminal Firmware ssm number and version, and the Terminal CPU type. This information is used to troubleshoot advanced control and firmware problems. See *About Page* on page 45 for more information.

System Configuration Page

Figure 9 shows an example System Configuration page for a System 450 control system that is already configured and in operation. The System Configuration page is the first page that appears when you log in to the System 450 web UI.

Note: You can block access to the System 450 UI configuration pages by enabling a remote access lock. When remote access is locked, you can access the System Overview page to view system status, but you cannot log in to the web UI and make system changes. You enable and disable the remote access lock in the control module's local UI (four-button touch pad and LCD display).

The System Configuration page provides system status information (just as the Overview page does) and access to the Sensor Configuration page, Analog Output Configuration pages, Relay Output Configuration pages, and Network Configuration page.

Table 14 provides descriptions, user actions, and references for the items called out in Figure 9.
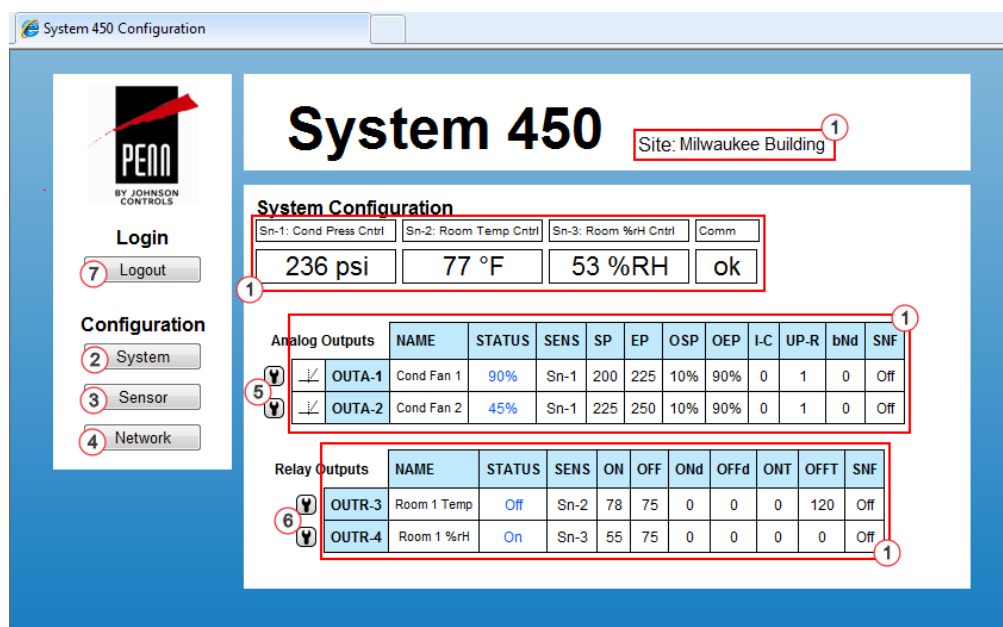
Figure 9: System 450 System Configuration Page Example

Table 14: System 450 Web UI System Configuration Page User Actions, Descriptions, and References (Part 1 of 2)

Callout Number	Identifier / *Item Name*	User Actions, Descriptions, References
1	*Site Name and System Status Information*	See *System Overview Page* on page 28 for information regarding the system status information and site name. This information is the same on both the System Overview page and the System Configuration page.
2	**System** *Button*	Click **System** to go to this System Configuration page. **Note:** Clicking the System button on the System Configuration page simply refreshes the page. Click the System button on any other configuration page to go to the System Configuration page.
3	**Sensor** *Button*	Click **Sensor** to go to the Sensor Configuration page. **Note:** You set up your control system sensors on the Sensor Configuration page. You must set up the system sensors before you can set up the outputs. See *Sensor Configuration Page* on page 33 for more information on setting up your control system sensors in the web UI.

Table 14: System 450 Web UI System Configuration Page User Actions, Descriptions, and References (Part 2 of 2)

Callout Number	Identifier / *Item Name*	User Actions, Descriptions, References
4	**Network** *Button*	Click **Network** to go to the Network Configuration page. **Note:** You set up your control system Network communications setting on the Network Configuration page. See *Network Configuration Page* on page 41 for more information on setting up network communications in the web UI.
5	*Analog Output Setup Access Buttons*	Click the button (showing a small wrench head) to the left of an Analog Output (OUTA-*x*) status row to go to that analog output's configuration page. **Note:** The control module automatically detects the type and position of the control system outputs in the module assembly and assigns an output type and unique output number for each output in your system. See *Analog Output Configuration Page* on page 36 for more information on setting up analog outputs in the web UI. In this example, Outputs 1 and 2 are analog outputs.
6	*Relay Output Setup Access Buttons*	Click the button (showing a small wrench head) to the left of a Relay Output (OUTR-*x*) status row to go to that relay output's configuration page. **Note:** The control module automatically detects the type and position of the control system outputs in the module assembly and assigns an output type and unique output number for each output in your system. See *Relay Output Configuration Page* on page 39 for more information on setting up relay outputs in the web UI. In this example, Outputs 3 and 4 are relay outputs.
7	**Logout** *Button*	Click **Logout** to log out of the System Configuration page and go to the System Overview page. **Note:** After 15 minutes of inactivity in the System Configuration page, the System 450 UI automatically logs out of the web UI.

Sensor Configuration Page

Figure 10 shows an example Sensor Configuration page for a System 450 control system that is already configured and in operation. On the Sensor Configuration page, you set up the hard-wire sensors (Sn-1, Sn-2, and Sn-3) and the Differential Sensor (Sn-d), if your control system uses the Differential Control feature.

This example uses a pressure sensor (Sn-1), a temperature sensor (Sn-2), and a humidity sensor (Sn-3). This control system example does not use the Differential Control feature.

Table 15 provides descriptions, user actions, and references for the items called out in Figure 10.

Figure 10: System 450 Sensor Configuration Page Example

Table 15: **System 450 Web UI Sensor Configuration Page User Actions, Descriptions, and References (Part 1 of 3)**

Callout Number	Identifier / *Item Name*	User Actions, Descriptions, References
1	**Logout and Configuration Buttons**	See *System Configuration Page* on page 31 for descriptions and user actions regarding the System, Sensor, and Network buttons.
2	**Site Name**	Displays the assigned site name. You can assign a website name on the Network Configuration page. See *Network Configuration Page* on page 41 for more information about assigning a site name.
3	**Sn-1: Sensor 1**	Sensor 1 Configuration Section: Select the Sn-1 sensor type, select an offset value (only if Sn-1 is a temperature sensor), and assign a name for Sn-1.

Table 15: System 450 Web UI Sensor Configuration Page User Actions, Descriptions, and References (Part 2 of 3)

Callout Number	Identifier / *Item Name*	User Actions, Descriptions, References
4	**Sensor Type** (Sn-1)	Click the drop-down menu arrow to select the desired **sensor type** for Sn-1. The selected sensor type provides the condition, the units of measurement, range of usable values, resolution increments, and minimum proportional or control band for each output that references Sn-1. In this example, the **P 500** sensor type is selected for Sn-1.
5	(Temperature) **Offset** (Sn-1)	Enter an **offset** value for temperature sensors (only). **Note:** You cannot select an offset value for pressure or humidity sensors. When the sensor type is a pressure or humidity sensor type, the 0 (zero) value in the Offset field is gray and cannot be changed. In this example, the Sn-1 Sensor Type is P 500 (pressure sensor). Therefore, a temperature offset value cannot be selected.
6	**Sensor Name** (Sn-1)	Assign a web UI **sensor name** for the Sn-1 sensor by entering a 16 character (maximum) name in this field. **Note:** You are not required to assign a sensor name. When you assign a sensor name, the assigned Sn-1 sensor name is displayed on the Overview page, the System Configuration page, and the Output Configuration pages for outputs that reference Sn-1. In this example, the assigned sensor name is **Con Press Cntrl**.
7	**Sn-2: Sensor 2**	Sensor 2 Configuration Section: Select the Sn-2 sensor type, select an offset value (only if Sn-2 is a temperature sensor), and assign a name for Sn-2.
8	**Sensor Type** (Sn-2)	Click the drop-down menu arrow to select the desired **sensor type** for Sn-2. The selected sensor type determines the condition, the units of measurement, range of usable values, resolution increments, and minimum proportional or control band for each output that references Sn-2. In this example, the **°F** sensor type is selected for Sn-2.
9	(Temperature) **Offset** (Sn-2)	Enter an **Offset** value for temperature sensors (only). Enter the desired value to offset the displayed temperature from actual sensed temperature. Sensor Type °F allows an offset of up to +/- 5°F in 1 degree increments. Sensor Type °C allows an offset of up to +/- 2.5°C in 0.5 degree increments. **Note:** You cannot select an offset value for pressure or humidity sensors. When the sensor type is a pressure or humidity sensor type, the 0 (zero) value in the Offset field is gray and cannot be changed. In this example, the Sn-2 sensor type is **°F** (temperature sensor), and 0 is selected for the Temperature Offset value.
10	**Sensor Name** (Sn-2)	Assign a web UI **sensor name** for the Sn-2 sensor by entering a 16 character (maximum) name in this field. **Note:** You are not required to assign a sensor name. When you assign a sensor name, the assigned Sn-2 sensor name is displayed on the Overview page, the System Configuration page, and the Output Configuration pages for outputs that reference Sn-2. In this example, the assigned sensor name is **Room Temp Cntrl**.
11	**Sn-3: Sensor 3**	Sensor 3 Configuration Section: Select the Sn-3 sensor type, select an offset value (only if Sn-3 is a temperature sensor), and assign a name for Sn-3.
12	**Sensor Type** (Sn-3)	Click the drop-down arrow to select the desired sensor type for Sn-3. The selected sensor type provides the condition, the units of measurement, range of usable values, resolution increments, and minimum proportional or control band for each output that references Sn-3. In this example, the **rH** sensor type is selected for Sn-3.
13	(Temperature) **Offset** (Sn-3)	Enter an **Offset** value for temperature sensors (only). **Note:** You cannot select an offset value for pressure or humidity sensors. When the Sensor Type is a pressure or humidity sensor type, the 0 (zero) value in the Offset field is gray and cannot be changed. In this example, the Sn-3 sensor type is **rH** (humidity sensor). Therefore, a temperature offset value cannot be selected.

Table 15: System 450 Web UI Sensor Configuration Page User Actions, Descriptions, and References (Part 3 of 3)

Callout Number	Identifier / *Item Name*	User Actions, Descriptions, References
14	**Sensor Name** (Sn-3)	Assign a web UI **sensor name** for the Sn-3 sensor by entering a 16 character (maximum) name in this field. **Note:** You are not required to assign a sensor name. When you assign a sensor name, the assigned Sn-3 sensor name is displayed on the Overview page, the System Configuration page, and the Output Configuration pages for outputs that reference Sn-3. In this example, the assigned sensor name is **Room %rH Cntrl**.
15	**Sn-d: Differential[1] Sensor**	Sn-d: Differential Sensor Configuration Section: Assign a web UI sensor name for Sn-d.
16	**Sensor Name** (Sn-d)	Assign a web UI **sensor name** for the Sn-d sensor by entering a 16 character (maximum) name in this field. **Note:** You are not required to assign a sensor name. When you assign a sensor name, the assigned Sn-d sensor name is displayed on the Overview page, the System Configuration page, and the Output Configuration pages for outputs that reference Sn-d. In this example, there is no Sn-d (Differential Sensor). Therefore, no sensor name is assigned.
17	**Ok** *Button*	Click **Ok** to save any changes you made on this web page and go to the System Configuration page. **Note:** If you leave a web page before clicking Ok, any changes made on the page are not saved, and the page reverts to the previous values.
18	**Cancel** *Button*	Click **Cancel** to cancel any changes you made on this web page, revert to the previous values on the web page, and go to the System Configuration page.

1.   Whenever Sn-1 and Sn-2 are set up with the same sensor type, the Sn-d (Differential Sensor) 1 automatically set up and made available in the SENS drop-down menus in the Output Configuration pages. You are not required to use Sn-d, but the Sn-d status is displayed in the System Overview page, Sensor Configuration page, System Configuration page, and the Output Configuration pages.

Analog Output Configuration Page

Figure 11 shows an example Analog Output Configuration Page for a System 450 control system that is set up and operating.

Table 16 provides descriptions, user actions, and references for the items called out in Figure 11.

Figure 11: System 450 Analog Output Configuration Page Example

Table 16: System 450 Web UI Analog Output Configuration Page, User Actions, Descriptions, and References (Part 1 of 3)

Callout Number	Identifier / *Item Name*	User Actions, Descriptions, References
1	**Logout and Configuration Buttons**	See *System Configuration Page* on page 31 for descriptions and user actions regarding the System, Sensor, and Network buttons.
2	**Site Name**	Displays the assigned site name. You can assign a website name on the Network Configuration page. See *Network Configuration Page* on page 41 for more information about assigning a site name.
3	**Output Configuration: OUTA-2**	Displays the output type (OUTA or OUTR) and output number (-*n*), which are assigned by the control module. **Note:** When you first power on a System 450 module assembly, the control module automatically detects the connected outputs and assigns an output type and number for each connected output. In this example, an analog output is detected and identified in the number 2 position in the module assembly (OUTA-2).

Table 16: System 450 Web UI Analog Output Configuration Page, User Actions, Descriptions, and References (Part 2 of 3)

Callout Number	Identifier / *Item Name*	User Actions, Descriptions, References
4	SENS (Reference Sensor)	Click the drop-down menu to select the sensor that this output references. The reference sensor selected for this output is displayed in this field. **Note:** If Sn-1 and Sn-2 have the same sensor type, the Sn-d and HI-2 sensors are available for selection. If Sn-1, Sn-2, and Sn-3 have the same sensor type, the Sn-d, HI-2 and HI-3 sensors are available for selection. After a sensor is selected for the output, the sensor number is displayed in the field, along with the sensor's sensor type and the usable range of values. In this example, Sn-1 is the selected reference sensor and Sn-1 is configured as a P 500 sensor type, which provides a 90 to 500 psi range.
5	Sensor Name	Displays the assigned sensor name. **Note:** You can assign a 16-character (maximum) name for each sensor that you set up on the Sensor Configuration page. See *Sensor Configuration Page* on page 33 for more information on assigning sensor names.
6	SP (Setpoint)	Enter the desired **SP** (Setpoint) value for the analog output. The range of usable values and the Setpoint units of measurement are displayed in the gray box to the right of the Setpoint field. **Note:** The sensor type of the selected reference sensor determines the units of measurement, the range of usable values, and the minimum differential between the Setpoint and End Point values. In this example, the SP value is 225 (psi) and the usable range is 90 to 500 psi.
7	EP (End Point)	Enter the **EP** (End Point) value for the analog output. The range of usable values and the end point units of measurement are displayed in the gray box to the right of the End Point field. **Note:** The sensor type of the selected reference sensor determines the units of measurement, the range of usable values, and the minimum differential between the End Point and Setpoint values. In this example, the EP value is 250 (psi) and the usable range is 90 to 500 psi.
8	OSP (Output at Setpoint)	Enter the **OSP** (Output at Setpoint) value that you want the analog output signal strength to be when the sensed condition is at SP (Setpoint). The Output at Setpoint value is a percentage of the total output signal strength range. The default OSP value is 0 and the range of usable values is 0 to 100. In this example, the OSP value is 10 (10%).
9	OEP (Output at End Point)	Enter the **OEP** (Output at End Point) value that you want the analog output signal strength to be when the sensed condition is at EP (End Point). The Output at End Point value is a percentage of the total output signal strength range. The default OEP value is 100 and the range of usable values is 0 to 100. In this example, the OEP value is 90 (90%).
10	I-C (Integration Constant)	Enter the **I-C** (Integration Constant) value for the output. There are six integration constant values (1 to 6). The default value (0) indicates that **no** integration constant is applied to the analog output. **Note:** Johnson Controls recommends using the default value (0) when setting up your application for the first time. Refer to the *System 450™ Series Modular Control Systems with Communications Control Modules Technical Bulletin (LIT-12011826)* for information on setting up and testing an integration constant for your application. In this example, the I-C value is the default value 0 and the integration feature is Off.
11	UP-R (Update Rate)	Enter the **UP-R** (Update Rate) value at which the analog output signal strength is updated. You can select an Update Rate value (time-interval in seconds) between 1 and 300. In this example, the Update Rate value is the default value 1 (second).
12	bNd (Output Deadband)	Enter the desired **bNd** (Output Deadband), within which the output signal strength remains constant. The Output Deadband value is a percentage of the total usable sensor range. You can set the Output Deadband value to be 0 to 50 of the total range. In this example, Output Deadband is the default value 0.

Table 16: System 450 Web UI Analog Output Configuration Page, User Actions, Descriptions, and References (Part 3 of 3)

Callout Number	Identifier / *Item Name*	User Actions, Descriptions, References
13	**Sensor Failure Mode of Operation**	Select from the drop-down menu how you want the relay output to respond when the reference sensor or reference sensor wiring fails. • If you choose **Fail Off**, the analog output generates the selected OSP (Output Signal Strength at Setpoint) value to the controlled device. • If you choose **Fail On**, the analog output generates the selected OEP (Output Signal Strength at End Point) value to the controlled device. In this example, Fail Off is selected. Therefore, if the reference sensor (Sn-1) or sensor wiring fail, OUTA-2 provides the selected OSP (10%) to the controlled device until the sensor failure is resolved.
14	**(Output) Name**	Assign a 16-character or less web UI name for the analog output. **Note:** You are not required to assign an output name. When you assign an output name, the assigned name is displayed on the Overview page, the System Configuration page, the Output Configuration pages and the Sensor Configuration page. In this example, the assigned name is **Cond Fan 2**.
15	**Ok** *Button*	Click **Ok** to save any changes you made on this web page and go to the System Configuration page. **Note:** If you leave a web page before clicking Ok, any changes made on the page are not saved, and the page reverts to the previous values.
16	**Cancel** *Button*	Click **Cancel** to cancel any changes you made on this web page, revert to the previous values on the web page, and go to the System Configuration page.

Relay Output Configuration Page

Figure 12 shows an example Relay Output Configuration Page for a System 450 control system that is set up and operating.

Table 17 provides descriptions, user actions, and references for the items called out in Figure 12.

Figure 12: System 450 Relay Output Configuration Page Example

Table 17: System 450 Web UI Relay Output Configuration Page, User Actions, Descriptions, and References (Part 1 of 3)

Callout Number	Identifier / *Item Name*	User Actions, Descriptions, References
1	**Logout and Configuration Buttons**	See *System Configuration Page* on page 31 for descriptions and user actions regarding the System, Sensor, and Network buttons.
2	**Site Name**	Displays the assigned site name. You can assign a website name on the Network Configuration page. See *Network Configuration Page* on page 41 for more information on assigning a site name.
3	**Output Configuration:** *OUTR-3*	Displays the output type (OUTA or OUTR) and output number (*-n*), which are assigned by the control module. **Note:** When you first power on a System 450 module assembly, the control module automatically detects the connected outputs and assigns an output type and number for each connected output. In this example, a relay output is detected and identified in the number 3 position in the module assembly (**OUTR-3**).

Table 17: System 450 Web UI Relay Output Configuration Page, User Actions, Descriptions, and References (Part 2 of 3)

Callout Number	Identifier / *Item Name*	User Actions, Descriptions, References
4	**SENS (Reference Sensor)**	Click the drop-down menu to select the sensor that this output references. The reference sensor selected for this output is displayed in this field. **Note:** If Sn-1 and Sn-2 have the same sensor type, the Sn-d and HI-2 sensors are available for selection. If Sn-1, Sn-2, and Sn-3 have the same sensor type, the Sn-d, HI-2 and HI-3 sensors are available for selection. After a sensor is selected for the output, the sensor number is displayed in the field, along with the sensor's sensor type and the usable range of values. In this example, Sn-2 is the selected reference sensor and Sn-2 is configured as a **°F** sensor type, which provides a -40 to 250°F temperature range.
5	**Sensor Name**	Displays the assigned **sensor name** for the selected reference sensor. **Note:** You can assign a 16-character (maximum) name for each sensor that you set up on the Sensor Configuration page. See *Sensor Configuration Page* on page 33 for more information on assigning sensor names. In this example, the sensor name is **Room Temp Cntrl**.
6	**ON (Relay On)**	Enter the desired **ON** (Relay On) value for the relay output. The range of usable values and units of measurement for ON are displayed in the gray box to the right of the ON value field. **Note:** The sensor type of the selected reference sensor determines the units of measurement, the range of usable values, and the minimum differential between the ON and OFF values. In this example, the ON value is 78 (°F) and the usable range is -40 to 250°F.
7	**OFF (Relay Off)**	Enter the **OFF** (Relay Off) value for the relay output. The range of usable values and units of measurement for OFF are displayed in the gray box to the right of the OFF value field **Note:** The sensor type of the selected reference sensor determines the units of measurement, the range of usable values, and the minimum differential between the OFF and ON values. In this example, the ON value is 75 (°F) and the usable range is -40 to 250°F.
8	**ONd (ON Time Delay)**	Enter the **ONd** (ON Time Delay) value in seconds that you want the relay output to delay going on after the Relay ON value is reached and maintained.
9	**OFFd (OFF Time Delay)**	Enter the **OFFd** (OFF Time Delay) value in seconds that you want the relay output to delay going off after the Relay OFF value is reached and maintained.
10	**ONT (Minimum On Time)**	Enter the **ONT** (Minimum On Time) value in seconds (0 to 300). The ONT determines the minimum time that the relay output remains on after reaching the ON point, regardless of changing conditions.
11	**OFFT (Minimum Off Time)**	Enter the **OFFT** (Minimum Off Time) value in seconds (0 to 300). The OFFT determines the minimum time that the relay output remains off after reaching the OFF point, regardless of changing conditions.
12	**SNF (Sensor Failure Mode)**	Select from the drop-down menu how you want the relay output to respond when the reference sensor or reference sensor wiring failure. • If you choose **Fail Off**, the relay output goes off when the reference sensor or sensor wiring fail. • If you choose **Fail On**, the relay output goes on when the reference sensor or sensor wiring fail. In this example, **Fail Off** is selected.
13	**Name (Optional)**	Assign a 16 character or less web UI name for the relay output. **Note:** You are not required to assign an output name. When you assign a name, the assigned name is displayed on the Overview page, the System Configuration page, the Sensor Configuration page and the Output Configuration pages. In this example, the name is **Room 1 Temp**.

Table 17: System 450 Web UI Relay Output Configuration Page, User Actions, Descriptions, and References (Part 3 of 3)

Callout Number	Identifier / *Item Name*	User Actions, Descriptions, References
14	**Ok** *Button*	Click **Ok** to save any changes you made on this web page and go to the System Configuration page. **Note:** If you leave a web page before clicking Ok, any changes made on the page are not saved, and the page reverts to the previous values.
15	**Cancel** *Button*	Click **Cancel** to cancel any changes you made on this web page, revert to the previous values on the web page, and go to the System Configuration page.

Network Configuration Page

Figure 13 shows an example Network Configuration Page for a System 450 control system that is set up and operating.

Table 18 provides descriptions, user actions, and references for the items called out in Figure 13.

Figure 13: System 450 Network Configuration Page Example

Table 18: System 450 Web UI Relay Output Configuration Page, User Actions, Descriptions, and References (Part 1 of 2)

Callout Number	Identifier / *Item Name*	User Actions, Descriptions, References
1	**Logout and Configuration** Buttons	See *System Configuration Page* on page 31 for descriptions and user actions regarding the Logout, System, Sensor, and Network buttons.
2	**Site Name**	Displays the assigned site name. You can assign a website name on the Network Configuration page. See Site Name below for more information about assigning the site name.
3	**MAC ID**	Displays the unique physical address assigned to the communications control module when the module is manufactured. A module's MAC ID address cannot be changed.
4	**Static IP Address**	Select **Static IP Address** to enable and configure a static IP address for your System 450 control system with communications.
	C450 IP Address	If you select the **Static IP Address** radio button, you must assign a unique IP address for the C450 control module. Typically, the network administrator for the network the C450 is connected to provides an IP address for your C450 communications control module. The default C450 IP Address is **169.254.1.1**.
	Subnet Mask	If you select the **Static IP Address** radio button, you must assign a subnet mask for the C450 control module. Typically, the network administrator for the network that the C450 is connected to provides the subnet mask for your C450 communications control module. The default subnet mask is **255.255.0.0**.
	Default Gateway	If you select the **Static IP Address** radio button, you must assign a default gateway address for the modem, router, or switch that connects your C450 control module to the network. Typically, the network administrator for the network that the C450 is connected to provides the default gateway address for your C450 communications control module. The default Default Gateway address is **169.254.1.2**.
5	**Automatically Obtain an IP Address**	Select **Automatically Obtain an IP Address** to obtain an IP address and the required network settings from the network DHCP server.
6	**Direct Connect**	Select **Direct Connect** when you are connecting the communications control module directly to a laptop or desktop computer with an Ethernet cable. **Note:** The communications control module is shipped in the Direct Connect network mode. You must establish a direct connection between the control and your computer to set up the control module for connection to a local network and the Internet.
7	**Site Name:**	Assign a **site name** for your System 450 control system with communications. The assigned site name appears at the top of each web page to the right of **System 450**. The site name must be 16 characters or less. A site name is not required.
8	**Web User Name:**	Assign a **web user name** for your System 450 control system. The web user name is used to log in to the System 450 web UI configuration pages. The web user name must be 16 characters or less. A user name is not required. If you do not assign a web user name, users must leave the user name field blank when logging into the web UI. See *System Overview Page* on page 28 for more information about user name, password, and login. The default web user name is **System450User1**.
9	**Web Password:**	Assign a **Web Password** for your System 450 control system. The web password is used to log in to the System 450 web UI. The password must be 16 characters or less. A password is not required. If you do not assign a web password here, users must leave the Password field blank when logging into the web UI. See *System Overview Page* on page 28 for more information about user name, password, and login. The default web Password is **Wx9jc3**.
10	**HTTP Port:**	Assign the port number to be used by the HTTP Server. The default HTTP Port number is **80**.
11	**DNS Server IP:**	Enter the IP address of the DNS (Domain Name System) server that the C450 control module queries to resolve Internet addresses when Dynamic DNS is enabled.

Table 18: System 450 Web UI Relay Output Configuration Page, User Actions, Descriptions, and References (Part 2 of 2)

Callout Number	Identifier / *Item Name*	User Actions, Descriptions, References
12	**Service Provider:**	Select the dynamic DNS provider. Options include **None** (dynamic DNS not used) or **DynDNS.com.**
13	**Host Name:**	Enter the host name used by your dynamic DNS provider. Leave this field blank if your system does not use dynamic DNS.
14	**User Name:**	Enter the user name for the account that is set up with your dynamic DNS provider. Leave this field blank if your system does not use dynamic DNS.
15	**Password:**	Enter the password for the account that is set up with your dynamic DNS provider. Leave this field blank if your system does not use dynamic DNS.
16	**External IP:**	This field automatically displays the C450 communications control module's IP address as seen from the Internet. This address can be used to troubleshoot Internet connectivity issues between the control module and the dynamic DNS provider.
17	**Ok** *Button*	Click **Ok** to save any changes you made on this web page. **Note:** Changing the network configuration values initiates a reset of the System 450 communications module, which overwrites the direct connection values and the new network configuration values take effect. Therefore the direct connection is broken and you must use the new network settings to establish connection with the control module or initiate a manual reset of the control module (in the control modules local UI) to re-establish the direct connection values. **Note:** If you leave a web page before clicking Ok, any changes made on the page are not saved, and the page reverts to the previous values.
18	**Cancel** *Button*	Click **Cancel** to cancel any changes you made on this web page, revert to the previous values on the web page, and go to the System Configuration page.

Network Settings Reset Page

When you change the IP Address mode, Static IP Address, Subnet Mask, Default Gateway, or HTTP Port value and click Ok, the communication controls module initiates a control reset and the Network Configuration Reset page (Figure 14) appears while the control resets the network settings for the new values.
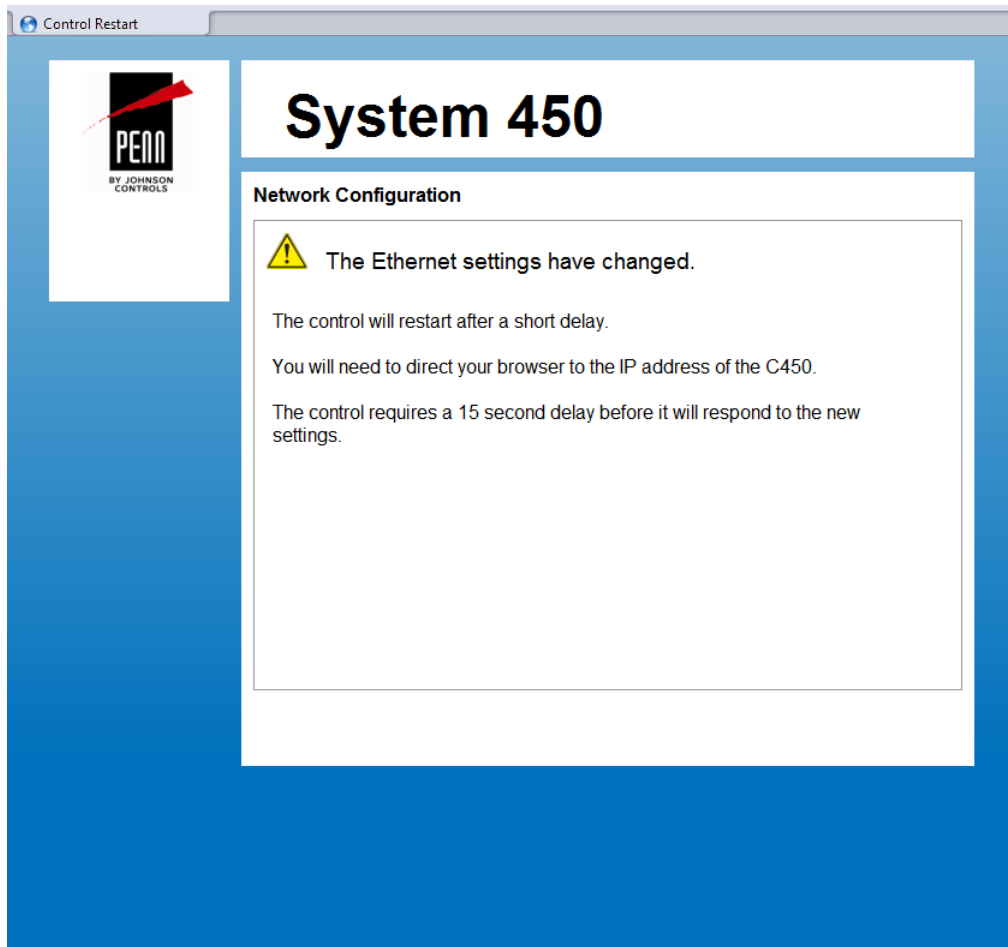

Figure 14: Network Configuration Settings Reset Page

About Page

Figure 15 shows an example About Page for a System 450 control module.

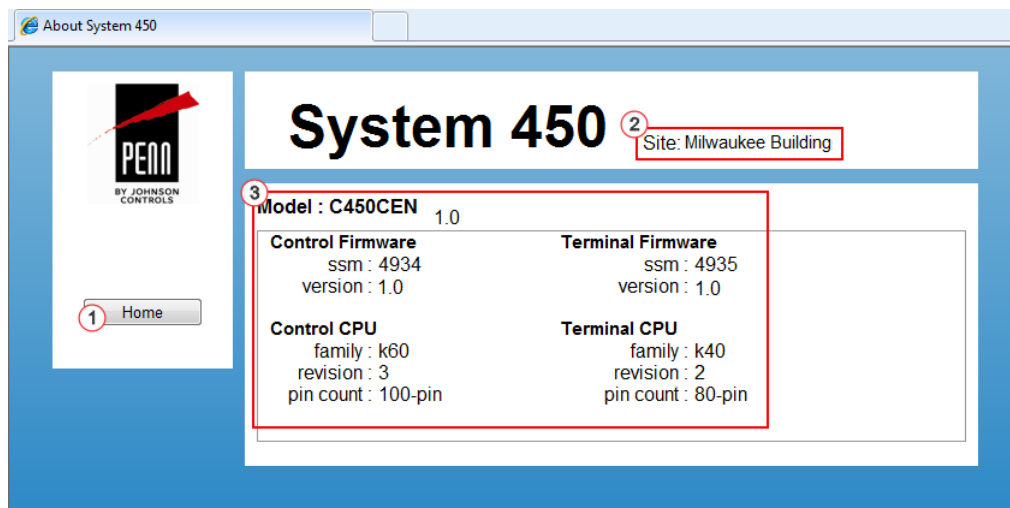Table 19 provides descriptions, user actions, and/or references for the items called out in Figure 15.

Figure 15: System 450 About Page Example

Table 19: System 450 Web UI Relay Output Configuration Page, User Actions, Descriptions, and References

Callout Number	Identifier / *Item Name*	User Actions, Descriptions, References
1	**Home** Button	Click **Home** to go to the **System Overview** page.
2	**Site Name**	Displays the assigned site name. You can assign a web site name on the Network Configuration page. See *Network Configuration Page* on page 41 for more information about assigning a site name.
3	**Model:** **Control Firmware** **Terminal Firmware** **Control CPU** **Terminal CPU**	Displays information about the control module model, firmware, and chip set. This information may be used for identification and advanced troubleshooting by Johnson Controls PENN product technical support.This information cannot be changed in the field.

Technical Specifications

C450CEN-1C Control Module with Ethernet Communications

Product	C450CEN: System 450 control modules are sensing controls and operating controls with LCD and four-button touchpad UI, Ethernet communications capability, and no outputs. C450CEN-1C: Control module with Ethernet communications capability
Supply Power	**Internal Supply Power:** C450YNN-1C Power Supply Module **External Supply Power:** 24 VAC (20–30 VAC) Safety Extra-Low Voltage (SELV) (Europe), Class 2 (North America), 50/60 Hz, 10 VA minimum; or 22 to 30 VDC **Note:** A System 450 control module or module assembly can use an internal or an external supply power source, but must not be connected to both simultaneously.
Ambient Operating Conditions	**Temperature:** -40 to 66°C (-40 to 150°F) **Humidity:** Up to 95% RH noncondensing; Maximum Dew Point 29°C (85°F)
Ambient Shipping and Storage Conditions	**Temperature:** -40 to 80°C (-40 to 176°F) **Humidity:** Up to 95% RH noncondensing; Maximum Dew Point 29°C (85°F)
Input Signal	0–5 VDC; 1,035 ohm at 25°C (77°F) for an A99 PTC Temperature Sensor
Analog Input Accuracy	**Resolution:** 16 bit
Control Construction	Independently mounted control, surface mounted with Lexan® 950 enclosure suitable for DIN rail mounting or direct mounting to a hard, even surface.
Dimensions (H x W x D)	127 x 63 x 63 mm (5 x 2-3/8 x 2-3/8 in.)
Weight	C450CEN-1C: 207 g (0.46 lb)
Compliance	**North America:** cULus Listed; UL 60730, File E27734; FCC Compliant to CFR47, Part 15, Subpart B, Class B Industry Canada (IC) Compliant to Canadian ICES-003, Class B limits
CE	**Europe:** CE Mark – Johnson Controls, Inc. declares that this product is in compliance with the essential requirements and other relevant provisions of the EMC Directive; Low Voltage Directive; CISPR22, class B.
	Australia: Mark: C-Tick Compliant (N1813)

The performance specifications are nominal and conform to acceptable industry standards. For application at conditions beyond these specifications, consult Johnson Controls Application Engineering at (414) 524-5535. Johnson Controls, Inc. shall not be liable for damages resulting from misapplication or misuse of its products.

United States Emissions Compliance

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

 - Reorient or relocate the receiving antenna.

 - Increase the separation between the equipment and receiver.

 - Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

 - Consult the dealer or an experienced radio/TV technician for help.

Canadian Emissions Compliance

This Class (B) digital apparatus meets all the requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numérique de la Classe (B) respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.