



System 450™ Series Control Modules with Analog Outputs Installation Instructions

C450CPN-3
C450CQN-3

Part No. 24-7664-2853, Rev. D
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Refer to the [QuickLIT website](http://www.quicklit.com) for the most up-to-date version of this document.

Application

IMPORTANT: Use this System 450™ Series Control Module with Analog Output only as an operating control. Where failure or malfunction of the System 450™ Series 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™ Series Control Module.

IMPORTANT: Utiliser ce System 450™ Series Control Module with Analog Output uniquement en tant que dispositif de régulation. Lorsqu'une défaillance ou un dysfonctionnement du System 450™ Series Control Module risque de provoquer des blessures ou d'endommager l'équipement contrôlé ou un autre équipement, la conception du système de contrôle doit intégrer des dispositifs de protection supplémentaires. Veiller dans ce cas à intégrer de façon permanente d'autres dispositifs, tels que des systèmes de supervision ou d'alarme, ou des dispositifs de sécurité ou de limitation, ayant une fonction d'avertissement ou de protection en cas de défaillance ou de dysfonctionnement du System 450™ Series 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 Heating, Ventilating, Air Conditioning, and Refrigeration (HVACR) and commercial/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 and/or analog) outputs, including control systems that can monitor and control temperature, pressure, and humidity applications simultaneously.

You can easily install and quickly configure a stand-alone System 450 control module and sensor in the field as a replacement control for almost any temperature, pressure, and humidity control.

C450CxN-3 models are analog output control modules with Liquid Crystal Display (LCD) and four-button touchpad User Interface (UI) that allows you to set up a System 450 control system. C450CPN-3 models provide one self-selecting analog output, C450CQN-3 models provide two self-selecting analog outputs.

Refer to the *System 450™ Series Modular Control Systems with Standard Control Modules Technical Bulletin (LIT-12011459)* for more detailed information on designing, installing, setting up, and troubleshooting System 450 Series control systems. The System 450 technical bulletin can be accessed and downloaded on the Johnson Controls® Online Product Literature Web site at the following Web address:

<http://cgproducts.johnsoncontrols.com/default.aspx>.

Installation

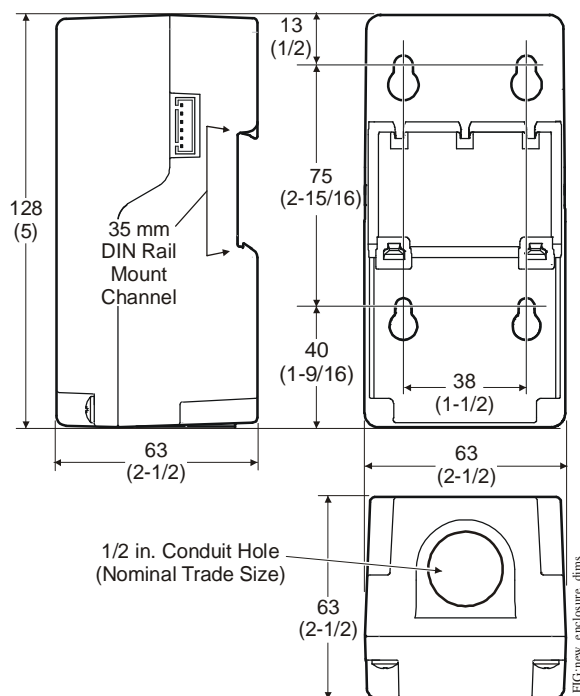


Figure 1: System 450 Module Dimensions, mm (in.)

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 heat-generating devices in an enclosure with the modules that may cause the temperature to exceed the ambient operating limit.

Mounting

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 appropriate mounting hardware/fasteners.
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 power and/or expansion 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-hand side of the control module.

To direct-mount modules to wall surfaces:

1. Plug the modules together, remove the module covers, place the assembly against wall surface horizontally in a suitable location and mark the mount hole locations on the surface (Figure 1).
2. Install appropriate screw fasteners, leaving screw heads approximately one to two turns away from flush to the surface.

3. Place the assembly over screw heads on the mounting slots, and carefully tighten the mounting screws.

Note: If you mount the modules on an uneven surface, do not damage the housings when tightening mounting screws. Use shims/washers to mount module assembly evenly on the surface.

Refer to the control 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 23 for electrical ratings.



WARNING: Risk of Electric Shock.

Disconnect or isolate all power supplies before making electrical connections. More than one disconnection 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.

AVERTISSEMENT : Risque de décharge électrique.

Débrancher ou isoler toute alimentation avant de réaliser un raccordement électrique. Plusieurs isolations et débranchements sont peut-être nécessaires pour -couper entièrement l'alimentation de l'équipement. Tout contact avec des composants porteurs de tensions dangereuses risque d'entraîner une décharge électrique et de provoquer des blessures graves, voire mortelles.

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.

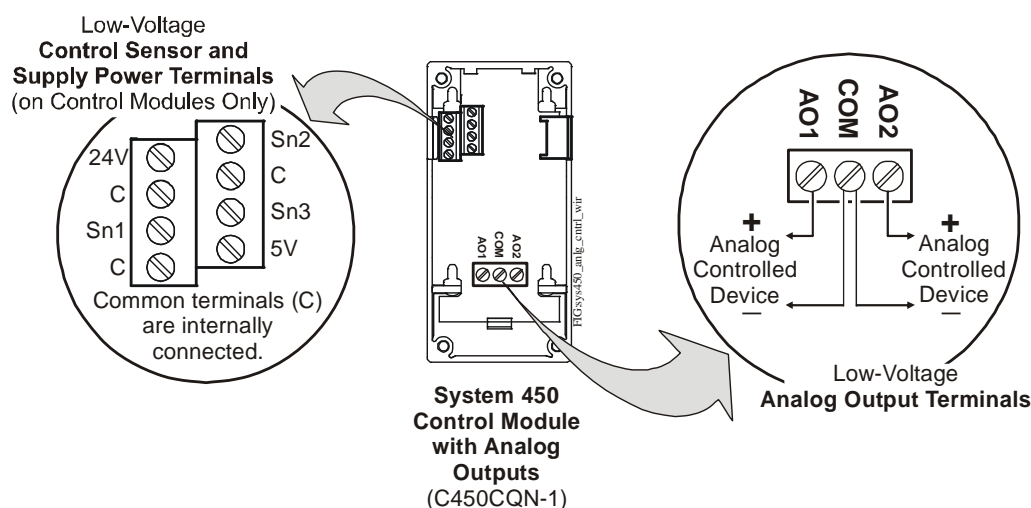


Figure 2: C450CxN-3 Wiring Terminals

Table 1: System 450 Analog Output Control Module Terminal Wiring Information (Part 1 of 2)

Label	Terminal Function	Wire Sizes
24V	Accepts 24 VAC supply power, when a C450YNN power module is not connected, and provides power terminal for 24 VAC (humidity) sensors.	0.8 mm ² to 1.5 mm ² 28 AWG to 16 AWG
5V	Provides 5 VDC power for active sensors.	
S1, S2, S3	Accepts passive or active (0-5 VDC) input signals from control sensors.	
C (Three Terminals)	Provide low-voltage Common connections for 24 VAC power and passive or active sensors connected to the 5V, Sn1, Sn2, and Sn3 terminals. Note: The three C terminals are connected internally and can be connected to ground in the field.	

Table 1: System 450 Analog Output Control Module Terminal Wiring Information (Part 2 of 2)

Label	Terminal Function	Wire Sizes
AO1, AO2	Provides a self-detecting analog output signal in conjunction with the COM terminal; either 0–10 VDC or 4–20 mA.	0.08 mm ² to 1.5 mm ² 28 AWG to 16 AWG
COM	Provides a self-detecting analog output signal in conjunction with the AO1 or AO2 terminal; either 0–10 VDC or 4–20 mA.	

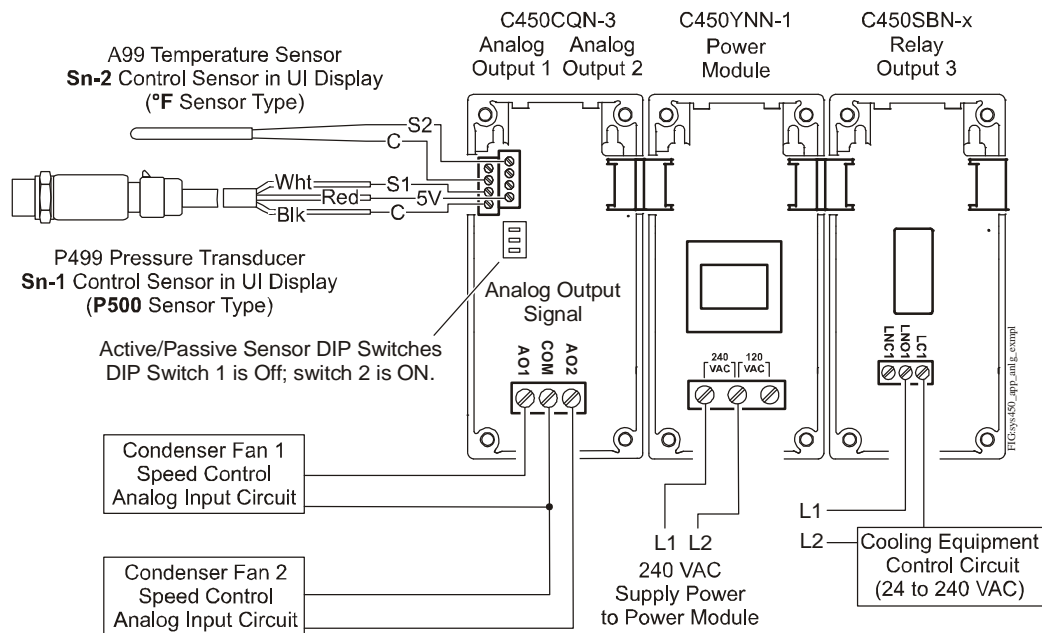


Figure 3: Example System 450 Heat/Cool System with Condenser Fan Speed Control

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 and/or analog control. Figure 3 shows an example System 450 module assembly with two sensors and three outputs (two analog outputs and one relay output).

Setting Up 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-1 power module, it must be plugged into the control module. Plug in any expansion modules (for your control system) to the right of the power module.

4. Apply supply power to the module assembly.

You can now set up your control system in the System 450 reset control module UI.

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 Active/Passive Sensor DIP Switches

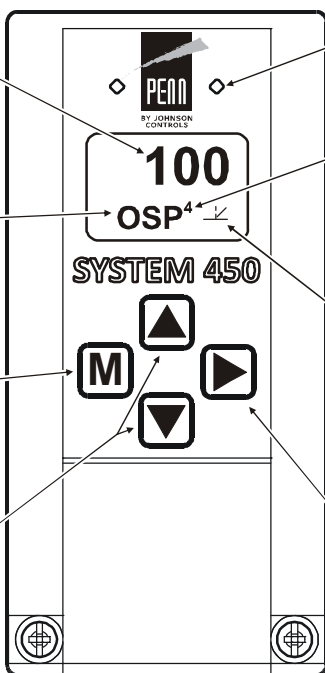
Before putting your control system into operation, you must set up each sensor in the system as either passive or active by positioning the associated switch (On or Off) on the DIP switch block located below the sensor terminal block. See Figure 3.

Status or Setup Value: Displays the current input status, output status or setup parameter value for the displayed input sensor, output and/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 set up start screen.

Up and Down Buttons: Press or to select a different 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.



Light-Emitting Diode (LED): Green LEDs on Relay Control Module and Relay Expansion Modules (only) indicates if the associated relay output is on or off.

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 Control Module Output Relay LEDs, LCD, Four-Button Touchpad User Interface

Temperature sensors are passive (2-wire) sensors and corresponding switches must be set to ON. Humidity and pressure transducers are active (3-wire) sensors and corresponding switches must be set to Off. See Figure 5 for the switch settings for the System 450 example shown in Figure 3.

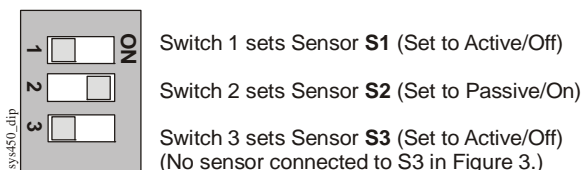


Figure 5: Active/Passive Sensor DIP Switch Block (Set up for Example in Figure 3)

Setting Up a Control System in the User Interface

System 450 control modules have a backlit LCD and a four-button touchpad 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 [Setting Up a System 450 Module Assembly](#) on page 4.

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 7.
3. Set up the control system inputs in the UI. See [Setting Up System 450 Sensors](#) on page 7.
4. Set up the control system outputs in the UI. See [Setting Up System 450 Outputs](#) on page 10.


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.

Use the worksheet provided on page 24 to plan and record the settings for your System 450 control system.

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.






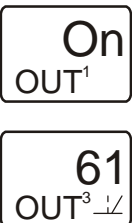







After you install, wire, power on, and set up your control system in the UI, the Main screens appear on the LCD, immediately after the Startup screen. During normal operation, the Main screens automatically scroll through the current status of each sensor in your control system. See Table 2 for more 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. Standard System 450 control modules with Version 2.00 firmware and later include the High Input-Signal Selection and Differential Control features. See [High Input-Signal Selection](#) on page 9 and [Differential Control](#) on page 16 for more information.



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


LCD Screen	Name, Description/Function, User Action, and Example
	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. 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.
	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 7 and Figure 8 for example 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. The screen examples show Sensor 1 sensing 232 psi and Sensor 2 sensing 74°F.
	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, signal strength, and control ramp icon. 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 Standard Control or High Input-Signal Selection Control for information about ramp icons.
	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 a Control System in the User Interface 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 is displayed, 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, and Analog Output 3 Setup Start screens.

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 to go to the **Sensor Setup Start** screen.

3. Press  repeatedly to scroll through the **Output Setup Start** screens. See Figure 7.

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

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/transducer product code numbers.

Table 3: System 450 Sensor Types, Setup Values, and Sensor/Transducer Product Codes

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 0.5	INWC (Pressure/in. W.C.)	0 to 0.5	0.025 to 0.5	0.005	0.025	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
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
P100	PSI (Pressure/psi)	0 to 100	0 to 100	0.5	1	P499Rxx-101C
P110 ³	Hg/PSI (Pressure/Hg-psi)	-10 to 100	-10 to 100	0.5	1	P499Rxx-100C
P200	PSI (Pressure/psi)	0 to 200	0 to 200	1	1	P499Rxx-102C
P500	PSI (Pressure/psi)	0 to 500	90 to 500	1	5	P499Rxx-105C
P750	PSI (Pressure/psi)	0 to 750	150 to 750	2	6	P499Rxx-107C
HI°F	°F (Temperature/degrees)	-50 to 340	-40 to 340 ⁴	1	1	TE-631x, TE-6000-x TE-68NT-0N00S
HI°C	°C (Temperature/degrees)	-45.5 to 170	-40 to 170 ⁴	0.5	0.5	TE-631x, TE-6000-x TE-68NT-0N00S

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 *Technical Bulletin (LIT-12011459)* for additional ordering information for System 450 compatible sensors and transducers.
3. See [Setting Up Outputs That Reference a P110 Sensor](#) on page 9 for information on setting up System 450 outputs that reference the P110 Sensor Type.

4. Many of the 1,000 ohm Nickel 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* sections in the *TE-6000 Series Temperature Sensing Elements Product Bulletin (LIT-216288)*, the *TE-6300 Series Temperature Sensors Product Bulletin (LIT-216320)*, and the *TE-6800 Series Temperature Sensor Product Bulletin (LIT-12011542)* to determine the temperature range that the various 1,000 ohm Nickel temperature sensors are specified to operate in.

Table 4 provides sensor setup information, procedures, and example screens. Figure 7 on page 21 provides a System 450 UI setup example.

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

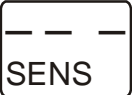

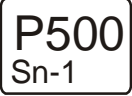
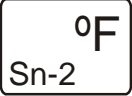
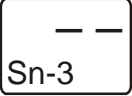


















LCD Screen	Name, Description/Function, User Action, and Example
	<p>Sensor Setup Start Screen: The Sensor Setup Start screen is the first screen displayed when you access the System 450 setup screens. From the Sensor Setup Start screen you can navigate to the Output Setup Start screens or the Sensor Setup screens. See Figure 7.</p> <p>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.</p> <p>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.</p> <p>The screen example shows the Sensors Setup Start screen with flashing dashes.</p>
  	<p>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/transducers, Sensor Types, condition type, units of measurement, minimum control band or proportional band, setup values, value ranges, and product code numbers.</p> <p>Note: For outputs to operate properly, the selected Sensor Type must match the sensor/transducer model wired to the control module, and the sensor/transducer must be wired to the proper control module input terminals.</p> <p>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.</p> <p>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.</p> <p>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.</p> <p>4. In the Sn-3 Sensor Type Selection screen, press  or  to select the desired Sensor Type. Press  to save your selection and either:</p> <ul style="list-style-type: none"> 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. <p>Note: Beginning with firmware Version 2.00, 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 9 and Differential Control on page 16 for more information.</p> <p>The screen examples show Sn-1 with the P500 Sensor Type selected; Sn-2 with the °F Sensor Type selected; and Sn-3 with the no Sensor Type selected.</p>
	<p>Temperature Offset Selection Screens: Select a temperature offset for the temperature inputs (only) in your control system.</p> <p>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.</p> <p>Note: The temperature offset changes the displayed temperature value by the selected offset value.</p> <p>5. Press  or  to select the desired temperature offset value. Press :</p> <ul style="list-style-type: none"> 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. <p>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).</p>

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

LCD Screen	Name, Description/Function, User Action, and Example
	<p>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.</p> <p>Note: You can edit the sensor set up 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.</p> <p>After the sensors are set up for your control system, you can:</p> <ul style="list-style-type: none"> 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. <p>The screen example shows Sensors Setup Start screen with flashing dashes.</p>

Setting Up Outputs That Reference a P110 Sensor

The P110 Sensor Type can monitor negative pressure down to 20 InHg (-10 psi). When referencing a P110 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 P110 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/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 P110 Sensor Type and the output is set up for Differential Control (Sn-1 and Sn-2 are P110 Sensor Type), the negative pressure values displayed in the differential pressure System Status screen (dIFP) are displayed as negative psi values, not InHg values. See [Differential Control](#) on page 16 for more information.

High Input-Signal Selection

Beginning with firmware Version 2.00, standard System 450 control modules include the High Input-Signal Selection control capability.

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.

If the multi-circuit condensing unit has single speed fan motors, multiple relay outputs can be set up to reference the high input-signal and System 450 can stage the fans on and off based on the pressure sensed at the coil with the highest pressure.




If the multi-circuit condensing unit has variable speed fan motors, one or more analog outputs can be set up to reference the high input-signal and control the fan motor speeds based on the pressure sensed at the coil with the highest pressure.

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 7 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 standard Relay Outputs and Relay Outputs with High Input-Signal Selection, see [Setting Up a Relay Output for Standard Control or High Input-Signal Selection Control](#) and Table 6 for setup information and procedures.
5. For standard Analog Outputs and Analog Outputs with High Input-Signal Selection, see [Setting Up an Analog Output for Standard Control or High Input-Signal Selection Control](#) and Table 8 for setup information and procedures.
6. For Relay Outputs with Differential Control, see [Setting Up an Output for Differential Control](#) on page 16 and Table 10.
7. For Analog Outputs with Differential Control, see [Setting Up an Output for Differential Control](#) on page 16 and Table 11.

Setting Up a Relay Output for Standard Control or High Input-Signal Selection Control

Table 6 provides information, procedures, guidelines, and screen examples for setting up relay outputs for standard or High Input-Signal Selection control. See Figure 7 on page 21 for example menu flow of the Relay Output 1 set up in Table 6.

Table 6: System 450 Setup Screen Information and Procedures for Relay Outputs with Standard Control and High Input-Signal Selection Control (Part 1 of 3)




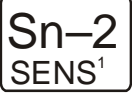
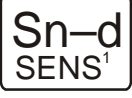
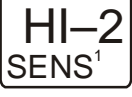



LCD Screen	Name, Description/Function, User Action, and Example
	<p>Relay Output Setup Start Screen: The output numbers and the output type (relay or analog) are determined by the module types and configuration of your control system's module assembly and are automatically assigned when you connect power to the module assembly. (See Setting Up a Control System in the User Interface on page 5.)</p> <p>Note: You must set up the control system input sensors before you can set up the outputs.</p> <p>1. In the Relay Output Setup Start screen, press  to go to the output's Sensor Selection screen.</p> <p>The screen example shows a Relay Output Setup Start screen for Output 1.</p>
   	<p>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.</p> <p>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.)</p> <p>Note: Beginning with firmware Version 2.00, 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.</p> <p>2. Press  or  to select the sensor that this output references:</p> <ul style="list-style-type: none"> • 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. <p>Then press  to save your sensor selection and go to the Relay ON Selection screen.</p> <p>Note: For Differential Control, select Sn-d and go to Table 10 on page 17 for information, procedures, guidelines, and screen examples for setting up outputs for Differential Control.</p> <p>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.</p>

Table 6: System 450 Setup Screen Information and Procedures for Relay Outputs with Standard Control and High Input-Signal Selection Control (Part 2 of 3)



























LCD Screen	Name, Description/Function, User Action, and Example
	<p>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.</p> <p>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.</p> <p>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.</p> <p>The screen example shows an ON value of 78 (°F) selected for Relay Output 1.</p>
	<p>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.</p> <p>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.</p> <p>4. Press  or  to select the value at which output relay turns Off, then press  to save your selection and go to Minimum Relay ON Time Selection screen.</p> <p>The screen example shows an OFF value of 75 (°F) selected for Relay Output 1.</p>
	<p>Minimum Relay ON Time Selection Screen: Minimum ON Time range is 0 to 300 seconds.</p> <p>5. 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.</p> <p>Screen example shows an ONT value of 0 (seconds) selected for Output 1.</p>
	<p>Minimum Relay OFF Time Selection Screen: Minimum OFF Time range is 0 to 300 seconds.</p> <p>6. 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.</p> <p>The screen example shows an OFFT value of 120 (seconds) selected for Output 1.</p>
	<p>Sensor Failure Mode Selection Screen: Select the output's mode of operation if a referenced sensor or sensor wiring fails. If the output references functional sensors HI-2 or HI-3, the output enters the Sensor Failure mode whenever a referenced sensor or sensor wiring fails. The output operates in the selected Sensor Failure mode until the failure is remedied. Sensor Failure mode selections for Relay Outputs include:</p> <ul style="list-style-type: none"> • ON = Output relay remains On during sensor failure. • OFF = Output relay remains Off during sensor failure. <p>7. 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.</p> <p>The screen example shows OFF selected as the Sensor Failure mode for Output 1.</p>
	<p>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.</p> <p>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.</p> <p>8. 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.</p> <p>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.</p> <p>This Relay Output is now set up in the System 450 UI.</p> <p>The screen example shows Sn-2 is selected Sensor for Output 1.</p>

Table 6: System 450 Setup Screen Information and Procedures for Relay Outputs with Standard Control and High Input-Signal Selection Control (Part 3 of 3)

LCD Screen	Name, Description/Function, User Action, and Example
	<p>Relay Output Setup Start Screen</p> <p>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.</p> <p>9. Press [M] to scroll through the remaining Output Setup Start screens and return to the Sensor Setup Start screen, or press [A] and [V] simultaneously to return to the System 450 Main screens.</p> <p>The screen example shows a Relay Output Setup Start screen for Output 1.</p>

Setting Up an Analog Output for Standard Control or High Input-Signal Selection Control

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 *Setting Up an Output for Differential Control* on page 16 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 6 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).

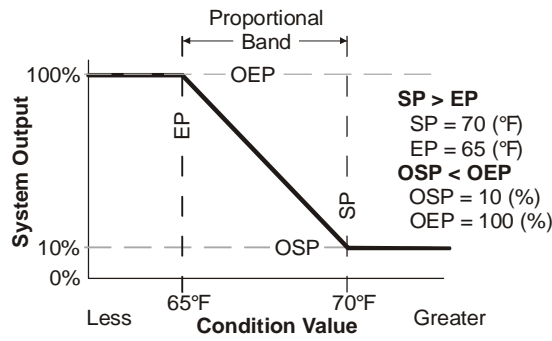


Figure 6: Control Ramp Example for a Typical Heating Application (SP > EP and OSP < OEP)

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

Table 7: Analog Output Control Ramp Icons


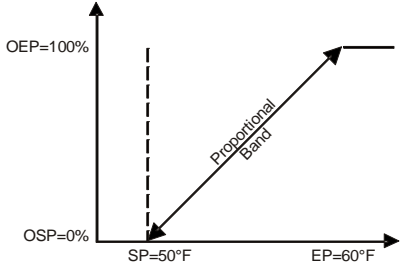
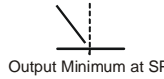
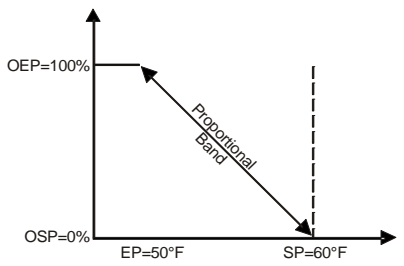

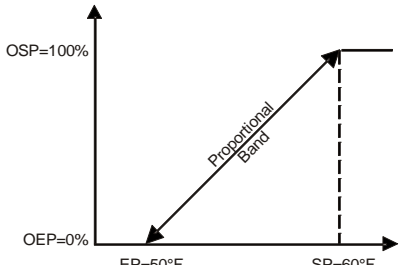

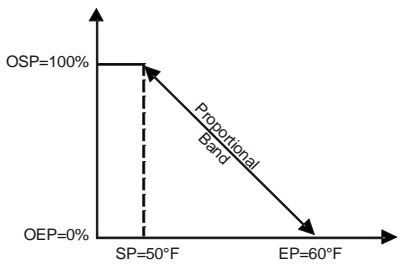
Control Ramp Displayed on LCD	Control Action	Set the Analog Output Value Relationships for the Desired Control Action and Corresponding Control Ramp
 <p>Output Minimum at SP</p>		<p>$SP < EP$</p> <p>$OSP < OEP$</p>
 <p>Output Minimum at SP</p>		<p>$SP > EP$</p> <p>$OSP < OEP$</p>
 <p>Output Maximum at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

Table 8 provides information, procedures, guidelines, and screen examples for setting up analog outputs that reference standard or High Input-Signal Selection sensors. See Figure 7 on page 21 for example menu flow of the Analog Output 3 set up in Table 8.

Table 8: System 450 Setup Screen Information and Procedures for Analog Output with Standard and High Input-Signal Selection Control (Part 1 of 2)




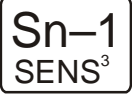
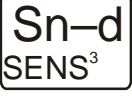




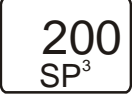







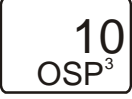



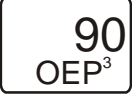



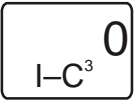







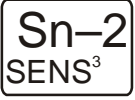








LCD Screen	Name, Description/Function, User Action, Example
	<p>Analog Output Setup Start Screen: The output numbers and the output type (relay or analog) are determined by the module types and configuration of your control system's module assembly and are automatically assigned when you connect power to the module assembly. (See Setting Up a Control System in the User Interface on page 5.)</p> <p>Note: You must set up the system's sensors before you can set up the outputs.</p> <p>1. Press  to go to this output's Sensor Selection screen.</p> <p>The screen example shows the Analog Output Setup Start screen for Output 3.</p>
   	<p>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.</p> <p>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.)</p> <p>Note: Beginning with firmware Version 2.00, 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.</p> <p>2. Press  or  to select the sensor that this output references:</p> <ul style="list-style-type: none"> • 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. <p>Then press  to save your sensor selection and go to the Setpoint Selection screen.</p> <p>Note: For Differential Control, select Sn-d and go to Table 11 on page 18 for information, procedures, guidelines, and screen examples for setting up an Analog Output for Differential Control.</p> <p>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.</p>
	<p>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.</p> <p>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.</p> <p>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.</p> <p>The screen example shows a Setpoint value of 200 (psi) selected for Output 3.</p>
	<p>End Point Selection Screen: End Point is the (condition) value that the controlled system drives away from (towards Setpoint) and, along with Setpoint, defines this output's proportional band.</p> <p>Note: An output's proportional band (between Setpoint and End Point) is automatically enforced in the output's Setpoint and End Point Selection screens.</p> <p>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.</p> <p>The screen example shows an End Point value of 250 (psi) selected for Output 3.</p>
	<p>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 (%).</p> <p>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.</p> <p>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).</p>
	<p>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 (%).</p> <p>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.</p> <p>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).</p>

Table 8: System 450 Setup Screen Information and Procedures for Analog Output with Standard and High Input-Signal Selection Control (Part 2 of 2)

LCD Screen	Name, Description/Function, User Action, Example
	<p>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.</p> <p>Note: Initially, you should select the I-C value of 0 (zero) for no integration constant. Refer to the <i>System 450 Series Technical Bulletin (LIT-12011459)</i> for more information on proportional plus integral control and setting an integration constant in the System 450 UI.</p> <p>7. Press  or  to select this output's Integration Constant for proportional plus integral control. Press  to save your selection and go to the Sensor Failure Mode Selection screen.</p> <p>The screen example shows an I-C value of 0 (zero) selected for Output 3.</p>
	<p>Sensor Failure Mode Selection Screen: Select the output's mode of operation if a referenced sensor or sensor wiring fails. If the output references functional sensors HI-2 or HI-3, the output enters the Sensor Failure mode whenever one of the referenced sensors or sensor wiring fails. The output operates in the selected Sensor Failure mode until the failure is remedied. Sensor Failure mode selections for Analog Outputs include:</p> <ul style="list-style-type: none"> • ON = Output generates the selected OEP signal strength during sensor failure. • OFF = Output generates the selected OSP signal strength during sensor failure. <p>8. 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.</p> <p>The screen example shows OFF selected as the Sensor Failure mode for Output 3.</p>
	<p>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.</p> <p>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.</p> <p>9. 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.</p> <p>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.</p> <p>The screen example shows Sn-2 as the selected Sensor for Output 3.</p>
	<p>Analog Output Setup Start Screen</p> <p>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.</p> <p>10. 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.</p> <p>The screen example shows the Analog Output Setup Start screen for Output 3.</p>

Differential Control

Beginning with Version 2.00 firmware, standard System 450 control modules include Differential Control capability. Differential control is used to monitor and/or 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; $(Sn-d) = (Sn-1) - (Sn-2)$.

Note: The System 450 Differential Control sensor (Sn-d) value is always equal to Sn-1 minus Sn-2. Therefore, depending on the intended control action of the output, the differential value may be either a positive or negative value.

The Sn-d value is displayed 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 7 for Sensor Types and their units of measurement.

The relay output setup values dON and dOFF are also 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 (0 to 100%) 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 Failure Mode

Any output set up to reference the Differential Sensor (Sn-d) enters the selected Sensor Failure mode when either Sn-1 sensor, Sn-2 sensor, or the sensor wiring fails.

Differential Sensor Range of Usable Values

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.

Table 9: 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	P100	-100.0 to 100.0
P 0.5	-0.500 to 0.500	P110	-110.0 to 110.0
P 2.5	-2.50 to 2.50	P200	-200 to 200
P 5	-5.00 to 5.00	P500	-500 to 500
P 8	-9.00 to 9.00	P750	-750 to 750
P 10	-10.00 to 10.00	HI°F	-380 to 380
P 15	-16.0 to 16.0	HI°C	-210.0 to 210.0

Setting Up an Output for Differential Control

Table 10 provides information, procedures, guidelines, and screen examples for setting up relay outputs that reference the Differential Control sensor.

Table 11 provides information, procedures, guidelines, and screen examples for setting up analog outputs that reference the Differential Control sensor.

Figure 8 on page 22 shows the menu flow used to set up the output examples in Table 10 and Table 11.

Table 10: System 450 Setup Screen Information and Procedures for Relay Outputs with Differential Control (Part 1 of 2)








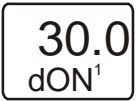







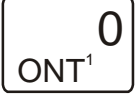







LCD Screen	Name, Description/Function, Procedures, and Example
	<p>Relay Output Setup Start Screen: The output numbers and the output type (relay or analog) are determined by the module types and configuration of your control system's module assembly and are automatically assigned when you connect power to the module assembly. (See Setting Up a Control System in the User Interface on page 5.)</p> <p>Note: You must set up the system's sensors before you can set up the system outputs, and you must set up the Differential Control sensor (Sn-d) before you can set up an output with Differential Control. (See Setting Up System 450 Sensors for information on setting up the Differential Control sensor.)</p> <p>1. Press  to go to this output's Sensor Selection screen.</p> <p>The screen example shows the Relay Output Setup Start screen for Output 1.</p>
 	<p>Sensor Selection Screen: Selecting the Differential Control sensor (Sn-d) here establishes this output as a Differential Control output. Differential Control outputs have several different setup parameters and value ranges from standard and High Input-Signal Selection outputs.</p> <p>Note: To set up an output for Differential Control, the Differential Control sensor (Sn-d) must be already set up in the System 450 UI (See Setting Up System 450 Sensors for more information.), and you must select Sn-d in the Sensor Selection screen. If Sn-d is not selected here, the Differential Control setup screens do not appear. If a sensor is already selected for this output, the Sensor Selection screen does not appear here, instead the Relay ON Selection screen (ON or dON) appears.</p> <p>2. Press  or  to select the Differential Control sensor (Sn-d) as the sensor this output references. Press  to save your sensor selection and go to the Relay dON Selection Screen.</p> <p>The screen example shows Sn-d is the selected Sensor for Output 1.</p>
	<p>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. Relay dON is defined as relay LED On/Lit, relay contacts N.O. to C are closed, and N.C. to C contacts are open.</p> <p>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 9 for more information.)</p> <p>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.</p> <p>The screen example shows a dON value of 30 (psi) selected for Relay Output 1.</p>
	<p>Relay dOFF Selection Screen: Select the dOFF value at which the relay turns off. 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.</p> <p>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 9 for more information.)</p> <p>4. Press  or  to select the differential value at which output relay turns Off. Press  to save your selection and go to Minimum Relay ON Time Selection Screen.</p> <p>The screen example shows a dOFF value of 32 (psi) selected for Relay Output 1.</p>
	<p>Minimum Relay ON Time Selection Screen: Minimum ON Time range is 0 to 300 seconds.</p> <p>5. Press  or  to select the minimum time that the output relay remains On after reaching the Relay dON value. Press  to save your selection and go to the Minimum Relay OFF Time Selection Screen.</p> <p>The screen example shows an ONT value of 0 (seconds) selected for Output 1.</p>
	<p>Minimum Relay OFF Time Selection Screen: Minimum OFF Time range is 0 to 300 seconds.</p> <p>6. Press  or  to select the minimum time that this output relay remains Off after reaching the Relay dOFF value. Press  to save your selection and go to the Sensor Failure Mode Selection screen.</p> <p>The screen example shows an OFFT value of 30 (seconds) selected for Output 1.</p>

Table 10: System 450 Setup Screen Information and Procedures for Relay Outputs with Differential Control (Part 2 of 2)














LCD Screen	Name, Description/Function, Procedures, and Example
	<p>Sensor Failure Mode Selection Screen: Select the differential output's mode of operation if either of the referenced sensors (Sn-1 or Sn-2) or the sensor wiring fails. The output operates in the selected mode until the failure is remedied. Sensor Failure mode selections for Relay Outputs include:</p> <ul style="list-style-type: none"> • ON = Output relay remains On during sensor failure. • OFF = Output relay remains Off during sensor failure. <p>7. Press  or  to select this output's mode of operation if a referenced sensor or sensor wiring fail. Press  to save your sensor failure mode selection and go to the Edit Sensor Screen.</p> <p>The screen example shows OFF selected as the Sensor Failure mode for Output 1.</p>
	<p>Edit Sensor Screen: This screen displays the Differential Sensor (Sn-d) 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.</p> <p>Note: If you change the Sn-d sensor to a different sensor, the output is no longer a Differential Control output and you must set the output up again for the new sensor selection.</p> <p>8. 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.</p> <p>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.</p> <p>This Relay Output is now set up in the System 450 UI.</p> <p>The screen example shows Sn-d as the selected Sensor for Output 1.</p>
	<p>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.</p> <p>9. 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.</p> <p>The screen example shows the Relay Output Setup Start screen for Output 1.</p>

Table 11: System 450 Setup Screen Information and Procedures for Analog Outputs with Differential Control (Part 1 of 3)

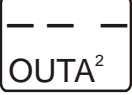

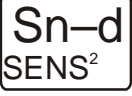



LCD Screen	Name, Description/Function, User Action, Example
	<p>Analog Output Setup Start Screen: The output numbers and the output type (relay or analog) are determined by the module types and configuration of your control system's module assembly and are automatically assigned when you connect power to the module assembly. (See Setting Up a Control System in the User Interface on page 5.)</p> <p>Note: You must set up the system's sensors before you can set up the system outputs, and you must set up the Differential Control sensor (Sn-d) before you can set up an output with Differential Control. (See Setting Up System 450 Sensors for information on setting up the Differential Control sensor.)</p> <p>1. Press  to go to this output's Sensor Selection screen.</p> <p>The screen example shows the Analog Output Setup Start screen for Output 2.</p>
	<p>Sensor Selection Screen: Selecting the Differential Control sensor (Sn-d) here establishes this output as a Differential Control output. Differential Control outputs have several different setup parameters and value ranges from standard and High Input-Signal Selection outputs.</p> <p>Note: To set up an output for Differential Control, the Differential Control sensor (Sn-d) must be already set up in the System 450 UI (See Setting Up System 450 Sensors for more information.), and you must select Sn-d in the Sensor Selection screen. If Sn-d is not selected here, the Differential Control setup screens do not appear. If a sensor is already selected for this output, the Sensor Selection screen does not appear here, instead the Setpoint Selection screen (SP or dSP) appears instead.</p> <p>2. Press  or  to select the Differential Control sensor (Sn-d) as the sensor this output references. Press  to save your sensor selection and go to the Setpoint Selection screen.</p> <p>The screen example shows Sn-d as the selected Sensor for Output 2.</p>

Table 11: System 450 Setup Screen Information and Procedures for Analog Outputs with Differential Control (Part 2 of 3)

















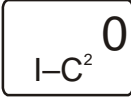







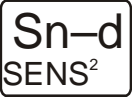








LCD Screen	Name, Description/Function, User Action, Example
	<p>Differential Setpoint Selection Screen: Differential Setpoint (dSP) is the target value that the controlled system drives towards and along with Differential End Point (dEP), defines this output's proportional band. The dSP value is a differential 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.</p> <p>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 9 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.</p> <p>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.</p> <p>The screen example shows a dSP value of 30 (psi) selected for Output 2.</p>
	<p>Differential End Point Selection Screen: Differential End Point (dEP) is the target value that the controlled system drives towards 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.</p> <p>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 9 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.</p> <p>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.</p> <p>The screen example shows a dEP value of 25 (psi) selected for Output 2.</p>
	<p>Output Signal Strength at Setpoint Selection Screen: Select the strength of the signal that this output generates when the sensed condition is at the Differential Setpoint (dSP) value. The signal strength range is 0 to 100 (%).</p> <p>5. Press  or  to select this output's %Output Signal Strength at Setpoint value. Press  to save your selection and go to the %Output Signal Strength at End Point Selection screen.</p> <p>The screen example shows an OSP value of 0 (%) selected for Output 2. Therefore Output 2 generates 0% of the total signal strength (0 V or 4.0 mA) when the input is at the Setpoint value of 30.0 (psi).</p>
	<p>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 Differential End Point (dEP) value. The signal strength range is 0 to 100 (%).</p> <p>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.</p> <p>The screen example shows an OEP value of 100 (%) selected for Output 2. Therefore Output 3 generates 100% of the total signal strength (10 V or 20 mA) when the input is at the Differential End Point value of 25 (psi).</p>
	<p>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.</p> <p>Note: Initially, you should select the I-C value of 0 (zero) for no integration constant. Refer to the <i>System 450 Series Technical Bulletin (LIT-12011459)</i> for more information on proportional plus integral control and setting an integration constant in the System 450 UI.</p> <p>7. Press  or  to select this output's Integration Constant for proportional plus integral control. Press  to save your selection and go to the Sensor Failure Mode Selection screen.</p> <p>The screen example shows an I-C value of 0 (zero) selected for Output 2.</p>

Table 11: System 450 Setup Screen Information and Procedures for Analog Outputs with Differential Control (Part 3 of 3)

LCD Screen	Name, Description/Function, User Action, Example
	<p>Sensor Failure Mode Selection Screen: Select the differential output's mode of operation if either of the referenced sensors (Sn-1 or Sn-2) or the sensor wiring fails. The output operates in the selected mode until the failure is fixed. Sensor Failure Mode selections for Analog Outputs include:</p> <ul style="list-style-type: none"> • ON = Output generates the selected OEP signal strength during sensor failure. • OFF = Output generates the selected OSP signal strength during sensor failure. <p>8. Press  or  to select this output's mode of operation if a referenced sensor or sensor wiring fail. Press  to save your selection and go to the Edit Sensor Selection screen.</p> <p>The screen example shows OFF selected as the Sensor Failure mode for Output 2.</p>
	<p>Edit Sensor Screen: This screen displays the Differential Sensor (Sn-d) 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.</p> <p>Note: If you change the Sn-d sensor to a different sensor, the output is no longer a Differential Control output and you must set the output up again for the new sensor selection.</p> <p>9. 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.</p> <p>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.</p> <p>The screen example shows Sn-d as the selected Sensor for Output 2.</p>
	<p>Analog Output Setup Start Screen</p> <p>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.</p> <p>10. 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.</p> <p>The screen example shows the Analog Output Setup Start screen for Output 2.</p>

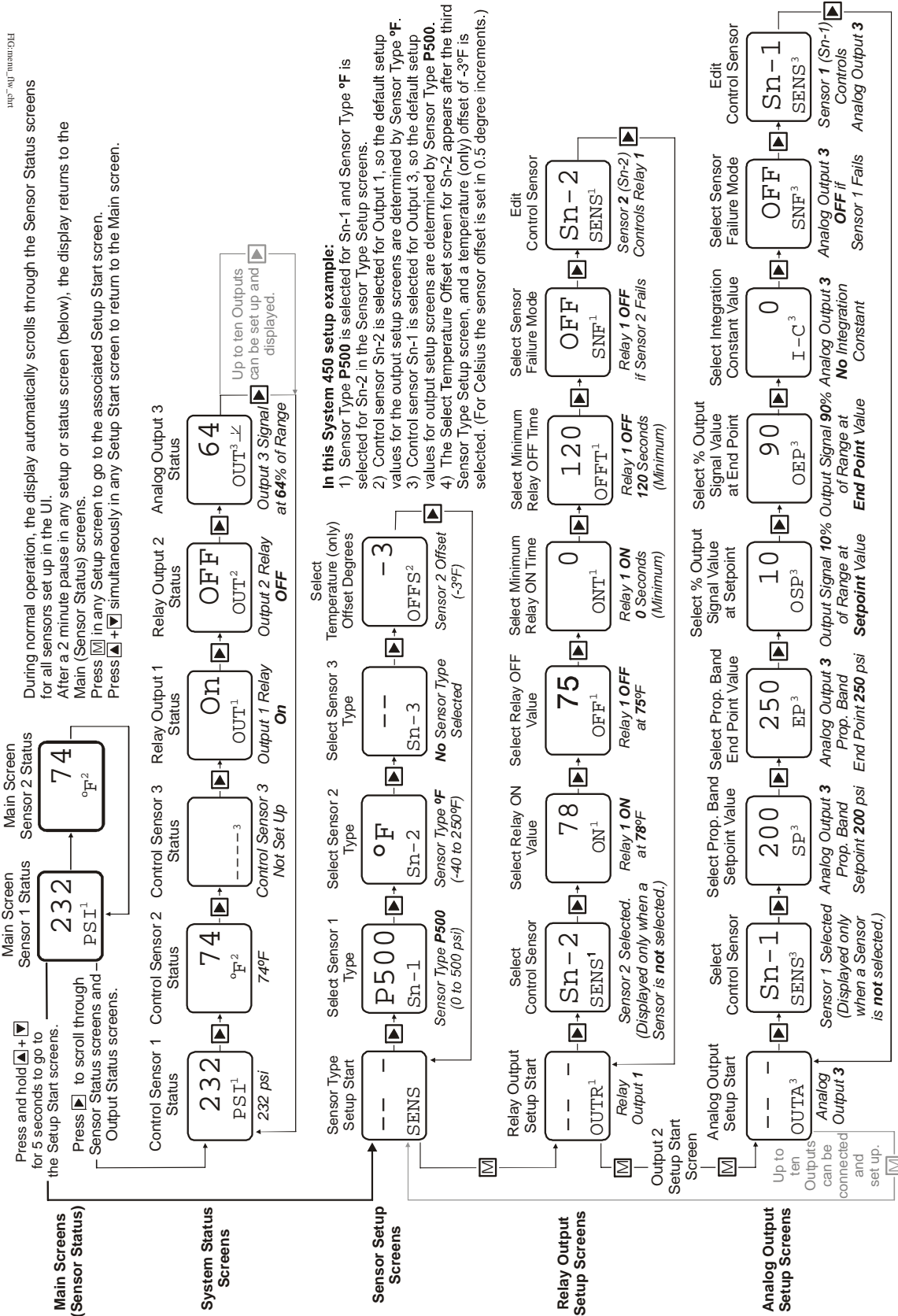


Figure 7: System 450 Status Screens, Setup Screens, and Menu Flow Example

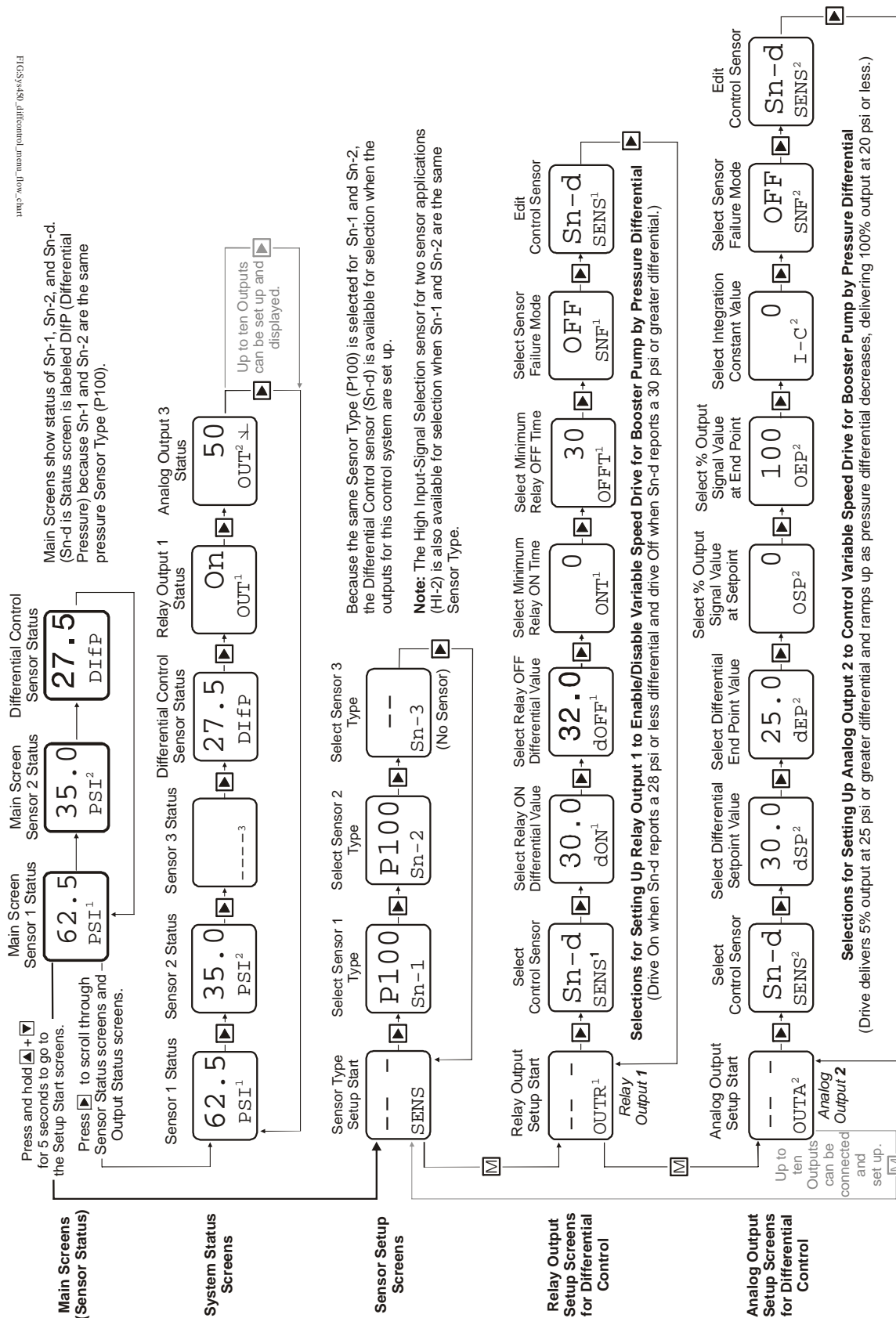



Figure 8: System 450 Status Screens, Setup Screens, and Menu Flow Example for Differential Control

Technical Specifications

C450CxN-3

Product	C450CxN-3: System 450 Control Module models are sensing controls and operating controls with LCD, four-button touchpad, and analog output. C450CPN-3: Control Module with One Analog Output C450CQN-3: Control Module with Two Analog Outputs
Supply Power	C450YNN-1 Power Supply Module or 24 (20-30) VAC Safety Extra-Low Voltage (SELV) (Europe) Class 2 (North America) 50/60 Hz, 10 VA minimum
Ambient Operating Conditions	Temperature: -40 to 66°C (-40 to 150°F) when using 0-10 VDC outputs; -40 to 40°C (-40 to 104°F) when using 4-20 mA outputs 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; 1035 ohms at 25°C (77°F) for an A99 PTC Temperature Sensor
Analog Output	Voltage Mode (0–10 VDC): Requires an external load of 1,000 ohm or more 10 VDC maximum output voltage; 10 mA maximum output current Note: The AO operates in Voltage Mode when connected to devices with impedances greater than 1,000 ohm. Devices that drop below 1,000 ohm may not operate as intended for Voltage Mode applications.
	Current Mode (4–20 mA): Requires an external load between 0–300 ohm Note: The AO operates in Current Mode when connected to devices with impedances less than 300 ohm. Devices that exceed 300 ohm may not operate as intended for Current Mode applications.
Analog Input Accuracy	Resolution: 14 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 61 x 61 mm (5 x 2-3/8 x 2-3/8 in.)
Weight	C450CPN-3: 195 g (0.43 lb) C450CQN-3: 195 g (0.43 lb)
Compliance 	North America: cULus Listed; UL 60730, File E27734, Vol. 1; FCC Compliant to CFR47, Part 15, Subpart B, Class B Industry Canada (IC) Compliant to Canadian ICES-003, Class B limits
	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.
	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.



Building Efficiency

507 E. Michigan Street, Milwaukee, WI 53202

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System 450™ Series Control Module with Ethernet Communications

Installation Instructions

C450CEN-1

Part No. 24-7664-2934, Rev. D
Issued April 17, 2014
Supersedes December 6, 2013

Refer to the [QuickLIT website](#) for the most up-to-date version of this document.

Application

IMPORTANT: Use this System 450™ Series Control Module with Ethernet Communications only as an operating control. Where failure or malfunction of the System 450™ Series 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™ Series Control Module.

IMPORTANT: Utiliser ce System 450™ Series Control Module uniquement en tant que dispositif de régulation. Lorsqu'une défaillance ou un dysfonctionnement du System 450™ Series Control Module risque de provoquer des blessures ou d'endommager l'équipement contrôlé ou un autre équipement, la conception du système de contrôle doit intégrer des dispositifs de protection supplémentaires. Veiller dans ce cas à intégrer de façon permanente d'autres dispositifs, tels que des systèmes de supervision ou d'alarme, ou des dispositifs de sécurité ou de limitation, ayant une fonction d'avertissement ou de protection en cas de défaillance ou de dysfonctionnement du System 450™ Series 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 Modular Control Systems with Communications Control Modules 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

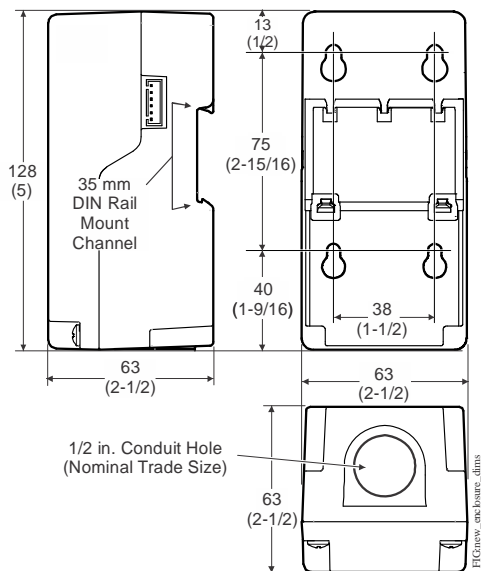


Figure 1: System 450 Module Dimensions, mm (in.)

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).
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 disconnection 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.

AVERTISSEMENT : Risque de décharge électrique.

Débrancher ou isoler toute alimentation avant de réaliser un raccordement électrique. Plusieurs isolations et débranchements sont peut-être nécessaires pour -couper entièrement l'alimentation de l'équipement. Tout contact avec des composants porteurs de tensions dangereuses risque d'entraîner une décharge électrique et de provoquer des blessures graves, voire mortelles.

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.

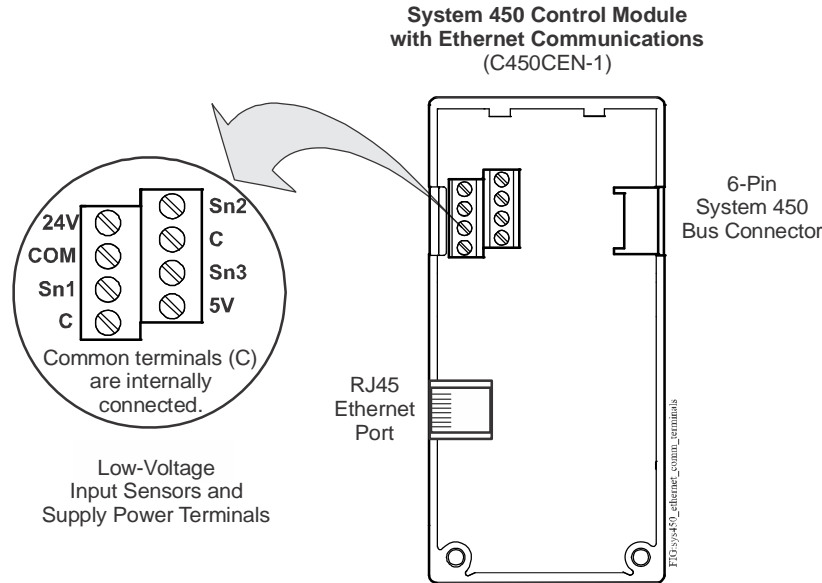


Figure 2: C450CEN-x Control Module with Ethernet Communications Showing Wiring Terminals

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.

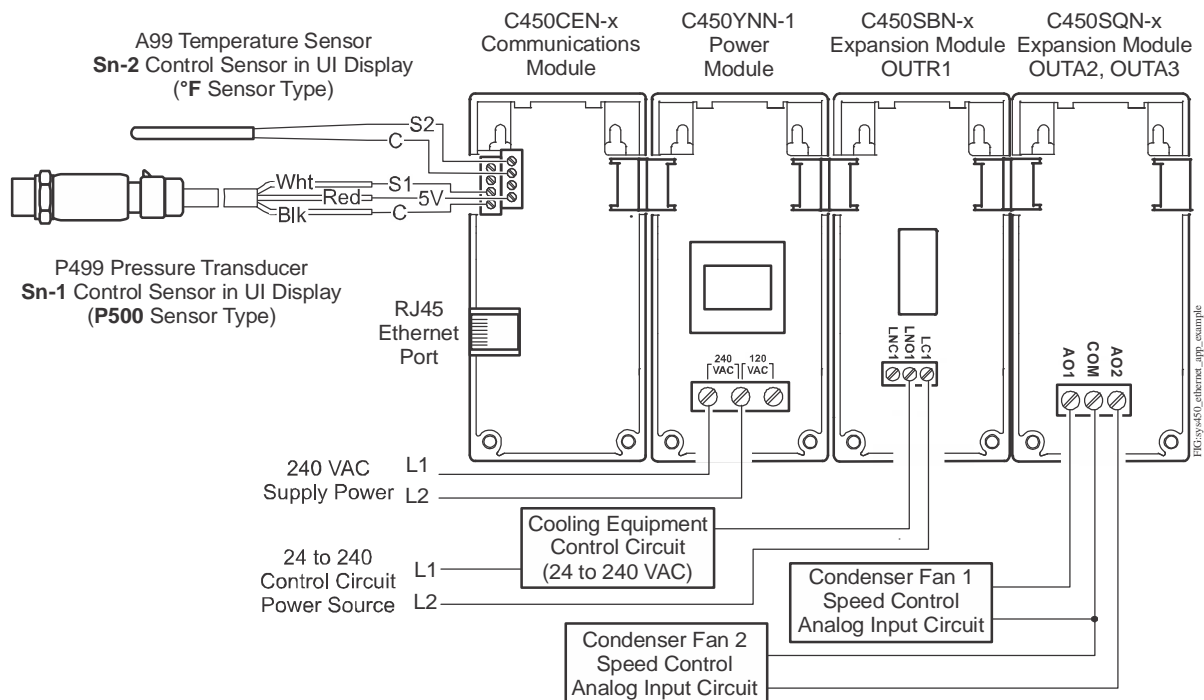


Figure 3: Example System 450 Control System with an Ethernet Communications Module Controlling a Cooling System with Condenser Fan Speed Control

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.)

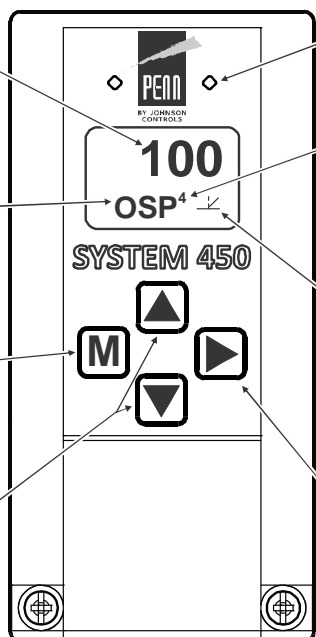
2. Access the System 450 setup screens in the UI. See [Accessing the System 450 Setup Start Screens](#) on page 6.
3. Set up the control system inputs in the UI. See [Setting Up System 450 Sensors](#) on page 8.

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 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

- 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:

- 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.
- 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.
- 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)






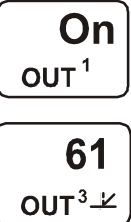











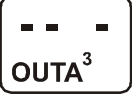



LCD Screen	Name, Description or Function, User Action, and Example
	<p>Startup Screen: When you power a System 450 control module, the LCD displays the control module's current firmware version for approximately five seconds before it displays the Main (Input Status) screen. The screen example shows 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.</p>
	<p>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.</p> <p>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.</p> <p>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.</p> <p>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.</p> <p>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.</p>
	<p>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.</p> <p>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.</p> <p>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.</p>
	<p>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.</p>

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
	<p>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.</p> <p>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 <i>Setting Up the Control System in the UI</i> on page 5 for more information.</p> <p>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.</p> <p>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.</p>
	
	
	
	
	

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)

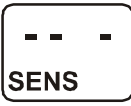

















LCD Screen	Name, Description or Function, User Action, and Example
	<p>Sensor Setup Start Screen: The Sensor Setup Start screen is the first screen displayed when you access the System 450 setup screens. From the Sensor Setup Start screen you can navigate to the Output Setup Start screens or the Sensor Setup screens. See Figure 6.</p> <p>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.</p> <p>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.</p> <p>The screen example shows the Sensors Setup Start screen with flashing dashes.</p>

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

LCD Screen	Name, Description or Function, User Action, and Example
<div> P500 Sn-1 </div> <div> °F Sn-2 </div> <div> - - Sn-3 </div>	<p>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.</p> <p>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.</p> <p>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.</p> <p>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.</p> <p>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.</p> <p>4. In the Sn-3 Sensor Type Selection screen, press  or  to select the desired Sensor Type. Press  to save your selection and either:</p> <ul style="list-style-type: none"> 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. <p>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.</p> <p>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.</p>
<div> - 3 OFFS ² </div>	<p>Temperature Offset Selection Screens: Select a temperature offset for the temperature inputs (only) in your control system.</p> <p>Sensor Type °F enables an offset of +/- 5°F in 1 degree increments.</p> <p>Sensor Type °C enables an offset of +/- 2.5°C in 0.5 degree increments.</p> <p>Note: The temperature offset changes the displayed temperature value by the selected offset value.</p> <p>5. Press  or  to select the desired temperature offset value. Press :</p> <ul style="list-style-type: none"> 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. <p>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).</p>
<div> - - - SENS </div>	<p>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.</p> <p>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.</p> <p>After the sensors are set up for your control system, you can:</p> <ul style="list-style-type: none"> 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. <p>The screen example shows Sensors Setup Start screen with flashing dashes.</p>

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 page 18 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.

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
	<p>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.)</p> <p>Note: You must set up the control system input sensors before you can set up the outputs.</p> <p>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.</p>

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 2 of 4)










LCD Screen	Name, Description or Function, User Action, Example
<div> <div>— —</div> <div>SENS¹</div> </div> <div> <div>Sn-2</div> <div>SENS¹</div> </div> <div> <div>HI-2</div> <div>SENS¹</div> </div> <div> <div>Sn-d</div> <div>SENS¹</div> </div> <div> <div>bin</div> <div>SENS¹</div> </div>	<p>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.</p> <p>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.)</p> <p>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.</p> <p>2. Press  or  to select the sensor that this output references:</p> <ul style="list-style-type: none"> • 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 bin. <p>Then, press  to save your sensor selection and go to the Standard Relay ON Selection screen or the Relay dON Selection.</p> <p>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.</p>
<div> <div>78</div> <div>ON¹</div> <div>OR</div> </div> <div> <div>30.0</div> <div>dON¹</div> </div>	<p>When a Relay Output references Sn-1, Sn-2, Sn-3, HI-2, or HI-3, the Standard Relay ON Selection screen appears.</p> <p>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.</p> <p>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.</p> <p>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.</p> <p>The screen example shows an ON value of 78 (°F) selected for Relay Output 1.</p>
	<p>When a Relay Output References Sn-d, the Differential Relay dON Selection screen appears.</p> <p>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.</p> <p>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.)</p> <p>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.</p> <p>The screen example shows a dON value of 30 (psi) selected for Relay Output 1.</p>
	<p>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.</p> <p>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.</p>

Table 7: System 450 Setup Screen Information and Procedures for Relay Outputs (Part 3 of 4)

























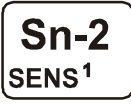








LCD Screen	Name, Description or Function, User Action, Example
<div> 75 OFF¹ </div> <p>OR</p> <div> 32.0 dOFF¹ </div>	<p><i>When a relay output references Sn-1, Sn-2, Sn-3, HI-2, or HI-3, the Standard Relay OFF Selection screen appears.</i></p> <p>Standard Relay OFF Selection Screen: Select the value 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.</p> <p>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.</p> <p>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.</p> <p>The screen example shows an OFF value of 75 (°F) selected for Relay Output 1.</p> <hr/> <p><i>When a relay output references Sn-d, the Differential Relay dOFF Selection screen appears.</i></p> <p>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.</p> <p>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.)</p> <p>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.</p> <p>The screen example shows a dOFF value of 32 (psi) selected for Relay Output 1.</p> <hr/> <p><i>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.</i></p> <p>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.</p>
<div> 30 ONd¹ </div>	<p>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.</p> <p>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.</p> <p>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.</p> <p>The screen example shows an ONd value of 30 (seconds) selected for Output 1.</p>
<div> 0 OFFd¹ </div>	<p>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.</p> <p>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.</p> <p>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.</p> <p>The screen example shows an OFFd value of 0 (seconds) selected for Output 1.</p>

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
	<p>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.</p> <p>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.</p> <p>The screen example shows an ONT value of 0 (seconds) selected for Output 1.</p>
	<p>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.</p> <p>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.</p> <p>The screen example shows an OFFT value of 120 (seconds) selected for Output 1.</p>
	<p>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:</p> <ul style="list-style-type: none"> • ON = Output relay remains on during sensor failure. • OFF = Output relay remains off during sensor failure. <p>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.</p> <p>The screen example shows OFF selected as the Sensor Failure mode for Output 1.</p>
	<p>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.</p> <p>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.</p> <p>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.</p> <p>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.</p> <p>This relay output is now set up in the System 450 UI.</p> <p>The screen example shows Sn-2 is selected Sensor for Output 1.</p>
	<p>Relay Output Setup Start Screen</p> <p>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.</p> <p>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.</p> <p>The screen example shows a Relay Output Setup Start screen for Output 1.</p>

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).

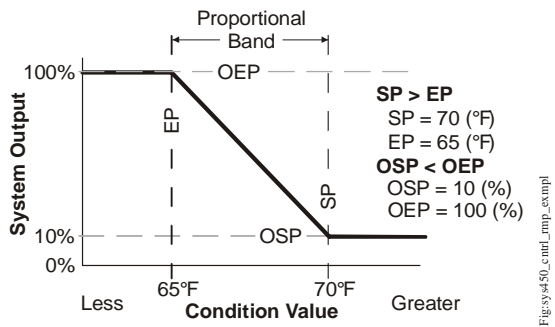

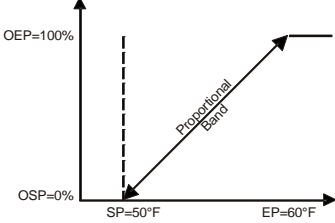

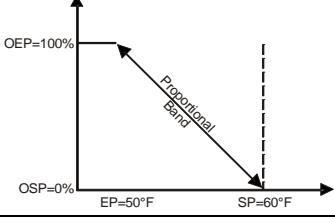
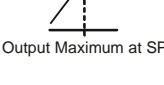
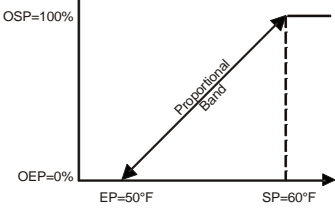
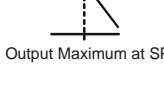
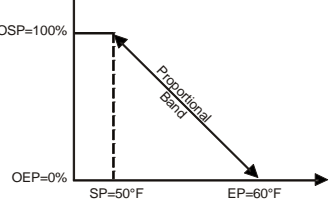


Figure 5: Control Ramp Example for a Typical Heating Application (SP > EP and OSP < OEP)

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
		SP < EP OSP < OEP
		SP > EP OSP < OEP
		SP > EP OSP > OEP
		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
	<p>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 <i>Setting Up the Control System in the UI</i> on page 5.)</p> <p>Note: You must set up the system's sensors before you can set up the outputs.</p> <p>1. Press  to go to this output's Sensor Selection screen.</p> <p>The screen example shows the Analog Output Setup Start screen for Output 3.</p>
   	<p>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.</p> <p>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 <i>Setting Up System 450 Sensors</i>.)</p> <p>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.</p> <p>2. Press  or  to select the sensor that this output references:</p> <ul style="list-style-type: none"> • 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. <p>Then press  to save your sensor selection and go to the Setpoint Selection screen.</p> <p>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.</p>

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
<div> 225 SP³ </div> <p>Or</p> <div> 30.0 dSP³ </div>	<p>When an analog output references Sn-1, Sn-2, Sn-3, HI-2, or HI-3, the Standard Setpoint Selection screen appears.</p> <p>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.</p> <p>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.</p> <p>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.</p> <p>The screen example shows a Setpoint value of 225 (psi) selected for Output 3.</p> <hr/> <p>When an analog output references Sn-d, the Differential Setpoint Selection screen appears.</p> <p>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.</p> <p>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.</p> <p>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.</p> <p>The screen example shows a dSP value of 30 (psi) selected for Output 3.</p>
<div> 250 EP³ </div> <p>Or</p> <div> 25.0 dEP³ </div>	<p>When the output references Sn-1, Sn-2, Sn-3, HI-2, or HI-3, the Standard End Point Selection screen appears.</p> <p>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.</p> <p>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.</p> <p>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.</p> <p>The screen example shows an End Point value of 250 (psi) selected for Output 3.</p> <hr/> <p>When the Output references Sn-d, the Differential End Point Selection screen appears.</p> <p>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.</p> <p>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.</p> <p>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.</p> <p>The screen example shows a dEP value of 25 (psi) selected for Output 3.</p>
<div> 10 OSP³ </div>	<p>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 (%).</p> <p>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.</p> <p>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).</p>

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

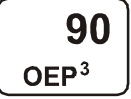
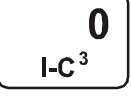
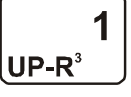
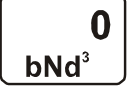










LCD Screen	Name, Description or Function, User Action, Example
	<p>Output Signal Strength at End Point Selection Screen: Select the strength of the signal that this output generates when the sensed condition is at the End Point value. The signal strength range is 0 to 100 (%).</p> <p>6. Press or to select this output's %Output Signal Strength at End Point value. Press to save your selection and go to the Integration Constant Selection screen.</p> <p>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).</p>
	<p>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.</p> <p>Note: Initially, you should select the I-C value of 0 (zero) for no integration constant. Refer to the <i>System 450 Series Technical Bulletin (LIT-12011459)</i> for more information on proportional plus integral control and setting an integration constant in the System 450 UI.</p> <p>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.</p> <p>The screen example shows an I-C value of 0 (zero) selected for Output 3.</p>
	<p>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).</p> <p>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.</p> <p>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.</p> <p>The screen example shows an Output Update Rate value of 1 (second), which is the default and lowest update rate you can select.</p>
	<p>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.</p> <p>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.</p> <p>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.</p> <p>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.</p> <p>The screen example shows an Output Dead Band value of 0 (%), which is the default value and disables the Output Dead Band feature.</p>
	<p>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:</p> <ul style="list-style-type: none"> • ON = Output generates the selected OEP signal strength during sensor failure. • OFF = Output generates the selected OSP signal strength during sensor failure. <p>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.</p> <p>The screen example shows OFF selected as the Sensor Failure mode for Output 3.</p>

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
	<p>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.</p> <p>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.</p> <p>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.</p> <p>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.</p> <p>The screen example shows Sn-2 as the selected Sensor for Output 3.</p>
	<p>Analog Output Setup Start Screen</p> <p>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.</p> <p>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.</p> <p>The screen example shows the Analog Output Setup Start screen for Output 3.</p>

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 Communications Control Modules 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)







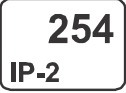

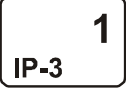













LCD Screen	Name, Description or Function, User Action, and Example
	<p>Communications View and Setup Start Screen: From the Communications Setup Start screen, you can access the communications screens for the control module with Ethernet communications.</p> <p>1. In the Communications Setup Start screen, press  to go to the Remote Network Access Lock screen.</p> <p>The screen example show the Communications Setup Start screen.</p>
	<p>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.</p> <p>2. Select On or OFF and press  to save the selection and go to the next screen.</p> <p>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.</p>

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
	<p>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.</p> <p>3. Press  to go to the next screen.</p> <p>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.</p>
	<p>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.</p> <p>4. Press  to go to the next screen.</p> <p>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.</p>
	<p>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.</p> <p>5. Press  to go to the next screen.</p> <p>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.</p>
	<p>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.</p> <p>6. Press  to go to the next screen.</p> <p>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.</p>
	<p>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:</p> <ul style="list-style-type: none"> • drct ModE (Direct Connection mode) • StAt ModE (Static IP Connection mode) • Auto ModE (Automatically Obtain IP Address mode) <p>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.</p> <p>7. Press  to go to the next screen.</p> <p>This screen example shows that the communications control module is in the Direct Connection mode.</p>
	<p>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.</p> <p>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.</p> <p>This screen example shows the Reset Network Configuration screen.</p>
	<p>Communications Setup Start Screen: From the Communications Setup Start screen, you can access the communications screens for the control module with Ethernet communications.</p> <p>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.</p> <p>This screen example show the Communications Setup Start screen.</p>

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
	<p>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.</p> <p>1. In the User Password Setup Start screen, press ▶ to go to the User Password Setup Access screen.</p> <p>The screen example shows the User Password Setup Start screen.</p>
	<p>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.</p> <p>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.</p> <ul style="list-style-type: none">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. <p>The screen example shows the User Password Setup Access screen with the default Admin password entered.</p>

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
	<p>Change User Password Screen: Allows you to change the User password.</p> <p>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.</p> <p>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.</p> <p>This screen example shows the Change User Password screen with the default password ready to be changed in the screen.</p>

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)



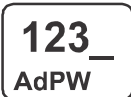






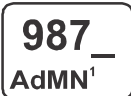







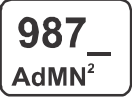










LCD Screen	Name, Description or Function, User Action, and Example
	<p>Admin Password Setup Start Screen: From the Admin Password Setup Start screen, you can access Admin Password setup screens and change the Admin password for your control system.</p> <p>1. In the Admin Password Setup Start screen, press  to go to the Admin Password Setup Access Setup screen.</p> <p>The screen example shows the Communications Setup Start screen.</p>
	<p>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.</p> <p>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.</p> <ul style="list-style-type: none"> • 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. <p>The screen example shows the default Admin password being enter in the Admin Password Setup Access screen.</p>
	<p>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.</p> <p>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.</p> <p>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.</p> <p>This screen example shows the Admin password being changed to a new password.</p>

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
	<p>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.</p> <p>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.</p> <p>The screen example shows the new Admin password being entered in the Confirm Admin Password screen.</p>
 	<p>Validate Admin Password Change Screen: Validates that the Admin Password was successfully changed (OK).</p> <p>5. Press  to return to the Main screens</p> <p>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.</p> <p>The top screen example shows the Admin password change is successful (OK). The bottom screen example shows the Admin password change failed (FAIL).</p>

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.

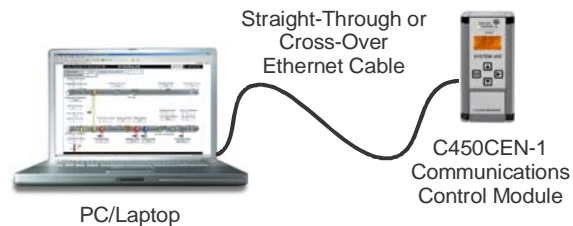


Figure 7: Direct Connection Between a Laptop and a System 450 Communications Control Module

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.

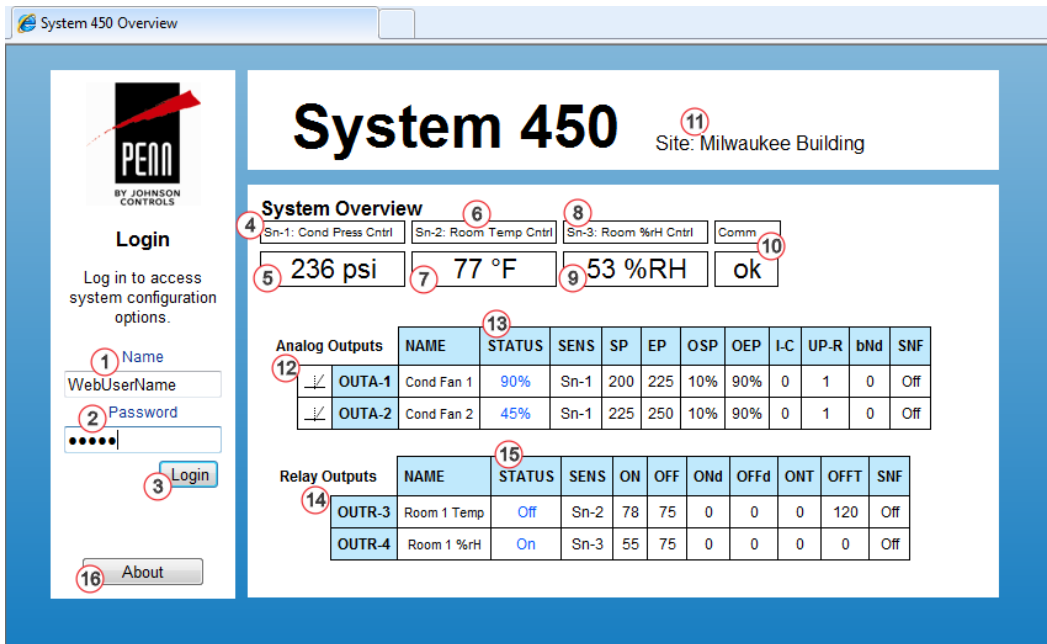


Figure 8: System 450 System Overview Page Example

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 <i>Web User Name:</i> field in the <i>Web Server</i> section on the <i>Network Configuration</i> page. See Network Configuration Page on page 41 for more information about assigning a user name. In this example, <i>WebUserName</i> 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 <i>Web Password:</i> field in the <i>Web Server</i> section on the <i>Network Configuration</i> page. See Network Configuration Page 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 System Configuration Page 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 <i>Name</i> field in the <i>Sn-1: Sensor 1</i> section on the Sensor Configuration Page . 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 <i>Name</i> field in the <i>Sn-2: Sensor 2</i> section on the Sensor Configuration Page . 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 <i>Name</i> field in the <i>Sn-3: Sensor 3</i> section on the Sensor Configuration Page . 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 <i>Site Name:</i> field in the <i>Web Server</i> section on the <i>Network Configuration</i> page. See Network Configuration Page 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.

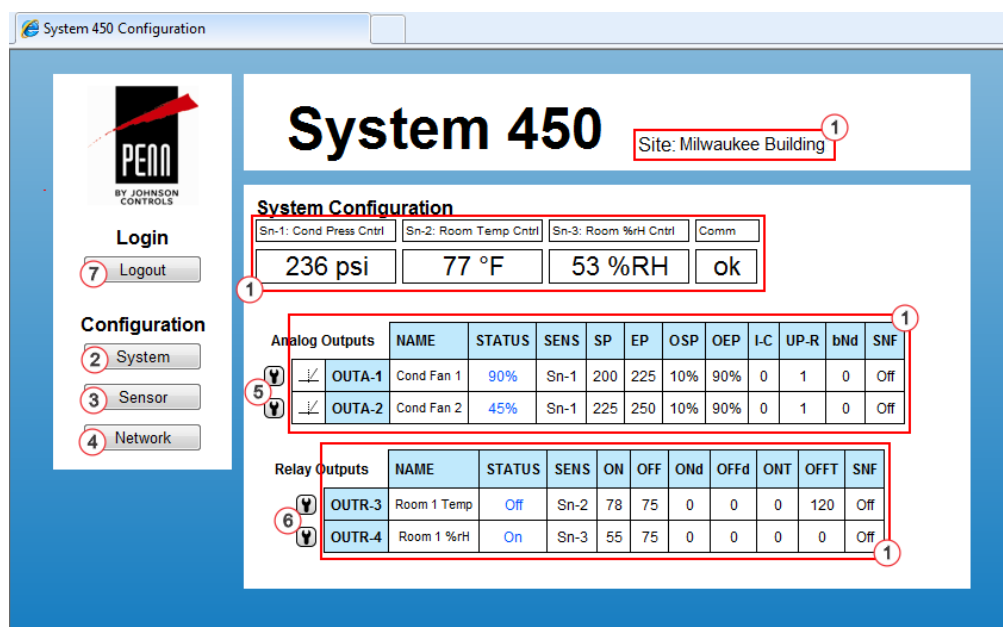


Figure 9: System 450 System Configuration Page Example

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: Differential¹ 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)	<p>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.</p> <p>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.</p> <p>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.</p> <p>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.</p>
5	Sensor Name	<p>Displays the assigned sensor name.</p> <p>Note: You can assign a 16-character (maximum) name for each sensor that you set up on the Sensor Configuration page.</p> <p>See <i>Sensor Configuration Page</i> on page 33 for more information on assigning sensor names.</p>
6	SP (Setpoint)	<p>Enter the desired SP (Setpoint) value for the analog output.</p> <p>The range of usable values and the Setpoint units of measurement are displayed in the gray box to the right of the Setpoint field.</p> <p>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.</p> <p>In this example, the SP value is 225 (psi) and the usable range is 90 to 500 psi.</p>
7	EP (End Point)	<p>Enter the EP (End Point) value for the analog output.</p> <p>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.</p> <p>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.</p> <p>In this example, the EP value is 250 (psi) and the usable range is 90 to 500 psi.</p>
8	OSP (Output at Setpoint)	<p>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).</p> <p>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.</p> <p>In this example, the OSP value is 10 (10%).</p>
9	OEP (Output at End Point)	<p>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).</p> <p>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.</p> <p>In this example, the OEP value is 90 (90%).</p>
10	I-C (Integration Constant)	<p>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.</p> <p>Note: Johnson Controls recommends using the default value (0) when setting up your application for the first time. Refer to the <i>System 450™ Series Modular Control Systems with Communications Control Modules Technical Bulletin (LIT-12011826)</i> for information on setting up and testing an integration constant for your application.</p> <p>In this example, the I-C value is the default value 0 and the integration feature is Off.</p>
11	UP-R (Update Rate)	<p>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.</p> <p>In this example, the Update Rate value is the default value 1 (second).</p>
12	bNd (Output Deadband)	<p>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.</p> <p>In this example, Output Deadband is the default value 0.</p>

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	<p>Select from the drop-down menu how you want the relay output to respond when the reference sensor or reference sensor wiring fails.</p> <ul style="list-style-type: none"> • 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. <p>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.</p>
14	(Output) Name	<p>Assign a 16-character or less web UI name for the analog output.</p> <p>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.</p> <p>In this example, the assigned name is Cond Fan 2.</p>
15	Ok Button	<p>Click Ok to save any changes you made on this web page and go to the System Configuration page.</p> <p>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.</p>
16	Cancel Button	<p>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.</p>

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)	<p>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.</p> <p>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.</p> <p>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.</p> <p>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.</p>
5	Sensor Name	<p>Displays the assigned sensor name for the selected reference sensor.</p> <p>Note: You can assign a 16-character (maximum) name for each sensor that you set up on the Sensor Configuration page.</p> <p>See <i>Sensor Configuration Page</i> on page 33 for more information on assigning sensor names.</p> <p>In this example, the sensor name is Room Temp Cntrl.</p>
6	ON (Relay On)	<p>Enter the desired ON (Relay On) value for the relay output.</p> <p>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.</p> <p>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.</p> <p>In this example, the ON value is 78 (°F) and the usable range is -40 to 250°F.</p>
7	OFF (Relay Off)	<p>Enter the OFF (Relay Off) value for the relay output.</p> <p>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.</p> <p>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.</p> <p>In this example, the ON value is 75 (°F) and the usable range is -40 to 250°F.</p>
8	ONd (ON Time Delay)	<p>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.</p>
9	OFFd (OFF Time Delay)	<p>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.</p>
10	ONT (Minimum On Time)	<p>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.</p>
11	OFFT (Minimum Off Time)	<p>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.</p>
12	SNF (Sensor Failure Mode)	<p>Select from the drop-down menu how you want the relay output to respond when the reference sensor or reference sensor wiring failure.</p> <ul style="list-style-type: none"> 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. <p>In this example, Fail Off is selected.</p>
13	Name (Optional)	<p>Assign a 16 character or less web UI name for the relay output.</p> <p>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.</p> <p>In this example, the name is Room 1 Temp.</p>

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.

The screenshot shows the 'System 450' Network Configuration page. The header includes the 'System 450' title and the site name 'Milwaukee Building'. The left sidebar has a 'Login' button (callout 1) and a 'Logout' button (callout 2). The 'Configuration' section has buttons for 'System', 'Sensor', and 'Network'. The main content area is titled 'Network Configuration' (callout 3) and shows the MAC ID '00:00:5E:A8:01:04' (callout 4). The 'IP Address' section has radio buttons for 'Static IP Address' (callout 5) and 'Automatically Obtain an IP Address' (callout 6). The 'Web Server' section has fields for 'Site Name' (callout 7), 'Web User Name' (callout 8), 'Web Password' (callout 9), and 'HTTP Port' (callout 10). The 'DNS Server' section has a field for 'DNS Server IP' (callout 11). The 'Dynamic DNS' section has a dropdown for 'Service Provider' (callout 12), and fields for 'Host Name' (callout 13), 'User Name' (callout 14), 'Password' (callout 15), and 'External IP' (callout 16). At the bottom are 'Ok' (callout 17) and 'Cancel' (callout 18) buttons.

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	<p>Click Ok to save any changes you made on this web page.</p> <p>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.</p> <p>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.</p>
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.

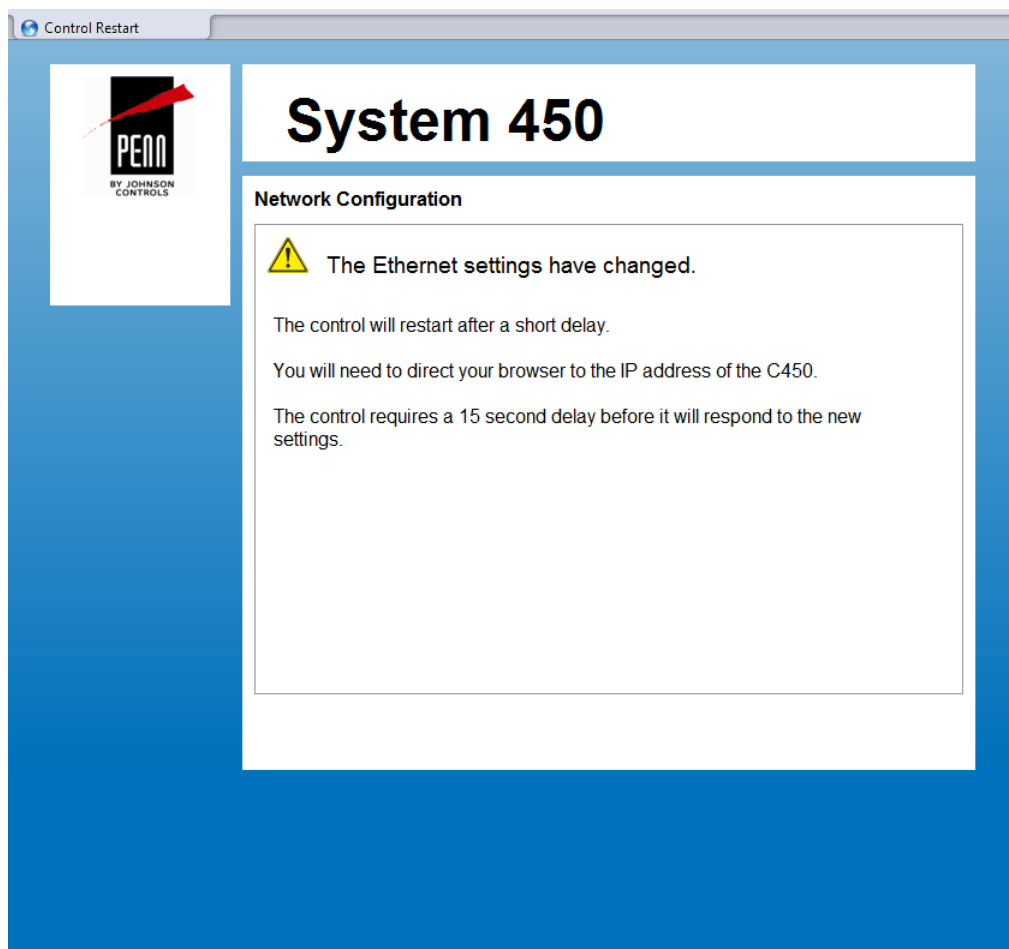


Figure 14: Network Configuration Settings Reset Page

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.

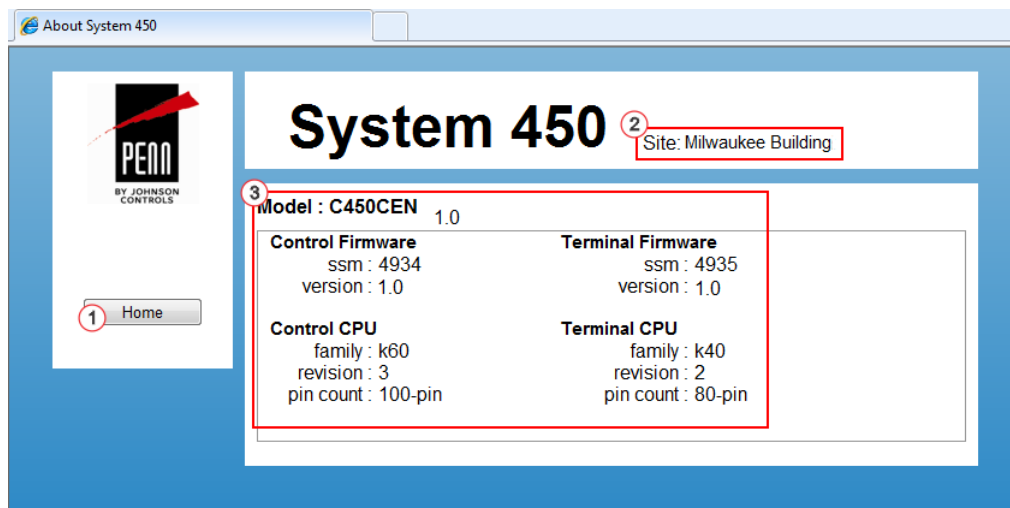



Figure 15: System 450 About Page Example

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 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
	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.



Building Efficiency

507 E. Michigan Street, Milwaukee, WI 53202

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System 450™ Series Control Module with Hybrid Analog Output and High Input Signal Selection

Installation Instructions

C450CPW-100

Part No. 24-7664-2802, Rev. B

Issued April 17, 2014

Supersedes January 17, 2013

Refer to the [QuickLIT website](#) for the most up-to-date version of this document.

Application

IMPORTANT: Use this System 450 Series Control Module with Hybrid Analog Output and High Input Signal Selection only as an operating control. Where failure or malfunction of the System 450 Series 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 Series Control Module.

IMPORTANT: Utiliser ce System 450 Series Control Module with Analog Output uniquement en tant que dispositif de régulation. Lorsqu'une défaillance ou un dysfonctionnement du System 450 Series Control Module risque de provoquer des blessures ou d'endommager l'équipement contrôlé ou un autre équipement, la conception du système de contrôle doit intégrer des dispositifs de protection supplémentaires. Veiller dans ce cas à intégrer de façon permanente d'autres dispositifs, tels que des systèmes de supervision ou d'alarme, ou des dispositifs de sécurité ou de limitation, ayant une fonction d'avertissement ou de protection en cas de défaillance ou de dysfonctionnement du System 450 Series 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 Heating, Ventilating, Air Conditioning, and Refrigeration (HVACR), and commercial/industrial process applications.

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

You can easily install and quickly configure a stand-alone System 450 control module and sensor in the field as a replacement control for almost any temperature, pressure, and humidity control.

The C450CPW-100 model is a hybrid analog output control module with Liquid Crystal Display (LCD) and four-button touchpad User Interface (UI) that allows you to set up a System 450 control system. This model uses the same hardware and setup screens as the C450CPN-1, but adds two new functions:

- the ability to use the highest of two or three sensor inputs (High Input Signal selection)
- the ability to configure a hybrid Analog Output (AO) to transition between a pulse output and a standard VDC output, depending on the sensor value relative to the proportional band. At low output levels, the pulse output signal provides an average motor speed that is less than the EC motor's fixed minimum speed.

Note: This model was designed for (but is not limited to) controlling an EC motor. By using temperature, humidity, or pressure sensor inputs, this control can be used for a wide range of applications.

Refer to the *System 450™ Series Modular Control Systems with Standard Control Modules Technical Bulletin (LIT-12011459)* for detailed information on designing, installing, setting up, and troubleshooting System 450 Series control applications.

The System 450 technical bulletin can be accessed and downloaded on the Johnson Controls® QuickLIT Product Literature Web site at the following Web address:

<http://cgproducts.johnsoncontrols.com/default.aspx>.

Installation

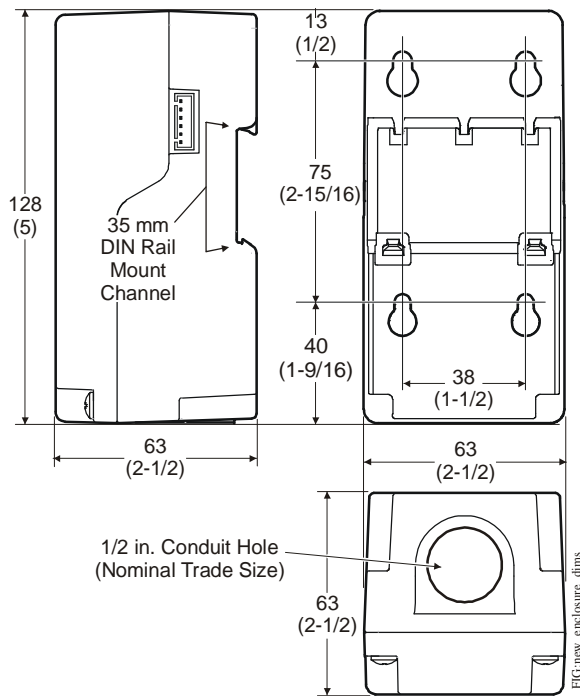


Figure 1: System 450 Module Dimensions, mm (in.)

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. 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 in [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 heat-generating devices in an enclosure with the modules that may cause the temperature to exceed the ambient operating limit.

Mounting

Mount System 450 modules on a 35 mm DIN rail (recommended) or directly to an even wall surface. To mount the modules on a 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 appropriate mounting hardware/fasteners.
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 onto the DIN rail and plug together.

To direct mount modules to wall surfaces:

1. Plug the modules together, remove the module covers, place the assembly against wall surface horizontally in a suitable location, and mark the mount hole locations on the surface.
2. Install appropriate screw fasteners, leaving screw heads approximately one to two turns away from flush to the surface.
3. Place the assembly over screw heads and on the mounting slots, and carefully tighten mount screws.

Note: If you mount the module assembly on an uneven surface, do not damage the module housing when tightening the mounting screws. Use shims/washers to mount the module assembly evenly on the surface.

Refer to the control 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* for electrical ratings.



WARNING: Risk of Electric Shock.

Disconnect or isolate all power supplies before making electrical connections. More than one disconnection 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.

AVERTISSEMENT : Risque de décharge électrique.

Débrancher ou isoler toute alimentation avant de réaliser un raccordement électrique. Plusieurs isolations et débranchements sont peut-être nécessaires pour -couper entièrement l'alimentation de l'équipement. Tout contact avec des composants porteurs de tensions dangereuses risque d'entraîner une décharge électrique et de provoquer des blessures graves, voire mortelles.

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.

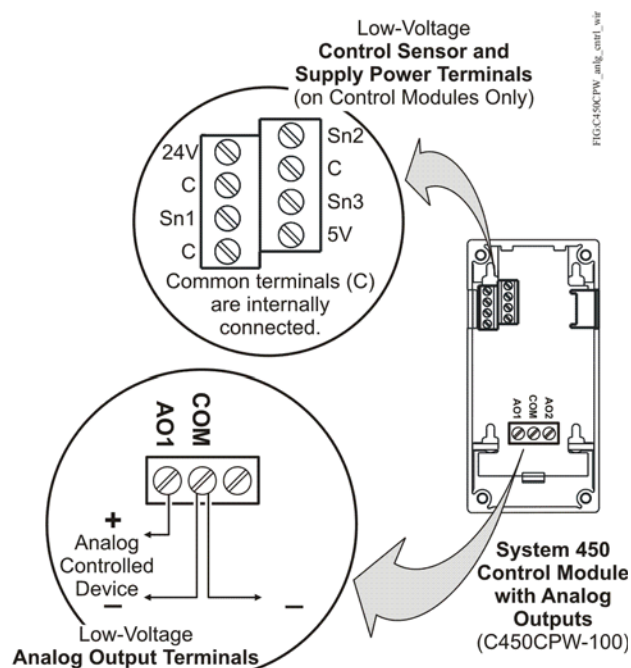


Figure 2: C450CPW-100 Wiring Terminals

Table 1: System 450 Analog Output Control Module Terminal Wiring Information

Label	Terminal Function	Wire Sizes
24V	Accepts 24 VAC supply power, when a C450YNN power module is not connected, and provides power terminal for 24 VAC (humidity) sensors.	0.8 mm ² to 1.5 mm ² 28 AWG to 16 AWG
5V	Provides 5 VDC power for active sensors.	
S1, S2, S3	Accepts passive or active (0–5 VDC) input signals from control sensors.	
C (Three Terminals)	Provide low-voltage Common connections for 24 VAC power and passive or active sensors connected to the 5V, Sn1, Sn2, and Sn3 terminals. Note: The three C terminals are connected internally and can be connected to ground in the field.	
AO1	Provides a self-detecting analog output signal in conjunction with the COM terminal; either 0–10 VDC or 4–20 mA; Provides option to transition standard output to pulse output for controlling EC motors at speeds below the motor's minimum speed	0.08 mm ² to 1.5 mm ² 28 AWG to 16 AWG
COM	Provides a common connection for AO1.	

Setup and Adjustments

System 450 Components

A System 450 control system consists of one control module, one to three control sensors, and one to ten outputs that provide analog control and/or On/Off control. Figure 3 shows an example System 450 module assembly with two sensors and three outputs (two analog outputs and one relay output).

Setting up a 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.
3. Assemble the control and expansion modules, starting with the control module on the left.

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

4. Apply power to the module assembly.

You can now set up the module assembly in the control module UI.

Setting up a Control System in User Interface

System 450 control modules have a back-lit LCD and a four-button touchpad User Interface (UI) that enable you to set up all of the inputs (sensors) and outputs in the module assembly (Figure 4).

Figure 8 provides an example System 450 setup overview that corresponds to the control system example shown in Figure 3 and the following setup examples and procedures.

To set up a control system in the System 450 UI:

1. Build your control system module assembly and connect it to power. See [Setting up a Module Assembly](#).

IMPORTANT: Each 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 Screens](#).
3. Set up the control system inputs in the UI. See [Setting up System 450 Sensors](#).

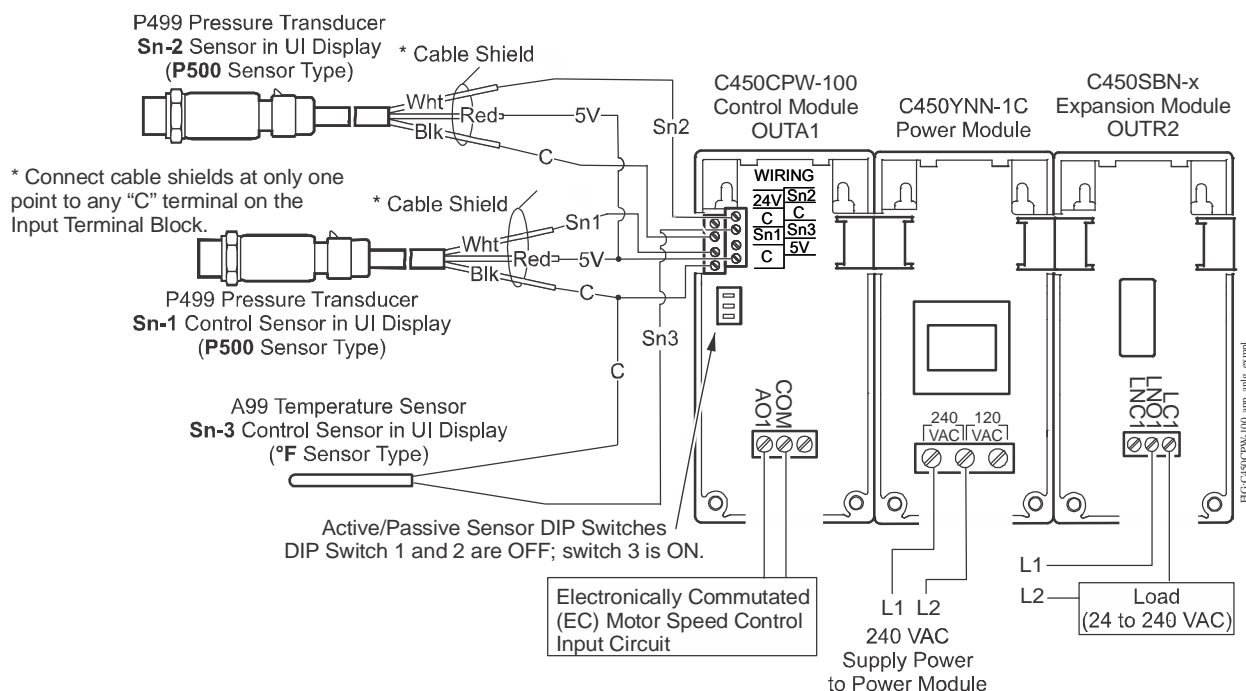


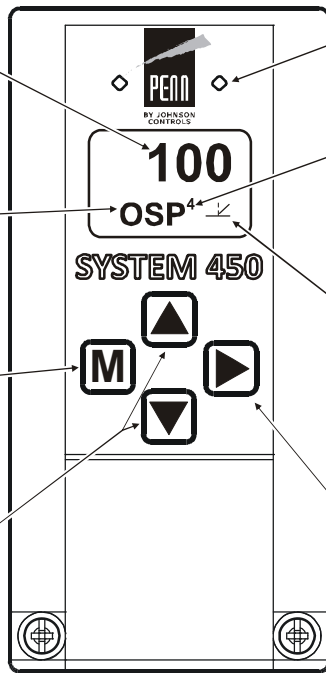
Figure 3: Example System 450 EC Motor Fan Speed Control

Status or Setup Value: Displays the current input status, output status **or** setup parameter value for the displayed input sensor, output and/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 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 set up start screen.

Up and Down Buttons: Press or to select a different value for any flashing value in the Setup Value field. In the Main/Default (Sensor Status) screen, press and hold both and for 5 seconds to access the Setup Start screens.



Light-Emitting Diode (LED): Green LEDs on Relay Control Module and Relay Expansion Modules (only) indicates if the associated Relay Output is On or Off.

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/Default 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 Control Module Output Analog LEDs, LCD, Four-Button Touchpad User Interface

4. Set up the control system outputs in the UI. See [Setting up System 450 Outputs](#).

IMPORTANT: Do not change the module positions after a System 450 control system is set up in the System 450 UI. System 450 control logic is set up in the UI according to the input 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/or the setup values of the assembly outputs, which will require setting up the outputs again.

Use the worksheet provided to plan and record the settings for your System 450 control system.

Viewing the Main and System Status Screens

After your control system is installed, wired, and set up, the Main (Input Status) screen appears when you connect power to your system. During normal operation, the Main screen displays the current status of each input (sensor) in your control system. See Table 2 for more information on the Main screens.

The System Status screens can display an output status screen for each output in your control system along with the Input Status screens; in the Main (Input Status) screen, press repeatedly to scroll through and view all of the Output Status screens in your control system. See Table 2 for more information on the System Status screens.

Accessing the System 450 Setup Screens

You can access the setup screens from the Main screen. To access the System 450 setup screens:

1. Apply power to your module assembly. After a startup check, 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.

Note: 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 all of the remaining setup screens for your control system.

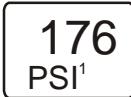
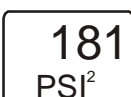
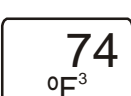





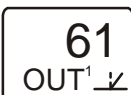


3. Press repeatedly to scroll through the setup start screens. See Figure 8.

Note: The setup start screens are view-only; selections cannot be made in setup start screens. Press in a Setup Start screen to go to the sensor or output setup 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 Screens](#).

Table 2: System 450 Main Screens and Status Screens Information and Procedures

LCD Screen	Name, Description/Function, User Action, and Example
  	<p>Main (Input Status) Screen: During normal operation, the Main screen automatically scrolls through the current status at each input sensor in your control system and displays the sensor number, the unit of measurement, and the sensed condition value. See Figure 8.</p> <p>Note: Main screens are view-only, selections are not made in Main screens.</p> <p>Press  repeatedly to scroll through and view the System Status screens for all inputs and outputs in your control system.</p> <p>Press and hold both  and  for 5 seconds to access your control system's setup screens.</p> <p>Note: In any system setup 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.</p> <p>Screen examples show Sensor 1 sensing 232 psi, Sensor 2 sensing 181 psi, and Sensor 3 sensing 74°F.</p>
 	<p>System Status Screens: The System Status screens display current status of all inputs and outputs in your control system. Relay output status screens display output number and relay status (On/Off). Analog output status screens display output number, signal strength, and control ramp icon. See Figure 8.</p> <p>Note: System Status screens are view-only; selections are not made in Status screens.</p> <p>Press  repeatedly to scroll and view the System Status screens for the inputs and outputs in your control system.</p> <p>Screen examples show Output 1 signal strength is 61% of the total signal strength and Output 2 relay is OFF. The control ramp icon in the top screen example indicates that the Analog Output is set up with SP<EP and OSP<OEP. (See Setting up an Analog Output (OUTAx) for information about control ramp icons.)</p>

The Sensor Setup Start screen is the first screen displayed when you access the system setup screens in the System 450 UI.

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

Table 4 provides information, procedures, and examples regarding Sensor Setup screens and setting up sensors. Figure 8 provides a System 450 UI and setup overview example.

Setting Active/Passive Sensor DIP Switches

Before putting your control system into operation, you must set up each sensor in the system as either passive or active by positioning the associated switch (On or Off) on the DIP switch block located below the sensor terminal block. See Figure 3.

Temperature sensors are passive (2-wire) sensors and corresponding switches must be set to ON. Humidity and pressure transducers are active (3-wire) sensors and corresponding switches must be set to Off. See Figure 5 for the switch settings for the System 450 example shown in Figure 3.



Figure 5: Active/Passive Sensor DIP Switch Block (Set up for Example in Figure 3)

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

Sensor Type	Unit of Measurement Value (Condition/Units)	Effective Sensing Range	Range of Usable Values	Resolution Increment Value	Minimum Differential or Proportional Band	Sensor / Transducer Product Type Number ¹
°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
P 05	INWC (Pressure/in. W.C.)	0 to 0.5	0.025 to 0.5	0.005	0.025	DPT2650-0R5D-AB

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

Sensor Type	Unit of Measurement Value (Condition/Units)	Effective Sensing Range	Range of Usable Values	Resolution Increment Value	Minimum Differential or Proportional Band	Sensor / Transducer Product Type Number ¹
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
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
P100	PSI (Pressure/psi)	0 to 100	0 to 100	0.5	1	P499Rxx-101C
P200	PSI (Pressure/psi)	0 to 200	0 to 200	1	1	P499Rxx-102C
P500	PSI (Pressure/psi)	0 to 500	90 to 500	1	5	P499Rxx-105C
P750	PSI (Pressure/psi)	0 to 750	150 to 750	2	6	P499Rxx-107C

1. Refer to the *System 450 Series Modular Controls Product Bulletin (LIT-12011458)*, *Catalog Page (LIT-1900549)*, or *Technical Bulletin (LIT-12011459)* for complete ordering information for System 450 compatible sensors and transducers.

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




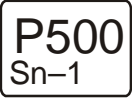
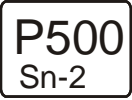
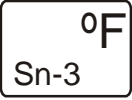














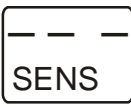



LCD Screen	Name, Description/Function, User Action, and Example
	<p>Sensor Setup Start Screen: The Sensor Setup Start screen is the first screen displayed when you access the System 450 setup screens. From the Sensor Setup Start screen you can navigate to the Output Setup Start screens or the Sensor Setup screens. See Figure 8.</p> <p>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.</p> <p>Press  (repeatedly) to scroll through the Output Setup Start screens. (See <i>Setting up a Relay Output (OUTRx)</i> and <i>Setting up an Analog Output (OUTAx)</i> for information and procedures on setting up outputs.)</p> <p>1. Press  to go to the first Sensor Type Selection screen (Sn-1) and begin setting up the sensors in your control system.</p> <p>Screen example shows the Sensors Setup Start screen with four flashing dashes.</p>
  	<p>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/transducers, Sensor Types, condition type, units of measurement, minimum differential or proportional band, setup values, value ranges, and product code numbers.</p> <p>Note: For an output to operate properly, the selected Sensor Type must match the sensor/transducer model wired to the control module, and the sensor/transducer must be wired to the proper control module input terminals.</p> <p>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.</p> <p>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.</p> <p>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.</p> <p>4. In the Sn-3 Sensor Type Selection screen, press  or  to select the desired Sensor Type. Press  to save your selection and either:</p> <ul style="list-style-type: none"> 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. <p>Screen examples show Sensor 1 and Sensor 2 with the P500 Sensor Type selected and Sensor 3 with the °F Sensor Type selected.</p>

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


LCD Screen	Name, Description/Function, User Action, and Example
	<p>Temperature Offset Selection Screens: Select a temperature offset for the temperature inputs (only) in your control system.</p> <p>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.</p> <p>Note: The temperature offset changes the displayed temperature value by the selected offset value.</p> <p>5. Press  or  to select the desired temperature offset value. Press :</p> <ul style="list-style-type: none"> to go to the next Temperature Offset Selection screen and repeat this step (if required). to return to the Sensors Setup-Start Screen. <p>Screen example shows -1 (flashing) is the selected temperature offset value for Sensor 3, thus a sensed temperature of 75°F at Sensor 3 is displayed as 74°F.</p>
	<p>Sensors Setup Start Screen: The Sensor Setup screens return to the Sensor Setup Start screen.</p> <p>After the sensors are set up for your control system, you can:</p> <ul style="list-style-type: none"> Press  to scroll through the Output Setup Start screens and begin setting up your system outputs. See Setting up a Relay Output (OUTRx) and Setting up an Analog Output (OUTAx) for more information and procedures. Press  and  simultaneously and hold for 5 seconds to return to the Main screens. <p>Screen example shows Input Sensors Setup-Start screen with four flashing dashes.</p>

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.

To set up System 450 outputs in the UI:

1. Access the System 450 setup screens, the **Sensor Setup Start** screen (**SENS**) appears. (See [Accessing the System 450 Setup Screens](#).)
2. In the **Sensor Setup Start** screen (**SENS**), 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.

For Analog Outputs, see [Setting up an Analog Output \(OUTAx\)](#) and Table 6 for setup information and procedures.

The C450CPW-100 model has a special hybrid Analog Output mode. See [Setting up the Pulse Region of the Hybrid Analog Output](#) and Table 7 for setup information and procedures.

For Relay Outputs, see [Setting up a Relay Output \(OUTRx\)](#) and Table 8 for setup information and procedures.

Setting up an Analog Output (OUTAx)

Analog outputs provide an auto-selecting analog signal that is proportional to the sensed input condition. The analog output circuit senses the impedance and automatically selects voltage or current mode operation.

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

Figure 6 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).

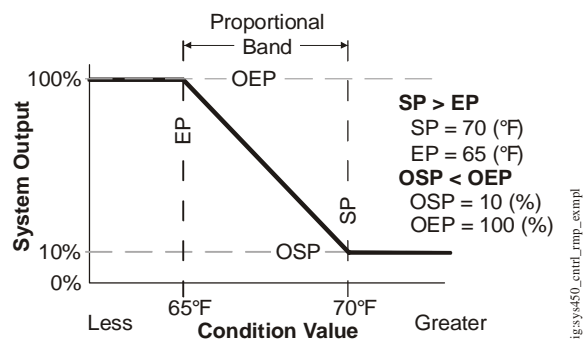

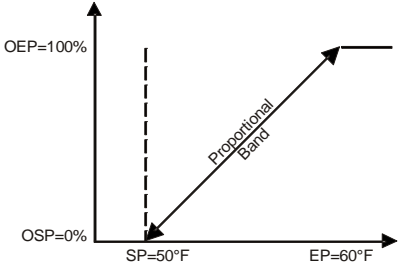
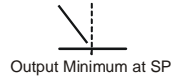
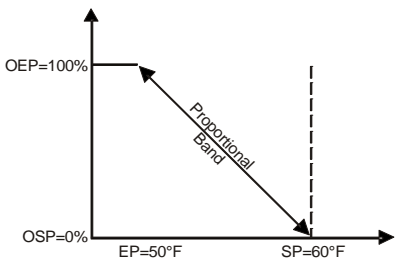

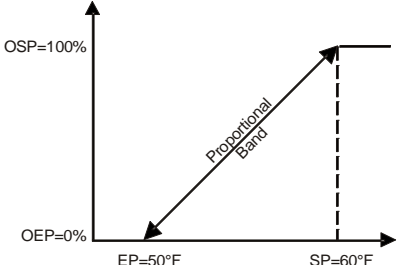
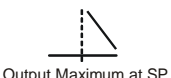
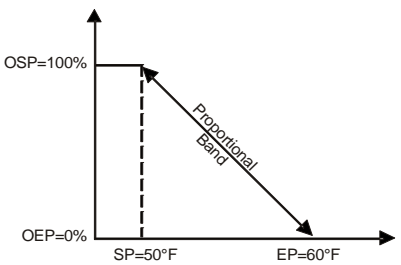


Figure 6: Control Ramp Example for a Typical Heating Application (SP > EP and OSP < OEP)

Table 5 shows the four Control Ramp icons and the associated analog output setup value relationships.

Table 5: Analog Output Control Ramp Icons

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

See Table 6 for analog output setup information and procedures.

Table 6: System 450 Analog Output Setup Screens Information (Part 1 of 2)




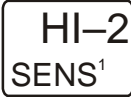



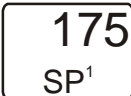







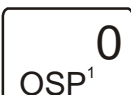







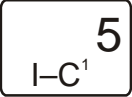







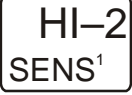



LCD Screen	Name, Description/Function, User Action, Example
	<p>Analog Output Setup Start Screen: Output number and the output type (relay or analog) are automatically assigned when you connect power to your control system's module assembly.</p> <p>Note: You must set up the system's sensors before you can set up the outputs.</p> <p>1. Press  or  to go to this output's Sensor Selection screen.</p> <p>Screen example shows the Analog Output Setup-Start screen for Output 1.</p>
	<p>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; instead, the Setpoint Selection screen appears.</p> <p>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 <i>Setting up System 450 Sensors</i>.)</p> <p>2. Press  or  to select the Sensor (Sn-1, Sn-2, Sn-3, HI-2 or HI-3) that this output references.</p> <p>Press  to save your sensor selection and go to the Setpoint Selection screen.</p> <p>Screen example shows High Input (HI-2) automatic signal selection (between Sn-1 and Sn-2).</p>
	<p>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.</p> <p>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.</p> <p>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.</p> <p>Screen example shows a Setpoint of 175 (psi) selected for Output 1.</p>
	<p>End Point Selection Screen: End Point is the (condition) value that the controlled system drives away from (towards Setpoint) and, along with Setpoint, defines this output's proportional band.</p> <p>Note: An output's proportional band (between Setpoint and End Point) is automatically enforced in the output's Setpoint and End Point Selection screens.</p> <p>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.</p> <p>Screen example shows a End Point of 185 (psi) selected for Output 1.</p>
	<p>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 (%).</p> <p>5. Press  or  to select this output's %Output Signal Strength at Setpoint value. Press  to save your selection and go to the %Output Signal Strength at End Point Selection screen.</p> <p>Screen example shows Analog Output 1 is set up to generate 0% of the total signal strength when the input is at the Setpoint value (= 0 V or 4 mA).</p>
	<p>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 (%).</p> <p>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.</p> <p>Screen example shows Output 1 is set up to generate 100% of the total signal strength when the input is at the End Point value (= 10 V or 20 mA).</p>

Table 6: System 450 Analog Output Setup Screens Information (Part 2 of 2)

LCD Screen	Name, Description/Function, User Action, Example
	<p>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.</p> <p>Note: Initially, you should select the I-C value of 0 (zero) for no integration constant. Refer to the <i>System 450 Series Technical Bulletin (LIT-12011459)</i> for more information on proportional plus integral control and setting an integration constant in the System 450 UI.</p> <p>7. Press  or  to select this output's Integration Constant for proportional plus integral control. Press  to save your selection and go to the Sensor Failure Mode Selection screen.</p> <p>Screen example shows an Integration Constant of 5 (zero) selected for Output 1.</p>
	<p>Sensor Failure Mode Selection Screen:</p> <p>8. 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.</p> <p>You can select this output's mode of operation in the event of a sensor or sensor wiring failure. The output operates in the selected mode until the failure is fixed. Sensor Failure Mode selections for Analog Outputs include:</p> <ul style="list-style-type: none"> • ON - output generates maximum signal strength during sensor failure. • OFF - output generates minimum signal strength during sensor failure. <p>Screen example shows the OFF Sensor Failure Mode selected for Output 1.</p>
	<p>Edit Sensor Selection Screen:</p> <p>9. Press  or  to change the sensor that this output references (only if required), then press  to go to this output's setup start screen.</p> <p>Note: Changing the sensor that an output references to a sensor with a different sensor type changes the default setup values for the output, and requires setting up the output again.</p> <p>Screen example shows the High Input (HI-2) signal selection (between Sn-1 and Sn-2).</p>

High Input Signal Selection

The C450CPW-100 model has the ability to control an output using the High Input signal value of two (HI-2) or three (HI-3) sensors.

When you configure Sn-1 and Sn-2 as the same sensor type (temperature, humidity, or pressure), the SENS^X screen includes the option of selecting Sn-1, Sn-2, Sn-3, or HI-2. Selecting **HI-2** results in the highest input signal of Sn-1 or Sn-2 (controlling the analog output).

When you configure Sn-1, Sn-2, and Sn-3 as the same sensor type (temperature, humidity, or pressure), the SENS^X screen includes the option of selecting Sn-1, Sn-2, Sn-3, HI-2, or HI-3. Selecting **HI-3** results in the highest input signal of Sn-1, Sn-2, or Sn-3 controlling the analog output.

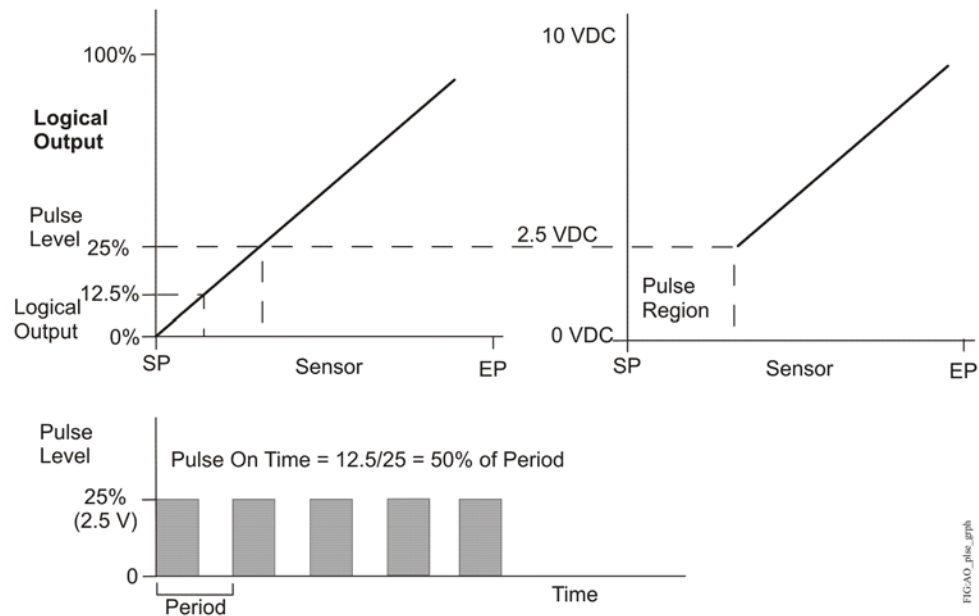


Figure 7: Pulse Signal with Pulse Level = 25% and Logical Output = 12.5%

Setting up the Pulse Region of the Hybrid Analog Output

The C450CPW-100 control's single hybrid Analog Output (AO) (OUTA¹) transitions between a pulse output and a standard VDC output, depending on the sensor value relative to the proportional band. At low output levels, the pulse output signal provides an average motor speed that is less than the EC motor's fixed minimum speed.

Note: This control function is not limited to EC Motor applications.

The **Pulse Region Hybrid AO Setup Screens** allow the user to select a Period (in seconds) and Level (expressed in %) for the Hybrid AO (see Table 7).

Table 7: Pulse Region Hybrid Analog Output Setup Screens Information

LCD Screen	Name, Description/Function, User Action, Example
	Pulse Region Hybrid AO Setup Start Screen: Only OUTA1 is capable of using the hybrid AO. 1. Press to go to this output's Pulse Output Level selection screen. Screen example shows Pulse Region Hybrid AO Setup Start Screen for Analog Output 1. Note: Additional AO expansion modules provide a standard 0–10 VDC output signal.
	Pulse Output Level: Set the Pulse Output Level to a value higher than required for the EC Motor to run. If the motor requires a minimum speed reference of 2 VDC before it runs, set the Pulse Level higher than 2 VDC. 2. Press or to select this Output's Pulse Output Level value. Press to save your Pulse Output Level value selection and go to the Pulse Period Selection screen. Range is 0 to 100%. Set the Pulse Output Level to 0% to disable the pulse output. Set the Pulse Output Level to 100% to use the pulse output over the entire 0–10 V output range. Screen example shows the Pulse Output Level set to 25% .
	Pulse Period: 3. Press or to select this output's Pulse Period value. Press to save your Pulse Period value selection and go to the Pulse Region Hybrid AO Setup Start Screen. Screen example shows the Pulse Period set for 2 seconds. Range is 1 to 30 seconds.

Setting up a Relay Output (OUTR^x)

Relay outputs provide On/Off control for the equipment in your application based on input from the sensor the output is set up to reference. See Table 8 for relay output setup information and procedures.

Table 8: System 450 Relay Output Setup Screen Information, and User Actions (Part 1 of 2)




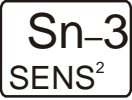



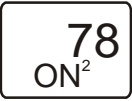





























LCD Screen	Name, Description/Function, User Action, and Example
	<p>Relay Output Setup Start Screen: Output number and the output type (relay or analog) are automatically assigned when you connect power to your control system's module assembly.</p> <p>Note: You must set up the system's sensors before you can set up the outputs.</p> <p>1. Press  to go to this output's Sensor Selection screen.</p> <p>Screen example shows the Relay Output Setup Start screen for Output 2.</p>
 	<p>Sensor Selection Screen: The sensor you select in this screen determines this output's setup parameters and values, including condition type, unit of measurement, minimum differential, default setup values, and setup value ranges for several of the remaining output setup screens. If a sensor is not selected in this screen, 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; instead, the Relay ON Selection screen appears.</p> <p>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.)</p> <p>2. Press  or  to select the Sensor (Sn-1, Sn-2, or Sn-3) that this output references. Press  to save your sensor selection and go to the Relay ON Selection Screen.</p> <p>Screen example shows input Sensor 3 selected for Output 2.</p>
	<p>Relay ON Selection Screen: Select the value at which the relay turns On. Relay ON is defined as relay LED On/Lit, relay contacts NO to C are closed, and NC to C contacts are open.</p> <p>Note: The value ranges and minimum differential are determined by the Sensor Type selected for the sensor that this output references and are enforced in the Relay ON and Relay OFF Selection screens.</p> <p>3. Press  or  to select the value at which the output relay turns On. Press  to save your selection and go to Relay OFF Selection Screen.</p> <p>Screen example shows an ON value of 78 (°F) selected for Relay Output 2.</p>
	<p>Relay OFF Selection Screen: Select the value at which the relay turns Off. Relay OFF is defined as relay LED Off, relay contacts NC to C are closed, and NO to C contacts are open.</p> <p>Note: The value ranges and minimum differential are determined by the Sensor Type selected for the sensor that this output references and are enforced in the Relay ON and Relay OFF Selection screens.</p> <p>4. Press  or  to select the value at which output relay turns Off. Press  to save your selection and go to Minimum Relay ON Time Selection Screen.</p> <p>Screen example shows an OFF value of 75 (°F) selected for Relay Output 2.</p>
	<p>Minimum Relay ON Time Selection Screen: Minimum ON Time range is 0 to 300 seconds.</p> <p>5. Press  or  to select the minimum time that the output relay remains On after reaching the Relay ON value. Press  to save your selection and go to the Minimum Relay OFF Time Selection Screen.</p> <p>Screen example shows 0 (zero) seconds selected for the minimum ON-Time for Output 2.</p>
	<p>Minimum Relay OFF Time Selection Screen: Minimum OFF Time range is 0 to 300 seconds.</p> <p>6. 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.</p> <p>Screen example shows 120 seconds selected for the minimum OFF-Time for Output 2.</p>

Table 8: System 450 Relay Output Setup Screen Information, and User Actions (Part 2 of 2)

LCD Screen	Name, Description/Function, User Action, and Example
	<p>Sensor Failure Mode Selection Screen: Select this output's mode of operation if the referenced sensor or sensor wiring fails. The output operates in the selected mode until the failure is remedied. Sensor Failure mode selections for Relay Outputs include:</p> <ul style="list-style-type: none"> • ON - output relay remains On during sensor failure. • OFF - output relay remains Off during sensor failure. <p>7. Press  or  to select this output 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.</p> <p>Screen example shows OFF sensor failure mode selected for Output 2. This output relay is Off if the referenced sensor or sensor wiring fails.</p>
	<p>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.</p> <p>Note: Changing the sensor that an output references to a sensor with a different Sensor Type changes the default setup values for the output, and requires setting up the output again.</p> <p>8. To change this output's sensor, press  or  to select the sensor that this output will reference. After you select a different sensor for this output, press  to return to the Relay ON Selection screen (Step 3 above) and repeat the output relay setup procedure for this output and the new Sensor Type values associated with the new sensor selection.</p> <p>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.</p> <p>This Relay Output is now set up in the System 450 UI. Screen example shows input Sensor 3 selected for Output 2 (Output 3 references Sensor 3).</p>
	<p>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.</p> <p>9. Press  to scroll through the remaining Output Setup Start screens and return to the Sensor Setup Start screen, or press  and  simultaneously and hold for 5 seconds to return to the System 450 Main screens.</p> <p>Screen example shows the Relay Output Setup-Start screen for Output 2.</p>

Technical Specifications

C450CPW-100 Control Module with Hybrid Analog Input and High Input Signal Selection

Product	C450Cxx: System 450 Control Module models are sensing controls and operating controls with LCD, four-button touchpad, and analog output. C450CPW-100: Control Module with Hybrid Analog Output and High Input Signal Selection
Supply Power	C450YNN-1 Power Supply Module or 24 (20–30) VAC Safety Extra-Low Voltage (SELV) (Europe) Class 2 (North America) 50/60 Hz, 10 VA minimum
Ambient Operating Conditions	Temperature: -40 to 66°C (-40 to 150°F) when Voltage Mode is selected; -40 to 40°C (-40 to 104°F) when Current Mode is selected 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 Output	Voltage Mode (0–10 VDC): 10 VDC maximum output voltage 10 mA maximum output current Requires an external load of 1,000 ohm or more Note: The hybrid AO operates in Voltage Mode when connected to devices with impedances greater than 1,000 ohm. Devices that drop below 1,000 ohm may not operate as intended for Voltage Mode applications.
	Current Mode (4–20 mA): Requires an external load between 0–300 ohm Note: The hybrid AO operates in Current Mode when connected to devices with impedances less than 300 ohm. Devices that exceed 300 ohm may not operate as intended for Current Mode applications.
Analog Input Accuracy	Resolution: 14 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 61 x 61 mm (5 x 2-3/8 x 2-3/8 in.)
Weight	195 g (0.43 lb)
Compliance 	North America: cULus Listed; UL 60730, File E27734, Vol. 1; FCC Compliant to CFR47, Part 15, Subpart B, Class B Industry Canada (IC) Compliant to Canadian ICES-003, Class B limits
	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.
	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.

**Building Efficiency**

507 E. Michigan Street, Milwaukee, WI 53202

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System 450™ Series Control Modules with Relay Outputs Installation Instructions

C450CBN-3
C450CCN-3

Part No. 24-7664-2896, Rev. D
Issued April 17, 2014
Supersedes January 17, 2013

Refer to the [QuickLIT website](http://www.quicklit.com) for the most up-to-date version of this document.

Application

IMPORTANT: Use this System 450™ Series Control Module with Relay Outputs only as an operating control. Where failure or malfunction of the System 450™ Series 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™ Series Control Module.

IMPORTANT: Utiliser ce System 450™ Series Control Module with Relay Outputs uniquement en tant que dispositif de régulation. Lorsqu'une défaillance ou un dysfonctionnement du System 450™ Series Control Module risque de provoquer des blessures ou d'endommager l'équipement contrôlé ou un autre équipement, la conception du système de contrôle doit intégrer des dispositifs de protection supplémentaires. Veiller dans ce cas à intégrer de façon permanente d'autres dispositifs, tels que des systèmes de supervision ou d'alarme, ou des dispositifs de sécurité ou de limitation, ayant une fonction d'avertissement ou de protection en cas de défaillance ou de dysfonctionnement du System 450™ Series 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 Heating, Ventilating, Air Conditioning, and Refrigeration (HVACR) and commercial/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 and/or analog) outputs, including control systems that can monitor and control temperature, pressure, and humidity applications simultaneously.

You can easily install and quickly configure a stand-alone System 450 control module and sensor in the field as a replacement control for almost any temperature, pressure, and humidity control.

C450CxN-3 models are Single-Pole, Double-Throw (SPDT) relay control modules with Liquid Crystal Display (LCD) and four-button touch pad User Interface (UI) that allows you to set up a System 450 control system. C450CBN-3 models provide one SPDT relay. C450CCN-3 models provide two SPDT relays.

Refer to the *System 450™ Series Modular Control Systems with Standard Control Modules Technical Bulletin (LIT-12011459)* for more detailed information on designing, installing, setting up, and troubleshooting System 450 Series control systems. The System 450 technical bulletin can be accessed and downloaded on the Johnson Controls® Online Product Literature Web site at the following Web address:

<http://cgproducts.johnsoncontrols.com/default.aspx>.

Installation

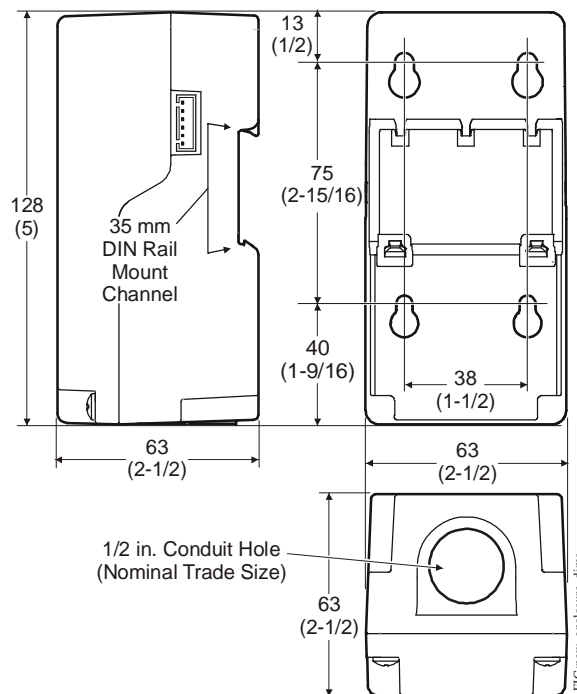


Figure 1: System 450 Module Dimensions, mm (in.)

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 heat-generating devices in an enclosure with the modules that may cause the temperature to exceed the ambient operating limit.

Mounting

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 appropriate mounting hardware/fasteners.
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 power and/or expansion 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-hand side of the control module.

To direct-mount modules to wall surfaces:

1. Plug the modules together, remove the module covers, place the assembly against wall surface horizontally in a suitable location and mark the mount hole locations on the surface (Figure 1).
2. Install appropriate screw fasteners, leaving screw heads approximately one to two turns away from flush to the surface.

3. Place the assembly over screw heads on the mounting slots, and carefully tighten the mounting screws.

Note: If you mount the modules on an uneven surface, do not damage the housings when tightening mounting screws. Use shims/washers to mount module assembly evenly on the surface.

Refer to the control 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 24 for electrical ratings.



WARNING: Risk of Electric Shock.

Disconnect or isolate all power supplies before making electrical connections. More than one disconnection 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.

AVERTISSEMENT : Risque de décharge électrique.

Débrancher ou isoler toute alimentation avant de réaliser un raccordement électrique. Plusieurs isolations et débranchements sont peut-être nécessaires pour -couper entièrement l'alimentation de l'équipement. Tout contact avec des composants porteurs de tensions dangereuses risque d'entraîner une décharge électrique et de provoquer des blessures graves, voire mortelles.

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.

Note: The relay output terminals connect to an internal SPDT relay and do **not** supply any power to the application.

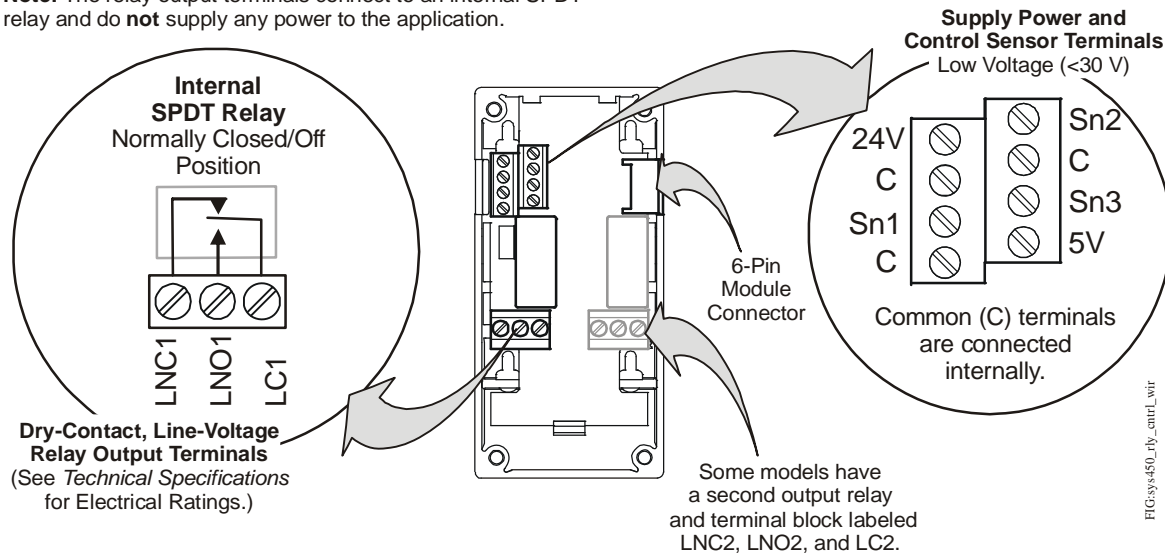
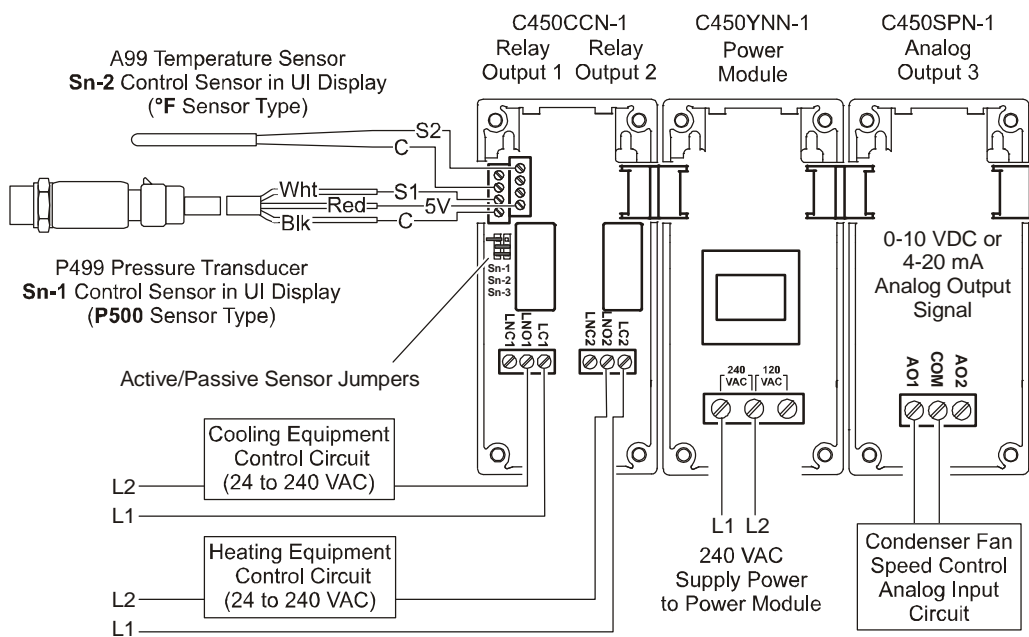




Figure 2: C450CxN-3 Wiring Terminals









Note: In 120 VAC applications, L1 must be the Hot lead and L2 must be the Neutral/Common lead.

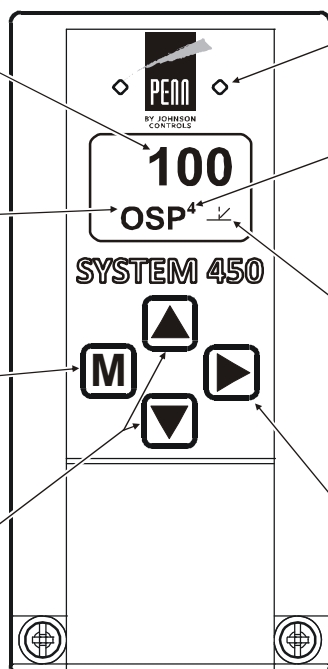
Figure 3: Example System 450 Heat/Cool System with Condenser Fan Speed Control

Status or Setup Value: Displays the current input status, output status or setup parameter value for the displayed input sensor, output and/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 set up start screen.

Up and Down Buttons: Press  or  to select a different 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.



Light-Emitting Diode (LED): Green LEDs on Relay Control Module and Relay Expansion Modules (only) indicates if the associated relay output is on or off.

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 Control Module Output Relay LEDs, LCD, Four-Button Touch Pad User Interface

Table 1: System 450 Terminal Wiring Information

Label	Terminal Function	Wire Sizes
24V	Accepts 24 VAC supply power, when a C450YNN power module is not connected, and provides power terminal for 24 VAC (humidity) sensors.	0.08 mm ² to 1.5 mm ² 28 AWG to 16 AWG
5V	Provides 5 VDC power for active sensors.	
Sn-1, Sn-2, Sn-3	Accepts passive or active (0–5 VDC) input signals from sensors. Note: You must position the Active/Passive Sensor Jumper (Figure 3 and Figure 6) correctly for each sensor in your control system before operating the system. See Setting Active/Passive Sensor Jumpers for more information.	
C (Three Terminals)	Provide low-voltage Common connections for 24 VAC power and passive or active sensors connected to the 5V, Sn1, Sn2, and Sn3 terminals. Note: The three C terminals are connected internally and can be connected to ground in the field.	
LNC1, LNC2	Connects control circuit to the Normally Closed (N.C.) contact on the SPDT relay.	0.08 mm ² to 2.5 mm ² 28 AWG to 14 AWG
LNO1, LNO2	Connects control circuit to the Normally Open (N.O.) contact on the SPDT relay.	
LC1, LC2	Connects line (power) to Common (C) on the SPDT ¹ relay.	

1. See Internal SPDT Relay insert in Figure 2 for more System 450 relay contact and terminal information. See [Technical Specifications](#) for SPDT relay electrical ratings.

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 and/or analog control. Figure 3 shows an example System 450 module assembly with two input sensors and three outputs (two relay outputs and one analog output).

Setting Up 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-1 power module, it must be plugged into the control module. Plug in any expansion modules (for your control system) to the right of the power module.

4. Apply supply power to the module assembly.

You can now set up your control system in the System 450 reset control module UI.

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 Active/Passive Sensor Jumpers

Before putting your System 450 reset control system into operation, you must set up each sensor in your system as either passive or active by positioning the jumper on the terminal pins on the terminal block located below the sensor terminal block. See Figure 3.

Temperature sensors are passive (two-wire) sensors and the corresponding jumpers must be positioned across both pins. Humidity and pressure transducers are active (three-wire) sensors and corresponding jumpers must be positioned on one pin (or removed completely). Figure 5 shows the jumper positions for the System 450 example shown in Figure 3.

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

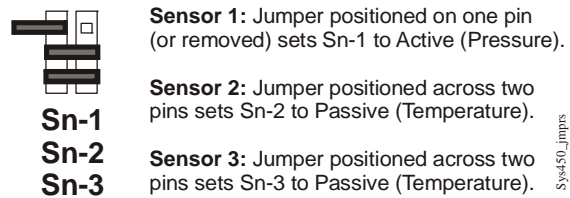


Figure 5: Active/Passive Sensor Terminal Pin Block Set Up for the Example in Figure 3

Setting Up a Control System in the User Interface

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 [Setting Up a System 450 Module Assembly](#) on page 6.

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 8.
3. Set up the control system inputs in the UI. See [Setting Up System 450 Sensors](#) on page 8.
4. Set up the control system outputs in the UI. See [Setting Up System 450 Outputs](#) on page 11.

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.

Use the worksheet provided on page 24 to plan and record the settings for your System 450 control system.

screen displays the current firmware version for the module. See Table 2 and [System 450 Firmware Versions](#) for more information.

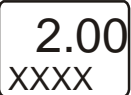
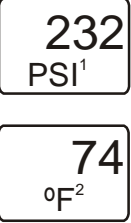






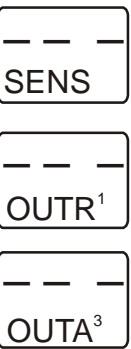




After you install, wire, power on, and set up your control system in the UI, the Main screens appear on the LCD, immediately after the Startup screen. During normal operation, the Main screens automatically scroll through the current status of each sensor in your control system. See Table 2 for more 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. Standard System 450 control modules with Version 2.00 firmware and later include the High Input-Signal Selection and Differential Control features. See [High Input-Signal Selection](#) on page 10 and [Differential Control](#) on page 17 for more information.



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


LCD Screen	Name, Description/Function, User Action, and Example
	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. 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.
	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 7 and Figure 8 for example 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. The screen examples show Sensor 1 sensing 232 psi and Sensor 2 sensing 74°F .
	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, signal strength, and control ramp icon. 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 Standard Control or High Input-Signal Selection Control for information about ramp icons.
	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 a Control System in the User Interface on page 6 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 is displayed, 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 , and Analog Output 3 Setup Start screens.

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 to go to the **Sensor Setup Start** screen.

3. Press  repeatedly to scroll through the **Output Setup Start** screens. See Figure 7.

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

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/transducer product code numbers.

Table 3: System 450 Sensor Types, Setup Values, and Sensor/Transducer Product Codes

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 0.5	INWC (Pressure/in. W.C.)	0 to 0.5	0.025 to 0.5	0.005	0.025	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
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
P100	PSI (Pressure/psi)	0 to 100	0 to 100	0.5	1	P499Rxx-101C
P110 ³	Hg/PSI (Pressure/Hg-psi)	-10 to 100	-10 to 100	0.5	1	P499Rxx-100C
P200	PSI (Pressure/psi)	0 to 200	0 to 200	1	1	P499Rxx-102C
P500	PSI (Pressure/psi)	0 to 500	90 to 500	1	5	P499Rxx-105C
P750	PSI (Pressure/psi)	0 to 750	150 to 750	2	6	P499Rxx-107C
HI°F	°F (Temperature/degrees)	-50 to 340	-40 to 340 ⁴	1	1	TE-631x, TE-6000-x TE-68NT-0N00S
HI°C	°C (Temperature/degrees)	-45.5 to 170	-40 to 170 ⁴	0.5	0.5	TE-631x, TE-6000-x TE-68NT-0N00S

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 *Technical Bulletin (LIT-12011459)* for additional ordering information for System 450 compatible sensors and transducers.
3. See [Setting Up Outputs That Reference a P110 Sensor](#) on page 10 for information on setting up System 450 outputs that reference the P110 Sensor Type.

4. Many of the 1,000 ohm Nickel 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* sections in the *TE-6000 Series Temperature Sensing Elements Product Bulletin (LIT-216288)*, the *TE-6300 Series Temperature Sensors Product Bulletin (LIT-216320)*, and the *TE-6800 Series Temperature Sensor Product Bulletin (LIT-12011542)* to determine the temperature range that the various 1,000 ohm Nickel temperature sensors are specified to operate in.

Table 4 provides sensor setup information, procedures, and example screens. Figure 7 on page 22 provides a System 450 UI setup example.

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

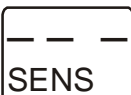

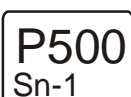
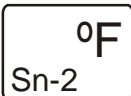
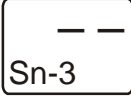















LCD Screen	Name, Description/Function, User Action, and Example
	<p>Sensor Setup Start Screen: The Sensor Setup Start screen is the first screen displayed when you access the System 450 setup screens. From the Sensor Setup Start screen you can navigate to the Output Setup Start screens or the Sensor Setup screens. See Figure 7.</p> <p>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.</p> <p>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.</p> <p>The screen example shows the Sensors Setup Start screen with flashing dashes.</p>
  	<p>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/transducers, Sensor Types, condition type, units of measurement, minimum control band or proportional band, setup values, value ranges, and product code numbers.</p> <p>Note: For outputs to operate properly, the selected Sensor Type must match the sensor/transducer model wired to the control module, and the sensor/transducer must be wired to the proper control module input terminals.</p> <p>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.</p> <p>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.</p> <p>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.</p> <p>4. In the Sn-3 Sensor Type Selection screen, press  or  to select the desired Sensor Type. Press  to save your selection and either:</p> <ul style="list-style-type: none"> • 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. <p>Note: Beginning with firmware Version 2.00, 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 10 and Differential Control on page 17 for more information.</p> <p>The screen examples show Sn-1 with the P500 Sensor Type selected; Sn-2 with the °F Sensor Type selected; and Sn-3 with the no Sensor Type selected.</p>
	<p>Temperature Offset Selection Screens: Select a temperature offset for the temperature inputs (only) in your control system.</p> <p>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.</p> <p>Note: The temperature offset changes the displayed temperature value by the selected offset value.</p> <p>5. Press  or  to select the desired temperature offset value. Press .</p> <ul style="list-style-type: none"> • 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. <p>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).</p>

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

LCD Screen	Name, Description/Function, User Action, and Example
	<p>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.</p> <p>Note: You can edit the sensor set up 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.</p> <p>After the sensors are set up for your control system, you can:</p> <ul style="list-style-type: none"> Press [M] to scroll through the Output Setup Start screens and begin setting up your system outputs. Press [A] and [V] simultaneously to return to the Main screens. <p>The screen example shows Sensors Setup Start screen with flashing dashes.</p>

Setting Up Outputs That Reference a P110 Sensor

The P110 Sensor Type can monitor negative pressure down to 20 InHg (-10 psi). When referencing a P110 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 P110 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/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 P110 Sensor Type and the output is set up for Differential Control (Sn-1 and Sn-2 are P110 Sensor Type), the negative pressure values displayed in the differential pressure System Status screen (dIFP) are displayed as negative psi values, not InHg values. See [Differential Control](#) on page 17 for more information.

High Input-Signal Selection

Beginning with firmware Version 2.00, standard System 450 control modules include the High Input-Signal Selection control capability.

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.

If the multi-circuit condensing unit has single speed fan motors, multiple relay outputs can be set up to reference the high input-signal and System 450 can stage the fans on and off based on the pressure sensed at the coil with the highest pressure.




If the multi-circuit condensing unit has variable speed fan motors, one or more analog outputs can be set up to reference the high input-signal and control the fan motor speeds based on the pressure sensed at the coil with the highest pressure.

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 standard Relay Outputs and Relay Outputs with High Input-Signal Selection, see [Setting Up a Relay Output for Standard Control or High Input-Signal Selection Control](#) and Table 6 for setup information and procedures.
5. For standard Analog Outputs and Analog Outputs with High Input-Signal Selection, see [Setting Up an Analog Output for Standard Control or High Input-Signal Selection Control](#) and Table 8 for setup information and procedures.
6. For Relay Outputs with Differential Control, see [Setting Up an Output for Differential Control](#) on page 17 and Table 10.
7. For Analog Outputs with Differential Control, see [Setting Up an Output for Differential Control](#) on page 17 and Table 11.

Setting Up a Relay Output for Standard Control or High Input-Signal Selection Control

Table 6 provides information, procedures, guidelines, and screen examples for setting up relay outputs for standard or High Input-Signal Selection control. See Figure 7 on page 22 for example menu flow of the Relay Output 1 set up in Table 6.

Table 6: System 450 Setup Screen Information and Procedures for Relay Outputs with Standard Control and High Input-Signal Selection Control (Part 1 of 3)




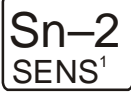





LCD Screen	Name, Description/Function, User Action, and Example
	<p>Relay Output Setup Start Screen: The output numbers and the output type (relay or analog) are determined by the module types and configuration of your control system's module assembly and are automatically assigned when you connect power to the module assembly. (See Setting Up a Control System in the User Interface on page 6.)</p> <p>Note: You must set up the control system input sensors before you can set up the outputs.</p> <p>1. In the Relay Output Setup Start screen, press  to go to the output's Sensor Selection screen.</p> <p>The screen example shows a Relay Output Setup Start screen for Output 1.</p>
   	<p>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.</p> <p>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.)</p> <p>Note: Beginning with firmware Version 2.00, 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.</p> <p>2. Press  or  to select the sensor that this output references:</p> <ul style="list-style-type: none"> • 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. <p>Then press  to save your sensor selection and go to the Relay ON Selection screen.</p> <p>Note: For Differential Control, select Sn-d and go to Table 10 on page 18 for information, procedures, guidelines, and screen examples for setting up outputs for Differential Control.</p> <p>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.</p>

Table 6: System 450 Setup Screen Information and Procedures for Relay Outputs with Standard Control and High Input-Signal Selection Control (Part 2 of 3)

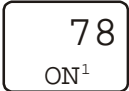







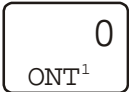











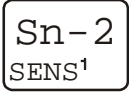








LCD Screen	Name, Description/Function, User Action, and Example
	<p>Relay ON Selection Screen: Select the value at which the relay turns On. Relay ON is defined as relay LED On/Lit, relay contacts N.O. to C are closed, and N.C. to C contacts are open.</p> <p>Note: The value ranges and minimum control 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.</p> <p>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.</p> <p>The screen example shows an ON value of 78 (°F) selected for Relay Output 1.</p>
	<p>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.</p> <p>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.</p> <p>4. Press  or  to select the value at which output relay turns Off, then press  to save your selection and go to Minimum Relay ON Time Selection screen.</p> <p>The screen example shows an OFF value of 75 (°F) selected for Relay Output 1.</p>
	<p>Minimum Relay ON Time Selection Screen: Minimum ON Time range is 0 to 300 seconds.</p> <p>5. 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.</p> <p>Screen example shows an ONT value of 0 (seconds) selected for Output 1.</p>
	<p>Minimum Relay OFF Time Selection Screen: Minimum OFF Time range is 0 to 300 seconds.</p> <p>6. 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.</p> <p>The screen example shows an OFFT value of 120 (seconds) selected for Output 1.</p>
	<p>Sensor Failure Mode Selection Screen: Select the output's mode of operation if a referenced sensor or sensor wiring fails. If the output references functional sensors HI-2 or HI-3, the output enters the Sensor Failure mode whenever a referenced sensor or sensor wiring fails. The output operates in the selected Sensor Failure mode until the failure is remedied. Sensor Failure mode selections for Relay Outputs include:</p> <ul style="list-style-type: none"> • ON = Output relay remains On during sensor failure. • OFF = Output relay remains Off during sensor failure. <p>7. 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.</p> <p>The screen example shows OFF selected as the Sensor Failure mode for Output 1.</p>
	<p>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.</p> <p>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.</p> <p>8. 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.</p> <p>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.</p> <p>This Relay Output is now set up in the System 450 UI.</p> <p>The screen example shows Sn-2 is selected Sensor for Output 1.</p>

Table 6: System 450 Setup Screen Information and Procedures for Relay Outputs with Standard Control and High Input-Signal Selection Control (Part 3 of 3)

LCD Screen	Name, Description/Function, User Action, and Example
	<p>Relay Output Setup Start Screen</p> <p>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.</p> <p>9. 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.</p> <p>The screen example shows a Relay Output Setup Start screen for Output 1.</p>

Setting Up an Analog Output for Standard Control or High Input-Signal Selection Control

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 [Setting Up an Output for Differential Control](#) on page 17 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 6 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).

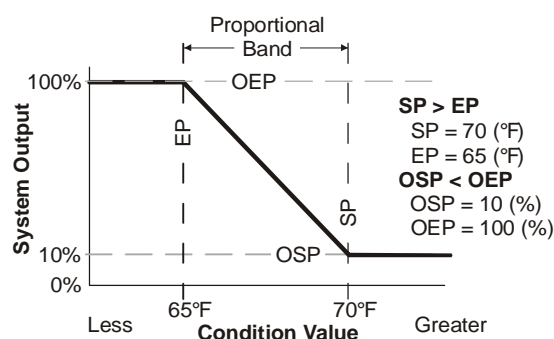


Figure 6: Control Ramp Example for a Typical Heating Application (SP > EP and OSP < OEP)

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

Table 7: Analog Output Control Ramp Icons


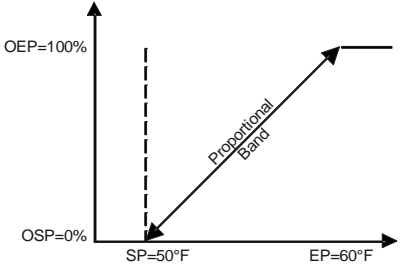

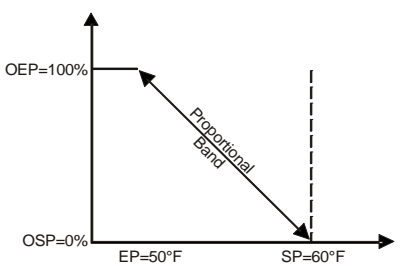
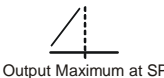
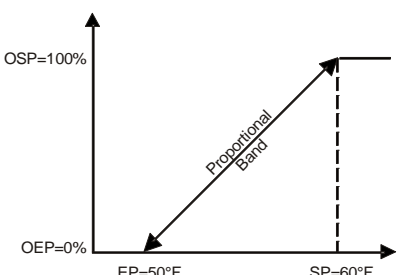

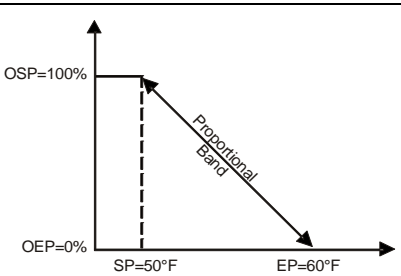
Control Ramp Displayed on LCD	Control Action	Set the Analog Output Value Relationships for the Desired Control Action and Corresponding Control Ramp
 <p>Output Minimum at SP</p>		$SP < EP$ $OSP < OEP$
 <p>Output Minimum at SP</p>		$SP > EP$ $OSP < OEP$
 <p>Output Maximum at SP</p>		$SP > EP$ $OSP > OEP$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

Table 8 provides information, procedures, guidelines, and screen examples for setting up analog outputs that reference standard or High Input-Signal Selection sensors. See Figure 7 on page 22 for example menu flow of the Analog Output 3 set up in Table 8.

Table 8: System 450 Setup Screen Information and Procedures for Analog Output with Standard and High Input-Signal Selection Control (Part 1 of 2)




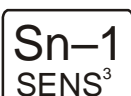
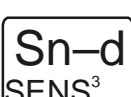
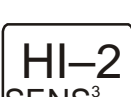



















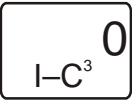







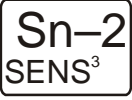








LCD Screen	Name, Description/Function, User Action, Example
	<p>Analog Output Setup Start Screen: The output numbers and the output type (relay or analog) are determined by the module types and configuration of your control system's module assembly and are automatically assigned when you connect power to the module assembly. (See Setting Up a Control System in the User Interface on page 6.)</p> <p>Note: You must set up the system's sensors before you can set up the outputs.</p> <p>1. Press  to go to this output's Sensor Selection screen.</p> <p>The screen example shows the Analog Output Setup Start screen for Output 3.</p>
   	<p>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.</p> <p>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.)</p> <p>Note: Beginning with firmware Version 2.00, 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.</p> <p>2. Press  or  to select the sensor that this output references:</p> <ul style="list-style-type: none"> • 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. <p>Then press  to save your sensor selection and go to the Setpoint Selection screen.</p> <p>Note: For Differential Control, select Sn-d and go to Table 11 on page 19 for information, procedures, guidelines, and screen examples for setting up an Analog Output for Differential Control.</p> <p>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.</p>
	<p>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.</p> <p>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.</p> <p>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.</p> <p>The screen example shows a Setpoint value of 200 (psi) selected for Output 3.</p>
	<p>End Point Selection Screen: End Point is the (condition) value that the controlled system drives away from (towards Setpoint) and, along with Setpoint, defines this output's proportional band.</p> <p>Note: An output's proportional band (between Setpoint and End Point) is automatically enforced in the output's Setpoint and End Point Selection screens.</p> <p>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.</p> <p>The screen example shows an End Point value of 250 (psi) selected for Output 3.</p>
	<p>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 (%).</p> <p>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.</p> <p>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).</p>
	<p>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 (%).</p> <p>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.</p> <p>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).</p>

Table 8: System 450 Setup Screen Information and Procedures for Analog Output with Standard and High Input-Signal Selection Control (Part 2 of 2)

LCD Screen	Name, Description/Function, User Action, Example
	<p>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.</p> <p>Note: Initially, you should select the I-C value of 0 (zero) for no integration constant. Refer to the <i>System 450 Series Technical Bulletin (LIT-12011459)</i> for more information on proportional plus integral control and setting an integration constant in the System 450 UI.</p> <p>7. Press  or  to select this output's Integration Constant for proportional plus integral control. Press  to save your selection and go to the Sensor Failure Mode Selection screen.</p> <p>The screen example shows an I-C value of 0 (zero) selected for Output 3.</p>
	<p>Sensor Failure Mode Selection Screen: Select the output's mode of operation if a referenced sensor or sensor wiring fails. If the output references functional sensors HI-2 or HI-3, the output enters the Sensor Failure mode whenever one of the referenced sensors or sensor wiring fails. The output operates in the selected Sensor Failure mode until the failure is remedied. Sensor Failure mode selections for Analog Outputs include:</p> <ul style="list-style-type: none"> • ON = Output generates the selected OEP signal strength during sensor failure. • OFF = Output generates the selected OSP signal strength during sensor failure. <p>8. 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.</p> <p>The screen example shows OFF selected as the Sensor Failure mode for Output 3.</p>
	<p>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.</p> <p>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.</p> <p>9. 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.</p> <p>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.</p> <p>The screen example shows Sn-2 as the selected Sensor for Output 3.</p>
	<p>Analog Output Setup Start Screen</p> <p>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.</p> <p>10. 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.</p> <p>The screen example shows the Analog Output Setup Start screen for Output 3.</p>

Differential Control

Beginning with Version 2.00 firmware, standard System 450 control modules include Differential Control capability. Differential control is used to monitor and/or 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; $(Sn-d) = (Sn-1) - (Sn-2)$.

Note: The System 450 Differential Control sensor (Sn-d) value is always equal to Sn-1 minus Sn-2. Therefore, depending on the intended control action of the output, the differential value may be either a positive or negative value.

The Sn-d value is displayed 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 also 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 (0 to 100%) 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 Failure Mode

Any output set up to reference the Differential Sensor (Sn-d) enters the selected Sensor Failure mode when either Sn-1 sensor, Sn-2 sensor, or the sensor wiring fails.

Differential Sensor Range of Usable Values

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.

Table 9: 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	P100	-100.0 to 100.0
P 0.5	-0.500 to 0.500	P110	-110.0 to 110.0
P 2.5	-2.50 to 2.50	P200	-200 to 200
P 5	-5.00 to 5.00	P500	-500 to 500
P 8	-9.00 to 9.00	P750	-750 to 750
P 10	-10.00 to 10.00	HI°F	-380 to 380
P 15	-16.0 to 16.0	HI°C	-210.0 to 210.0

Setting Up an Output for Differential Control

Table 10 provides information, procedures, guidelines, and screen examples for setting up relay outputs that reference the Differential Control sensor.

Table 11 provides information, procedures, guidelines, and screen examples for setting up analog outputs that reference the Differential Control sensor.

Figure 8 on page 23 shows the menu flow used to set up the output examples in Table 10 and Table 11.

Table 10: System 450 Setup Screen Information and Procedures for Relay Outputs with Differential Control
(Part 1 of 2)
















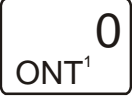







LCD Screen	Name, Description/Function, Procedures, and Example
	<p>Relay Output Setup Start Screen: The output numbers and the output type (relay or analog) are determined by the module types and configuration of your control system's module assembly and are automatically assigned when you connect power to the module assembly. (See Setting Up a Control System in the User Interface on page 6.)</p> <p>Note: You must set up the system's sensors before you can set up the system outputs, and you must set up the Differential Control sensor (Sn-d) before you can set up an output with Differential Control. (See Setting Up System 450 Sensors for information on setting up the Differential Control sensor.)</p> <p>1. Press  to go to this output's Sensor Selection screen.</p> <p>The screen example shows the Relay Output Setup Start screen for Output 1.</p>
 	<p>Sensor Selection Screen: Selecting the Differential Control sensor (Sn-d) here establishes this output as a Differential Control output. Differential Control outputs have several different setup parameters and value ranges from standard and High Input-Signal Selection outputs.</p> <p>Note: To set up an output for Differential Control, the Differential Control sensor (Sn-d) must be already set up in the System 450 UI (See Setting Up System 450 Sensors for more information.), and you must select Sn-d in the Sensor Selection screen. If Sn-d is not selected here, the Differential Control setup screens do not appear. If a sensor is already selected for this output, the Sensor Selection screen does not appear here, instead the Relay ON Selection screen (ON or dON) appears.</p> <p>2. Press  or  to select the Differential Control sensor (Sn-d) as the sensor this output references. Press  to save your sensor selection and go to the Relay dON Selection Screen.</p> <p>The screen example shows Sn-d is the selected Sensor for Output 1.</p>
	<p>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. Relay dON is defined as relay LED On/Lit, relay contacts N.O. to C are closed, and N.C. to C contacts are open.</p> <p>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 9 for more information.)</p> <p>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.</p> <p>The screen example shows a dON value of 30 (psi) selected for Relay Output 1.</p>
	<p>Relay dOFF Selection Screen: Select the dOFF value at which the relay turns off. 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.</p> <p>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 9 for more information.)</p> <p>4. Press  or  to select the differential value at which output relay turns Off. Press  to save your selection and go to Minimum Relay ON Time Selection Screen.</p> <p>The screen example shows a dOFF value of 32 (psi) selected for Relay Output 1.</p>
	<p>Minimum Relay ON Time Selection Screen: Minimum ON Time range is 0 to 300 seconds.</p> <p>5. Press  or  to select the minimum time that the output relay remains On after reaching the Relay dON value. Press  to save your selection and go to the Minimum Relay OFF Time Selection Screen.</p> <p>The screen example shows an ONT value of 0 (seconds) selected for Output 1.</p>
	<p>Minimum Relay OFF Time Selection Screen: Minimum OFF Time range is 0 to 300 seconds.</p> <p>6. Press  or  to select the minimum time that this output relay remains Off after reaching the Relay dOFF value. Press  to save your selection and go to the Sensor Failure Mode Selection screen.</p> <p>The screen example shows an OFFT value of 30 (seconds) selected for Output 1.</p>

Table 10: System 450 Setup Screen Information and Procedures for Relay Outputs with Differential Control (Part 2 of 2)














LCD Screen	Name, Description/Function, Procedures, and Example
	<p>Sensor Failure Mode Selection Screen: Select the differential output's mode of operation if either of the referenced sensors (Sn-1 or Sn-2) or the sensor wiring fails. The output operates in the selected mode until the failure is remedied. Sensor Failure mode selections for Relay Outputs include:</p> <ul style="list-style-type: none"> • ON = Output relay remains On during sensor failure. • OFF = Output relay remains Off during sensor failure. <p>7. Press  or  to select this output's mode of operation if a referenced sensor or sensor wiring fail. Press  to save your sensor failure mode selection and go to the Edit Sensor Screen.</p> <p>The screen example shows OFF selected as the Sensor Failure mode for Output 1.</p>
	<p>Edit Sensor Screen: This screen displays the Differential Sensor (Sn-d) 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.</p> <p>Note: If you change the Sn-d sensor to a different sensor, the output is no longer a Differential Control output and you must set the output up again for the new sensor selection.</p> <p>8. 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.</p> <p>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.</p> <p>This Relay Output is now set up in the System 450 UI.</p> <p>The screen example shows Sn-d as the selected Sensor for Output 1.</p>
	<p>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.</p> <p>9. 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.</p> <p>The screen example shows the Relay Output Setup Start screen for Output 1.</p>

Table 11: System 450 Setup Screen Information and Procedures for Analog Outputs with Differential Control (Part 1 of 3)

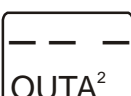

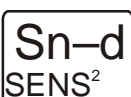



LCD Screen	Name, Description/Function, User Action, Example
	<p>Analog Output Setup Start Screen: The output numbers and the output type (relay or analog) are determined by the module types and configuration of your control system's module assembly and are automatically assigned when you connect power to the module assembly. (See Setting Up a Control System in the User Interface on page 6.)</p> <p>Note: You must set up the system's sensors before you can set up the system outputs, and you must set up the Differential Control sensor (Sn-d) before you can set up an output with Differential Control. (See Setting Up System 450 Sensors for information on setting up the Differential Control sensor.)</p> <p>1. Press  to go to this output's Sensor Selection screen.</p> <p>The screen example shows the Analog Output Setup Start screen for Output 2.</p>
	<p>Sensor Selection Screen: Selecting the Differential Control sensor (Sn-d) here establishes this output as a Differential Control output. Differential Control outputs have several different setup parameters and value ranges from standard and High Input-Signal Selection outputs.</p> <p>Note: To set up an output for Differential Control, the Differential Control sensor (Sn-d) must be already set up in the System 450 UI (See Setting Up System 450 Sensors for more information.), and you must select Sn-d in the Sensor Selection screen. If Sn-d is not selected here, the Differential Control setup screens do not appear. If a sensor is already selected for this output, the Sensor Selection screen does not appear here, instead the Setpoint Selection screen (SP or dSP) appears instead.</p> <p>2. Press  or  to select the Differential Control sensor (Sn-d) as the sensor this output references. Press  to save your sensor selection and go to the Setpoint Selection screen.</p> <p>The screen example shows Sn-d as the selected Sensor for Output 2.</p>

Table 11: System 450 Setup Screen Information and Procedures for Analog Outputs with Differential Control (Part 2 of 3)

















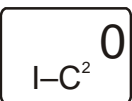







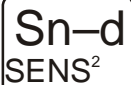








LCD Screen	Name, Description/Function, User Action, Example
	<p>Differential Setpoint Selection Screen: Differential Setpoint (dSP) is the target value that the controlled system drives towards and along with Differential End Point (dEP), defines this output's proportional band. The dSP value is a differential 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.</p> <p>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 9 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.</p> <p>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.</p> <p>The screen example shows a dSP value of 30 (psi) selected for Output 2.</p>
	<p>Differential End Point Selection Screen: Differential End Point (dEP) is the target value that the controlled system drives towards 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.</p> <p>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 9 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.</p> <p>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.</p> <p>The screen example shows a dEP value of 25 (psi) selected for Output 2.</p>
	<p>Output Signal Strength at Setpoint Selection Screen: Select the strength of the signal that this output generates when the sensed condition is at the Differential Setpoint (dSP) value. The signal strength range is 0 to 100 (%).</p> <p>5. Press  or  to select this output's %Output Signal Strength at Setpoint value. Press  to save your selection and go to the %Output Signal Strength at End Point Selection screen.</p> <p>The screen example shows an OSP value of 0 (%) selected for Output 2. Therefore Output 3 generates 0% of the total signal strength (0 V or 4.0 mA) when the input is at the Setpoint value of 30.0 (psi).</p>
	<p>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 Differential End Point (dEP) value. The signal strength range is 0 to 100 (%).</p> <p>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.</p> <p>The screen example shows an OEP value of 100 (%) selected for Output 2. Therefore Output 3 generates 100% of the total signal strength (10 V or 20.0 mA) when the input is at the End Point value of 25.0 (psi).</p>
	<p>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.</p> <p>Note: Initially, you should select the I-C value of 0 (zero) for no integration constant. Refer to the <i>System 450 Series Technical Bulletin (LIT-12011459)</i> for more information on proportional plus integral control and setting an integration constant in the System 450 UI.</p> <p>7. Press  or  to select this output's Integration Constant for proportional plus integral control. Press  to save your selection and go to the Sensor Failure Mode Selection screen.</p> <p>The screen example shows an I-C value of 0 (zero) selected for Output 2.</p>

Table 11: System 450 Setup Screen Information and Procedures for Analog Outputs with Differential Control (Part 3 of 3)

LCD Screen	Name, Description/Function, User Action, Example
	<p>Sensor Failure Mode Selection Screen: Select the differential output's mode of operation if either of the referenced sensors (Sn-1 or Sn-2) or the sensor wiring fails. The output operates in the selected mode until the failure is fixed. Sensor Failure Mode selections for Analog Outputs include:</p> <ul style="list-style-type: none"> • ON = Output generates the selected OEP signal strength during sensor failure. • OFF = Output generates the selected OSP signal strength during sensor failure. <p>8. Press  or  to select this output's mode of operation if a referenced sensor or sensor wiring fail. Press  to save your selection and go to the Edit Sensor Selection screen.</p> <p>The screen example shows OFF selected as the Sensor Failure mode for Output 2.</p>
	<p>Edit Sensor Screen: This screen displays the Differential Sensor (Sn-d) 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.</p> <p>Note: If you change the Sn-d sensor to a different sensor, the output is no longer a Differential Control output and you must set the output up again for the new sensor selection.</p> <p>9. 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.</p> <p>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.</p> <p>The screen example shows Sn-d as the selected Sensor for Output 2.</p>
	<p>Analog Output Setup Start Screen</p> <p>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.</p> <p>10. 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.</p> <p>The screen example shows the Analog Output Setup Start screen for Output 2.</p>

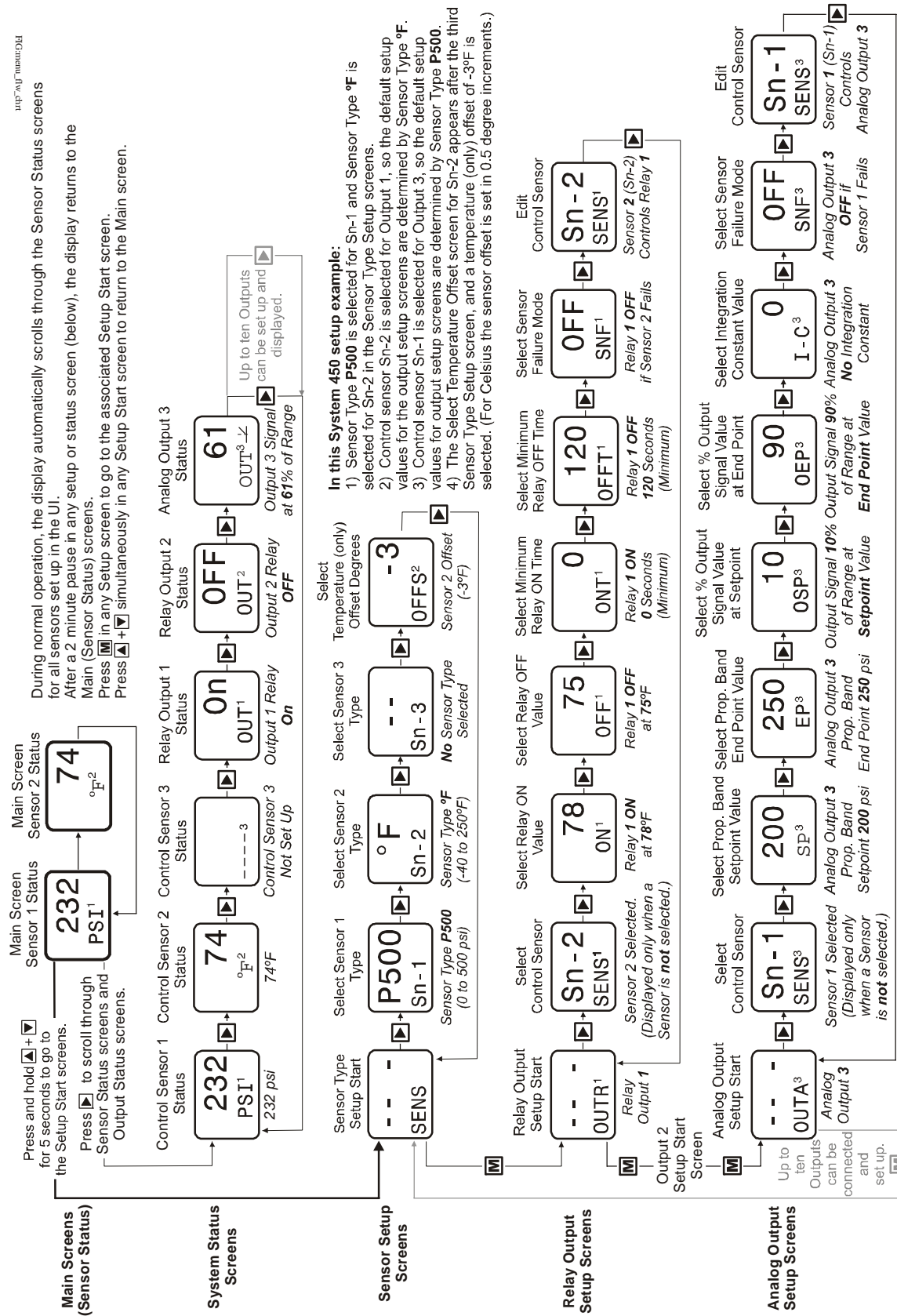


Figure 7: System 450 Status Screens, Setup Screens, and Menu Flow Example

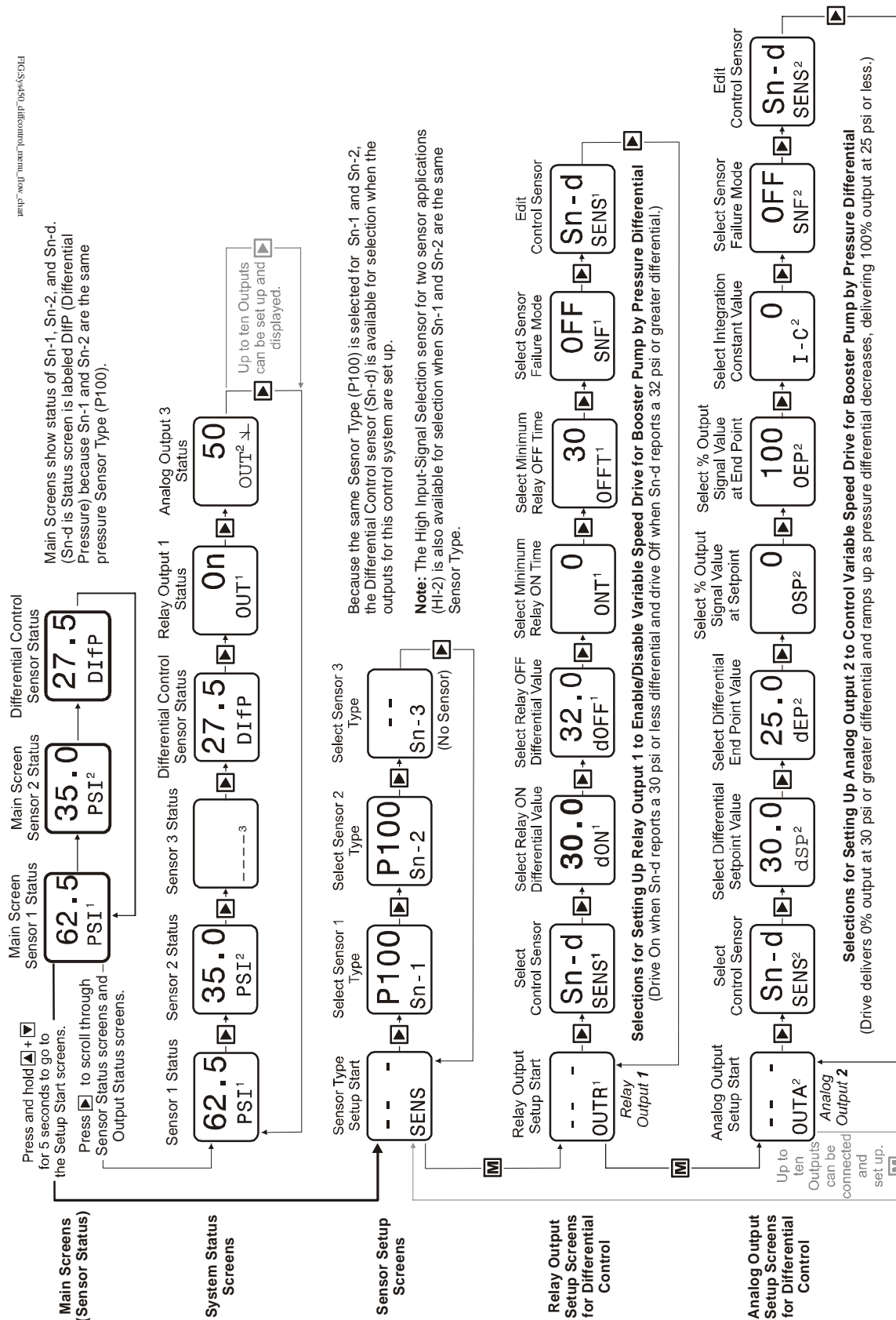


Figure 8: System 450 Status Screens, Setup Screens, and Menu Flow Example for Differential Control

Technical Specifications

C450CxN-3

Product	C450CxN-3: System 450 Control Modules are sensing controls and operating controls with LCD, four-button touch pad, and On/Off relay output. C450CBN-3: Control Module with one SPDT output relay C450CCN-3: Control Module with two SPDT output relays		
Supply Power	C450YNN-1 Power Supply Module or 24 (20-30) VAC Safety Extra-Low Voltage (SELV) (Europe) Class 2 (North America), 50/60 Hz, 10 VA minimum		
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 to 5 VDC; 1,035 ohms at 25°C (77°F) for an A99 PTC Temperature Sensor; 1,000 ohms at 21.1°C (70°F) for a Nickel Temperature Sensor		
Output Relay Contacts	General: 1/2 HP at 120/240 VAC, SPDT		
	Specific: AC Motor Ratings	120 VAC	208/240 VAC
	AC Full-Load Amperes:	9.8 A	4.9 A
	AC Locked-Rotor Amperes:	58.8 A	29.4 A
	10 Amperes AC Non-Inductive at 24/240 VAC Pilot Duty: 125 VA at 24/240 VAC		
Analog Input	Resolution: 14 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 61 x 61 mm (5 x 2-3/8 x 2-3/8 in.)		
Weight	C450CBN-3: 209 gm (0.46 lb) C450CCN-3: 222 gm (0.49 lb)		
Compliance	North America: cULus Listed; UL 60730, File E27734, Vol. 1; FCC Compliant to CFR47, Part 15, Subpart B, Class B Industry Canada (IC) Compliant to Canadian ICES-003, Class B limits		
	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.		
	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.



Building Efficiency

507 E. Michigan Street, Milwaukee, WI 53202

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System 450™ Series Control Module with RS485 Modbus® Communications

Installation Instructions

C450CRN-1

Part No. 24-7664-2926, Rev. C
Issued April 17, 2014
Supersedes September 19, 2013

Refer to the [QuickLIT website](#) for the most up-to-date version of this document.

Application

IMPORTANT: Use this System 450 Series Control Module with RS485 Modbus Communications only as an operating control. Where failure or malfunction of the System 450 Series 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 Series Control Module.

IMPORTANT: Utiliser ce System 450 Series Control Module uniquement en tant que dispositif de régulation. Lorsqu'une défaillance ou un dysfonctionnement du System 450 Series Control Module risque de provoquer des blessures ou d'endommager l'équipement contrôlé ou un autre équipement, la conception du système de contrôle doit intégrer des dispositifs de protection supplémentaires. Veiller dans ce cas à intégrer de façon permanente d'autres dispositifs, tels que des systèmes de supervision ou d'alarme, ou des dispositifs de sécurité ou de limitation, ayant une fonction d'avertissement ou de protection en cas de défaillance ou de dysfonctionnement du System 450 Series 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.

C450CRN-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 RS485 terminal block that enables you to connect your control system to and communicate on an RS485 Modbus® network. The C450CRN-1 control module is an RS485, RTU compliant Modbus slave device.

Refer to the *System 450™ Series Modular Control Systems with Communications Control Modules Technical Bulletin (LIT-12011826)* for detailed information on designing, installing, setting up, and troubleshooting System 450 Series control systems with network communications. The System 450 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 communications also include the High Input Signal Selection, Differential Control, Output Signal Update Rate, and Output Signal Dead Band features.

Installation

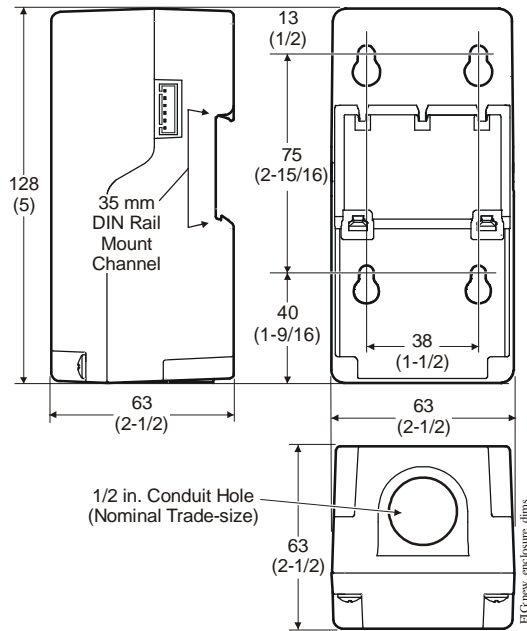


Figure 1: System 450 Module Dimensions, mm (in.)

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 7). 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 heat-generating devices in an enclosure with the modules 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 7).

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 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 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 the Control System

See Figure 2 and Table 1 for electrical termination locations and wiring information. See [Technical Specifications](#) on page 28 for electrical ratings. .



WARNING: Risk of Electric Shock.

Disconnect or isolate all power supplies before making electrical connections. More than one disconnection 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.

AVERTISSEMENT : Risque de décharge électrique.

Débrancher ou isoler toute alimentation avant de réaliser un raccordement électrique. Plusieurs isolations et débranchements sont peut-être nécessaires pour -couper entièrement l'alimentation de l'équipement. Tout contact avec des composants porteurs de tensions dangereuses risque d'entraîner une décharge électrique et de provoquer des blessures graves, voire mortelles.

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.

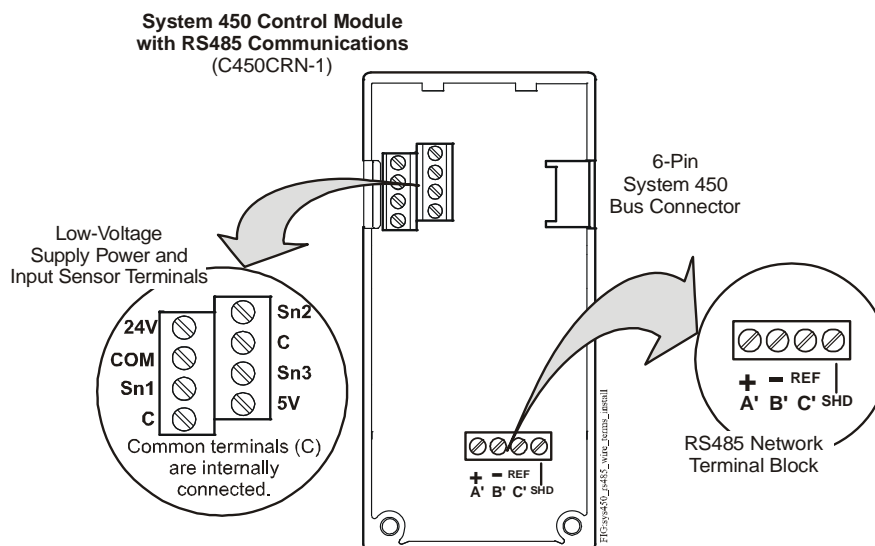


Figure 2: C450CRN-1 Control Module with RS485 Modbus Communications Showing Wiring Terminals

Table 1: System 450 Control Module with RS485 Modbus 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 24VAC 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 used for sensor common connections only. The two C terminals are connected internally.	
	5V	Provides 5 VDC power for active sensors.	
Modbus Network Terminal Block	A' +	RS485 Modbus Communications	0.13 mm ² to 0.34 mm ² (26 AWG to 22 AWG) stranded, 3-wire shielded cable recommended
	B' -		
	C' REF	RS485 Modbus signal Common or Reference	
	SHD	Shield connection terminal Note: SHD is an isolated terminal and is not connected to any internal System 450 circuit. The SHD terminal is used to splice the cable shield drains on an RS485 trunk daisy chain.	

- 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.

Connecting to an RS485 Modbus Network

The System 450 Control Module with Modbus Communications enables you to connect your System 450 control system to a Modbus network.

RS485 Modbus Network Requirements

The System 450 control module with RS485 Modbus communications implements the 2-wire Modbus Remote Terminal Unit (RTU) transmission mode.

Table 2 lists the general requirements and limits for a System 450 control system on a 2-wire RS485 Modbus communications networks.

Refer to the *System 450 Series Modular Control Systems with Network Communications Technical Bulletin (LIT-12011826)* for detailed information on and procedures for connecting a System 450 control system to a Modbus network.

For general information regarding RS485 Modbus networks, refer to the *Modbus Serial Line Planning and Installation Guide* published by Schneider Electric (www.schneider-electric.com).

Table 2: RS485 Modbus Network Requirements for System 450 Control Systems

System 450 Control Module on RS485 Modbus Parameter	Requirements and Limits	Additional Information, Guidelines, and Issues
Modbus Transmission Mode	2-wire Modbus Remote Terminal Unit (RTU)	Refer to the <i>Modbus Serial Line Planning and Installation Guide</i> published by Schneider Electric (www.schneider-electric.com).
Maximum Number of Devices or Nodes per Bus Trunk	Maximum of 32 devices without a repeater	
Topology	3-wire (plus shield) connected in a daisy-chain trunk for RS485 2-wire systems.	
Communications Wire Size	26 AWG to 22 AWG stranded recommended	
Cable Type	3-wire stranded (with one twisted pair), shielded cable recommended	Twisted pair for A (+) and B (-) communications leads
Device Connection	4-wire Terminal Block: A' (+), B' (-), and C' (REF); plus an isolated terminal (SHD) for connecting cable shield drains along the daisy-chain trunk.	System 450 control module with Modbus communications has a 4-wire terminal block (Figure 7).
Total Bus Length	1,000 m (3,280 ft) maximum using 24 AWG, stranded 3-wire (with one twisted pair), shielded cable	
Bus EOL Termination	End-of-Line (EOL) termination is required on both ends of the Modbus trunk daisy chain.	Communications Module has integral EOL switch. Set switch according to module's location on the Modbus trunk.
Grounding	Splice all cable shield drains along the daisy-chain trunk, and connect the spliced cable shield to earth ground at only one point, the trunk's master control.	SHD terminal on System 450 module's RS485 terminal is isolated and not grounded, and can be used to splice cable shield drains.
Baud Rates	9600, 19,200, and 38,400 baud capability	Default Baud Rate is 19,200.
Parity	Even, Odd, and No Parity	Default Parity is Even.
Stop Bits	1 or 2	Default Stop Bits values is 1.
Device Address	Range of Addresses 1 to 247	Default Address is 50.

Wiring an RS485 Modbus Network

RS485 Modbus Terminal Block

The RS-485 Modbus network terminal block is a green, 4-wire terminal block mounted on the PCB under the control module cover (Figure 7).

Connect the RS485 network terminal block on the System 450 control module to the other RS485 Modbus devices in a daisy-chain configuration using 3-wire twisted, shielded cable as shown in Figure 3.

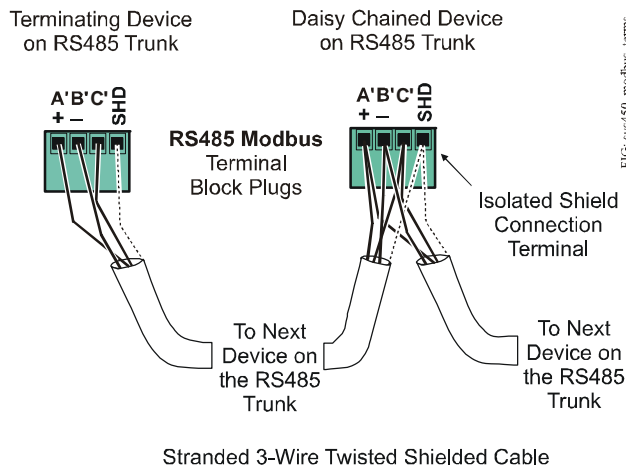


Figure 3: Modbus Terminal Block Wiring Detail

The cable shield drain terminal (SHD) on the RS485 network terminal block is isolated and is used to splice the cable shields along the daisy-chain bus.

Note: The cable shield drains should be spliced and isolated at all of the slave devices on the network trunk. The cable shield should be connected to ground at only one point along the daisy chain.

Setting the System 450 EOL Switch

Each device (master or slave) connected to the end of an RS485 daisy-chain trunk must be set up as a network trunk terminating device (Figure 4). The System 450 control module with RS485 communications has an integral End-of-Line (EOL) switch, which when set to On, sets the control module as a terminating device on the trunk. See Figure 7 for the EOL switch location on the control module. The default EOL switch position is factory set to Off.

To set the EOL switch to the correct position on the Modbus communications control module:

1. Determine the physical location of the System 450 control module RS485 connection on the network trunk. If the control module terminates the trunk, it must be set as a terminating device on the trunk (Figure 4).

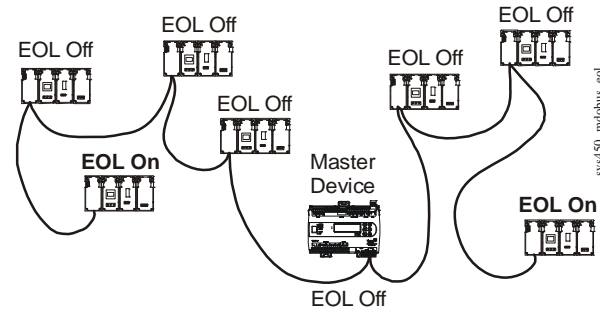


Figure 4: EOL Switch Settings on an Example Modbus Network Trunk

2. If the System 450 control module is a terminating device on the Modbus trunk, position the EOL switch to On (up). If the field controller is not a terminating device on the trunk, position the EOL switch to Off (down) as shown in Figure 5.

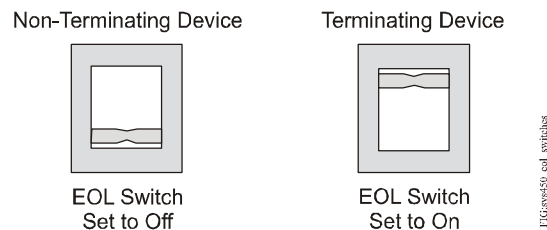


Figure 5: EOL Switch Positions for Terminating and Non-Terminating Devices

Figure 6 shows the internal EOL circuit on the System 450 control module with Modbus communications that is connected to the end of the Modbus network trunk when the System 450 EOL switch is set to the On position.

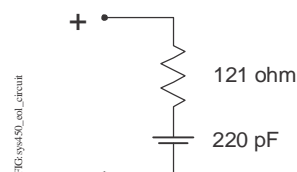


Figure 6: System 450 Internal EOL Circuit That Is Applied to Network When EOL is On

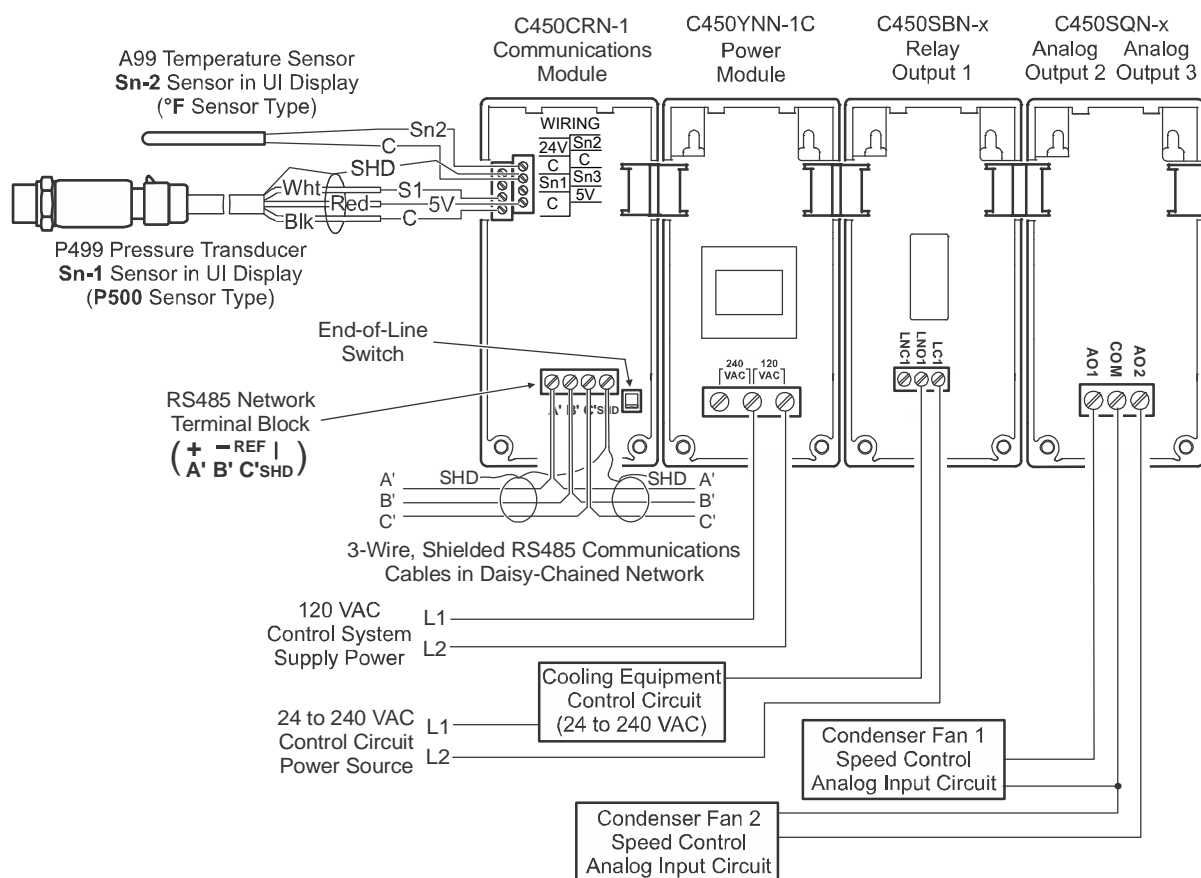


Figure 7: Example System 450 Control System with an RS485 Modbus Communications Module Controlling a Cooling System with Condenser Fan Speed Control

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 7 shows an example System 450 control system module assembly, with two sensors and three outputs, connected to an RS485 communications 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-1 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.

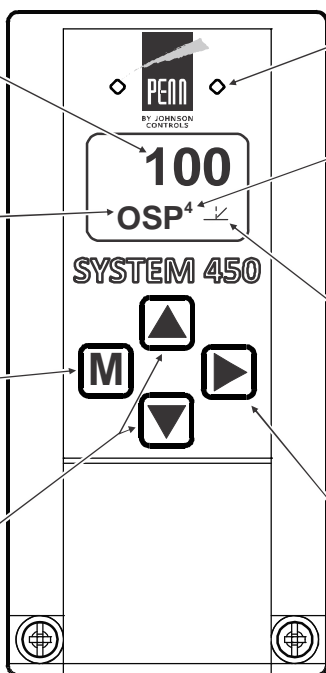
Note: After you power on your module assembly, you can set up your control system in the control module UI before wiring the sensors or outputs to your assembly.

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 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 communications performance between the module (slave) and the Modbus master device.

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

Setting Up the Control System in the UI

System 450 control modules have a backlit LCD and a four-button touch pad UI (Figure 8) that enable you to set up your control system.

To set up a control system using 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 7.

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 8.)

2. Access the System 450 setup screens in the UI. See [Accessing the System 450 Setup Start Screens](#) on page 9.
3. Set up the control system inputs in the UI. See [Setting Up System 450 Sensors](#) on page 11.
4. Set up the control system outputs in the UI. See [Setting Up System 450 Outputs](#) on page 14.

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 3 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 3 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 3 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](#) on page 13 and [Differential Control](#) on page 14 for more information.

Accessing the System 450 Setup Start Screens

Access the System 450 Setup Start screens from the Main screen. See Table 3 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 10.

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

Table 3: System 450 Startup Screen, Main Screens, Status Screens, and Setup Start Screens Information and Procedures (Part 1 of 2)


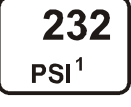
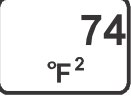






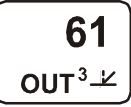


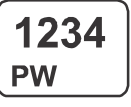






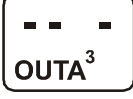





LCD Screen	Name, Description or Function, User Action, and Example
	Startup Screen: When you power a System 450 control module, the LCD displays the control module's current firmware version for approximately 5 seconds before it displays the Main (Input Status) screen. The screen example shows System 450 firmware version number 2.00 on the top of the screen. The number on the bottom (indicated in this example with xxxx) identifies the Johnson Controls firmware.
   	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 10 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 pass word 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 screens and the rest of the System 450 setup screens. See Setting Up Password Protection on page 24 for more information. 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 .
 	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, signal strength, and control ramp icon. 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.
	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 24 for more information on System 450 password protection.

Table 3: 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
	<p>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.</p> <p>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 <i>Setting Up the Control System in the UI</i> on page 8 for more information.</p>
	<p>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.</p>
	<p>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.</p>
	<p>The screen examples show the Sensor, Relay Output 1, Analog Output 3, Communications, User Password, and Administrator Password Setup Start screens.</p>
	
	

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

Table 4: System 450 Sensor Types, Setup Values, and Sensor or Transducer Product Codes

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	0.010	DPT2650-R25B-AB
P 0.5	INWC (Pressure/in. W.C.)	0 to 0.5	0.025 to 0.5	0.005	0.010	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
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	N/A	N/A	N/A	N/A	Dry Contacts

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 7 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 13 for information on setting up System 450 outputs that reference the P110 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 13 for more information.

Table 5 provides sensor setup information, procedures, and example screens. Figure 10 on page 27 provides a System 450 UI setup example.

Table 5: System 450 Sensor Setup Screen Information and Procedures (Part 1 of 2)




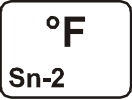
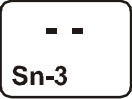


















LCD Screen	Name, Description or Function, User Action, and Example
	<p>Sensor Setup Start Screen: The Sensor Setup Start screen is the first screen displayed when you access the System 450 setup screens. From the Sensor Setup Start screen you can navigate to the Output Setup Start screens or the Sensor Setup screens. See Figure 10.</p> <p>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.</p> <p>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.</p> <p>The screen example shows the Sensors Setup Start screen with flashing dashes.</p>
  	<p>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 4 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.</p> <p>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.</p> <p>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.</p> <p>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.</p> <p>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.</p> <p>4. In the Sn-3 Sensor Type Selection screen, press  or  to select the desired Sensor Type. Press  to save your selection and either:</p> <ul style="list-style-type: none"> • 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. <p>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 13 and Differential Control on page 14 for more information.</p> <p>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.</p>
	<p>Temperature Offset Selection Screens: Select a temperature offset for the temperature inputs (only) in your control system.</p> <p>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.</p> <p>Note: The temperature offset changes the displayed temperature value by the selected offset value.</p> <p>5. Press  or  to select the desired temperature offset value. Press .</p> <ul style="list-style-type: none"> • 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. <p>The screen example shows an OFFS value of -3 (°F) for Sensor 2. Therefore a sensed temperature value of 75 (°F) at Sensor 2 appears as 72 (°F).</p>

Table 5: System 450 Sensor Setup Screen Information and Procedures (Part 2 of 2)

LCD Screen	Name, Description or Function, User Action, and Example
	<p>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.</p> <p>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.</p> <p>After the sensors are set up for your control system, you can:</p> <ul style="list-style-type: none"> 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. <p>The screen example shows Sensors Setup Start screen with flashing dashes.</p>

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 PSI values as positive InHg values 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 6 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 6: 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 to 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.

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.

Note: Binary Inputs cannot be set up for High Input-Signal Selection.

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; $(\text{Sn-d}) = (\text{Sn-1}) - (\text{Sn-2})$.

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 4 on page 11 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 7 for a list of Sensor Types that can be set up as a differential sensor (Sn-d) and the Range of Usable Values when an output references sensors set up as Sn-d.

Table 7: 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
P 0.25	-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 11 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 8 for setup information and procedures.
5. To set up Analog Outputs, see [Setting Up an Analog Output](#) and Table 10 for setup information and procedures.

Setting Up a Relay Output

Table 8 provides information, procedures, guidelines, and screen examples for setting up relay outputs on System 450 control modules with communications. See Figure 10 on page 27 for example menu flow of the Relay Output 1 set up in Table 8.

Note: The differential sensor, Sn-d, is used to set up analog and relay outputs for Differential Control. See *Differential Control* on page 14 for more information.

Table 8: System 450 Setup Screen Information and Procedures for Relay Outputs (Part 1 of 4)




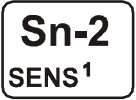






LCD Screen	Name, Description or Function, User Action, Example
	<p>Relay Output Setup Start Screen: The output numbers and the output type (relay or analog) are determined by the module types and configuration of your control system's module assembly and are automatically assigned when you connect power to the module assembly. (See <i>Setting Up the Control System in the UI</i> on page 8.)</p> <p>Note: You must set up the control system input sensors before you can set up the outputs.</p> <p>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.</p>
    	<p>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.</p> <p>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 <i>Setting Up System 450 Sensors</i>.)</p> <p>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.</p> <p>2. Press  or  to select the sensor that this output references:</p> <ul style="list-style-type: none"> • 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 bin. <p>Then, press  to save your sensor selection and go to the Standard Relay ON Selection screen or the Relay dON Selection.</p> <p>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.</p>

Table 8: System 450 Setup Screen Information and Procedures for Relay Outputs (Part 2 of 4)













LCD Screen	Name, Description or Function, User Action, Example
<div> <div>78</div> <div>ON¹</div> </div> <div>OR</div> <div> <div>30.0</div> <div>dON¹</div> </div>	<p><i>When a Relay Output references Sn-1, Sn-2, Sn-3, HI-2, or HI-3, the Standard Relay ON Selection screen appears.</i></p> <p>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.</p> <p>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.</p> <p>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.</p> <p>The screen example shows an ON value of 78 (°F) selected for Relay Output 1.</p> <hr/> <p><i>When a Relay Output References Sn-d, the Differential Relay dON Selection screen appears.</i></p> <p>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.</p> <p>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 4 and Table 7 for more information.)</p> <p>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.</p> <p>The screen example shows a dON value of 30 (psi) selected for Relay Output 1.</p> <hr/> <p><i>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.</i></p> <p>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.</p>
<div> <div>75</div> <div>OFF¹</div> </div> <div>OR</div> <div> <div>32.0</div> <div>dOFF¹</div> </div>	<p><i>When a Relay Output references Sn-1, Sn-2, Sn-3, HI-2, or HI-3, the Standard Relay OFF Selection screen appears.</i></p> <p>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.</p> <p>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.</p> <p>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.</p> <p>The screen example shows an OFF value of 75 (°F) selected for Relay Output 1.</p> <hr/> <p><i>When a Relay Output references Sn-d, the Differential Relay dOFF Selection screen appears.</i></p> <p>Differential Relay dOFF Selection Screen: Select the dOFF value at which the relay turns Off. 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.</p> <p>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 4 and Table 7 for more information.)</p> <p>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.</p> <p>The screen example shows a dOFF value of 32 (psi) selected for Relay Output 1.</p> <hr/> <p><i>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.</i></p> <p>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.</p>

Table 8: System 450 Setup Screen Information and Procedures for Relay Outputs (Part 3 of 4)





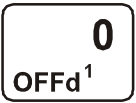






















LCD Screen	Name, Description or Function, User Action, Example
	<p>Relay-On Delay Time Selection Screen: Select the value (in seconds) that you want output relay to delay turning ON after the condition reaches and maintains the Relay On value. The Relay-On Delay time range is 0 to 300 seconds.</p> <p>Note: 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.</p> <p>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-Off Delay Time Selection Screen.</p> <p>The screen example shows an ONd value of 30 (seconds) selected for Output 1.</p>
	<p>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.</p> <p>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.</p> <p>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 Minimum Relay ON Time Selection Screen.</p> <p>The screen example shows an OFFd value of 0 (seconds) selected for Output 1.</p>
	<p>Minimum Relay ON Time Selection Screen: Select the minimum time that the output relay is required to stay On after it turns On. Minimum ON Time range is 0 to 300 seconds.</p> <p>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.</p> <p>The screen example shows an ONT value of 0 (seconds) selected for Output 1.</p>
	<p>Minimum Relay OFF Time Selection Screen: Minimum OFF Time range is 0 to 300 seconds.</p> <p>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.</p> <p>The screen example shows an OFFT value of 120 (seconds) selected for Output 1.</p>
	<p>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:</p> <ul style="list-style-type: none"> • ON = Output relay remains On during sensor failure. • OFF = Output relay remains Off during sensor failure. <p>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.</p> <p>The screen example shows OFF selected as the Sensor Failure mode for Output 1.</p>

Table 8: System 450 Setup Screen Information and Procedures for Relay Outputs (Part 4 of 4)

LCD Screen	Name, Description or Function, User Action, Example
<div style="border: 1px solid black; padding: 5px; width: fit-content;"> Sn-2 SENS¹ </div>	<p>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.</p> <p>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.</p> <p>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.</p> <p>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.</p> <p>This Relay Output is now set up in the System 450 UI. The screen example shows Sn-2 is selected Sensor for Output 1.</p>
<div style="border: 1px solid black; padding: 5px; width: fit-content;"> - - - OUTR¹ </div>	<p>Relay Output Setup Start Screen</p> <p>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.</p> <p>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.</p> <p>The screen example shows a Relay Output Setup Start screen for Output 1.</p>

Setting Up an Analog Output

Analog outputs provide an analog signal to control equipment in your 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 14 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 9 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).

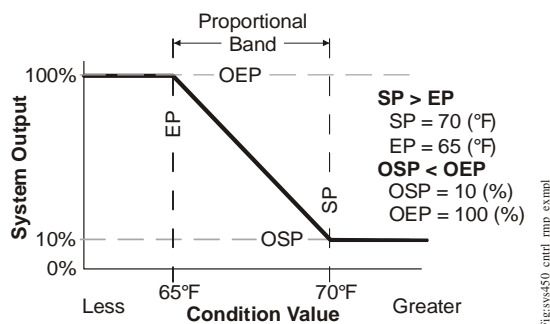

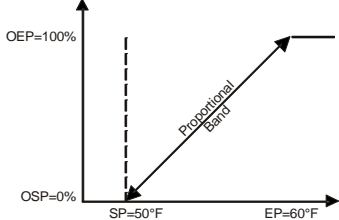
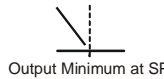
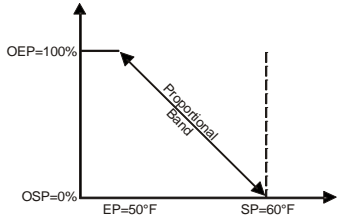
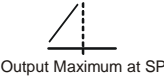
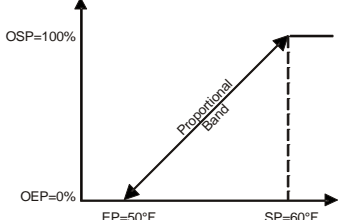
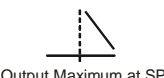
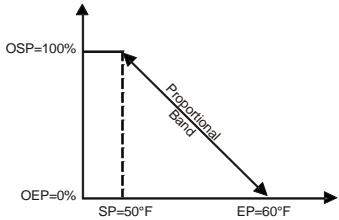


Figure 9: Control Ramp Example for a Typical Heating Application (SP > EP and OSP < OEP)

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

Table 9: 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
 <p>Output Minimum at SP</p>		<p>$SP < EP$</p> <p>$OSP < OEP$</p>
 <p>Output Minimum at SP</p>		<p>$SP > EP$</p> <p>$OSP < OEP$</p>
 <p>Output Maximum at SP</p>		<p>$SP > EP$</p> <p>$OSP > OEP$</p>
 <p>Output Maximum at SP</p>		<p>$SP < EP$</p> <p>$OSP > OEP$</p>

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 Control Systems with Network Communications Technical Bulletin (LIT-12011826)* for detailed information on the Integration Constant, Update Rate, and Output Deadband features.

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

See Figure 10 on page 27 for example menu flow of the Analog Output 3 set up in Table 10.

Table 10: System 450 Setup Screen Information and Procedures for Analog Output (Part 1 of 4)



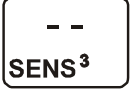
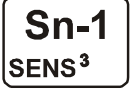
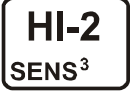




LCD Screen	Name, Description or Function, User Action, Example
	<p>Analog Output Setup Start Screen: The output numbers and the output type (relay or analog) are determined by the module types and configuration of your control system's module assembly and are automatically assigned when you connect power to the module assembly. (See <i>Setting Up the Control System in the UI</i> on page 8.)</p> <p>Note: You must set up the system's sensors before you can set up the outputs.</p> <p>1. Press  to go to this output's Sensor Selection screen.</p> <p>The screen example shows the Analog Output Setup Start screen for Output 3.</p>
   	<p>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.</p> <p>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 <i>Setting Up System 450 Sensors</i>.)</p> <p>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.</p> <p>2. Press  or  to select the sensor that this output references:</p> <ul style="list-style-type: none"> • 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. <p>Then press  to save your sensor selection and go to the Setpoint Selection screen.</p> <p>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.</p>

Table 10: System 450 Setup Screen Information and Procedures for Analog Output (Part 2 of 4)
















LCD Screen	Name, Description or Function, User Action, Example
<div> <div>225</div> <div>SP³</div> </div> <p>Or</p> <div> <div>30.0</div> <div>dSP³</div> </div>	<p>When an Analog Output references Sn-1, Sn-2, Sn-3, HI-2, or HI-3, the Standard Setpoint Selection screen appears.</p> <p>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.</p> <p>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.</p> <p>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.</p> <p>The screen example shows a Setpoint value of 225 (psi) selected for Output 3.</p> <hr/> <p>When an Analog Output references Sn-d, the Differential Setpoint Selection screen appears.</p> <p>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.</p> <p>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 4 and Table 7 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.</p> <p>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.</p> <p>The screen example shows a dSP value of 30 (psi) selected for Output 3.</p>
<div> <div>250</div> <div>EP³</div> </div> <p>Or</p> <div> <div>25.0</div> <div>dEP³</div> </div>	<p>When the Output references Sn-1, Sn-2, Sn-3, HI-2, or HI-3, the Standard End Point Selection screen appears.</p> <p>End Point Selection Screen: End Point is the (condition) value that the controlled system drives away from (towards Setpoint) and, along with Setpoint, defines this output's proportional band.</p> <p>Note: An output's proportional band (between Setpoint and End Point) is automatically enforced in the output's Setpoint and End Point Selection screens.</p> <p>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.</p> <p>The screen example shows an End Point value of 250 (psi) selected for Output 3.</p> <hr/> <p>When the Output references Sn-d, the Differential End Point Selection screen appears.</p> <p>Differential End Point Selection Screen: Differential End Point (dEP) is the target value that the controlled system drives towards 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.</p> <p>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 4 and Table 7 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.</p> <p>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.</p> <p>The screen example shows a dEP value of 25 (psi) selected for Output 3.</p>
<div> <div>10</div> <div>OSP³</div> </div>	<p>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 (%).</p> <p>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.</p> <p>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 225 (psi).</p>

Table 10: System 450 Setup Screen Information and Procedures for Analog Output (Part 3 of 4)





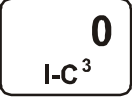







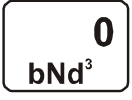
















LCD Screen	Name, Description or Function, User Action, Example
	<p>Output Signal Strength at End Point Selection Screen: Select the strength of the signal that this output generates when the sensed condition is at the End Point value. The signal strength range is 0 to 100 (%).</p> <p>6. Press  or  to select this output's %Output Signal Strength at End Point value. Press  to save your selection and go to the Integration Constant Selection screen.</p> <p>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).</p>
	<p>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.</p> <p>Note: Initially, you should select the default I-C value of 0 (zero) for no integration constant. Refer to the <i>System 450 Series Modular Controls Technical Bulletin (LIT-12011459)</i> for more information on proportional plus integral control and setting an integration constant in the System 450 UI.</p> <p>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.</p> <p>The screen example shows an I-C value of 0 (zero) selected for Output 3.</p>
	<p>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).</p> <p>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.</p> <p>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.</p> <p>The screen example shows an Output Update Rate value of 1 (second), which is the default update rate and the fastest update rate you can select.</p>
	<p>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 at the rate selected in the Output Signal Update Rate Selection screen.</p> <p>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 total OSP to OEP range.</p> <p>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.</p> <p>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.</p> <p>The screen example shows an Output Dead Band value of 0 (%), which is the default value and disables the Output Dead Band feature.</p>
	<p>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:</p> <ul style="list-style-type: none"> • ON = Output generates the selected OEP signal strength during sensor failure. • OFF = Output generates the selected OSP signal strength during sensor failure. <p>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.</p> <p>The screen example shows OFF selected as the Sensor Failure mode for Output 3.</p>

Table 10: System 450 Setup Screen Information and Procedures for Analog Output (Part 4 of 4)

LCD Screen	Name, Description or Function, User Action, Example
	<p>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.</p> <p>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.</p> <p>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.</p> <p>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.</p> <p>The screen example shows Sn-1 as the selected Sensor for Output 3.</p>
	<p>Analog Output Setup Start Screen</p> <p>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.</p> <p>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.</p> <p>The screen example shows the Analog Output Setup Start screen for Output 3.</p>

Setting Up Modbus Communications

Table 11 provides procedures, examples, and general information for setting up a System 450 control module with communications on a Modbus network.

Table 11: System 450 RS485 Modbus Network Setup Screen Information and Procedures (Part 1 of 2)







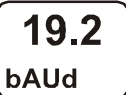







LCD Screen	Name, Description or Function, User Action, and Example
	<p>Communications Setup Start Screen: From the Communications Setup Start screen, you can access the communications setup screens and enable the control module to communicate on the RS485 Modbus network.</p> <p>1. In the Communications Setup Start screen, press  to go to the Device Address Setup screen.</p> <p>The screen example shows the Communications Setup Start screen.</p>
	<p>Device Address Setup Screen: Each device connected to a Modbus network (including System 450 control modules with communications) requires a unique device address on the network. The range of available Modbus device addresses is 1 to 247.</p> <p>2. Press  or  to select the unique device address value for your System 450 control system on the Modbus network. Press  to save your selection and go to the next setup screen.</p> <p>The screen example shows the Device Address Setup screen with 50 selected as the device address.</p>
	<p>Communications Baud Rate Setup Screen: The available baud rate values are 9600 = 9600 baud, 19.2 = 19,200 baud, and 38.4 = 38,400 baud.</p> <p>3. Press  or  to select the baud rate value that matches the baud rate of the Modbus network that your System 450 control module is connected to. Press  to save the baud rate selection and go to the next screen.</p> <p>This screen example shows the Baud Rate Setup screen with 19.2 (19,200 baud) selected.</p>
	<p>Data Parity Setup Screen: Modbus network use a parity check to confirm the integrity of received data packets. Set the data parity on your System 450 control module to match the data parity check used on Modbus network that the control module is connected to. The following parity values are available: 0 = No Parity, 1 = Odd, and 2 = Even.</p> <p>4. Press  or  to select the parity setting value that matches the parity of the Modbus network that your System 450 control module is connected to. Press  to save the parity value selection and go to the next screen.</p> <p>This screen example shows the Data Parity Setup screen with 0 (No Parity) selected.</p>

Table 11: System 450 RS485 Modbus Network Setup Screen Information and Procedures (Part 2 of 2)

LCD Screen	Name, Description or Function, User Action, and Example
	<p>Stop Bits Setup Screen: Modbus communications require that each data packet include at least one stop bit.</p> <p>5. Press or to select the Stop Bit value that matches the Modbus network that your System 450 control module is connected to. Press to save the stop bits value selection and go to the Communications Setup Start screen.</p> <p>Note: If you selected 0 (No Parity) in the Data Parity Setup screen, you can select either 1 or 2 stop bits. If you selected either 1 (Odd parity) or 2 (Even parity) in the Data Parity Setup screen, the Stop Bit Setup screen displays 1 (Stop Bit), and this value cannot be edited.</p> <p>This screen example shows the Stop Bits Setup screen with 1 stop bit selected.</p>

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 in the System 450 UI – a User level password and an Administrator (Admin) level password. Both 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 10).

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 12) and the Administrator Password Setup screens (Table 13). 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 previous digit. You must navigate to the Change Password Start screen and re-enter the entire four-digit password with the correct digits.

Note: If you change the Admin password, be sure to make a record of the new Admin 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 Admin or User password you cannot access the System Setup screens.

Table 12 provides information and procedures for changing the System 450 User password.

Table 12: System 450 User Password Setup Screen Information and Procedures



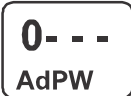
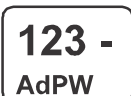






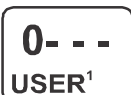








LCD Screen	Name, Description or Function, User Action, and Example
	<p>User Password Setup Start Screen: From the User Password Setup Start screen, you can access the User password setup screens and change the User password.</p> <p>1. In the User Password Setup Start screen, press  to go to the User Password Setup Access screen.</p> <p>The screen example shows the User Password Setup Start screen.</p>
 	<p>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.</p> <p>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.</p> <ul style="list-style-type: none"> 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. <p>The top screen example shows the initial view of the Admin Password Setup Access screen. The bottom screen shows the screen with the first three digits of the default Admin password value entered.</p>
 	<p>Change User Password Screen: Allows you to change the User password.</p> <p>Note: The factory set default User Password is 0000. When the User password is set to 0000, the System 450 password feature is disabled, and the password challenge screen does not appear when you access the System Setup screens.</p> <p>Note: After you change the 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 10 on page 27 for an example of the password challenge screen in the UI menu flow.</p> <p>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.</p> <p>The top screen example shows the Change User Password screen.</p>

Table 13 provides information and procedures for changing the System 450 Administrator (Admin) password.

Table 13: System 450 Administrator Password Setup Screen Information and Procedures (Part 1 of 2)
























LCD Screen	Name, Description or Function, User Action, and Example
	<p>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.</p> <p>1. In the Admin Password Setup Start screen, press  to go to the Admin Password Setup Access screen.</p> <p>The screen example shows the Communications Setup Start screen.</p>

Table 13: System 450 Administrator Password Setup Screen Information and Procedures (Part 2 of 2)


LCD Screen	Name, Description or Function, User Action, and Example
<div> 0 - - - AdPW </div> <div> 123- AdPW </div>	<p>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.</p> <p>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.</p> <ul style="list-style-type: none"> • 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 four digits for the Admin password. <p>The top screen example shows the initial view of the Admin Password Setup Access screen. The bottom screen shows the screen with the first three digits of the default Admin password value entered.</p>
<div> 987- AdMN¹ </div>	<p>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 the superscript (AdMN¹).</p> <p>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.</p> <p>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.</p> <p>Note: Pressing  to save the fourth digit advances the display to the Confirm New Admin Password screen.</p> <p>This screen example shows the first three digits of a new Admin password value entered in the Change Admin Password screen.</p>
<div> 987- AdMN² </div>	<p>Confirm New Admin Password Screen: Confirms the new Admin password enter in the previous (Change Admin Password) screen. The Confirm Admin Password screen is identified by a 2 in the superscript (AdMN²).</p> <p>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</p> <p>Note: Pressing  to save the fourth digit initiates confirmation of the new Admin password</p> <p>This screen example shows the first three digits of a new Admin password value entered in the Confirm New Admin Password screen.</p>
<div> - - - - OK </div> <div> - - - - FAIL </div>	<p>Validate Admin Password Change Screen: Validates that the Admin Password was successfully changed (OK).</p> <p>After an approximately 5 second delay, the Admin Password Setup Start screen appears.</p> <p>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.</p> <p>The top screen example shows the Admin password change is successful (OK). The bottom screen example shows the Admin password change failed (FAIL).</p>



System 450™ Series Control Module with RS485 Modbus® Communications Installation Instructions

Technical Specifications

C450CRN-1C Control Module with RS485 Modbus Communications

Product	C450CRN-1C: System 450 control modules are sensing controls and operating controls with LCD and four-button touchpad UI and no outputs. This control module is an RS485, RTU compliant Modbus slave device.
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 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	C450CRN-1C: 207 g (0.46 lb)
Compliance	<div style="display: flex; align-items: center;">  <div> <p>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</p> <p>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.</p> <p>Australia: Mark: C-Tick Compliant (N1813)</p> </div> </div>

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.



Building Efficiency

507 E. Michigan Street, Milwaukee, WI 53202

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System 450™ Series Expansion Modules with Analog Outputs

Installation Instructions

C450SPN-1

C450SQN-1

Part No. 24-7664-2799, Rev. C

Issued April 17, 2014

Supersedes January 17, 2013

Refer to the [QuickLIT website](http://www.quicklit.com) for the most up-to-date version of this document.

Application

System 450™ is a family of electronic control, expansion, and power modules that are easily assembled and set up to provide reliable digital temperature; pressuring humidity control for a wide variety of Heating, Ventilation, Air Conditioning, Refrigeration (HVACR); and commercial/industrial process applications.

C450SxN-1 models are expansion modules with analog outputs: C450SPN-1 model provides one self-selecting (0 to 10 VDC or 4 to 20 mA) analog output, and the C450SQN-1 model provides two self-selecting analog outputs.

IMPORTANT: Use this System 450 Series Expansion Module with Analog Output only as an operating control. Where failure or malfunction of the System 450 expansion 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 expansion module.

IMPORTANT: Utiliser ce System 450 Series Expansion Module with Analog Output uniquement en tant que dispositif de régulation. Lorsqu'une défaillance ou un dysfonctionnement du System 450 expansion module risque de provoquer des blessures ou d'endommager l'équipement contrôlé ou un autre équipement, la conception du système de contrôle doit intégrer des dispositifs de protection supplémentaires. Veiller dans ce cas à intégrer de façon permanente d'autres dispositifs, tels que des systèmes de supervision ou d'alarme, ou des dispositifs de sécurité ou de limitation, ayant une fonction d'avertissement ou de protection en cas de défaillance ou de dysfonctionnement du System 450 expansion module.

Mounting

Location Considerations

Observe the following System 450 location guidelines:

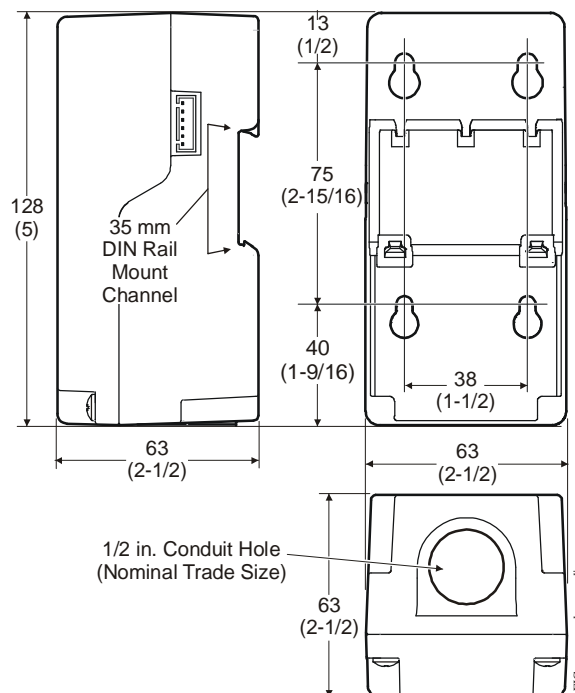


Figure 1: System 450 Module Dimensions, mm (in.)

- Ensure that the mounting surface can support the module assembly, mounting hardware, and any (user-supplied) panel or enclosure.
- Mount the modules horizontal, in an upright orientation wherever possible. DIN rail mount is recommended.
- Mount modules on flat, even surfaces.
- Mount the modules in locations free of corrosive vapors and observe the operating conditions in the Technical Specifications.
- Allow sufficient space for wires and connections.
- 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 heat-generating devices in an enclosure with the modules that may cause the temperature to exceed the ambient operating conditions.

Installation

Mount System 450 modules on 35 mm DIN rail (recommended) or directly to an even wall surface. To mount the 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 appropriate mounting hardware/fasteners.
2. Clip the control module on the rail, position the upper DIN rail clips on the top rail, and gently snap the lower clips on to the rail.
3. Clip the remaining modules to the right of the control module on to the DIN rail and plug together.

To direct mount modules to wall surfaces:

1. Plug the modules together, remove the module covers, place the assembly against wall surface horizontally in a suitable location, and mark the mount hole locations on the surface.
2. Install appropriate screw fasteners, leaving screw heads approximately one to two turns away from flush to the surface.
3. Place the assembly over screw heads and on the mounting slots, and carefully tighten mount screws.

Note: If you mount the modules on an uneven surface, do not damage the housings when tightening mounting screws. Use shims/washers to mount module assembly evenly on the surface.

Wiring

See Figure 2 and Table 1 for electrical termination locations, and wiring information. See the [Technical Specifications](#) table for electrical ratings.



WARNING: Risk of Electric Shock.

Disconnect or isolate all power supplies before making electrical connections. More than one disconnection 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.

AVERTISSEMENT : Risque de décharge électrique.

Débrancher ou isoler toute alimentation avant de réaliser un raccordement électrique. Plusieurs isolations et débranchements sont peut-être nécessaires pour -couper entièrement l'alimentation de l'équipement. Tout contact avec des composants porteurs de tensions dangereuses risque d'entraîner une décharge électrique et de provoquer des blessures graves, voire mortelles.

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

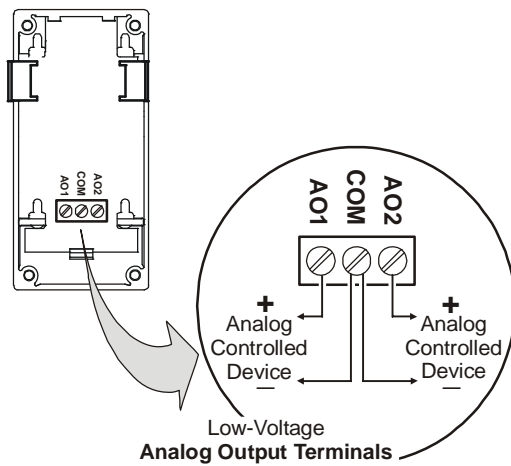
IMPORTANT: Do not exceed the System 450 module electrical ratings. Exceeding module electrical ratings can result in permanent damage to the modules and void any warranty.

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.

**System 450
Expansion Module
with Analog Outputs
(C450SQN-1)**



Note: C450SPN-1 Analog Expansion Modules have one analog output.

Figure 2: C450SQN-1 Wiring Terminals


Table 1: System 450 Terminal Wiring Information

Label	Terminal Function	Wire Sizes
AO1, AO2	Provides a self-detecting analog output signal in conjunction with the COM terminal; either 0 to 10 VDC or 4 to 20 mA.	28 AWG to 16 AWG (0.08 mm ² to 1.5 mm ²)
COM	Provides a self-detecting analog output signal in conjunction with the AO1 or AO2 terminal; either 0 to 10 VDC or 4 to 20 mA.	

FIG2system450_analog_expansion_wiring

Technical Specifications

C450SxN-1

Product	C450SPN-1: System 450 Expansion Module with One Analog Output C450SQN-1: System 450 Expansion Module with Two Analog Outputs
Supply Power	C450-YN-1 Power Supply Module or 24 (20-30) VAC Safety Extra-Low Voltage (SELV) (Europe), Class 2 (North America) 50/60 Hz, 10 VA minimum
Ambient Operating Conditions	Temperature: -40 to 66°C (-40 to 150°F) when using 0-10 VDC outputs; -40 to 40°C (-40 to 104°F) when using 4-20 mA outputs 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 Non-condensing; Maximum Dew Point 29°C (85°F)
Analog Output	Voltage Mode (0–10 VDC) 10 VDC Maximum Output Voltage 10 mA Maximum Output Current Requires an external load of 1,000 ohm or more Note: The AO operates in Voltage Mode when connected to devices with impedances greater than 1,000 ohm. Devices that drop below 1,000 ohm may not operate as intended for Voltage Mode applications.
	Current Mode (4–20 mA) Requires an external load between 0 to 300 ohm Note: The AO operates in Current Mode when connected to devices with impedances less than 300 ohm. Devices that exceed 300 ohm may not operate as intended for Current Mode applications.
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 61 x 61 mm (5 x 2-3/8 x 2-3/8 in.)
Weight	C450SPN-1: 150 g (0.33 lb) C450SQN-1: 150 g (0.33 lb)
Compliance 	North America: cULus Listed; UL 60730, File E27734, Vol. 1; FCC Compliant to CFR47, Part 15, Subpart B, Class B Industry Canada (IC) Compliant to Canadian ICES-003, Class B limits
	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.
	Australia: C-Tick Mark (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.



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System 450™ Series Expansion Modules with Relay Outputs Installation Instructions

C450SBN-3
C450SCN-3

Part No. 24-7664-2861, Rev. B
Release April 17, 2014
Supersedes January 17, 2013

Refer to the [QuickLIT website](http://www.quicklit.com) for the most up-to-date version of this document.

Application

IMPORTANT: Use this System 450 Series Expansion Module with Relay Output only as an operating control. Where failure or malfunction of the System 450™ Series 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™ Series Control Module.

IMPORTANT: Utiliser ce System 450 Series Expansion Module with Relay Output uniquement en tant que dispositif de régulation. Lorsqu'une défaillance ou un dysfonctionnement du System 450 expansion module risque de provoquer des blessures ou d'endommager l'équipement contrôlé ou un autre équipement, la conception du système de contrôle doit intégrer des dispositifs de protection supplémentaires. Veiller dans ce cas à intégrer de façon permanente d'autres dispositifs, tels que des systèmes de supervision ou d'alarme, ou des dispositifs de sécurité ou de limitation, ayant une fonction d'avertissement ou de protection en cas de défaillance ou de dysfonctionnement du System 450 expansion module.

System 450 is a family of electronic control, expansion, and power modules that are easily assembled and set up to provide reliable digital temperature, pressure, and humidity control for a wide variety of Heating, Ventilation, Air Conditioning, Refrigeration (HVACR), and commercial/industrial process applications.

C450SxN-3 models are Single-Pole, Double-Throw (SPDT) relay expansion modules: C450SBN-3 models provide one SPDT relay, C450SCN-3 models provide two SPDT relays.

Installation

Location Considerations

Observe the following System 450 location guidelines:

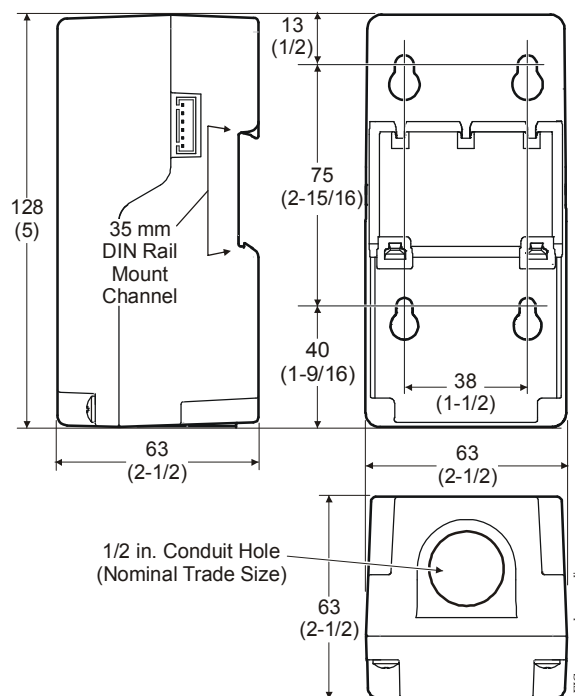


Figure 1: System 450 Module Dimensions mm (in.)

- Ensure that the mounting surface can support the module assembly, mounting hardware, and any (user-supplied) panel or enclosure.
- Mount the modules horizontal, in an upright orientation wherever possible. DIN rail mount is recommended.
- Mount modules on flat even surfaces.
- Mount the modules in locations free of corrosive vapors and observe the operating conditions in the Technical Specifications.
- Allow sufficient space for wires and connections.
- 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 heat-generating devices in an enclosure with the modules that may cause the temperature to exceed the ambient operating conditions.

Mounting

Mount System 450 modules on 35 mm DIN rail (recommended) or directly to an even wall surface. To mount the 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 appropriate mounting hardware/fasteners.
2. Clip the control module on the rail, position the upper DIN rail clips on the top rail, and gently snap the lower clips on to the rail.
3. Clip the remaining modules to the right of the control module on to the DIN rail and plug together.

To direct mount modules to wall surfaces:

1. Plug the modules together, remove the module covers, place the assembly against wall surface horizontally in a suitable location, and mark the mount hole locations on the surface.
2. Install appropriate screw fasteners, leaving screw heads approximately one to two turns away from flush to the surface.
3. Place the assembly over screw heads and on the mounting slots, and carefully tighten mount screws.

Note: If you mount the modules on an uneven surface, do not damage the housings when tightening mounting screws. Use shims/washers to mount module assembly evenly on the surface.

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

Wiring

See Figure 2 and Table 1 for electrical termination locations, wiring information, and electrical ratings.

Note: The System 450 Output Relay terminals connect to an internal SPDT relay and **do not** supply any power to the control application. See Figure 2.



WARNING: Risk of Electric Shock.

Disconnect or isolate all power supplies before making electrical connections. More than one disconnection 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.

AVERTISSEMENT : Risque de décharge électrique.

Débrancher ou isoler toute alimentation avant de réaliser un raccordement électrique. Plusieurs isolations et débranchements sont peut-être nécessaires pour -couper entièrement l'alimentation de l'équipement. Tout contact avec des composants porteurs de tensions dangereuses risque d'entraîner une décharge électrique et de provoquer des blessures graves, voire mortelles.

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.

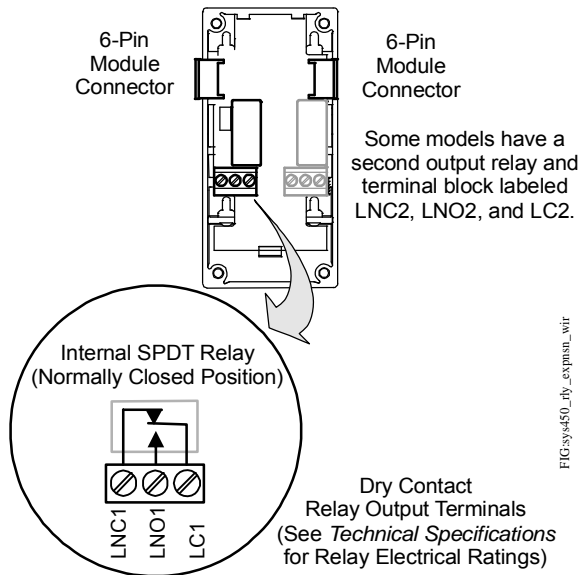



Figure 2: C450SxN-3 Wiring Terminals

Table 1: System 450 Terminal Wiring Information

Label	Terminal Function	Wire Sizes
LNC1, LNC2	Connects equipment control circuit to the Normally Close contact on the SPDT output relay.	28 AWG to 14 AWG 0.3 mm ² to 1.5 mm ²
LNO1, LNO2	Connects equipment control circuit to the Normally Open contact on the SPDT output relay.	
LC1, LC2	Connects line (power) to Common (C) on the SPDT relay.	

Technical Specifications

C450SxN-3

Product	C450SBN-3: System 450 Expansion Module with one SPDT output relay C450SCN-3: System 450 Expansion Module with two SPDT output relays		
Supply Power	C450-YNN-2 Power Supply Module or 24 (20-30) VAC Safety Extra-Low Voltage (SELV) (Europe) Class 2 (North America) 50/60 Hz, 10 VA minimum		
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)		
Output Relay Contacts	General: 1/2 HP at 120/240 VAC, SPDT		
	Specific:	<u>AC Motor Ratings</u>	<u>120 VAC</u> <u>208/240 VAC</u>
	AC Full-load amperes:	9.8 A	4.9 A
	AC Locked-rotor amperes:	58.8 A	29.4 A
	<hr/> 10 amperes AC Non-inductive at 24/240 VAC Pilot Duty: 125 VA at 24/240 VAC		
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 61 x 61 mm (5 x 2-3/8 x 2-3/8 in.)		
Weight	C450SBN-3: 172 gm (0.38 lb) C450SCN-3: 186 gm (0.41 lb)		
Compliance		North America: cULus Listed; UL 60730, File E27734, Vol. 1; FCC Compliant to CFR47, Part 15, Subpart B, Class B Industry Canada (IC) Compliant to Canadian ICES-003, Class B limits	
		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.	
		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.



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System 450™ Series Power Module

Installation Instructions

C450YNN-1

Part No. 24-7664-2691, Rev. E

Issued April 17, 2014

Supersedes January 17, 2013

Refer to the [QuickLIT website](http://www.QuickLIT.com) for the most up-to-date version of this document.

Application

IMPORTANT: Use this System 450 Series Power Module only as an operating control. Where failure or malfunction of the System 450 power 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 power module.

IMPORTANT: Utiliser ce System 450 Series Power Module uniquement en tant que dispositif de régulation. Lorsqu'une défaillance ou un dysfonctionnement du System 450 power module risque de provoquer des blessures ou d'endommager l'équipement contrôlé ou un autre équipement, la conception du système de contrôle doit intégrer des dispositifs de protection supplémentaires. Veiller dans ce cas à intégrer de façon permanente d'autres dispositifs, tels que des systèmes de supervision ou d'alarme, ou des dispositifs de sécurité ou de limitation, ayant une fonction d'avertissement ou de protection en cas de défaillance ou de dysfonctionnement du System 450 power module.

System 450 is a family of electronic control, expansion, and power modules that are easily assembled and set up to provide reliable digital temperature, pressure, and humidity control for a wide variety of Heating, Air Conditioning, Ventilation, and Refrigeration (HVACR) and commercial/industrial process applications.

The C450YNN models are step-down transformer supply power modules that provide 24 VAC power to System 450 module assemblies. Primary power to a C450YNN power module can be 120 or 240 VAC.

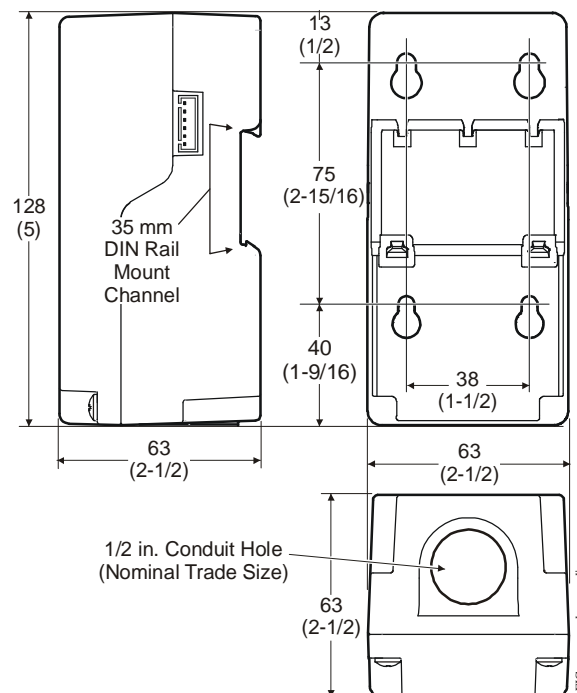


Figure 1: System 450 Module Dimensions, mm (in.)

Installation

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 in a horizontal, upright orientation. DIN rail mount is recommended.
- Mount modules on even surfaces.
- Mount the modules in locations free of corrosive vapors and observe the operating conditions in the Technical Specifications.
- Allow sufficient space for wires and connections.
- 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 heat-generating devices in an enclosure with the modules that may cause the temperature to exceed the ambient operating conditions.

Mounting

Mount System 450 modules on 35 mm DIN rail (recommended) or directly to an even wall surface. To mount the 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 appropriate mounting hardware/fasteners.
2. Clip the control module on the rail, position the upper DIN rail clips on the top rail and gently snap the lower clips on to the rail.
3. Clip the remaining modules to the right of the control module on to the DIN rail and plug together.

To direct mount modules to wall surfaces:

1. Plug the modules together, remove the module covers, place the assembly against wall surface horizontally in a suitable location and mark the mount hole locations on the surface.
2. Install appropriate screw fasteners, leaving screw heads approximately one to two turns away from flush to the surface.
3. Place the assembly over screw heads and on the mounting slots, and carefully tighten mount screws.

Note: If you mount the modules on an uneven surface, do not damage the housings when tightening mounting screws. Use shims/washers to mount module assembly evenly on the surface

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

Wiring

See Figure 2 for electrical terminal locations. See [Technical Specifications](#) on page 4 for electrical ratings.



WARNING: Risk of Electric Shock.

Disconnect or isolate all power supplies before making electrical connections. More than one disconnection 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.

AVERTISSEMENT : Risque de décharge électrique.

Débrancher ou isoler toute alimentation avant de réaliser un raccordement électrique. Plusieurs isolations et débranchements sont peut-être nécessaires pour -couper entièrement l'alimentation de l'équipement. Tout contact avec des composants porteurs de tensions dangereuses risque d'entraîner une décharge électrique et de provoquer des blessures graves, voire mortelles.

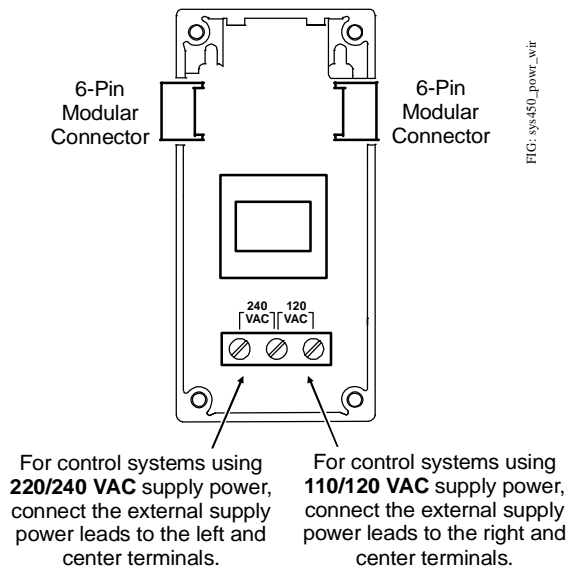
IMPORTANT: Use copper conductors only. Make all wiring in accordance with local, national, and regional regulations.

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.




Note: Use 0.5 to 1.5 mm² (22 to 14 AWG) wire when connecting external supply power to the C450YNN Power Module terminals.

Figure 2: C450YNN-1 Wiring Terminals

Technical Specifications

C450YNN-1

Product	C450YNN-1: System 450 Power Supply Module; 120 or 240 VAC stepdown to 24 VAC Class 2 (North America) or SELV (Europe)
Supply Power	110/120 VAC or 220/240 VAC at 50/60 Hz (100 mA maximum)
Secondary Power	24 VAC, 10 VA
Ambient Operating Conditions	Temperature: -40 to 66°C (-40 to 150°F) Humidity: Up to 95% RH non-condensing; 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 non-condensing; Maximum Dew Point 29°C (85°F)
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 61 x 61 mm (5 x 2-3/8 x 2-3/8 in.)
Weight	C450YNN-1: 390 gm (0.86 lb)
Compliance	<div style="display: flex; align-items: center;">  <div> <p>North America: cULus Listed; UL 60730, File E27734, Vol. 1; FCC Compliant to CFR47, Part 15, Subpart B, Class B Industry Canada (IC) Compliant to Canadian ICES-003, Class B limits</p> <p>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.</p> <p>Australia: Mark: C-Tick Compliant (N1813)</p> </div> </div>

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.



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System 450™ Series Reset Control Modules with Real-Time Clock and Relay Output Installation Instructions

C450RBN-3
C450RCN-3

Part No. 24-7664-2888, Rev. B
Issued April 17, 2014
Supersedes January 17, 2013

Refer to the [QuickLIT website](#) for the most up-to-date version of this document.

Application

IMPORTANT: Use this System 450™ Series Reset Control Modules with Real-Time Clock and Relay Output only as an operating control. Where failure or malfunction of the System 450™ Series 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™ Series Control Module.

IMPORTANT: Utiliser ce System 450™ Series Reset Control Modules with Real-Time Clock and Relay Output uniquement en tant que dispositif de régulation. Lorsqu'une défaillance ou un dysfonctionnement du System 450™ Series Control Module risque de provoquer des blessures ou d'endommager l'équipement contrôlé ou un autre équipement, la conception du système de contrôle doit intégrer des dispositifs de protection supplémentaires. Veiller dans ce cas à intégrer de façon permanente d'autres dispositifs, tels que des systèmes de supervision ou d'alarme, ou des dispositifs de sécurité ou de limitation, ayant une fonction d'avertissement ou de protection en cas de défaillance ou de dysfonctionnement du System 450™ Series 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 Heating, Air Conditioning, Ventilating, and Refrigeration (HVACR) and commercial/industrial process applications.

The System 450 reset control modules allow you to configure custom application-specific control systems with reset control and/or real-time setback control for temperature and humidity (only) control applications. System 450 expansion modules allow you to control up to 10 outputs, which can be relay and analog outputs.

C450RxN-3 Reset Control models are Single-Pole, Double-Throw (SPDT) relay control modules with temperature reset capability, real-time setback capability, a Liquid Crystal Display (LCD), and a four-button touch pad User Interface (UI) that allow you to set up custom System 450 control systems.

The C450RBN-3 model provides one SPDT relay. The C450RCN-3 model provides two SPDT relays.

Refer to the *System 450™ Series Modular Control Systems with Reset Control Modules Technical Bulletin (LIT-12011842)* for more detailed information on designing, installing, setting up, and troubleshooting System 450 Series components and control systems. The System 450 technical bulletin can be accessed and downloaded on the Johnson Controls® Online Product Literature Web site (QuickLIT) at the following Web address:

<http://cgproducts.johnsoncontrols.com/default.aspx>.

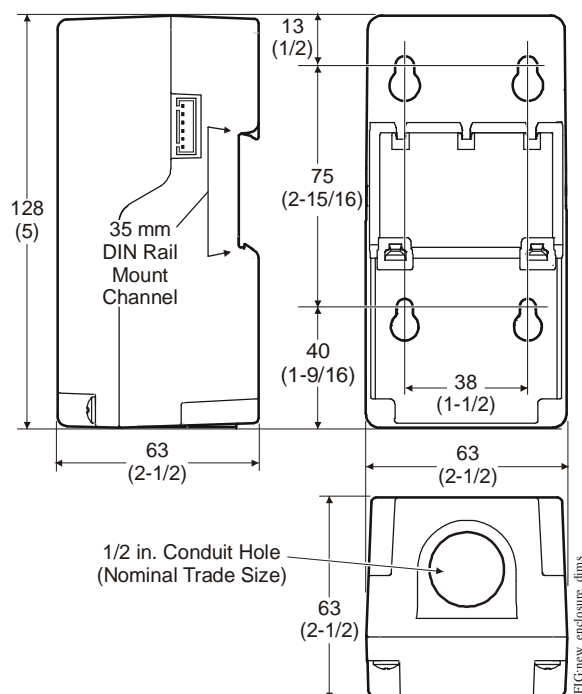


Figure 1: System 450 Module Dimensions, mm (in.)

Installation

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 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 heat-generating devices in an enclosure with the modules that may cause the temperature to exceed the ambient operating limit.

Mounting

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 appropriate mounting hardware/fasteners.
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 power and/or expansion 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-hand side of the control module.

To direct-mount modules to wall surfaces:

1. Plug the modules together, remove the module covers, place the assembly against wall surface horizontally in a suitable location, and mark the mount hole locations on the surface (Figure 1).
2. Install appropriate screw fasteners, leaving screw heads approximately one to two turns away from flush to the surface.
3. Place the assembly over screw heads on the mounting slots, and carefully tighten the mounting screws.

Note: If you mount the modules on an uneven surface, do not damage the housings when tightening mounting screws. Use shims/washers to mount module assembly evenly on the surface.

Refer to the control 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 25 for electrical ratings.



WARNING: Risk of Electric Shock.

Disconnect or isolate all power supplies before making electrical connections. More than one disconnection 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.

AVERTISSEMENT : Risque de décharge électrique.

Débrancher ou isoler toute alimentation avant de réaliser un raccordement électrique. Plusieurs isolations et débranchements sont peut-être nécessaires pour -couper entièrement l'alimentation de l'équipement. Tout contact avec des composants porteurs de tensions dangereuses risque d'entraîner une décharge électrique et de provoquer des blessures graves, voire mortelles.

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.

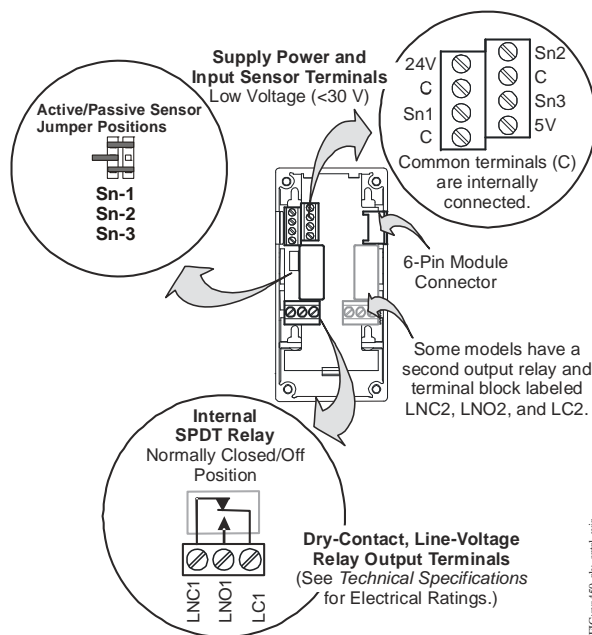


Figure 2: C450RxN-3 Wiring Terminals

See Figure 5 for the active/passive sensor jumper settings.

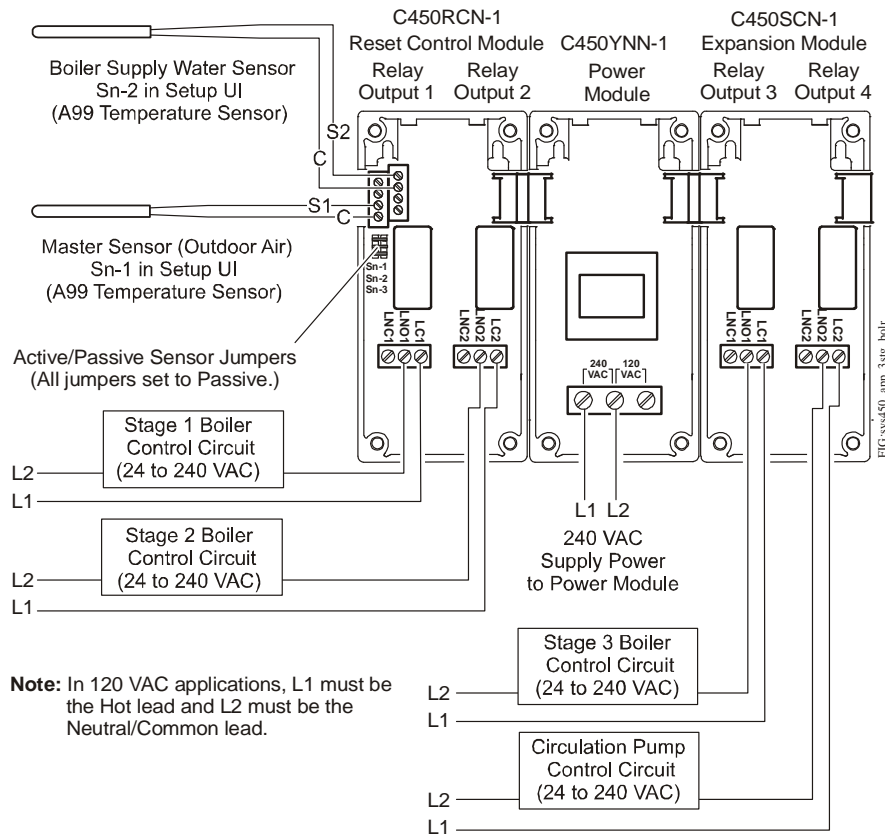


Figure 3: System 450 Reset Control System Example for a Three-Stage Boiler with or without Load Balancing (See Figure 9.)

Table 1: System 450 Terminal Wiring Information

Label	Terminal Function	Wire Sizes
24V	Accepts 24 VAC supply power, when a C450YNN power module is not connected, and provides power terminal for 24 VAC (humidity) sensors.	0.08 mm ² to 1.5 mm ² 28 AWG to 16 AWG
5V	Provides 5 VDC power for active sensors.	
Sn-1, Sn-2, Sn-3	Accepts passive or active (0-5 VDC) input signals from sensors. Note: In System 450 reset control systems, Sn-1 is the Master sensor (typically an outdoor air temperature sensor) and Sn-2 is the controlled loop sensor (a temperature or humidity sensor). Note: You must position the Active/Passive Sensor Jumper (Figure 3 and Figure 5) correctly for each sensor in your control system before operating the system. See <i>Setting Active/Passive Sensor Jumpers</i> for more information.	
C (Three Terminals)	Provide low-voltage common connections for 24 VAC power and passive or active sensors connected to the 5V, Sn1, Sn2, and Sn3 terminals. Note: The three C terminals are connected internally and can be connected to ground in the field.	0.08 mm ² to 2.5 mm ² 28 AWG to 14 AWG
LNC1, LNC2	Connects equipment control circuit to the normally closed contact on the SPDT ¹ relay.	
LNO1, LNO2	Connects equipment control circuit to the normally open contact on the SPDT ¹ relay.	
LC1, LC2	Connects line (power) to common on the SPDT ¹ relay.	

1. See Internal SPDT Relay insert in Figure 2 for more System 450 relay contact and terminal information. See *Technical Specifications* for SPDT relay electrical ratings.

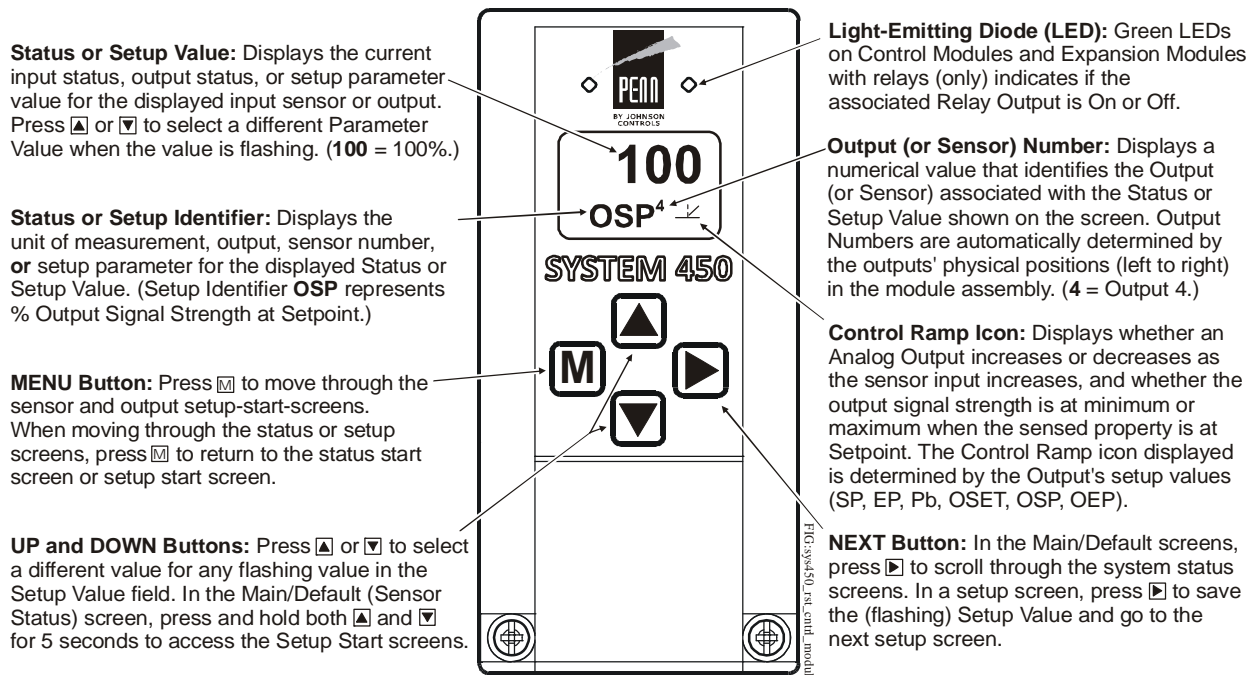


Figure 4: System 450 Reset Control Module Output Relay LEDs, LCD, and Four-Button Touch Pad User Interface

Setup and Adjustments

System 450 Reset Components

A System 450 reset control system consists of one reset control module, one to three input sensors, and one to ten outputs that provide any combination of (On/Off) relay control or (0–10 VDC or 4–20 mA) analog control. Figure 3 shows a reset control system for two boilers, a boiler water circulation pump, and an outside air damper.

Setting up a Module Assembly

To set up a System 450 module assembly:

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

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

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

4. Apply supply power to the module assembly.

You can now set up your control system in the System 450 reset control module UI.

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 Active/Passive Sensor Jumpers

Before putting your System 450 reset control system into operation, you must set up each sensor in your system as either passive or active by positioning the jumper on the terminal pins on the terminal block located below the sensor terminal block. See Figure 3.

Temperature sensors are passive (2-wire) sensors and the corresponding jumpers must be positioned across both pins. Humidity transducers are active (3-wire) sensors and corresponding jumpers must be positioned on one pin (or removed completely).

Figure 5 shows the jumper positions for the System 450 Reset Control example shown in Figure 3.



Sensor 1: Jumper positioned across two pins sets Sn-1 to Passive (Temperature).

Sensor 2: Jumper positioned across two pins sets Sn-2 to Passive (Temperature).

Sensor 3: Jumper positioned on one pin (or removed) sets Sn-3 to Active (Humidity).

Figure 5: Active/Passive Sensor Jumper Positions for System 450 Example Shown in Figure 3

Setting up a Control System in User Interface

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 [Setting up a 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 Screens](#).
3. Set up the control system sensors (inputs) in the UI. See [Setting up System 450 Sensors](#).
4. Set up the control system outputs in the UI. See [Setting up System 450 Outputs](#) on page 11.
5. Set up the clock and occupied/unoccupied schedule in the UI for systems that use setback. See [Setting up Time and Day of Week](#) on page 20 and [Setting up an Occupied/Unoccupied Schedule](#) on page 21.

IMPORTANT: When power is disconnected, the time clock keeps time for 12 hours before resetting to default; the remaining setup values entered into the UI remain in non-volatile memory indefinitely.

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.

See Figure 4 for an explanation of the System 450 display screen and the 4-button touch pad features and functions. See Table 3 for Reset Control Sensor Types and associated sensors. See Table 4 through Table 12 for System 450 UI setup information and procedures.

Viewing the Main and System Status Screens

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


The System Status screens display the current status of each output in your control system and the runtime hours for each Output Relay. In the Main screen, press  repeatedly to scroll through and view all of the Main and System Status screens in your control system. See Table 2 for more information on the System Status screens.

Table 2: System 450 Reset Control Main and Status Screens Information and Procedures (Part 1 of 2)

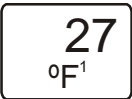



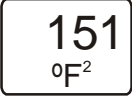
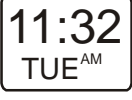


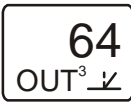
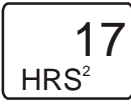


LCD Screen	Name, Description/Function, User Action, and Example
	<p>Main Screens: During normal operation, the Reset Control Main screens automatically scroll through the current temperature or humidity sensed at each sensor, the current time and day, and the current calculated Reset Setpoint (RSP) value. See the Main Screens row in the setup screens flow chart in Figure 9 on page 24.</p> <p>Note: You must set up time and day of week for control applications that use the setback feature, but you can also set up time and day on control systems that do not use the setback feature. If the time and day have not been set up, the Time/Day Status screen displays --:-- , MON, and AM.</p> <p>Note: Main screens are view-only; selections cannot be made in Main screens.</p> <p>1. During normal operation while the LCD is auto-scrolling through the Main screens:</p> <ul style="list-style-type: none"> • Press  repeatedly to scroll through and view the available System Status screens. • Press and hold  and  simultaneously for 5 seconds to access the Setup Start screens and the System 450 system setup screens. <p>Screen examples show Sensor 1 sensing 27°F outdoor air at the Master sensor, Sensor 2 sensing 151°F at the boiler water supply outlet, the current time and day is 11:32 A.M. on Tuesday, and the current calculated Reset Setpoint is 153°F.</p>
	
	
	

Table 2: System 450 Reset Control Main and Status Screens Information and Procedures (Part 2 of 2)



LCD Screen	Name, Description/Function, User Action, and Example
  	<p>System Status Screens: The System Status screens include all of the Main screens, plus additional status screens for all the outputs in your control system, including the following:</p> <ul style="list-style-type: none"> Relay Output Status screens, which display output number and relay status (On/Off). Analog Output Status screens, which display output number, the current analog signal strength (as a % of the total signal strength), and the control ramp icon. Runtime Hours Status screens, which display the runtime (ON) hours for the Relay Outputs in your control system. <p>See the System Status Screens row in the setup screens flow chart in Figure 9 on page 24.</p> <p>Note: System Status screens (except Runtime Hours Status screens) are view-only; selections cannot be made in Status screens.</p> <p>Note: When a Runtime Hours Status screen is displayed, you can press and hold  for 5 seconds to clear the displayed runtime hours and reset the Relay Output's total runtime hours to 0.</p> <p>2. Press  repeatedly to scroll through and view the System Status screens for your control system.</p> <p>Screen examples show Relay Output 1 is On; Analog Output 3 signal strength is 64 (%) and the control ramp icon indicates that the Analog Output is set up with SP<EP and OSP<OEP; Relay Output 2 has 17 hours of total runtime (relay ON).</p>

Accessing the System 450 Setup Screens


You can access the System 450 setup screens from the Main screens. To access the System 450 setup screens:



1. Apply power to your module assembly. After a startup check, the (available) Main screens appear and automatically scroll on the LCD.


Note: The only Main screen displayed, prior to setting up your control system in the UI, is the default time and day status screen, which displays --:-- , **MON**, and **AM**.

2. In any of the Main screens, press and hold  and  simultaneously for 5 seconds to go to the Sensor Setup Start screen and access the rest of the System 450 setup screens.

Note: 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 all of the remaining setup screens for your control system.

3. Press  repeatedly to scroll through all of the Setup Start screens. (See Figure 9 on page 24.)

Note: All Setup Start screens are view-only; selections cannot be made in Setup Start screens. In any Setup Start screen, you can return to the Main screens by pressing  and  simultaneously. Also, the UI returns to the Main screens after 2 minutes of inactivity in any screen in the UI.

4. Press  in any Setup Start screen to go to the setup screens. (See Figure 9 on page 24.)

Setting up System 450 Sensors




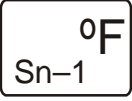
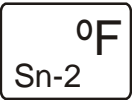
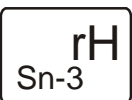


















You must set up the sensors (inputs) for your control system before you can set up any of the outputs. To set up the sensors, you must access the setup screens. See [Accessing the System 450 Setup Screens](#).

Table 3 provides information about System 450 compatible sensors for Reset Control Modules. Table 4 provides sensor setup information, procedures, and example screens. Figure 9 on page 24 provides a System 450 UI screen flowchart example.

Table 3: System 450 Reset Control Sensor Types, Setup Values, and Product Codes

Sensor Type	Unit of Measurement Value	Range of Usable Values	Resolution Increments Value	Minimum Differential or Proportional Band	Effective Sensing Range	Range of Usable Pb/dIFF and SbK Values for RSP	Range of Usable OSET Values for RSP	Sensor Product Type Number
°F	°F	-40 to 250	1	1	-46 to 255	-30 to 30	-30 to 30	A99B-xxx
°C	°C	-40 to 121	0.5	0.5	-43 to 124	-17 to 17	-17 to 17	A99B-xxx
rH	% Humidity	10 to 95	1	2	1 to 100	-20 to 20	-30 to 30	HE-67Sx-x

Table 4: System 450 Reset Control Sensor Setup Screen Information and Procedures

LCD Screen	Name, Description/Function, User Action, and Example
	<p>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 all of the remaining Setup Start screens in your control system. See the Setup Start screens in the column on the left side of the setup flow chart and the Sensor Setup screens row in Figure 9 on page 24.</p> <p>Note: You must set up the sensors for your control system, including the reset setpoint sensor (rES) (if required for your application) before you can set up the control system outputs. All Setup Start screens are view-only; selections cannot be made in Setup Start screens.</p> <p>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.</p> <p>If the sensors are already set up, press  (repeatedly) to scroll through the remaining Setup Start screens and continue setting up your control system.</p> <p>Screen example shows the Sensor Setup Start screen with four flashing dashes.</p>
  	<p>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/transducers, Sensor Types, setup values, and product code numbers.</p> <p>Note: System 450 Reset Control Modules are designed for use with temperature (°C or °F) and humidity (rH) Sensors Types only. Pressure Sensor Types are not available in the reset control module UI. You also can select no Sensor Type (- -) when your control systems uses less than three sensors.</p> <p>Note: In System 450 reset control systems, Sensor 1 (Sn-1) is the Master sensor and must always be a temperature sensor. Sn-2 must be the control loop sensor. The Sn-1 Master sensor is typically (but not always) an outdoor air temperature sensor. Sensor 2 (Sn-2) and Sensor 3 (Sn-3) can be temperature or humidity, depending on your application. The Reset Setpoint sensor (rES) cannot be set up for your control system until both the Sn-1 and Sn-2 are set up in the UI.</p> <p>Note: For an output to operate properly, the selected Sensor Type must match the sensor model wired to the control module, and the correct sensors must be wired to the correct control module input terminals.</p> <p>2. In the Sn-1 Sensor Type Selection screen, press  or  to select the desired Sensor Type (°F, °C, or --). Press  to save your selection and go to the Sn-2 Sensor Type Selection screen.</p> <p>3. In the Sn-2 Sensor Type Selection screen, press  or  to select the desired Sensor Type (°F, °C, rH, or --). Press  to save your selection and go to the Sn-3 Sensor Type Selection screen.</p> <p>Note: If your control system does not use three 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 screen.</p> <p>4. In the Sn-3 Sensor Type Selection screen, press  or  to select the desired Sensor Type (°F, °C, rH, or --). Press  to save your selection and go to the Temperature Offset Setup screen for Sn-1.</p> <p>Screen examples show Sn-1 set to Sensor Type °F; Sn-2 set to °F; and Sn-3 set to rH.</p>
	<p>Temperature Display Offset Selection Screens: You can select a temperature offset for each temperature (only) sensor in your control system. The selected offset value is added to the sensed temperature value to calculate the displayed temperature value (sensed °F + OFFS = displayed °F). The Temperature Display Offset value is typically 0 or a very low value.</p> <p>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.</p> <p>Note:</p> <p>5. Press  or  to select the desired temperature offset value. Press :</p> <ul style="list-style-type: none"> 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 Sensors Setup-Start Screen <p>Screen example shows 0 as the selected temperature display offset value for Sensor 2.</p>
	<p>Sensors Setup Start Screen: The hardwire sensors are setup in the UI.</p> <p>6. Press  to scroll through the remaining Setup Start screens and continue setting up your control system, or press  and  simultaneously to return to the System 450 Main screens.</p>

Setting up the System 450 Reset Setpoint

The System 450 Reset Control Modules feature temperature and humidity setpoint reset capability based on a Master temperature sensor (Sn-1) and a control loop sensor (Sn-2).

You easily can set up a custom calculated (floating) Reset Setpoint (RSP) that can be referenced by any of the outputs in your control system. All control system outputs that are set up to reference the Reset Setpoint sensor (rES) use the same RSP setup parameters and RSP to control output. During normal operation the current RSP is displayed in one of the Main screens.

Figure 6 illustrates the relationships between the setup parameters that define the calculated RSP.

Note: You must set up Sn-1 and Sn-2 before you can set up a RSP for your reset control system. Sn-1 is always the Master temperature sensor; typically an outdoor air temperature sensor. Sn-2 is always the control loop sensor; typically a boiler or chiller water supply loop sensor. But Sn-2 can also be a zone temperature or humidity sensor depending on your application, and the RSP can be a temperature or humidity value depending on the Sn-2 Sensor Type you select in the Sensor Setup screens.

Table 5 provides information and procedures for setting up the RSP for your reset control system.

When you select the rES sensor in an output's Sensor Selection screen, the output references the RSP, and System 450 displays the remaining output setup screens for setting up reset control based on a **calculated (floating) setpoint** (RSP) or proportional band (RSP + Pb).

Note: If you select Sn-1, Sn-2 or Sn-3 in the Sensor Selection screen, the output references a standard temperature or humidity sensor; and System 450 displays the remaining output setup screens for setting up standard control based on the **fixed setpoint** or proportional band (SP and EP) you select for the output.

You can also select a Shutdown High Temperature (SdHI) and/or Shutdown Low Temperature (SdLO) to shut down or limit the outputs that reference the rES sensor.

You can also enable Load Balancing (bAL) to balance the runtimes (relay ON times) of all relay outputs (only) that reference the rES sensor.

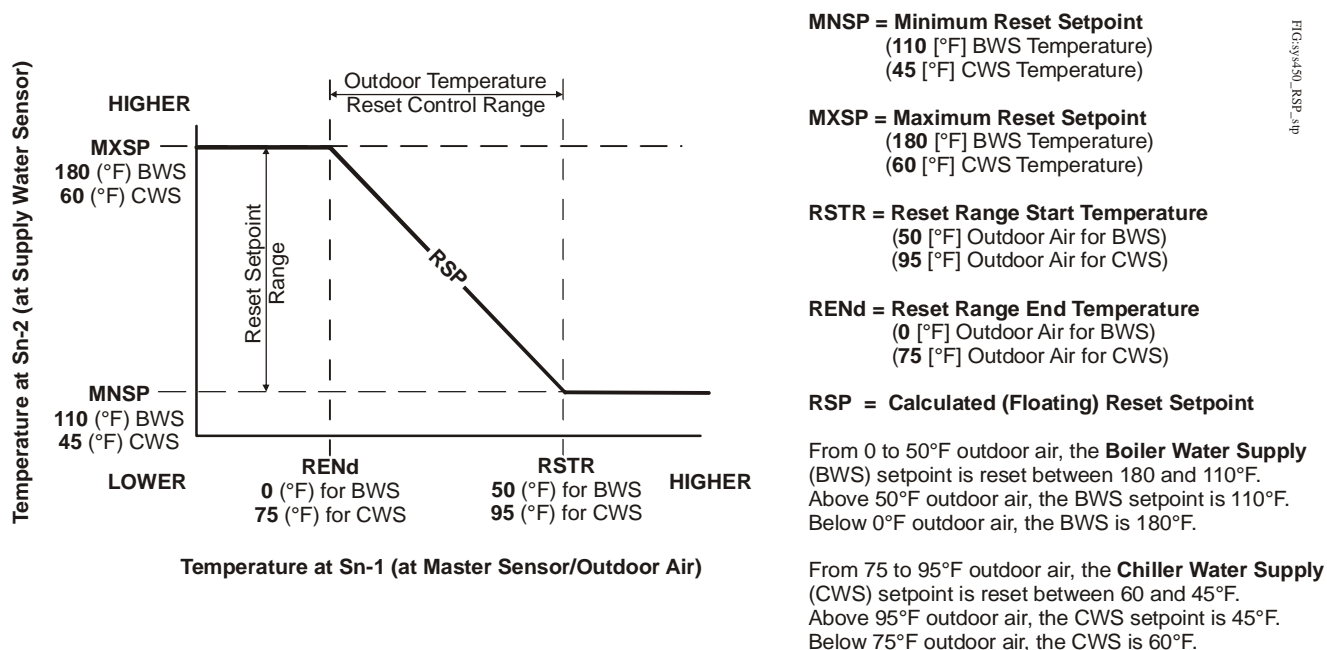


Figure 6: Example Reset Setpoint Applications for Boiler Water Supply and Chiller Water Supply Showing the Relationships between the Reset Setpoint Setup Parameters

Table 5: System 450 Reset Setpoint Setup Screen Information and Procedures (Part 1 of 2)


















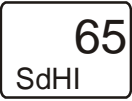



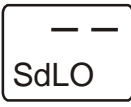



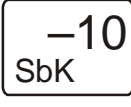











LCD Screen	Name, Description/Function, User Action, and Example
	<p>Reset Setpoint Setup Start Screen: You can set up a floating Reset Setpoint Sensor Type (rES) that can be referenced by the outputs in your System 450 reset control system. You can also select high and low temperature shutdown values (SdHI and SdLO) and an unoccupied Setback (SbK) for all Outputs with reset; and enable Load Balancing for relay (only) outputs with reset. See the Reset Setpoint Setup Screens row in the setup screens flow chart in Figure 9 on page 24.</p> <p>Note: Sn-1 and Sn-2 must be set up in the UI before the Reset Setpoint Setup Start screen is available. All Setup Start screens are view-only; selections cannot be made in Setup Start screens.</p> <p>1. Press the Next button to go to the next screen and begin setting up the Reset Setpoint.</p> <p>Screen example shows Reset Setpoint Setup Start screen. The remaining screens in this table show the setup parameter values selected for the RSP, high and low temperature shutdown, unoccupied setback, and load balancing that are used by the outputs setup to reference the rES sensor (Output 2 and Output 4) in the control system example in Figure 3.</p>
	<p>Minimum Reset Setpoint Selection Screen: The selected Minimum Reset Setpoint (MNSP) value establishes the lowest (temperature or humidity sensed at Sn-2) setpoint value that outputs with reset control can reference. The MNSP value and the Maximum Reset Setpoint (MXSP) value establish the total (temperature or humidity) range for the floating RSP value. See Figure 6.</p> <p>2. Press  or  to select the Minimum Reset Setpoint value for the controlled condition (sensed at Sn-2), then press  to save your selection and go to the next screen.</p> <p>Screen example shows a Minimum Reset Setpoint value of 110 (°F).</p>
	<p>Maximum Reset Setpoint Selection Screen: The selected Maximum Reset Setpoint (MXSP) value establishes the highest (temperature or humidity sensed at Sn-2) setpoint that outputs with reset control can reference. The MXSP value and the MNSP value establish the total (temperature or humidity) range for the floating RSP value. See Figure 6.</p> <p>3. Press  or  to select the Maximum Reset Setpoint value for the controlled condition (sensed at Sn-2), then press  to save your selection and go to the next screen.</p> <p>Screen example shows a Maximum Reset Setpoint value of 180 (°F).</p>
	<p>Reset Range Start Temperature Selection Screen: The Reset Start Temperature (RSTR) value and the Reset End Temperature (REnd) value establish the temperature range over which the RSP is calculated. RSTR and REnd are sensed at the Sn-1 Master sensor (typically outdoor air temperature). RSTR defines the high limit of temperature range and corresponds with MNSP. As the outdoor air temperature decreases below the RSTR, the RSP is driven from the MNSP towards MXSP. See Figure 6.</p> <p>Note: The relationship between RSTR and REnd (RSTR > REnd or RSTR < REnd) determines whether an increase in temperature sensed at Sn-1 increases or decreases the RSP. The examples shown in Figure 6 (RSTR > REnd) show RSP increases when the temperature increases at the Sn-1 Master sensor.</p> <p>4. Press  or  to select the Reset Start Temperature value (sensed at the Master sensor Sn-1), then press  to save your selection and go to the next screen.</p> <p>Screen example shows a Reset Range Start Temperature value of 50 (°F) selected.</p>
	<p>Reset Range End Temperature Selection Screen: The Reset End Temperature (REnd) value and the RSTR value establish the temperature range over which the RSP is calculated. RSTR and REnd are sensed at the Sn-1 Master sensor (typically outdoor air temperature). REnd defines the low limit of the temperature range and corresponds with the MXSP. As the outdoor air temperature increases above the REnd, the RSP is driven from the MXSP towards MNSP. See Figure 6.</p> <p>5. Press  or  to select the Reset End Temperature value (sensed at the Master sensor Sn-1), then press  to save your selection and go to the next screen.</p> <p>Screen example shows a Reset Range End Temperature value of 0 (°F) selected.</p>
	<p>Shutdown High Temperature Selection Screen: Shutdown High Temperature (SdHI) value establishes a high temperature limit (sensed at the Master sensor) at which relay outputs go to OFF and analog outputs go to the Output at Setpoint (OSP) value for all outputs in your control system that reference the Reset Setpoint sensor (rES). SdHI is typically used for heating systems to shutdown (relay) or limit (analog) output at high outdoor air temperatures.</p> <p>6. Press  or  to select the Shutdown High Temperature value (sensed at the Master sensor Sn-1) then press  to save your selection and go to the next screen.</p> <p>Screen example shows an Shutdown High Temperature value of 65 (°F) selected.</p>

Table 5: System 450 Reset Setpoint Setup Screen Information and Procedures (Part 2 of 2)


LCD Screen	Name, Description/Function, User Action, and Example
	<p>Shutdown Low Temperature Selection Screen: Shutdown Low Temperature (SdLO) value establishes a low temperature limit (sensed at the Master sensor) at which the relay outputs go to OFF and the analog outputs go to the Output at Setpoint (OSP) value for all outputs in your control system that references the Reset Setpoint sensor (rES). SdLO is typically used for cooling systems to shutdown (relay) or limit (analog) output at low outdoor air temperatures.</p> <p>7. Press  or  to select the Shutdown Low Temperature value (sensed at the Master sensor Sn-1), then press  to save your selection and go to the next screen.</p> <p>Screen example shows no Shutdown Low Temperature value selected.</p>
	<p>Unoccupied Setback Selection Screen: The selected Setback (SbK) value determines a (floating) unoccupied setback value (RSP + SbK) for all of the relay and analog outputs that reference the rES sensor. The unoccupied Setback value (RSP + SbK) is referenced during all scheduled unoccupied times.</p> <p>Note: To use the Setback feature in your control system, you must also set up the (real) time and day of week, and a weekly occupied/unoccupied schedule. See Setting up Time and Day of Week and Setting up an Occupied/Unoccupied Schedule for more information and setup procedures.</p> <p>8. Press  or  to select the Setback value for the controlled condition (temperature or humidity) during scheduled Unoccupied times, then press  to save your selection and go to the next screen.</p> <p>Screen example shows an Setback value of -10 (°F) selected.</p>
	<p>Load Balancing Selection Screen: Select ON to enable the Load Balancing feature.</p> <p>When the System 450 Load Balancing feature is enabled (ON), the control system uses the relay ON time of each Relay Output that references the RSP sensor and balances the total ON times of these Relay Outputs by cycling ON the Relay Output with the lowest total ON-time first, and the second lowest ON-time second, and so on.</p> <p>Note: The Load Balancing feature is not available for analog outputs.</p> <p>9. Press  or  to enable (ON) or disable (OFF) the Load Balancing feature for your Reset Control system then press  to save your selection and return to the Reset Setpoint Start screen.</p> <p>Screen example shows Load Balancing feature is enabled (ON).</p>
	<p>Reset Setpoint Setup Start Screen: The Reset Setpoint is now set up in the UI.</p> <p>10. Press  to scroll through the remaining Setup Start screens and continue setting up your control system, or press  and  simultaneously to return to the System 450 Main screens.</p>

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 system sensors for your control system before you can set up the outputs.

To set up System 450 outputs in the UI:

1. Access the System 450 setup screens. (See [Accessing the System 450 Setup Screens](#).) The **Sensor Setup Start** screen appears.
2. 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.

To set up Standard System 450 outputs **without** Reset Setpoint, see the following sections:

- [Setting up a Standard Relay Output](#) on page 11
- [Setting up a Standard Analog Output](#) on page 15

To set up System 450 outputs **with** Reset Setpoint, see the following sections:

- [Setting up a Relay Output with Reset Setpoint](#) on page 13
- [Setting up an Analog Output with Reset Setpoint](#) on page 18

Setting up a Standard Relay Output

A standard relay output provides On/Off control for your application based on a fixed setpoint sensor (Sn-1, Sn-2, or Sn-3).

Table 6 provides information, procedures, and screen examples for setting up standard relay outputs.

Table 6: System 450 Standard Relay Output Setup Screen Information and Procedures (Part 1 of 2)



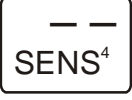




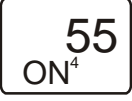















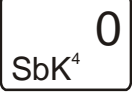



LCD Screen	Name, Description/Function, User Action, and Example
	<p>Relay Output Setup Start Screen: The output number and output type (relay or analog) are automatically assigned when you connect power to the module assembly.</p> <p>See the Standard Relay Output Setup Screens row in the setup screens flow chart in Figure 9 on page 24.</p> <p>Note: All Setup Start screens are view-only; selections cannot be made in Setup Start screens.</p> <p>1. Press  to go to the Sensor Selection screen.</p> <p>Screen example shows the Relay Output Setup-Start screen for Output 4. The remaining screens in this table show the parameter values selected for controlling the boiler water circulation pump connected to Relay Output 4 in Figure 3.</p>
 	<p>Sensor Selection Screen: The sensor you select here determines the output control type (standard or reset control), and output's setup parameters and value ranges. 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 next screen in the setup sequence appears instead.</p> <p>Note: To set up a Standard Relay Output, you must select Sn-1, Sn-2, or Sn-3 in this screen, and the selected sensor must already be set up in the System 450 UI. See Setting up System 450 Sensors on page 7 for information and procedures on setting up sensors.</p> <p>2. Press  or  to select the Sensor (Sn-1, Sn-2, or Sn-3) that this output references, then press  to save your sensor selection and go to the next screen.</p> <p>Screen examples show the initial Relay Output 4 Sensor Selection screen with no sensor selected, followed by the same screen with the (Master) Sensor 1 selected for Relay Output 4.</p>
	<p>Relay ON Selection Screen: Select the value at which the relay turns On. Relay ON is defined as relay LED On, relay contacts LNO to LC are closed, and LNC to LC contacts are open.</p> <p>Note: The value ranges and minimum differential are determined by the selected Sensor Type for the sensor that this output references and are enforced in the Relay ON and Relay OFF Selection screens.</p> <p>3. Press  or  to select the value at which the output relay turns On, then press  to save your selection and go to next screen.</p> <p>Screen example shows an ON value of 55 (°F) selected for Relay Output 4.</p>
	<p>Relay OFF Selection Screen: Select the value at which the relay turns Off. Relay OFF is defined as relay LED Off, relay contacts NC to C are closed, and NO to C contacts are open.</p> <p>Note: The value ranges and minimum differential are determined by the selected Sensor Type for the sensor that this output references and are enforced in the Relay ON and Relay OFF Selection screens.</p> <p>4. Press  or  to select the value at which output relay turns Off, then press  to save your selection and go to next screen.</p> <p>Screen example shows an OFF value of 65 (°F) selected for Relay Output 4.</p>
	<p>Minimum Relay ON Time Selection Screen: Minimum ON Time range is 0 to 300 seconds.</p> <p>5. 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 next screen.</p> <p>Screen example shows 0 seconds selected for the minimum relay-on time for Relay Output 4.</p>
	<p>Minimum Relay OFF Time Selection Screen: Minimum Relay OFF Time range is 0 to 300 seconds.</p> <p>6. Press  or  to select the minimum time that this output relay remains off after reaching the OFFT value, then press  to save your selection and go to the next screen.</p> <p>Screen example shows 10 seconds selected for the minimum relay-off time for Relay Output 4.</p>
	<p>Unoccupied Setback Selection Screen: The selected setback (SbK) value (temperature or humidity) is added to the ON value (ON + SbK) and OFF value (OFF + SbK) to calculate the setback ON and OFF values that this output references during the unoccupied times set up in the Occupied/Unoccupied Schedule Setup screens.</p> <p>Note: To use the Setback feature in your control system, you must also set up the (real) time and day of week, and a weekly occupied/unoccupied schedule. See Setting up Time and Day of Week and Setting up an Occupied/Unoccupied Schedule for more information and setup procedures.</p> <p>7. Press  or  to select the Unoccupied Setback value, then press  to save your selection and go to the next screen.</p> <p>Screen example shows 0 (°F) selected for the Unoccupied Setback value for Relay Output 4.</p>

Table 6: System 450 Standard Relay Output Setup Screen Information and Procedures (Part 2 of 2)

LCD Screen	Name, Description/Function, User Action, and Example
	<p>Sensor Failure Mode Selection Screen: Select this output's mode of operation if the referenced sensor or sensor wiring fails. The output operates in the selected mode until the failure is remedied. Sensor Failure mode selections for Relay Outputs include:</p> <ul style="list-style-type: none"> • ON: Output relay remains on during sensor failure. • OFF: Output relay remains off during sensor failure. <p>8. Press or to select Sensor Failure Mode for this output if the sensor or sensor wiring fails, then press to save your selection and go to the next screen.</p> <p>Screen example shows sensor failure mode ON selected for Relay Output 1; the output relay is on if the referenced sensor or sensor wiring fails.</p>
	<p>Edit Sensor Screen: Displays the (selected) sensor that this output references. Unless you need to change the sensor, press to complete the output setup and return to the Output Setup Start screen. If you need to change the sensor that this output references, you can select a different sensor in this screen.</p> <p>Note: Changing the sensor that an output references (in the Edit Sensor screen) changes the default setup parameters and values for the output, and requires setting up the output again.</p> <p>9. If you do not need to change this output's sensor, press to save the current sensor selection, complete the output setup, and return to the Output Setup Start screen.</p> <p>To change this output's sensor, press or to select the sensor that this output references. After you select a different sensor, press to go to the required output selection screen and repeat the output setup procedure for the new Sensor Type values.</p>
	<p>Relay Output Setup Start Screen: This Standard Relay Output is now set up in the UI.</p> <p>Press to scroll through the remaining Setup Start screens and continue setting up your control system, or press and simultaneously to return to the System 450 Main screens.</p>

Setting up a Relay Output with Reset Setpoint

A relay output with reset setpoint provides On/Off control to your application based on the Reset Setpoint sensor (rES) that you set up for your control system.

Table 7 provides information, procedures, and screen examples for setting up relay outputs with Reset Setpoint (RSP) and the Reset Setpoint sensor (rES).

Table 7: System 450 Relay Output with Reset Setup Screen Information and Procedures (Part 1 of 3)

LCD Screen	Name, Description/Function, User Action, and Example
	<p>Relay Output Setup Start Screen: The output number and output type (relay or analog) are automatically assigned when you connect power to the module assembly.</p> <p>See the Relay Output with Reset Setpoint Setup Screens row in the setup screens flow chart in Figure 9 on page 24.</p> <p>Note: All Setup Start screens are view-only; selections cannot be made in Setup Start screens.</p> <p>1. Press to go to the Sensor Selection screen.</p> <p>Screen example shows the Relay Output Setup Start screen for Output 2. The remaining screens in this table show the parameter values selected for Relay Output 2 to control the temperature of Boiler 1 in Figure 3 based on the RSP set up in Table 5.</p>
	<p>Sensor Selection Screen: The sensor selected here determines the output control type (standard or reset control), and the output's setup parameters and value ranges. 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, the next screen in the setup sequence appears instead.</p> <p>Note: To set up a Relay Output with Reset Setpoint, you must select rES in this screen. rES cannot be selected until the Reset Setpoint is set up in the System 450 UI. See Setting up the System 450 Reset Setpoint for information and procedures on setting up the RSP and rES.</p> <p>2. Press or to select the Reset Setpoint Sensor (rES) for this output to reference, then press to save your sensor selection and go to next screen.</p> <p>Screen examples show the initial Relay Output 2 Sensor Selection screen with no sensor selected, followed by the same screen with the Reset Setpoint sensor (rES) selected for Relay Output 2.</p>

Table 7: System 450 Relay Output with Reset Setup Screen Information and Procedures (Part 2 of 3)




























LCD Screen	Name, Description/Function, User Action, and Example
	<p>Reset Differential Selection Screen: Select a dIFF value to establish the fixed differential between the floating Relay-OFF setpoint (RSP) and the floating Relay-ON setpoint (RSP+dIFF). A positive differential (dIFF = +n) turns the relay ON when temperature or humidity increases; typically cooling. A negative differential (dIFF = -n) turns the relay ON when temperature or humidity decreases; typically heating. See Table 3 on page 7 for the (fixed) minimum differential and the range of usable dIFF values for outputs with RSP in your control system.</p> <p>3. Press  or  to select the Reset Differential value for this output, then press  to save your selection and go to the next screen.</p> <p>Screen example shows -5 differential selected for Output 2.</p>
	<p>Offset from Reset Setpoint Selection Screen: Select an OSET value to shift the (floating) Reset Setpoint (RSP) that the output references to a (floating) offset reset setpoint (RSP+OSET). A positive offset value (OSET = +n) raises the target reset setpoint referenced by the output. A negative offset value (OSET = -n) lowers the target reset setpoint referenced by the output. OSET is typically used to set up sequential offset reset setpoint values and stage multiple Relay Outputs. For example, four boilers can be staged with 0, 2, 4, and 6 (°F) OSET values to stage the four boilers ON according to load increases. (You can also enable bAL to load balance the boiler runtimes. See Setting up the System 450 Reset Setpoint for information on the Load Balancing feature.) See Table 3 on page 7 for the range of usable OSET values for the outputs with RSP in your control system.</p> <p>4. Press  or  to select the Reset Setpoint Offset value for this output, then press  to save your value and go to the next screen.</p> <p>Screen example shows 0 (°F) offset selected for Output 2.</p>
	<p>Minimum Relay ON Time Selection Screen: Minimum ON Time range is 0 to 300 seconds.</p> <p>5. 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 next screen.</p> <p>Screen example shows 5 seconds selected for the minimum ON-Time for Output 2.</p>
	<p>Minimum Relay OFF Time Selection Screen: Minimum OFF Time range is 0 to 300 seconds.</p> <p>6. Press  or  to select the minimum time that this output relay remains Off after reaching the Relay OFF value, then press  to save your selection and go to the next screen.</p> <p>Screen example shows 0 seconds selected for the minimum OFF-Time for Output 2.</p>
	<p>Sensor Failure Mode Selection Screen: Select this output's mode of operation if the referenced sensor or sensor wiring fails. The output operates in the selected mode until the failure is remedied. Sensor Failure mode selections for Relay Outputs include:</p> <ul style="list-style-type: none"> • ON: Output relay remains On during sensor failure. • OFF: Output relay remains Off during sensor failure. <p>7. Press  or  to select the Sensor Failure Mode for this output, then press  to save your selection and go to the next screen.</p> <p>Screen example shows OFF sensor failure mode selected for Output 2.</p>
	<p>Edit Sensor Screen: Displays the (selected) sensor that this output references. Unless you need to change the sensor, press  to complete the output setup and return to the Output Setup Start screen. If you need to change the sensor that this output references, you can select a different sensor in this screen.</p> <p>Note: Changing the sensor that an output references (in the Edit Sensor screen) changes the default setup parameters and values for the output, and requires setting up the output again.</p> <p>8. If you do not need to change this output's sensor, press  to save the current sensor selection, complete the output setup, and return to the Output Setup Start screen.</p> <p>To change this output's sensor, press  or  to select the sensor that this output references. After you select a different sensor, press  to go to the required output selection screen and repeat the output setup procedure for the new Sensor Type values.</p>

Table 7: System 450 Relay Output with Reset Setup Screen Information and Procedures (Part 3 of 3)

LCD Screen	Name, Description/Function, User Action, and Example
	Relay Output Setup Start Screen: This Relay Output with Reset Setpoint is now set up in the UI. 9. Press [M] to scroll through the remaining Setup Start screens and continue setting up your control system, or press [▲] and [▼] simultaneously to return to the System 450 Main screens.

Setting up a Standard Analog Output

A standard analog output provides an analog signal to control your application based on a fixed setpoint sensor (Sn-1, Sn-2, or Sn-3).

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.

The control action between the input signal and the output signal can be set up four different 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.

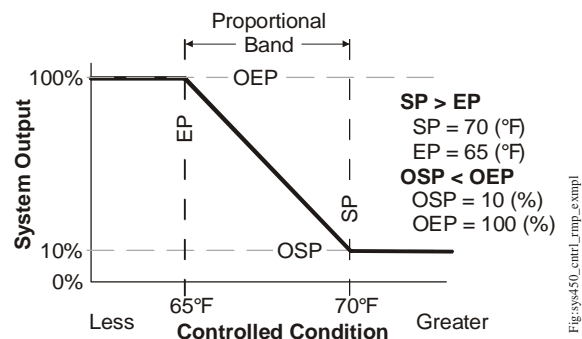

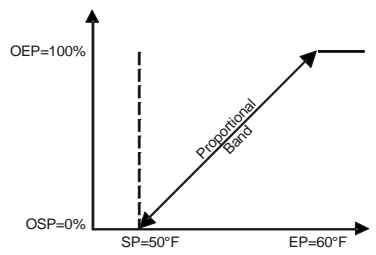

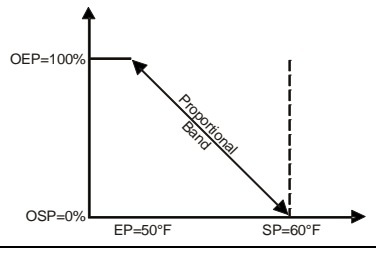
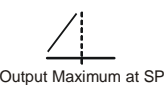
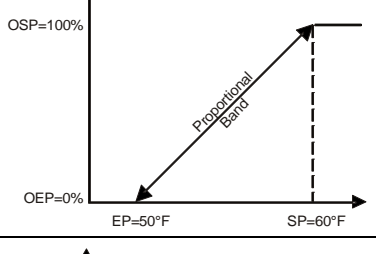
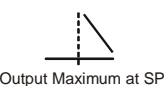
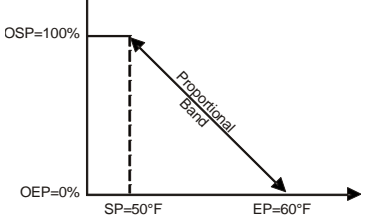


Figure 7: Control Ramp Example for a Typical Heating Application (SP > EP and OSP < OEP)

Figure 7 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 8 shows the four Control Ramp icons and describes their corresponding control actions and the setup value relationships required to configure the four control actions.

Table 8: System 450 Control Ramps, Analog Output Control Actions, and System Setup Value Relationships

Control Ramp Displayed	Control Action	Set the Analog Output Value Relationships for the Desired Control Action and Corresponding 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

See Table 9 for setup information, procedures, and screen examples for standard analog outputs.

Table 9: System 450 Standard Analog Output Setup Screen Information and Procedures (Part 1 of 3)



LCD Screen	Name, Description/Function, User Action, Example
	<p>Analog Output Setup Start Screen: The output number and output type (relay or analog) are automatically assigned when you connect power to the module assembly.</p> <p>See the Standard Analog Output Setup Screens row in the setup screens flow chart in Figure 9 on page 24.</p> <p>Note: All Setup Start screens are view-only; selections cannot be made in Setup Start screens.</p> <p>1. Press  to go to the Sensor Selection screen.</p> <p>Screen example shows the Analog Output Setup-Start screen for Output 3. The remaining screens in this table show the parameter values selected for Analog Output 3 to control an outside air damper in Figure 3.</p>

Table 9: System 450 Standard Analog Output Setup Screen Information and Procedures (Part 2 of 3)


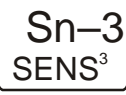



















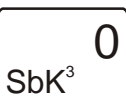



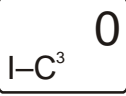







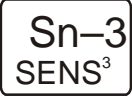









LCD Screen	Name, Description/Function, User Action, Example
 	<p>Sensor Selection Screen: The sensor you select here determines the output control type (standard or reset control), and output's setup parameters and value ranges. If a sensor is not selected, the remaining output setup screens do not appear. If a sensor is already selected for this output, the Sensor Selection screen does not appear here and the next screen in the setup sequence appears instead.</p> <p>Note: To set up a Standard Analog Output, you must select Sn-1, Sn-2, or Sn-3 in this screen, and the selected sensor must already be set up in the System 450 UI. See Setting up System 450 Sensors on page 7 for information and procedures on setting up sensors.</p> <p>2. Press  or  to select the Sensor (Sn-1, Sn-2, or Sn-3) that this output references, then press  to save your sensor selection and go to the next screen.</p> <p>Screen examples show the initial Analog Output 3 Sensor Selection screen with no sensor selected, followed by the same screen with the Sensor 3 (Sn-3) selected for Analog Output 3.</p>
	<p>Setpoint Selection Screen: Select the Setpoint value that the controlled system drives towards and which, along with the End Point value, defines this output's proportional band.</p> <p>Note: The output's minimum proportional band (between Setpoint and End Point) is automatically enforced in the Setpoint and End Point Selection screens.</p> <p>3. Press  or  to select this output's Setpoint value, then press  to save your selection and go to the next screen.</p> <p>Screen example shows a Setpoint of 50 (%RH) selected for Output 3.</p>
	<p>End Point Selection Screen: Select the End Point value that the controlled system drives away from (towards Setpoint) and which, along with the Setpoint value, defines this output's proportional band.</p> <p>Note: The output's minimum proportional band (between Setpoint and End Point) is automatically enforced in the Setpoint and End Point Selection screens.</p> <p>4. Press  or  to select this output's End Point value, then press  to save your selection and go to the next screen.</p> <p>Screen example shows a End Point of 60 (%RH) selected for Output 3.</p>
	<p>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. Signal strength range is 0 to 100 (%).</p> <p>5. Press  or  to select this output's %Output Signal Strength at Setpoint value, then press  to save your selection and go to the next screen.</p> <p>Screen example shows Analog Output 3 is set up to generate 10% of the total signal strength when the input is at the Setpoint value (= 1 V or 5.6 mA).</p>
	<p>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. Signal strength range is 0 to 100 (%).</p> <p>6. Press  or  to select this output's %Output Signal Strength at End Point value, then press  to save your selection and go to the next screen.</p> <p>Screen example shows Output 3 is set up to generate 90% of the total signal strength when the input is at the End Point value (= 9 V or 18.4 mA).</p>
	<p>Unoccupied Setback Selection Screen: The selected setback (SbK) value (temperature or humidity) is added to the SP value (SP+SbK) and EP value (EP+SbK) to calculate a setback proportional band that this output references during the unoccupied times set up in the Occupied/Unoccupied Schedule Setup screens.</p> <p>Note: To use the Setback feature in your control system, you must also set up the (real) time and day of week, and a weekly occupied/unoccupied schedule. See Setting up Time and Day of Week and Setting up an Occupied/Unoccupied Schedule for more information and setup procedures.</p> <p>7. Press  or  to select the Unoccupied Setback value, then press  to save the selected value and go to the next screen.</p> <p>Screen example shows 0 selected for the Unoccupied Setback value for Output 3.</p>
	<p>Integration Constant Selection Screen: An integration constant allows you to set up Proportional plus Integral (P+I) control for this analog output. When properly set up, P+I control can drive the load closer to Setpoint than proportional-only control.</p> <p>Initially, you should select the I-C value of 0 (zero) for no integration constant. Refer to the <i>System 450 Series Modular Controls Technical Bulletin (LIT-12011459)</i> for more information on proportional plus integral control and setting an integration constant in the System 450 UI.</p> <p>8. Press  or  to select the Integration Constant for this output, then press  to save your selection and go to the next screen.</p> <p>Screen example shows an Integration Constant of 0 (zero) selected for Output 3.</p>

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

LCD Screen	Name, Description/Function, User Action, Example
	<p>Sensor Failure Mode Selection Screen:</p> <p>You can select this output's mode of operation in the event of a sensor or sensor wiring failure. The output operates in the selected mode until the failure is fixed.</p> <p>Sensor Failure Mode selections for Analog Outputs include:</p> <ul style="list-style-type: none"> • ON: Output goes to the OEP value. • OFF: Output goes to the OSP value. <p>9. Press  or  to select the Sensor Failure Mode for this output, then press  to save your selection and go to the next screen.</p> <p>Screen example shows the OFF Sensor Failure Mode selected for Output 3.</p>
	<p>Edit Sensor Screen: Displays the (selected) sensor that this output references. Unless you need to change the sensor, press  to complete the output setup and return to the Output Setup Start screen. If you need to change the sensor that this output references, you can select a different sensor in this screen.</p> <p>Note: Changing the sensor that an output references (in the Edit Sensor screen) changes the default setup parameters and values for the output, and requires setting up the output again.</p> <p>10. If you do not need to change this output's sensor, press  to save the current sensor selection, complete the output setup, and return to the Output Setup Start screen.</p> <p>To change this output's sensor, press  or  to select the sensor that this output references. After you select a different sensor, press  to go to the required output selection screen and repeat the output setup procedure for the new Sensor Type values.</p>
	<p>Analog Output Setup Start Screen: This Standard Analog Output is now set up in the UI.</p> <p>11. Press  to scroll through the remaining Setup Start screens and continue setting up your control system, or press  and  simultaneously to return to the System 450 Main screens.</p>

Setting up an Analog Output with Reset Setpoint

An Analog Output with Reset Setpoint provides analog signal control for your application based the a Reset Setpoint sensor (rES) that you set up for your system.

See *Setting up a Standard Analog Output* for general information on setting up a System 450 Analog Output.

Table 10 provides information, procedures, and screen examples for setting up analog outputs with reset setpoint.

Table 10: System 450 Analog Output with Reset Setpoint Setup Screens Information and Procedures (Part 1 of 3)

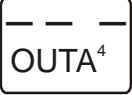






LCD Screen	Name, Description/Function, User Action, Example
	<p>Analog Output Setup Start Screen: The output number and output type (relay or analog) are automatically assigned when you connect power to the module assembly.</p> <p>See the Analog Output with Reset Setpoint Setup Screens row in the setup screens flow chart in Figure 9 on page 24.</p> <p>Note: All Setup Start screens are view-only; selections cannot be made in Setup Start screens.</p> <p>1. Press  to go to the Sensor Selection screen.</p> <p>Screen example shows the Analog Output Setup Start screen for Output 4. The remaining screens in this table show the parameter values selected for Analog Output 4 to control Boiler 2 in Figure 3 based on the RSP set up in Table 5.</p>
 	<p>Sensor Selection Screen: The sensor selected here determines the output control type (standard or reset control), and the output setup parameters and value ranges. 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, the next screen in the setup sequence appears instead.</p> <p>Note: To set up an Analog Output with Reset Setpoint, you must select rES in this screen. rES cannot be selected until the Reset Setpoint is set up in the System 450 UI. See <i>Setting up the System 450 Reset Setpoint</i> for information and procedures on setting up the RSP and rES.</p> <p>2. Press  or  to select the Reset Setpoint Sensor (rES) for this output to reference, then press  to save your sensor selection and go to the next screen.</p> <p>Screen examples show the initial Analog Output 4 Sensor Selection screen with no sensor selected, followed by the same screen with the Reset Setpoint sensor (rES) selected for Analog Output 4.</p>

Table 10: System 450 Analog Output with Reset Setpoint Setup Screens Information and Procedures (Part 2 of 3)

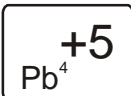







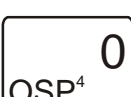



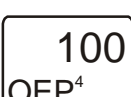



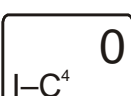













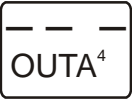



LCD Screen	Name, Description/Function, User Action, Example
	<p>Proportional Band Selection Screen: The Pb value establishes the fixed proportional band between the (floating) setpoint and end point. The (floating) proportional band's setpoint is RSP and the (floating) proportional band's end point is RSP+Pb.</p> <p>See Table 3 on page 7 for the (fixed) minimum proportional band and the range of usable Pb values for outputs with RSP in your control system.</p> <p>3. Press  or  to select this output's Proportional Band value, then press  to save your selection and go to the next screen.</p> <p>Screen example shows a (floating) Proportional Band of +5 (F) selected for Output 4.</p>
	<p>Offset from Reset Setpoint Point Selection Screen: Select an OSET value to shift the setpoint (RSP) (that the output references) to an offset reset setpoint (RSP+OSET). The OSET value also shifts the end point (RSP+Pb) to an offset end point (RSP+OSET+Pb), shifting the entire proportional band by the OSET value.</p> <p>A positive offset value (OSET = +n) raises the proportional band's setpoint and end point values.</p> <p>A negative offset value (OSET = -n) lowers the proportional band's setpoint and end point values.</p> <p>OSET is typically used to set up sequential offset reset setpoint values and stage multiple Analog Outputs. See Table 3 on page 7 for the range of usable OSET values for the outputs with RSP in your control system.</p> <p>4. Press  or  to select the Reset Setpoint Offset value for this output, then press  to save your selection and go to the next screen.</p> <p>Screen example shows an Offset value of 0 (zero) selected for Output 4.</p>
	<p>Output Signal Strength at Setpoint Selection Screen: Select the signal strength that this output generates when the sensed condition is at setpoint (RSP). The signal strength range is 0 to 100 (%).</p> <p>5. Press  or  to select the %Output strength at Reset Setpoint value, then press  to save your selection and go to the next screen.</p> <p>Screen example shows Analog Output 4 is set up to generate 0% of the total signal strength when the input is at the Setpoint value (= 0 VDC or 4 mA).</p>
	<p>Output Signal Strength at End Point Selection Screen: Select the signal strength that this output generates when the sensed condition is at end point (RSP+Pb). The signal strength range is 0 to 100 (%).</p> <p>6. Press  or  to select the %Output strength at Reset End Point value, then press  to save your selection and go to the next screen.</p> <p>Screen example shows Output 4 is set up to generate 100% of the total output signal strength when the input is at the End Point value (= 10 VDC or 20 mA).</p>
	<p>Integration Constant Selection Screen: An integration constant allows you to set up Proportional plus Integral (P+I) control for this analog output. When properly set up, P+I control can drive the load closer to Setpoint than proportional-only control.</p> <p>Initially, you should select the I-C value of 0 (zero) for no integration constant. Refer to the <i>System 450 Series Modular Controls Technical Bulletin (LIT-12011459)</i> for more information on proportional plus integral control and setting an integration constant in the System 450 UI.</p> <p>7. Press  or  to select the Integration Constant for this output, then press  to save your selection and go to the next screen.</p> <p>Screen example shows an Integration Constant of 0 selected for Output 4.</p>
	<p>Sensor Failure Mode Selection Screen:</p> <p>8. Press  or  to select the Sensor Failure Mode for this output, then press  to save your selection and go to the next screen.</p> <p>You can select this output's mode of operation in the event of a sensor or sensor wiring failure. The output operates in the selected mode until the failure is fixed. Sensor Failure Mode selections for Analog Outputs include:</p> <ul style="list-style-type: none"> • ON: Output goes to the OEP value. • OFF: Output goes to the OSP value. <p>Screen example shows the OFF Sensor Failure Mode selected for Output 4.</p>

Table 10: System 450 Analog Output with Reset Setpoint Setup Screens Information and Procedures (Part 3 of 3)












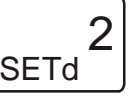







LCD Screen	Name, Description/Function, User Action, Example
	<p>Edit Sensor Screen: Displays the (selected) sensor that this output references. Unless you need to change the sensor, press  to complete the output setup and return to the Output Setup Start screen. If you need to change the sensor that this output references, you can select a different sensor in this screen.</p> <p>Note: Changing the sensor that an output references (in the Edit Sensor screen) changes the default setup parameters and values for the output, and requires setting up the output again.</p> <p>9. If you do not need to change this output's sensor, press  to save the current sensor selection, complete the output setup, and return to the Output Setup Start screen.</p> <p>To change this output's sensor, press  or  to select the sensor that this output references. After you select a different sensor, press  to go to the required output selection screen and repeat the output setup procedure for the new Sensor Type values.</p>
	<p>Analog Output Setup Start Screen: This Analog Output with Reset Setpoint is now set up in UI.</p> <p>10. Press  to scroll through the remaining Setup Start screens and continue setting up your control system, or press  and  simultaneously to return to the System 450 Main screens.</p>

Setting up Time and Day of Week

To use the System 450 Setback feature, you must set up the (real) time and day of the week. You can also set up time and day of week for any control system. However, time and day setup is not required for control systems that do not use the setback feature.

You must also set up a weekly occupied/unoccupied schedule and select setback values for outputs. See [Setting up an Occupied/Unoccupied Schedule](#) for setting up a weekly occupied/unoccupied schedule and [Setting up the System 450 Reset Setpoint](#) on page 9 for selecting setback values.

Table 11: System 450 Sensor Setup Information and Procedures

LCD Screen	Name, Description/Function, User Action, and Example
	<p>Time and Day Setup Start Screen: The Time Setup Start screen is displayed when you access the System 450 setup screens and scroll through the Setup Start screens by pressing  repeatedly. See the Time and Day Setup Screens row in the setup screens flow chart in Figure 9 on page 24.</p> <p>Note: All Setup Start screens are view-only; selections cannot be made in Setup Start screens.</p> <p>1. Press  to go to the 12 or 24 Hour Clock Selection screen.</p> <p>Screen example shows the Time and Day Setup Start screen with four flashing dashes.</p>
	<p>12 or 24 Hour Clock Selection Screen: The real-time clock can be set to display as a 12 hour or 24 hour format digital clock.</p> <p>2. In the 12 or 24 Hour Clock Selection screen, press  or  to select either the 12 hour or 24 hour format clock display, then press  to save your selection and go to the next screen.</p> <p>Screen example shows 12 hour clock format selected.</p>
	<p>Time of Day Setup Screen: Set the clock to real-time.</p> <p>3. Press  or  to set the current time, then press  to save the time setting and go to the next screen.</p> <p>Screen example shows (real) time selected is 11:32 A.M.</p>
	<p>Day of Week Setup Screen: Set the day to real-time.</p> <p>Note: 1 = MON, 2 = TUE, 3 = WED, 4 = THU, 5 = FRI, 6 = SA, and 7 = SUN.</p> <p>4. Press  or  to select the current day of the week, then press  to save the time setting and return to the Time and Day Setup Start screen.</p> <p>Screen example shows day of week set to 2 (TUE, Tuesday).</p>
	<p>Time and Day Setup Start Screen: The time of day and day of week are now set up in the System 450 UI and you have returned to the Setup Start screen.</p> <p>5. Press  to scroll through the remaining Setup Start screens and continue setting up your control system, or press  and  simultaneously to return to the System 450 Main screens.</p>

Setting up an Occupied/Unoccupied Schedule

To use the System 450 Setback feature, you must set up a weekly occupied/unoccupied schedule. However, a weekly occupied/unoccupied schedule is not required for control systems that do not use the setback feature. Table 12 provides occupied/unoccupied schedule setup information, procedures, and screen examples.

To use the System 450 Setback feature to provide setback control for a relay output, you must also select a Setback (SbK) value and set up the (real) time and day of the week. See [Setting up the System 450 Reset Setpoint](#) on page 9 for selecting setback values and [Setting up Time and Day of Week](#) for setting up time and day.

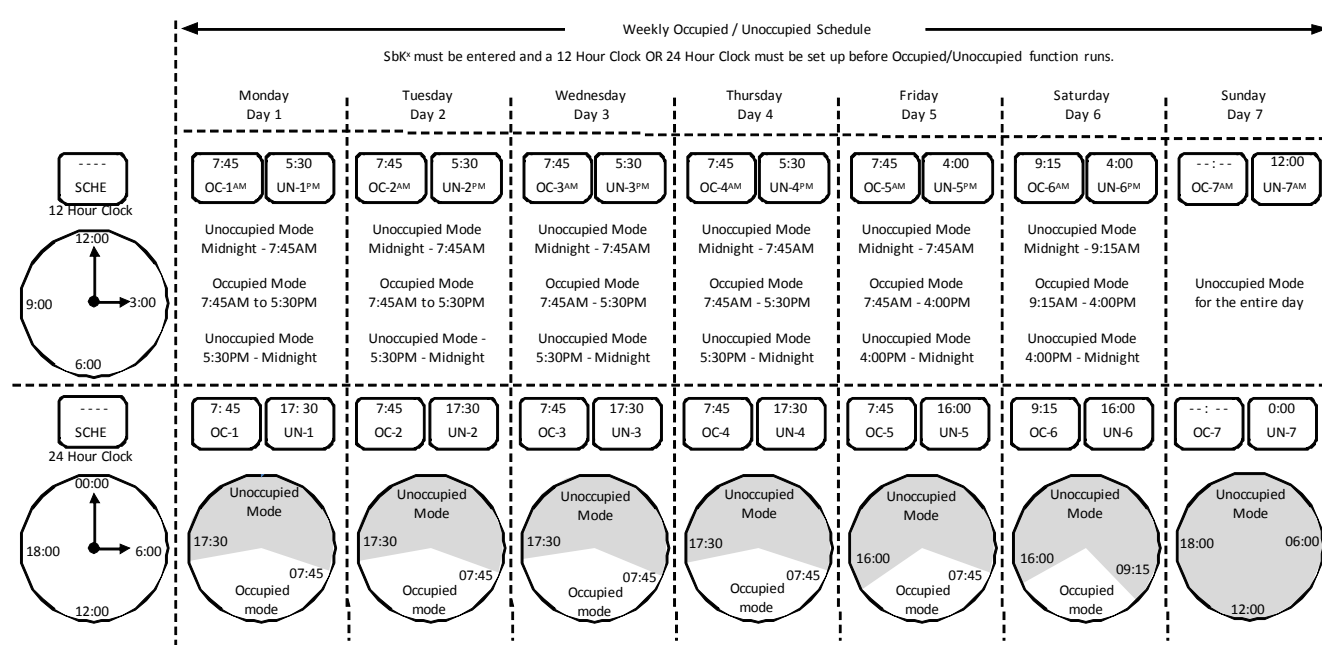


Figure 8: Example System 450 Reset Control Weekly Occupied/Unoccupied Setback Schedule

Occupied/Unoccupied Setback Modes

Relay Output That References an Input Sensor

See Figure 9. During the occupied time, OUTR4 relay turns ON at 55°F (13°C) and turns OFF at 65°F (18.5°C). During the unoccupied times with SbK = 0°F (0°C), there is no change to the On and OFF points.

Analog Output That References an Input Sensor

An analog output can be added to a Reset control system and controlled by Sn-1, Sn-2, or Sn-3. This analog output can also be Setback according to the Time Clock Schedule. For example, if SbK = -5°F (-3°C) is selected in the OUTA setup screens, then during the unoccupied times, the SP becomes 5°F (3°C) lower and the EP becomes 5°F (3°C) lower.

Relay Output and Analog Output That Reference the Reset Function

See Figure 9. During the occupied time, the RSP is calculated using the Reset Applications from Figure 6. During the unoccupied time with the SbK = -10°F (-5.5°C), the RSP is calculated and 10°F (5.5°C) is subtracted. Using the example in Figure 9, the RSP would change from 153°F (67°C) to 143°F (61.5°C) during the unoccupied times.

The load balancing feature is not effected in its function as a result of Occupied/Unoccupied modes.

Table 12: System 450 Sensor Setup Information and Procedures (Part 1 of 2)




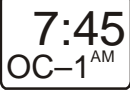





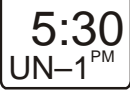





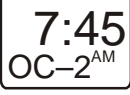

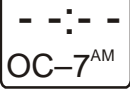



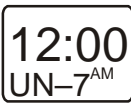







LCD Screen	Name, Description/Function, User Action, and Example
	<p>Occupied/Unoccupied Schedule Setup Start Screen: The Occupied/Unoccupied Schedule Setup Start screen is displayed when you access the System 450 setup screens and scroll through the Setup Start screens by pressing  repeatedly.</p> <p>See the Occupied/Unoccupied Schedule Setup Screens row in the setup screens flow chart in Figure 9 on page 24.</p> <p>Note: To use the System 450 Setback feature, you also must select a Setback (SbK) value for the outputs you want to set back and you must set up the (real) time and day of week. See Setting up the System 450 Reset Setpoint on page 9 and Setting up System 450 Outputs on page 11 for selecting output Setback (SbK) values. See Setting up Time and Day of Week on page 20 for setting up time and day of week.</p> <p>Note: You must set up the time and day of week before the schedule takes effect. You can select the output setback (SbK) values at any time.</p> <p>1. Press  to go to the Day 1 (SUN) Occupied Time Selection screen.</p> <p>Screen example shows the Occupied/Unoccupied Schedule Setup Start screen with four flashing dashes. The remaining screens in this table show how to set up the weekly schedule shown in Figure 8.</p>
	<p>Day 1 (MON) Occupied Time Selection Screen: Select the time of day to begin the occupied time period for Day 1. (The time previous to this occupied time value is unoccupied time.)</p> <p>Note: You can set up one (only) Occupied time for each day of the week (days 1 through 7). When you select no time (- :- -) in an Occupied Time Selection screen, there are no occupied time period for that day; the entire day is unoccupied and all outputs with setback values (other than 0) operate at their setback (unoccupied) setpoint value.</p> <p>Note: Occupied and Unoccupied time periods are available at 15-minute intervals only. For example, 12:00 AM, 2:45 PM, 11:15 AM, 19:30 or 23:45 are available time selections depending on the 12 or 24 Hour Clock selection you made when you set up time and day of week. You can press and hold either the  or  to scroll quickly forward or back through the time selections.</p> <p>2. In the Day 1 Occupied Time Selection screen, press  or  to select the time during Day 1 at which the Occupied time begins (and the previous Unoccupied time ends), then press  to save your time of day selection and go to the next screen.</p> <p>Screen example shows the Day 1 (MON, Monday) Occupied start time is set to 7:45 AM.</p>
	<p>Day 1 (MON) Unoccupied Time Selection Screen: Select the time of day to begin the unoccupied time period for Day 1. (The time previous to this unoccupied time value is occupied time.)</p> <p>Note: You can set up one (only) unoccupied time for each day of the week (days 1 through 7). When you select no time (- :- -) in an Unoccupied Time Selection screen, there are no unoccupied time periods for that day, and the entire day is occupied and all outputs operate at their occupied setpoint value.</p> <p>Note: Occupied and Unoccupied time periods are available at 15-minute intervals only. For example, 12:00 AM, 2:45 PM, 11:15 AM, 19:30, or 23:45 are available time selections depending on the 12 or 24 Hour Clock selection you made when you set up time and day of week. You can press and hold either the  or  to scroll quickly forward or back through the time selections.</p> <p>3. In the Day 1 Unoccupied Time Selection screen, press  or  to select the time during Day 1 at which the Unoccupied time begins (and the previous Occupied time ends), then press  to save your time of day selection and go to the next screen.</p> <p>Screen example shows the Day 1 (MON, Monday) Unoccupied start time is set to 5:30 PM.</p>
	<p>Day 2 (TUE) through Day 6 (SAT) Occupied/Unoccupied Time Selection Screens: Select the time of day to begin the next occupied or unoccupied time period for the remaining days of the week.</p> <p>4. Repeat Step 2 and Step 3 for each of the remaining days of the week, then press  to save your time of day selection and go to the next screen.</p> <p>Screen example shows the Day 2 (TUE, Tuesday) Occupied start time is set to 7:45 AM.</p>
	<p>Day 7 (SUN) Occupied Time Selection Screen: Select the time of day to begin the occupied time period for Day 7 and end the previous occupied time period.</p> <p>5. In the Day 7 Occupied Time Selection screen, press  or  to select the time during Day 7 at which the Occupied time begins (and the previous Unoccupied time ends), then press  to save your time of day selection and go to the next screen.</p> <p>Screen example shows the Day 7 (SUN, Sunday) Occupied start time is set to - :- - (none).</p>

Table 12: System 450 Sensor Setup Information and Procedures (Part 2 of 2)

LCD Screen	Name, Description/Function, User Action, and Example
	<p>Day 7 (SUN) Unoccupied Time Selection Screen: Select the time of day to begin the unoccupied time period for Day 7 and end the previous occupied time period.</p> <p>6. In the Day 7 Unoccupied Time Selection screen, press  or  to select the time during Day 7 at which the Unoccupied time begins (and the previous Occupied time ends), then press  to save your time of day selection and go to the next screen.</p> <p>Screen example shows the Day 7 (SUN, Sunday) Unoccupied start time is set to 12:00 AM, which along with the Day 7 Occupied Start Time of -:-, establishes a 24 hour unoccupied time for Day 7 (SUN, Sunday).</p>
	<p>Occupied/Unoccupied Schedule Setup Start Screen: The Weekly Occupied/Unoccupied Schedule is now set up in the System 450 UI and you have returned to the Setup Start screen.</p> <p>7. Press  to scroll through the remaining Setup Start screens and continue setting up your control system, or press  and  simultaneously to return to the System 450 Main screens.</p>

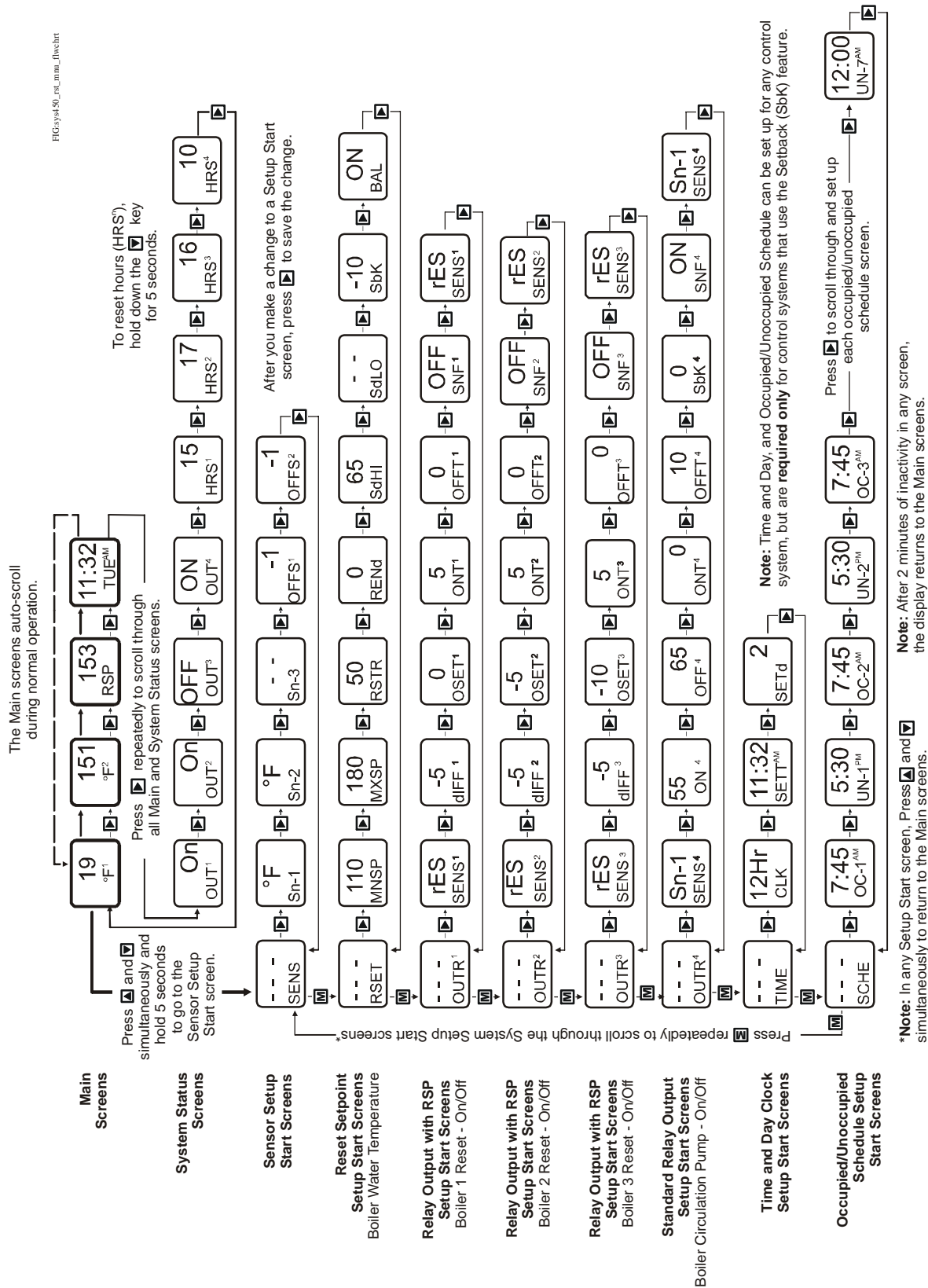



Figure 9: Menu, Status, and Setup Screens Flowchart Example (See Figure 3.)

Technical Specifications

C450RxN-3 System 450 Reset Control Modules

Product	C450RxN-3: System 450 Reset Control Module models are sensing controls and operating controls with LCD, four-button touch pad, and On/Off relay output. C450RBN-3: Reset Control Module with one SPDT output relay, one A99BC-25 temperature sensor, and one A99BC-300 temperature sensor C450RCN-3: Reset Control Module with two SPDT output relays, one A99BC-25 temperature sensor, and one A99BC-300 temperature sensor											
Supply Power	C450-YYN-1 Power Supply Module or 24 (20-30) VAC Safety Extra-Low Voltage (SELV) (Europe) Class 2 (North America) Transformer, 50/60 Hz, 10 VA minimum											
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 ohms at 25°C (77°F) for an A99 PTC Temperature Sensor											
Output Relay Contacts	General: 1/2 HP at 120/240 VAC, SPDT											
	Specific: <table><tr><td>AC Motor Ratings</td><td>120 VAC</td><td>208/240 VAC</td></tr><tr><td>AC Full-load Amperes:</td><td>9.8 A</td><td>4.9 A</td></tr><tr><td>AC Locked-Rotor Amperes:</td><td>58.8 A</td><td>29.4 A</td></tr></table> <div>10 Amperes AC Non-inductive at 24/240 VAC Pilot Duty: 125 VA at 24/240 VAC</div>			AC Motor Ratings	120 VAC	208/240 VAC	AC Full-load Amperes:	9.8 A	4.9 A	AC Locked-Rotor Amperes:	58.8 A	29.4 A
AC Motor Ratings	120 VAC	208/240 VAC										
AC Full-load Amperes:	9.8 A	4.9 A										
AC Locked-Rotor Amperes:	58.8 A	29.4 A										
Clock Accuracy	± 4 minutes per year											
Clock Backup Power	12 hours (capacitor reserve)											
Setback Events	one occupied event and one unoccupied event per day; 7 day schedule											
Analog Input Accuracy	Resolution: 14 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 61 x 61 mm (5 x 2-3/8 x 2-3/8 in.)											
Weight	C450RBN-3: 209 gm (0.46 lb) C450RCN-3: 222 gm (0.49 lb)											
Compliance	<div><div></div><div><p>North America: cULus Listed; UL 60730, File E27734, Vol. 1; FCC Compliant to CFR47, Part 15, Subpart B, Class B Industry Canada (IC) Compliant to Canadian ICES-003, Class B limits</p><p>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.</p><p>Australia: Mark: C-Tick Compliant (N1813)</p></div></div>											



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.



Building Efficiency

507 E. Michigan Street, Milwaukee, WI 53202

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