



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

Installation Instructions

C450RBN-1

C450RCN-1

Part No. 24-7664-2772, Rev. C

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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 control module could lead to personal injury or property damage to the controlled equipment or other property, additional precautions must be designed into the control system. Incorporate and maintain other devices, such as supervisory or alarm systems or safety or limit controls, intended to warn of or protect against failure or malfunction of the System 450 control module.

System 450 is a family of modular, digital electronic controls that is easily assembled and set up to provide reliable temperature, pressure, and humidity control for a wide variety of 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-1 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 touchpad User Interface (UI) that allow you to set up custom System 450 control systems.

The C450RBN-1 model provides one SPDT relay. The C450RCN-1 model provides two SPDT relays.

Refer to the *System 450 Series Modular Controls Technical Bulletin (LIT-12011459)* for more detailed information on designing, installing, setting up, and troubleshooting System 450 Series components and control systems.

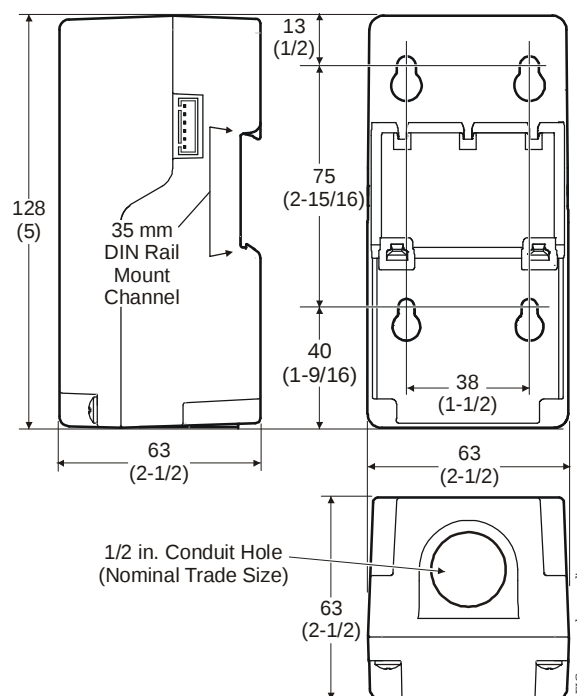


Figure 1: System 450 Module Dimensions, mm (in.)

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 26 for electrical ratings.



WARNING: Risk of Electric Shock.

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

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

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

IMPORTANT: 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: 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.

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

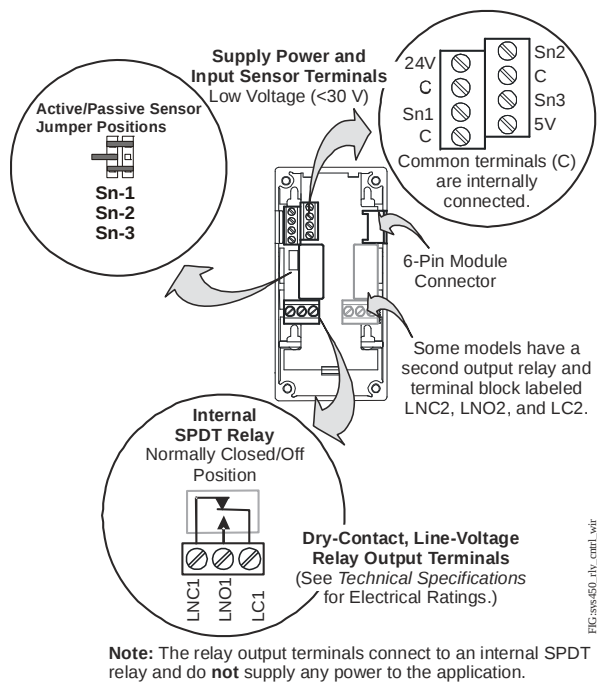


Figure 2: C450RxN-1 Wiring Terminals

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 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 equipment control circuit to the normally closed contact on the SPDT ¹ relay.	0.08 mm ² to 2.5 mm ² 28 AWG to 14 AWG
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.

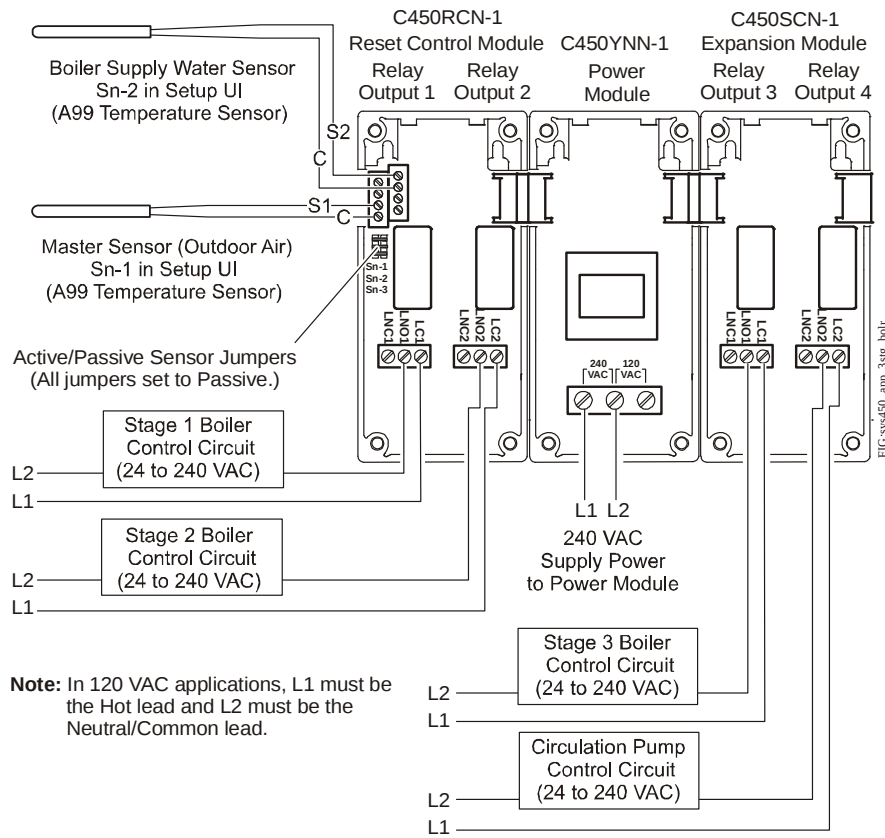


Figure 3: System 450 Reset Control System Example for a Three-Stage Boiler with or without Load Balancing (See Figure 9.)

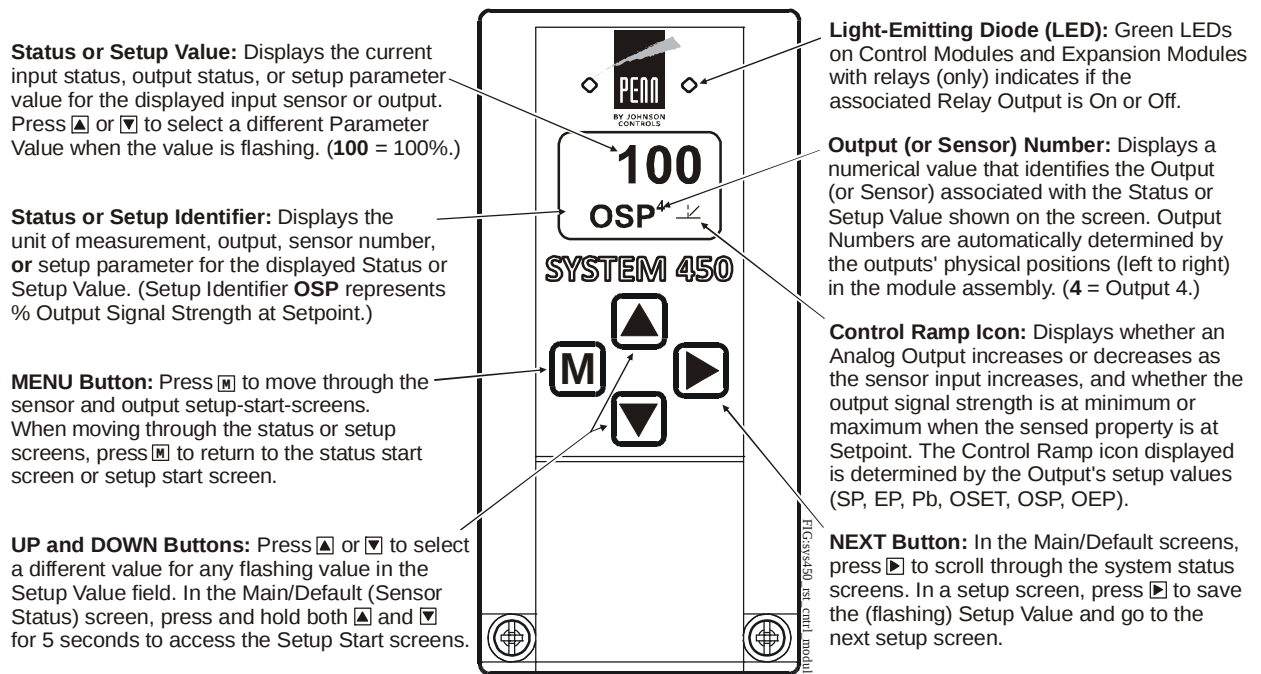


Figure 4: System 450 Reset Control Module Output Relay LEDs, LCD, and Four-Button Touchpad User Interface

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 back-lit 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 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 touchpad 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)

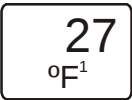
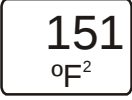
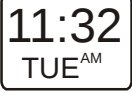
LCD Screen	Name, Description/Function, User Action, and Example
	Main Screens: During normal operation, the Reset Control Main screens automatically scroll through the current temperature or humidity sensed at each sensor, the current time and day, and the current calculated Reset Setpoint (RSP) value. See the Main Screens row in the setup screens flow chart in Figure 9 on page 24. 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. Note: Main screens are view-only; selections cannot be made in Main screens. 1. During normal operation while the LCD is auto-scrolling through the Main screens: • 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. 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.
	
	
	

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
 	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: - 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. See the System Status Screens row in the setup screens flow chart in Figure 9 on page 24. Note: System Status screens (except Runtime Hours Status screens) are view-only; selections cannot be made in Status screens. 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. 2. Press repeatedly to scroll through and view the System Status screens for your control system. 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 run-time (relay ON).

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](#).

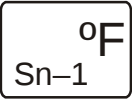
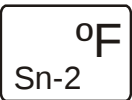
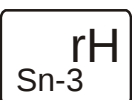
Table 3 provides information about System 450 compatible sensors for Reset Control Modules. Table 4 provides sensor setup information, procedures, and example screens. Figure 9 on page 24 provides a System 450 UI screen flowchart example.

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 ¹
°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

1. See Table 14 on page 25 for compatible System 450 temperature sensor product code numbers and ordering information. See Table 15 on page 26 for compatible System 450 humidity transducer product code numbers and ordering information.

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

LCD Screen	Name, Description/Function, User Action, and Example
	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. 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. 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. If the sensors are already set up, press  (repeatedly) to scroll through the remaining Setup Start screens and continue setting up your control system. Screen example shows the Sensor Setup Start screen with four flashing dashes.
  	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. 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. 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. 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. 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. 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. 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. 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. Screen examples show Sn-1 set to Sensor Type °F; Sn-2 set to °F; and Sn-3 set to rH.
	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. Sensor Type °F enables an offset of +/- 5°F in 1 degree increments. Sensor Type °C enables an offset of +/- 2.5°C in 0.5 degree increments. Note: 5. Press  or  to select the desired temperature offset value. Press : - to go to the next Temperature Offset Selection screen (if there are additional temperature sensors in your control system) and repeat this step for each temperature sensor - to return to the Sensors Setup-Start Screen Screen example shows 0 as the selected temperature display offset value for Sensor 2
	Sensors Setup Start Screen: The hardwire sensors are setup in the UI. 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.

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.

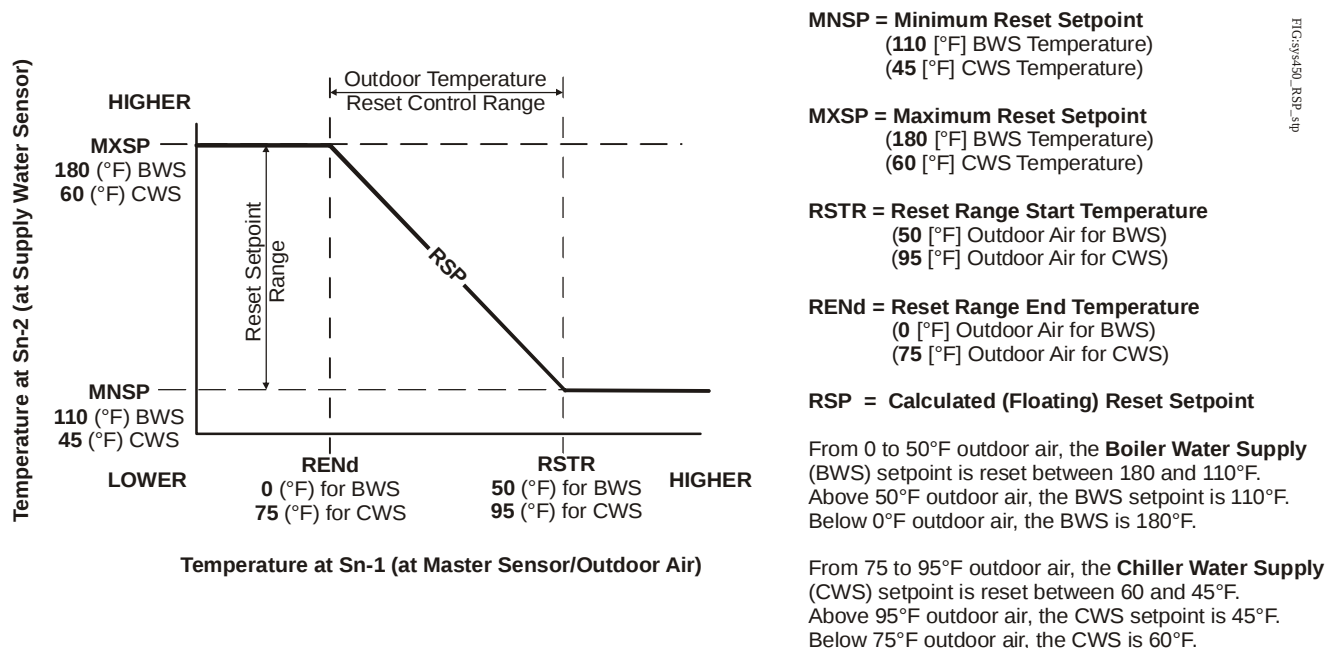
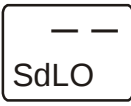
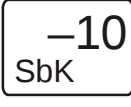


Figure 6: Example Reset Setpoint Applications for Boiler Water Supply and Chiller Water Supply Showing the Relationships between the Reset Setpoint Setup Parameters

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

LCD Screen	Name, Description/Function, User Action, and Example
	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. 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. 1. Press the Next button to go to the next screen and begin setting up the Reset Setpoint. 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.
	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. 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. Screen example shows a Minimum Reset Setpoint value of 110 (°F).
	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. 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. Screen example shows a Maximum Reset Setpoint value of 180 (°F).
	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. 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. 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. Screen example shows a Reset Range Start Temperature value of 50 (°F) selected.
	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. 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. Screen example shows a Reset Range End Temperature value of 0 (°F) selected.
	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. 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. Screen example shows an Shutdown High Temperature value of 65 (°F) selected.

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

LCD Screen	Name, Description/Function, User Action, and Example
	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. 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. Screen example shows no Shutdown Low Temperature value selected.
	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. 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. 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. Screen example shows an Setback value of -10 (°F) selected.
	Load Balancing Selection Screen: Select ON to enable the Load Balancing feature. 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. Note: The Load Balancing feature is not available for analog outputs. 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. Screen example shows Load Balancing feature is enabled (ON).
	Reset Setpoint Setup Start Screen: The Reset Setpoint is now set up in the UI. 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.

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)

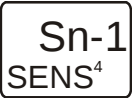
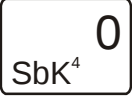
LCD Screen	Name, Description/Function, User Action, and Example
	Relay Output Setup Start Screen: The output number and output type (relay or analog) are automatically assigned when you connect power to the module assembly. See the Standard Relay Output Setup Screens row in the setup screens flow chart in Figure 9 on page 24. Note: All Setup Start screens are view-only; selections cannot be made in Setup Start screens. 1. Press  to go to the Sensor Selection screen. 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.
 	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. 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. 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. 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.
	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. 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. 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. Screen example shows an ON value of 55 (°F) selected for Relay Output 4.
	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. 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. 4. Press  or  to select the value at which output relay turns Off, then press  to save your selection and go to next screen. Screen example shows an OFF value of 65 (°F) selected for Relay Output 4.
	Minimum Relay ON Time Selection Screen: Minimum ON Time range is 0 to 300 seconds. 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. Screen example shows 0 seconds selected for the minimum relay-on time for Relay Output 4.
	Minimum Relay OFF Time Selection Screen: Minimum Relay OFF Time range is 0 to 300 seconds. 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. Screen example shows 10 seconds selected for the minimum relay-off time for Relay Output 4.
	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. 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. 7. Press  or  to select the Unoccupied Setback value, then press  to save your selection and go to the next screen. Screen example shows 0 (°F) selected for the Unoccupied Setback value for Relay Output 4.

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
	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: • ON: Output relay remains on during sensor failure. • OFF: Output relay remains off during sensor failure. 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. 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.
	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. 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. 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. 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.
	Relay Output Setup Start Screen: This Standard Relay Output is now set up in the UI. 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.

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
	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. See the Relay Output with Reset Setpoint Setup Screens row in the setup screens flow chart in Figure 9 on page 24. Note: All Setup Start screens are view-only; selections cannot be made in Setup Start screens. 1. Press to go to the Sensor Selection screen. 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.
	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. 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. 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. 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.

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
	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. 3. Press  or  to select the Reset Differential value for this output, then press  to save your selection and go to the next screen. Screen example shows -5 differential selected for Output 2.
	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. 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. Screen example shows 0 (°F) offset selected for Output 2.
	Minimum Relay ON Time Selection Screen: Minimum ON Time range is 0 to 300 seconds. 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. Screen example shows 5 seconds selected for the minimum ON-Time for Output 2.
	Minimum Relay OFF Time Selection Screen: Minimum OFF Time range is 0 to 300 seconds. 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. Screen example shows 0 seconds selected for the minimum OFF-Time for Output 2.
	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: • ON: Output relay remains On during sensor failure. • OFF: Output relay remains Off during sensor failure. 7. Press  or  to select the Sensor Failure Mode for this output, then press  to save your selection and go to the next screen. Screen example shows OFF sensor failure mode selected for Output 2.
	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. 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. 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. 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.

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  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.

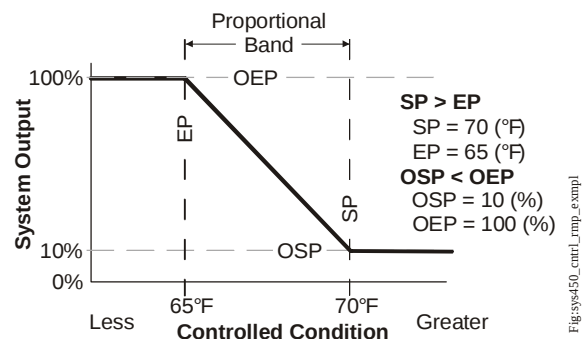
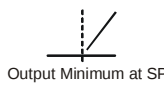
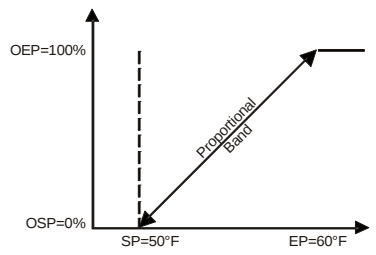
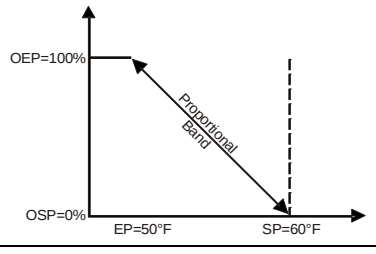
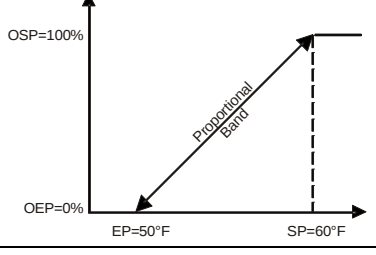
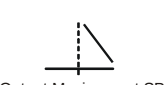
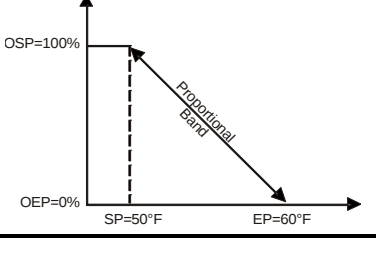


Figure 7: Control Ramp Example for a Typical Heating Application (SP > EP and OSP < OEP)

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
		SP < EP OSP < OEP
		SP > EP OSP < OEP
		SP > EP OSP > OEP
		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
	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. See the Standard Analog Output Setup Screens row in the setup screens flow chart in Figure 9 on page 24. Note: All Setup Start screens are view-only; selections cannot be made in Setup Start screens. 1. Press  to go to the Sensor Selection screen. 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.

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

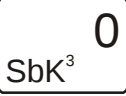
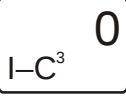
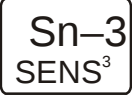
LCD Screen	Name, Description/Function, User Action, Example
 	Sensor Selection Screen: The sensor you select here determines the output control type (standard or reset control), and output's setup parameters and value ranges. If a sensor is not selected, the remaining output setup screens do not appear. 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. 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. 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. 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.
	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. Note: The output's minimum proportional band (between Setpoint and End Point) is automatically enforced in the Setpoint and End Point Selection screens. 3. Press  or  to select this output's Setpoint value, then press  to save your selection and go to the next screen. Screen example shows a Setpoint of 50 (%RH) selected for Output 3.
	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. Note: The output's minimum proportional band (between Setpoint and End Point) is automatically enforced in the Setpoint and End Point Selection screens. 4. Press  or  to select this output's End Point value, then press  to save your selection and go to the next screen. Screen example shows a End Point of 60 (%RH) selected for Output 3.
	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 (%). 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. 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).
	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 (%). 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. 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).
	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. 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. 7. Press  or  to select the Unoccupied Setback value, then press  to save the selected value and go to the next screen. Screen example shows 0 selected for the Unoccupied Setback value for Output 3.
	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. 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. 8. Press  or  to select the Integration Constant for this output, then press  to save your selection and go to the next screen. Screen example shows an Integration Constant of 0 (zero) selected for Output 3.

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

LCD Screen	Name, Description/Function, User Action, Example
	Sensor Failure Mode Selection Screen: 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: • ON: Output goes to the OEP value. • OFF: Output goes to the OSP value. 9. Press  or  to select the Sensor Failure Mode for this output, then press  to save your selection and go to the next screen. Screen example shows the OFF Sensor Failure Mode selected for Output 3.
	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. 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. 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. 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.
	Analog Output Setup Start Screen: This Standard Analog Output is now set up in the UI. 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.

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)

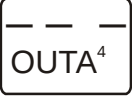
LCD Screen	Name, Description/Function, User Action, Example
	Analog Output Setup Start Screen: The output number and output type (relay or analog) are automatically assigned when you connect power to the module assembly. See the Analog Output with Reset Setpoint Setup Screens row in the setup screens flow chart in Figure 9 on page 24. Note: All Setup Start screens are view-only; selections cannot be made in Setup Start screens. 1. Press  to go to the Sensor Selection screen. 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.
 	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. 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. 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. 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.

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

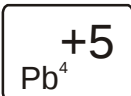
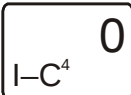
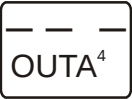
LCD Screen	Name, Description/Function, User Action, Example
	Proportional Band Selection Screen: The Pb value establishes the fixed proportional band between the (floating) setpoint and end point. The (floating) proportional band's setpoint is RSP and the (floating) proportional band's end point is RSP+Pb. 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. 3. Press  or  to select this output's Proportional Band value, then press  to save your selection and go to the next screen. Screen example shows a (floating) Proportional Band of +5 (F) selected for Output 4.
	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. A positive offset value (OSET = +n) raises the proportional band's setpoint and end point values. A negative offset value (OSET = -n) lowers the proportional band's setpoint and end point values. 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. 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. Screen example shows an Offset value of 0 (zero) selected for Output 4.
	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 (%). 5. Press  or  to select the %Output strength at Reset Setpoint value, then press  to save your selection and go to the next screen. 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).
	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 (%). 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. 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).
	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. 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. 7. Press  or  to select the Integration Constant for this output, then press  to save your selection and go to the next screen. Screen example shows an Integration Constant of 0 selected for Output 4.
	Sensor Failure Mode Selection Screen: 8. Press  or  to select the Sensor Failure Mode for this output, then press  to save your selection and go to the next screen. 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: • ON: Output goes to the OEP value. • OFF: Output goes to the OSP value. Screen example shows the OFF Sensor Failure Mode selected for Output 4.

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

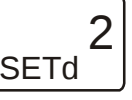
LCD Screen	Name, Description/Function, User Action, Example
	Edit Sensor Screen: Displays the (selected) sensor that this output references. Unless you need to change the sensor, press ▶ to complete the output setup and return to the Output Setup Start screen. If you need to change the sensor that this output references, you can select a different sensor in this screen. 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. 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. 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.
	Analog Output Setup Start Screen: This Analog Output with Reset Setpoint is now set up in UI. 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.

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
	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. Note: All Setup Start screens are view-only; selections cannot be made in Setup Start screens. 1. Press ▶ to go to the 12 or 24 Hour Clock Selection screen. Screen example shows the Time and Day Setup Start screen with four flashing dashes.
	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. 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. Screen example shows 12 hour clock format selected.
	Time of Day Setup Screen: Set the clock to real-time. 3. Press ▲ or ▼ to set the current time, then press ▶ to save the time setting and go to the next screen. Screen example shows (real) time selected is 11:32 A.M.
	Day of Week Setup Screen: Set the day to real-time. Note: 1 = MON, 2 = TUE, 3 = WED, 4 = THU, 5 = FRI, 6 = SA, and 7 = SUN. 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. Screen example shows day of week set to 2 (TUE, Tuesday).
	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. 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.

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.

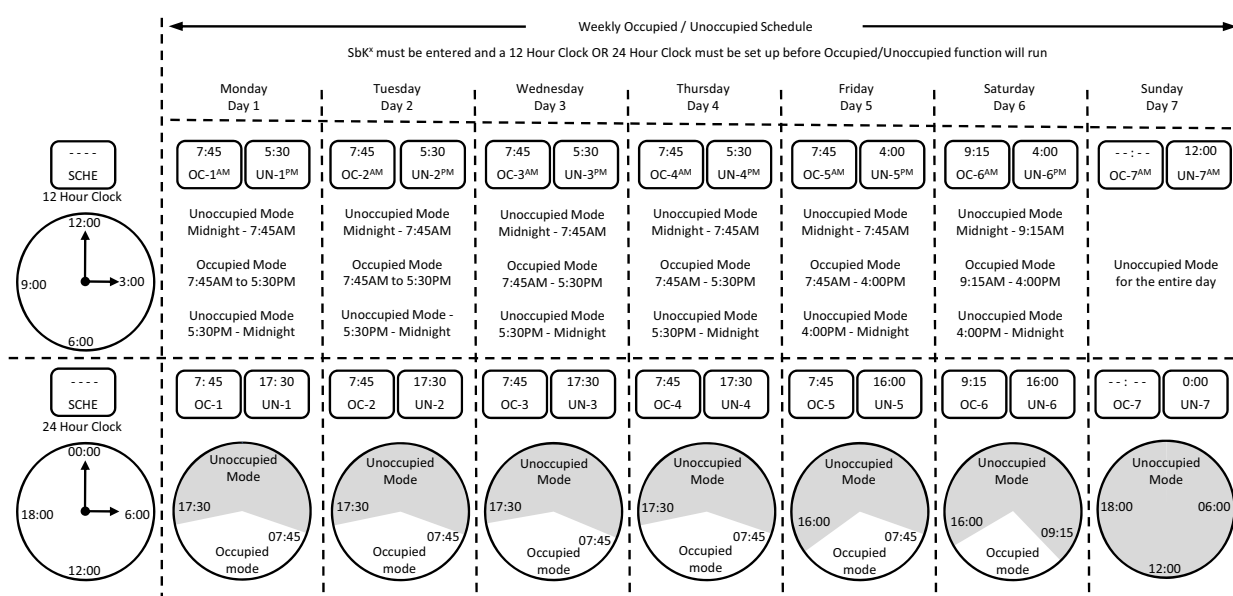


Figure 8: Example System 450 Reset Control Weekly Occupied/Unoccupied Setback Schedule

Occupied/Unoccupied Setback Modes

Relay Output That References an Input Sensor

See Figure 9. During the occupied time, OUTR4 relay will come ON at 55°F (13°C) and go 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)

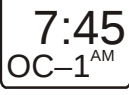
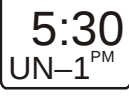
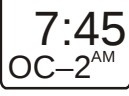
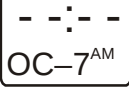
LCD Screen	Name, Description/Function, User Action, and Example
	Occupied/Unoccupied Schedule Setup Start Screen: The Occupied/Unoccupied Schedule Setup Start screen is displayed when you access the System 450 setup screens and scroll through the Setup Start screens by pressing  repeatedly. See the Occupied/Unoccupied Schedule Setup Screens row in the setup screens flow chart in Figure 9 on page 24. 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. Note: You must set up the time and day of week before the schedule will take effect. You can select the output setback (SbK) values at any time. 1. Press  to go to the Day 1 (SUN) Occupied Time Selection screen. 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.
	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.) 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. 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. 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. Screen example shows the Day 1 (MON, Monday) Occupied start time is set to 7:45 AM.
	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.) 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. 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. 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. Screen example shows the Day 1 (MON, Monday) Unoccupied start time is set to 5:30 PM.
	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. 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. Screen example shows the Day 2 (TUE, Tuesday) Occupied start time is set to 7:45 AM.
	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. 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. Screen example shows the Day 7 (SUN, Sunday) Occupied start time is set to - :- - (none).

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

LCD Screen	Name, Description/Function, User Action, and Example
	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. 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. 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).
	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. 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.

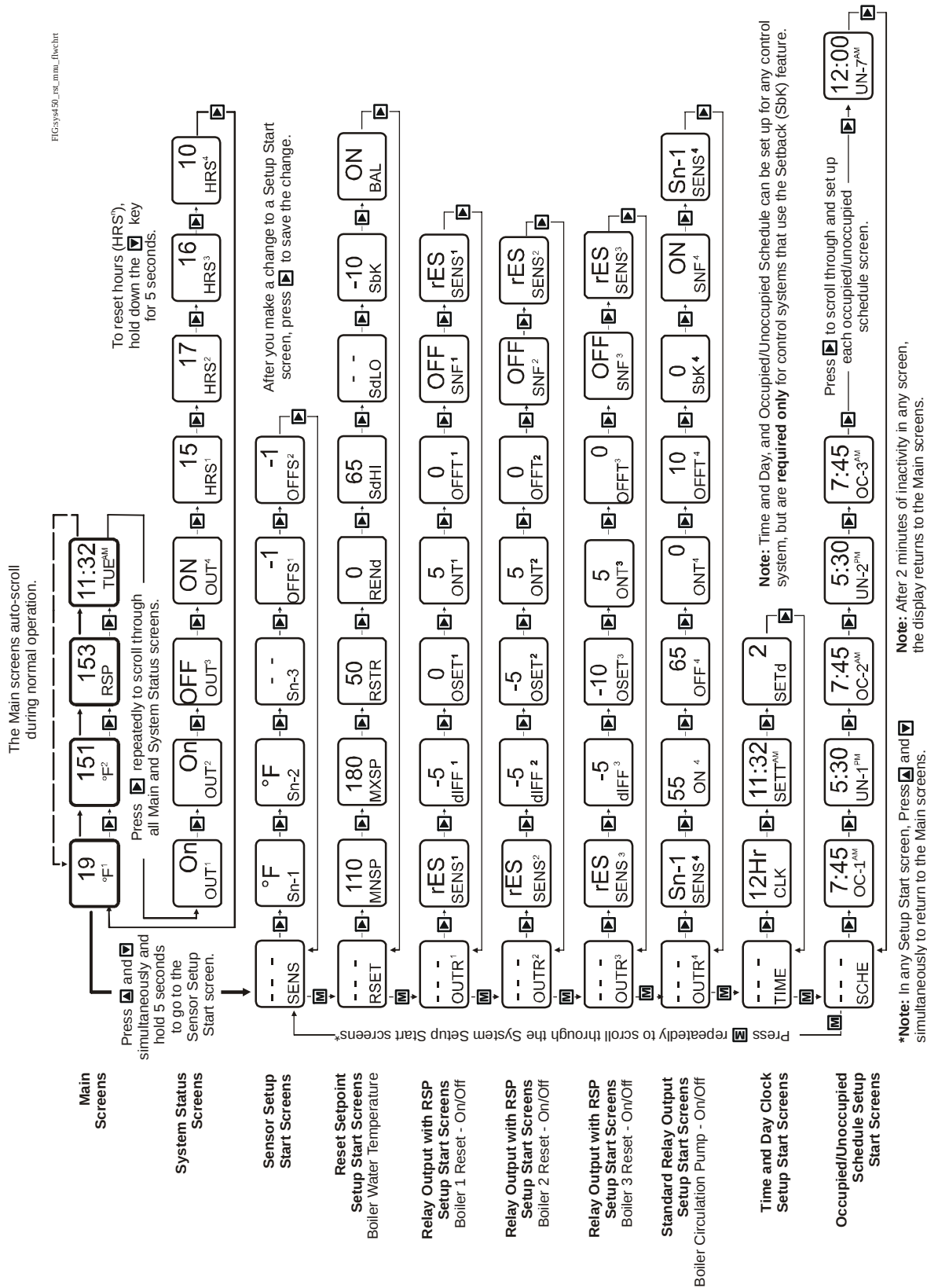


Figure 9: Menu, Status, and Setup Screens Flowchart Example (See Figure 3.)

Ordering Information

Table 13 provides ordering information for System 450 Expansion modules and DIN Rail components for mounting module assemblies.

Table 14 provides ordering information for System 450 Reset Control Module compatible temperature sensors and sensor mounting hardware.

Table 15 provides ordering information for System 450 Reset Control Module compatible humidity transducers.

Table 13: System 450 Module and DIN Rail Ordering Information

Product Code Number	Product Description
C450SBN-1	Relay Output Expansion Module; Provides one relay output (SPDT line-voltage relay) for On/Off control.
C450SCN-1	Relay Output Expansion Module; Provides two relay outputs (SPDT line-voltage relays) for On/Off control.
C450SPN-1	Analog Output Expansion Module; Provides one analog output (0–10 VDC or 4–20 mA self-selecting signal) for proportional control.
C450SQN-1	Analog Output Expansion Module; Provides two analog outputs (0–10 VDC or 4–20 mA self-selecting signals) for proportional control.
C450YNN-1	Power Module; Provides 24 V to System 450 Module Assembly; 120 VAC or 240 VAC supply power input terminals
BKT287-1R	DIN rail, 0.3 m (12 in.) long for mounting module assemblies
BKT287-2R	DIN rail, 1.0 m (39 in.) long for mounting module assemblies
BKT287-3R	DIN rail, 0.61 m (24 in.) long for mounting module assemblies
BKT287-4R	DIN rail, 0.36 m (14 in.) long for mounting module assemblies
PLT344-1R	DIN rail end clamp kit (consists of 2 end clamps)

Table 14: System 450 Compatible A99B Temperature Sensors and Sensor Mounting Ordering Information (Part 1 of 2)

Product Code Number	Product Description
A99BA-200C	PTC Silicon Sensor with Shielded Cable; Cable length (2 m) 6-1/2 ft Sensor Temperature Range: -40 to 120°C (-40 to 250°F) Note: Cable jacket temperature range -40 to 100°C (-40 to 212°F)
A99BB-25C	PTC Silicon Sensor with PVC Cable; Cable length (0.25 m) 9-3/4 in. Sensor Temperature Range: -40 to 120°C (-40 to 250°F) Note: Cable jacket temperature range -40 to 100°C (-40 to 212°F)
A99BB-200C	PTC Silicon Sensor with PVC Cable; Cable length (2 m) 6-1/2 ft Sensor Temperature Range: -40 to 120°C (-40 to 250°F) Note: Cable jacket temperature range -40 to 100°C (-40 to 212°F)
A99BB-300C	PTC Silicon Sensor with PVC Cable; Cable length (3 m) 9-3/4 ft Sensor Temperature Range: -40 to 120°C (-40 to 250°F) Note: Cable jacket temperature range -40 to 100°C (-40 to 212°F)
A99BB-500C	PTC Silicon Sensor with PVC Cable; Cable length (5 m) 16-3/8 ft Sensor Temperature Range: -40 to 120°C (-40 to 250°F) Note: Cable jacket temperature range -40 to 100°C (-40 to 212°F)
A99BB-600C	PTC Silicon Sensor with PVC Cable; Cable length (6 m) 19-1/2 ft Sensor Temperature Range: -40 to 120°C (-40 to 250°F) Note: Cable jacket temperature range -40 to 100°C (-40 to 212°F)
A99BC-25C	PTC Silicon Sensor with High Temperature Silicon Cable; Cable length (0.25 m) 9-3/4 in. Sensor Temperature Range: -40 to 120°C (-40 to 250°F) Cable jacket rated for full sensor temperature range.

Table 14: System 450 Compatible A99B Temperature Sensors and Sensor Mounting Ordering Information (Part 2 of 2)

Product Code Number	Product Description
A99BC-300C	PTC Silicon Sensor with High Temperature Silicon Cable; Cable length (3 m) 9-3/4 ft Sensor Temperature Range: -40 to 120°C (-40 to 250°F) Cable jacket rated for full sensor temperature range.
A99BC-1500C	PTC Silicon Sensor with High Temperature Silicon Cable; Cable length (15 m) 49 ft Sensor Temperature Range: -40 to 120°C (-40 to 250°F) Cable jacket rated for full sensor temperature range.
BOX10A-600R	PVC enclosure for A99 sensor; includes wire nuts and conduit connector (for outdoor sensor)
WEL11A-601R	Immersion well for A99 sensor liquid sensing applications
A99-CLP-1	Mounting clip for A99 temperature sensor
ADP11A-600R	Conduit adaptor, 1/2 in. snap-fit EMT conduit adaptor (box of 10)
TE-6001-1	Duct mounting hardware with handy box for A99 sensor
TE-6001-11	Duct mounting hardware without handy box for A99 sensor
SHL10A-603R	Sun Shield (for use with outside A99 sensors in sunny locations)

Table 15: System 450 Compatible HE67S3 Type Humidity Sensors with Integral A99B Temperature Sensor Ordering Information

Product Code Number	Product Description
HE-67S3-0N0BT	Wall Mount Humidity Sensor with A99B Type Temperature Sensor: 10 to 95% RH; -40 to 121°C (-40 to 250°F)
HE-67S3-0N00P	Duct Mount Humidity Sensor with A99B Type Temperature Sensor: 10 to 95% RH; -40 to 121°C (-40 to 250°F)

Technical Specifications

C450RxN-1 System 450 Reset Control Modules (Part 1 of 2)

Product	C450RxN-1: System 450 Reset Control Module models are sensing controls and operating controls with LCD, four-button touchpad, and On/Off relay output. C450RBN-1: Reset Control Module with one SPDT output relay, one A99BC-25 temperature sensor, and one A99BC-300 temperature sensor C450RCN-1: 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; 1035 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: 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	10 Amperes AC Non-inductive at 24/240 VAC		
	Pilot Duty: 125 VA at 24/240 VAC		
Clock Accuracy	± 4 minutes per year		

C450RxN-1 System 450 Reset Control Modules (Part 2 of 2)

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-1: 209 gm (0.46 lb) C450RCN-1: 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 Low Voltage Directive (2006/95/EC); EMC Directive (2004/108/EC); RoHS Directive (2002/95/EC); WEEE Directive (2002/96/EC)
	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

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