



# System 450 Series C450CCU Condensing Unit Control Module Installation Guide

24-7664-03809 Part No. Rev. C

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## Description

The System 450™ Series condensing unit control module controls space temperature, scheduled defrost cycles, evaporator fans, and optional pump down compressor control on medium and low temperature refrigeration condensing units.

You can use the C450CCU-4 control module, in conjunction with optional System 450 relay output expansion modules, to build a variety of custom condensing unit control systems for small and medium capacity refrigeration applications.

The C450CCU-4 condensing unit control system provides passive, off-cycle defrost control or active, electric heat defrost control. Depending on the application, you can terminate defrost cycles based on time or based on sensed evaporator temperature. You can use a menu option to manually initiate or terminate a defrost cycle at any time.

You can also control single-speed or two-speed evaporator fans, and add an optional pressure transducer for pump down pressure control of the compressor.

Refer to the *System 450 Series C450CCU Condensing Unit Control System Technical Bulletin (LIT-12013266)* for detailed information about how to set up, operate, and troubleshoot a System 450 condensing unit control system.

## Application

- **Important:** Use the System 450 Series C450CCU condensing unit control module only as an operating control. Where failure or malfunction of the condensing unit 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 condensing unit control module.
- **Important:** Utiliser ce System 450 Series C450CCU condensing unit control module uniquement en tant que dispositif de contrôle de fonctionnement. Lorsqu'une défaillance ou un dysfonctionnement du régulateur 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 régulateur.

## Installation

Figure 1: System 450 module dimensions, mm (in.)

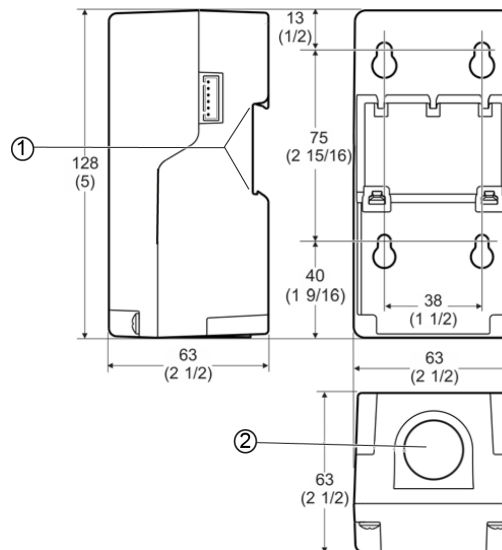


Table 1: System 450 module dimensions, mm (in.)

Callout	Description
1	35 mm DIN rail mount channel
2	12.7 mm (1/2 in.) conduit hole, nominal trade size

## Mounting modules and module assemblies

Observe the following location and mounting guidelines.

- Make sure that the mounting surface can support the module assembly, DIN rail, mounting hardware, and any user-supplied panel or enclosure.
- Mount the modules upright and plugged together in a horizontal row where possible, as shown in Figure 2. It is best practice to mount the control module on a DIN rail.
- In direct-mount applications, mount the modules on flat and even surfaces.
- Allow sufficient space to make connections, run wires, and view the LCD and LEDs.
- Mount the modules in locations free of corrosive vapors, and observe the ambient operating conditions listed in the [C450CCU condensing unit control module technical specifications](#).
- Do not mount the modules on surfaces that are prone to vibration or in locations where high-voltage relays and motor-starters, electromagnetic emissions, or strong radio frequency 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 ambient temperature to exceed 66°C (150°F).

## Mounting modules on DIN rail

### Before you begin:

- **Important:** When you mount a module assembly on a DIN rail, clip the modules on to the DIN rail individually before you slide and plug the mounted modules together. If you clip a complete module assembly that is already plugged together on to the DIN rail, it can damage the 6 pin modular plugs and void any warranties.
1. Mount the control module in a suitable location on a section of 35 mm DIN rail that is longer than the module assembly width. Use appropriate mounting hardware.
  2. Clip the control module on to the rail, position the module's upper DIN rail clips on the top rail, and gently snap the lower clips on to the bottom of the rail.
  3. Assemble the modules in the correct order. Clip the remaining modules to the right of the control module on to the DIN rail and gently slide and plug the modules together.
- ① **Note:**
- If you use a C450YNN power module, you must plug it into the control module. Plug in any expansion modules for your control system to the right of the power module.
  - When you power on your module assembly, you can then set up your control system in the control module UI before you wire the sensors or outputs to your assembly. If you set up the sensors in the UI but do not connect them, an SNF sensor failure notification displays.

## Direct-mounting modules to wall surfaces

1. Plug the modules together, remove the module covers.
  2. Place the module assembly horizontally against the wall surface in a suitable location, and mark the mount hole locations on the mounting surface.
  3. Install appropriate screws or fasteners, and leave the screw heads approximately one to two turns away from flush to the mounting surface.
  4. Position the assembly mounting slots over the screw heads, and then carefully tighten the mounting screws to secure the assembly to the surface.
- ① **Note:** If you mount the modules on an uneven surface, use shims or washers to mount the module assembly evenly on the surface.

## Wiring

See [C450CCU condensing unit control module 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 branchement électrique. Plusieurs isolations et débranchements sont peut-être nécessaires pour -couper entièrement l'alimentation de l'équipement. Tout contact avec des composants conducteurs de tensions dangereuses risque d'entraîner une décharge électrique et de provoquer des blessures graves, voire mortelles.

### ➤ Important:

- You can connect a System 450 control module and module assembly to an internal power source, such as a System 450 power module, or an external power source, such as 24 VAC/VDC power that connects to the 24 V and COM terminals on the control module. Do not connect a control module to both power sources simultaneously. If you connect a control module to both internal and external power sources, you can damage the modules and void any warranty.
- Use copper conductors only. Make all wiring connections in accordance with local, national, and regional regulations.
- Do not exceed the System 450 modules' electrical ratings. Exceeding electrical ratings can result in permanent damage to the modules and void any warranty.
- Run all low-voltage wiring and cables separately from all high-voltage wiring. It is best practice to use shielded cable for input sensor cables that are exposed to high electromagnetic or radio frequency noise.
- Electrostatic discharge (ESD) can damage System 450 modules. Use proper ESD precautions when you install and service the modules to avoid damage to System 450 modules.

- Do not apply power to a C450YNN power module or the 24 VAC/VDC power source for the System 450 modules before you finish wiring and checking all wiring connections. Short circuits or incorrectly connected wires can result in damage to the modules and void any warranty.
- When you connect System 450 compatible sensors with shielded cable to a System 450 control module, connect the cable shield drain lead to one of the C 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. If you connect a cable shield at more than one point, transient currents can flow through the sensor cable shield and can cause erratic control operation.
- Labels are included with the C450CCU controller that describe the Expansion Module LED and Relay operation. Place the label or labels below the LED relay indicator or indicators on the expansion modules.

**Table 2: System 450 wiring terminals and wire sizes**

Terminal block type	Terminal label	Terminal function	Wire sizes
Sensor and low-voltage supply power terminal block	24 V	Provides a power terminal to connect a 24 VAC input when you do not use the C450YNN module.	0.08 mm <sup>2</sup> to 1.50 mm <sup>2</sup> 28 AWG to 16 AWG
All control modules	COM	Provides a 24 VAC COM terminal to connect a 24 VAC COM input when you do not use a C450YNN module. This terminal is isolated from the C terminal by a common mode choke internal to the control.	
	5 V	Provides 5 VDC power for a low-pressure pump down transducer.	
	Sn1	Connect to an A99 temperature sensor only.	
	Sn2	Connect to an A99 temperature sensor or binary switch input.	
	Sn3	Connect a specified P499 or P598 pressure transducer only for low-pressure pump down control of the compressor.	
	C	Provides low-voltage common connections for passive or active sensors that you connect to the 5 V, Sn1, and Sn2 terminals. The terminals connect internally.	

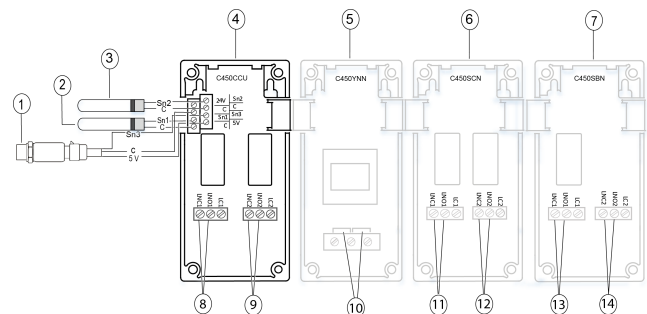
**Table 2: System 450 wiring terminals and wire sizes**

Terminal block type	Terminal label	Terminal function	Wire sizes
Line-voltage output relay terminal blocks Control and expansion modules with relay output	LNC1, LNC2	Connects equipment control circuit to the line-voltage normally closed (LNC) contact on the single-pole, double-throw (SPDT) relay. LNC2 terminals are only on control and expansion modules with two output relays.	0.08 mm <sup>2</sup> to 2.50 mm <sup>2</sup> 28 AWG to 14 AWG
	LNO1, LNO2	Connects equipment control circuit to the line-voltage normally open (LNO) contact on the SPDT relay. LNO2 terminals are only on control and expansion modules with two output relays.	
	LC1, LC2	You must connect line power to the line-voltage common (LC) on the SPDT relay so that the control module can switch line voltage between the LNO or LNC terminals to energize connected equipment control circuits. LC2 terminals are only on control and expansion modules with two output relays.	
Line-voltage supply power terminal block Power modules only	240 VAC	Left terminal is for one 240 VAC supply power lead.	0.34 mm <sup>2</sup> to 2.50 mm <sup>2</sup> 22 AWG to 14 AWG
	No label on the middle terminal	Middle terminal is the common connection for either the 120 VAC or 240 VAC supply power lead.	
	120 VAC	Right terminal is for one 120 VAC supply power lead.	

The following figure shows an example of a C450CCU condensing unit control system module assembly and the user-installed field wiring for a low-temperature refrigeration application with temperature control, active electric heat defrost control, and low-pressure pump down control of the compressor.

Refer to the *System 450 Series C450CCU Condensing Unit Control System Technical Bulletin (LIT-12013266)* for additional application wiring diagrams.

**Figure 2: C450CCU condensing unit control system**



**Table 3: C450CCU condensing unit control system**

Callout	Description
1	Sn3 low-pressure pump down transducer. To control a compressor or compressor starter with low pressure, connect a P499 Series pressure transducer to Sn3, 5V, and C.
2	Sn1 refrigerated space temperature sensor. To control the refrigeration output, either a compressor or a liquid line solenoid valve, connect an A99 Series temperature sensor to Sn1 and C on the input terminal block.
3	Sn2 defrost termination temperature sensor or switch. To terminate defrost using evaporator temperature, connect an A99 Series temperature sensor or user-supplied temperature switch to Sn2 and C on the input terminal block.
4	C450CCU condensing unit control module
5	C450YNN power module
6	C450SCN relay expansion module with two relay outputs
7	C450SCN relay expansion module with two relay outputs
8	OUTR1: output relay 1 terminal block. Connects to and controls the liquid line solenoid valve based on the temperature sensed at Sn1, the refrigerated space temperature sensor.
9	OUTR2: output relay 2 terminal block. Connects to and controls either a 1-speed evaporator fan or the high-speed on a 2-speed evaporator fan, based on the evaporator fan control selections you configure in the UI.
10	Power module line-voltage supply power terminals. Connect 120VAC or 240VAC power to the appropriate terminals to provide power to the condensing unit control system.
11	OUTR3: optional output relay 3 terminal block. Connects to and controls the low-speed on a 2-speed evaporator fan.
12	OUTR4: output relay 4 terminal block. Connects to and controls the defrost heater based on the condensing unit's daily defrost schedule that you configure. The temperature sensed at the defrost termination sensor or switch or the configured defrost duration time terminates the defrost cycles.
13	OUTR5: output relay 5 terminal block. Connects to and controls compressor pump down based on the suction pressure sensed at Sn3, the low-pressure pump down transducer.
14	OUTR6: output relay 6 terminal block. Connects to and controls an optional alarm output that may be used to provide an onsite notification of any active alarm condition within the CCU.

**Note:** To provide OUTR2, OUTR3, OUTR4, OUTR5, and OUTR6, you need a C450 expansion module.

## Ordering information

**Table 4: System 450 modules**

Product code	Product description
C450CCU-4C	Condensing unit control module with LCD, four-button touchpad, UI, and two SPDT line-voltage relay outputs Included in the box: quantity of two A99BB-500C temperature sensors with 5.00 m (16 3/8 ft) cable length Sensor temperature range: -40°C to 120°C (-40°F to 250°F) Cable jacket temperature range: -40°C to 100°C (-40°F to 212°F)
C450SBN-4C	Relay expansion module with one SPDT relay output
C450SCN-4C	Relay expansion module with two SPDT relay outputs
C450YNN-1C	Power module; provides 24 V to System 450 module assembly; 120 VAC or 240 VAC supply power input terminals

**Note:** Refer to the *System 450 Series C450CCU Condensing Unit Control System Technical Bulletin (LIT-12013266)* and the *System 450 Series C450CCU Condensing Unit Control System Catalog Page (LIT-1901123)* for more information.

**Table 5: Mounting accessories**

Product code	Product description
BKT287-1R	DIN rail; 0.30 m (12 in.)
BKT287-4R	DIN rail; 0.36 m (14 in.)
PLT344-1R	DIN rail end clamps (2 clamps)
WHA-C450-100C	System 450 module connection extension cable, 100 cm (3.3 ft) long

**Table 6: A99 Series temperature sensors**

Product code	Description
A99BA-200C	Positive temperature coefficient (PTC) silicon sensor with shielded cable; cable length 2 m (6.50 ft) Sensor temperature range: -40°C to 120°C (-40°F to 250°F) Cable jacket temperature range: -40°C to 100°C (-40°F to 212°F)
A99BB-25C	PTC silicon sensor with polyvinyl chloride (PVC cable); cable length 0.25 m (0.82 ft) Sensor temperature range: -40°C to 120°C (-40°F to 250°F) Cable jacket temperature range: -40°C to 100°C (-40°F to 212°F)
A99BB-200C	PTC silicon sensor with PVC cable; cable length 2 m (6.50 ft) Sensor temperature range: -40°C to 120°C (-40°F to 250°F) Cable jacket temperature range: -40°C to 100°C (-40°F to 212°F)
A99BB-300C	PTC silicon sensor with PVC cable; cable length 3 m 9.75 ft) Sensor temperature range: -40°C to 120°C (-40°F to 250°F) Cable jacket temperature range: -40°C to 100°C (-40°F to 212°F)
A99BB-500C	PTC silicon sensor with PVC cable; cable length 5 m (16.38 ft) Sensor temperature range: -40°C to 120°C (-40°F to 250°F) Cable jacket temperature range: -40°C to 100°C (-40°F to 212°F)
A99BB-600C	PTC silicon sensor with PVC cable; cable length 6 m (19.50 ft) Sensor temperature range: -40°C to 120°C (-40°F to 250°F) Cable jacket temperature range: -40°C to 100°C (-40°F to 212°F)
A99BC-25C	PTC silicon sensor with high temperature silicon cable; cable length 0.25 m (0.82 ft) Sensor temperature range: -40°C to 120°C (-40°F to 250°F) Cable jacket rated for full sensor temperature range
A99BC-300C	PTC silicon sensor with high temperature silicon cable; cable length 3 m (9.84 ft) Sensor temperature range: -40°C to 120°C (-40°F 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°C to 120°C (-40°F to 250°F) Cable jacket rated for full sensor temperature range
A99-CLP-1	Mounting clip for A99 temperature sensor

**Note:** Refer to the *A99B Series Temperature Sensors Product/Technical Bulletin (LIT-125186)* for more information.

**Table 7: P499 Series transducers with 1/4 in. SAE 45 flare internal thread with depressor (Style 47)**

Product code	Description
P499RCP5100C	-10 psig to 100 psig, sealed for wet and freeze and thaw applications; order WHA-PKD3 type wire harness separately.
P499RCP5100K	-10 psig to 100 psig, sealed for wet and freeze and thaw applications; WHA-PKD3-200C wire harness included.
P499RCP5102C	0 psig to 200 psig, sealed for wet and freeze and thaw applications; order a WHA-PKD3 type wire harness separately.
P499RCP5102K	0 psig to 200 psig, sealed for wet and freeze and thaw applications; WHA-PKD3-200C wire harness included.
P499RCP-101C	0 psig to 100 psig; order a WHA-PKD3 type wire harness separately.
P499RCP-101K	0 psig to 100 psig; WHA-PKD3-200C wire harness included.

**Table 8: P499 Series transducers with 1/8 in. 27 NPT external thread (Style 49)**

Product code	Description
P499RAPS100C	-10 psig to 100 psig, sealed for wet and freeze and thaw applications; order a WHA-PKD3 type wire harness separately.
P499RAPS100K	-10 psig to 100 psig, sealed for wet and freeze and thaw applications; WHA-PKD3-200C wire harness included.
P499RAPS102C	0 psig to 200 psig, sealed for wet and freeze and thaw applications; order a WHA-PKD3 type wire harness separately.

**Table 8: P499 Series transducers with 1/8 in. 27 NPT external thread (Style 49)**

Product code	Description
P499RAP5102K	0 psig to 200 psig, sealed for wet and freeze and thaw applications; WHA-PKD3-200C wire harness included.
P499RAP-101C	0 psig to 100 psig; order a WHA-PKD3 type wire harness separately.
P499RAP-101K	0 psig to 100 psig; WHA-PKD3-200C wire harness included.
P499RAP-102C	0 psig to 200 psig; order a WHA-PKD3 type wire harness separately.

**Note:** Power P499 sensors with the +5 VDC and C terminals and the output is 0.5 to 4.5 VDC ratiometric to the +5 VDC supply. Refer to the *P499 Series Electronic Pressure Transducers Product/Technical Bulletin (LIT-12011190)* for more information.

**Table 9: WHA-PKD3 wire harnesses**


Product code	Product description
WHA-PKD3-200C	Plug and 3-wire harness for P499 electronic pressure transducers: 2.0 m (6.5 ft) cable
WHA-PKD3-400C	Plug and 3-wire harness for P499 electronic pressure transducers: 4.0 m (13 ft) cable
WHA-PKD3-600C	Plug and 3-wire harness for P499 electronic pressure transducers: 6.0 m (19.6 ft) cable

## C450CCU condensing unit control module technical specifications

**Table 10: C450CCU condensing unit control module technical specifications**

Specification	Description
Product	System 450 Series C450CCU condensing unit control module
Power supply	Use one of the following power supplies: C450YNN power supply module 24 (20-30) VAC safety extra-low voltage (SELV) (Europe) Class 2 (North America), 50/60 Hz, 10 VA minimum 20 VDC–30 VDC, 2 watts minimum for control, and then 1 additional watt for each output you attach <b>Note:</b> Connect a System 450 control module to only one power supply.
Ambient operating conditions	Temperature: -40°C to 66°C (-40°F to 150°F) Humidity: Up to 95% RH non-condensing; maximum dew point 29°C (85°F)
Ambient shipping and storage conditions	Temperature: -40°C to 80°C (-40°F to 176°F) Humidity: Up to 95% RH non-condensing; maximum dew point 29°C (85°F)
Output relay contacts	General: 1/2 hp at 120/240 VAC, SPDT Specific: <b>120 VAC:</b> AC full-load amperes: 9.8 A AC locked-rotor amperes: 58.8 A <b>208/240 VAC:</b> AC full-load amperes: 4.9 A AC locked-rotor amperes: 29.4 A 10 amperes AC non-inductive at 24/240 VAC Pilot duty: 125 VA at 24/240 VAC
Enclosure	Type 1 (NEMA), IP20 high-impact thermoplastic
Dimensions (H x W x D)	127 mm x 61 mm x 61 mm (5 in. x 2 3/8 in. x 2 3/8 in.)
Weight	C450CCU: 222 g (0.49 lb)

**Table 10: C450CCU condensing unit control module technical specifications**

Specification	Description
Compliance	United States: ULus Listed; UL 60730-1, File E27734; FCC Compliant to CFR47, Part 15, Subpart B, Class B Canada: cUL Listed; CAN/CSA-E60730-1, File E27734; Industry Canada (IC) Compliant to Canadian ICES-003, Class B limits
	Europe: CE Mark – Johnson Controls declares that this product is in compliance with the essential requirements and other relevant provisions of the EMC Directive and RoHS Directive.
	Australia and New Zealand: RCM mark, Australia/NZ emissions compliant

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 shall not be liable for damages resulting from misapplication or misuse of its products.

## North American emissions compliance

### United States

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.

### Canada

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.

### Product warranty

This product is covered by a limited warranty, details of which can be found at [www.johnsoncontrols.com/buildingswarranty](http://www.johnsoncontrols.com/buildingswarranty).

### Software terms

**Use of the software that is in (or constitutes) this product, or access to the cloud, or hosted services applicable to this product, if any, is subject to applicable end-user license, open-source**

software information, and other terms set forth at [www.johnsoncontrols.com/techterms](http://www.johnsoncontrols.com/techterms). Your use of this product constitutes an agreement to such terms.

## Single point of contact

APAC	Europe	NA/SA
JOHNSON CONTROLS C/O CONTROLS PRODUCT MANAGEMENT NO. 32 CHANGJIJANG RD NEW DISTRICT WUXI JIANGSU PROVINCE 214028 CHINA	JOHNSON CONTROLS WESTENDHOF 3 45143 ESSEN GERMANY	JOHNSON CONTROLS 507 E MICHIGAN ST MILWAUKEE WI 53202 USA

For more contact information, refer to [www.johnsoncontrols.com/locations](http://www.johnsoncontrols.com/locations).

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