SmartX Controller

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RP-C Hardware

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Receptacle

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SmartX Controller

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Contents

Introduction

Reference

Introduction

The Introduction part contains information on the purpose of this guide, how this guide is organized, where to find more information, and information on regulatory notices.

1 About This Guide

Topics

1.1 Purpose of This Guide

This guide provides information about the SmartX hardware devices, such as SmartX servers, SmartX IP controllers, power supplies, and I/O modules. This information is intended to help you understand the different types of hardware that can be in an EcoStruxure BMS, as well as how to use the hardware.

1.2 How This Guide is Organized

This EcoStruxure Building Operation Guide is divided into the following parts:

Introduction

The Introduction part contains information on the purpose of this guide, how this guide is organized, where to find more information, and information on regulatory notices.

Reference

The Reference part contains conceptual information, procedures, user interface descriptions and troubleshooting information. If you want more information, see WebHelp or the other EcoStruxure BMS guides.

1.3 Safety Information

Important Information

Read these instructions carefully and look at the equipment to become familiar with the device before trying to install, operate, service or maintain it. The following special messages may appear throughout this bulletin or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.

The addition of either symbol to a “Danger” or “Warning” safety label indicates that an electrical hazard exists which will result in personal injury if the instructions are not followed.

This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

⚠ DANGER
DANGER indicates a hazardous situation which, if not avoided, **will result in** death or serious injury.

⚠ WARNING
WARNING indicates a hazardous situation which, if not avoided, **could result in** death or serious injury.

⚠ CAUTION
CAUTION indicates a hazardous situation which, if not avoided, **could result in** minor or moderate injury.

NOTICE
NOTICE is used to address practices not related to physical injury.

Please Note

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

A qualified person is one who has skills and knowledge related to the construction, installation, and operation of electrical equipment and has received safety training to recognize and avoid the hazards involved.

2 Additional Information

Topics

2.1 Where to Find Additional Information

All the technical EcoStruxure BMS information is available online, on WebHelp.

WebHelp is a web-based help system for the EcoStruxure Building Operation software and SmartX devices, the software and hardware that powers the EcoStruxure BMS.

By pressing F1 or clicking a Help button in the EcoStruxure Building Operation software your web browser opens WebHelp with the latest, up-to-date, technical documentation.

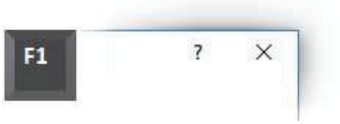


Figure: Help in EcoStruxure Building Operation software

Some EcoStruxure Building Operation software products give you context-sensitive help by opening a WebHelp page that explains the view or dialog box you have in focus. Some programs open up an overview page. From these pages, you can follow the links to get more detailed information.

WebHelp contains all the technical information that is in the guides, specification sheets, and installation sheets.

The WebHelp site

One of the advantages with WebHelp is that you can reach Help without having the EcoStruxure Building Operation software installed on your computer. By entering the URL address help.sbo.schneider-electric.com you can access WebHelp from any computer, smartphone, or tablet connected to the internet.

Finding information

The easiest way to find information on WebHelp is to search for it.

Figure: Home page search

All technical information is gathered in one place, so you do not need to know which guide, specification sheet, or installation sheet the information is in.

Filtering the information

To narrow down the search results, you can use these filters:

- Product
- Functionality
- Information type

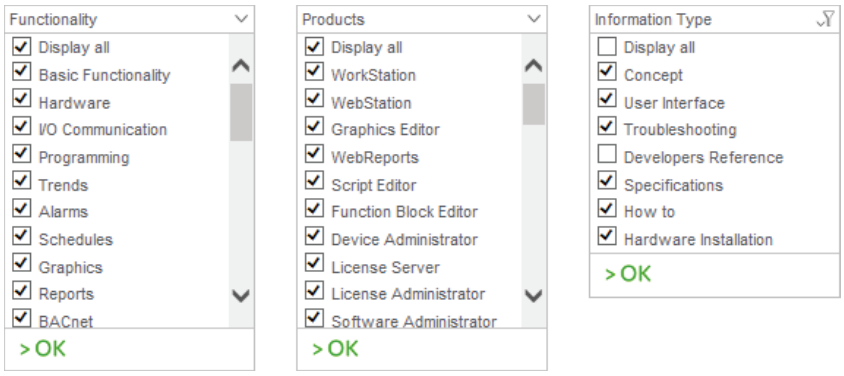


Figure: Search filters

Reference

The Reference part contains conceptual information, procedures, user interface descriptions and troubleshooting information. If you want more information, see WebHelp or the other EcoStruxure BMS guides.

3 RP-Cs

Topics

3

3.1 RP-Cs

SmartX IP Controller – RP-C is a room-purpose, fully programmable, IP based field controller. The RP-C models offer a flexible mix of I/O point types that suit a wide range of HVAC applications. The controller can either be used as a standalone BACnet/IP field controller or as part of an EcoStruxure BMS with a SmartX AS-P or AS-B server or an Enterprise Server as the parent server. The RP-C features a wireless chip that allows a mobile device running the eCommission SmartX Controllers mobile application to connect directly to the controller.

The RP-C allows for flexible control solutions due to the dual Ethernet ports, the interface to SmartX Sensors, the interface for future support of Connected Room Solution (CRS) devices, and the versatile mix of universal inputs/outputs, solid-state relay (SSR) outputs, relay outputs, and high power relay outputs.

When RP-Cs are part of an EcoStruxure BMS, you can take full advantage of the existing EcoStruxure Building Operation engineering tools.

Figure: RP-C

3.1.1 RP-C Models

The RP-C comes in four different models, which offer four different sets of I/O point types, named 12A, 12B, 12C, and 16A.

For more information, see section 3.2 “RP-C Models” on page 33.

3.1.2 RP-C Onboard I/O

The RP-C-12A, -12B, -12C, and -16A models provide 12 or 16 I/O points, consisting of four different sets of I/O point types. The versatile mix of I/O point types match a wide variety of applications. The universal inputs/outputs are highly flexible and can be configured as either inputs or outputs.

For more information, see section 3.3 “RP-C Onboard I/O” on page 34.

3.1.3 RP-C Built-in Power Supply

The RP-C-12A, -12B, and -12C models have a built-in power supply designed to accommodate a nominal operating voltage of 24 VAC at 50/60 Hz or 24 to 30 VDC input power. The RP-C-16A model's power supply is designed for a nominal operating voltage of 230 VAC at 50/60 Hz.

For more information, see section 3.4 “RP-C Built-in Power Supply” on page 36.

3.1.4 SmartX IP Controller Device Memory

SmartX IP Controller devices have three types of memory:

- Flash memory: for boot loader, operating system, application software, and configuration storage
- RAM: for runtime operation
- FRAM non-volatile memory: for data retention in the case of power outage

For more information, see section 3.5 “SmartX IP Controller Device Memory” on page 37.

3.1.5 SmartX IP Controller Supported Building Standards

One of the cornerstones of the EcoStruxure BMS is support for open standards. As a result, the SmartX IP controller complies with the BACnet open standard, one of the most popular standards for buildings.

For more information, see section 3.6 “SmartX IP Controller Supported Building Standards” on page 38.

3.1.6 RP-C Wireless Connectivity

RP-C is a Bluetooth Low Energy (BLE) enabled product. You can use this wireless connectivity option for connecting a smartphone or tablet running the eCommission SmartX Controllers mobile application to the RP-C.

For more information, see section 3.7 “RP-C Wireless Connectivity” on page 39.

3.1.7 RP-C Communication Ports

The RP-C contains a combination of Ethernet, USB, SmartX Sensor, and Connected Room Solution communication ports.

For more information, see section 3.8 “RP-C Communication Ports” on page 41.

3.1.8 SmartX IP Controller Sensor Bus

The SmartX IP controller provides a sensor bus, which allows SmartX Sensors to be connected to the controller.

For more information, see section 3.9 “SmartX IP Controller Sensor Bus” on page 42.

3.1.9 RP-C Room Bus

The Room bus means the RP-C is hardware-prepared for future support of Connected Room Solution (CRS) devices for control of electric lights and window blinds.

For more information, see section 3.11 “RP-C Room Bus” on page 48.

3.1.10 RP-C Screw Terminals

The RP-C has fixed screw terminals for the power input, SSR outputs, relay outputs, high power relay outputs, and universal inputs/outputs.

For more information, see section 3.12 “RP-C Screw Terminals” on page 49.

3.1.11 RP-C LEDs

There is one LED on the front panel of the RP-C.

For more information, see section 3.17 “RP-C LEDs” on page 62.

3.1.12 RP Series Controller Reset Modes

You can reset and restart the RP Series controllers in different ways depending on how long you press the reset button. The resets and restarts can affect the retention of values after restart based on the retain levels configured for the variables.

For more information, see section 3.18 “RP Series Controller Reset Modes” on page 64.

3.1.13 RP-C Device Installation

The RP-C can be installed on a DIN rail or flat surface.

For more information, see section 3.19 “RP-C Device Installation” on page 67.

3.1.14 24 VAC Output on RP-C-16A Model

The RP-C-16A model has a 24 VAC (19 VA) output that can be used to power external loads such as actuators, relays, or indicators. The external loads can be controlled using the controller's solid-state relay (SSR) or relay outputs.

For more information, see section 3.27 “24 VAC Output on the RP-C-16A Controller” on page 83.

3.1.15 Wiring

The wiring recommendations provide guidance regarding wiring of the I/O modules, SmartX servers, and SmartX IP Controller devices.

For more information, see section 4.1 “Wiring” on page 105.

3.1.16 SmartX IP Controller Firmware Management

Using WorkStation, you can update the firmware of multiple SmartX IP Controller devices and their attached SmartX Sensors at the same time with minimum downtime. SmartX Sensors are supported by the SmartX IP Controller - MP Series.

For more information, see the *SmartX IP Controller Device Firmware Management* topic on WebHelp.

3.1.17 RP-C Regulatory Compliance and Approvals

This section provides information on regulatory compliance and approvals for the RP-C controllers.

For more information, see section 3.32 “RP-C Regulatory Compliance and Approvals” on page 100.

3.1.18 Specifications

AC input

RP-C-12A, -12B, and -12C models

Nominal voltage.....24 VAC
Operating voltage range.....+/-15 %
Frequency.....50/60 Hz
Maximum power consumption.....23 VA
Power input protection.....MOV suppression and internal fuse

RP-C-16A model

Nominal voltage.....230 VAC
Operating voltage range.....+/-10 %
Frequency.....50/60 Hz

Maximum power consumption .....65 VA
Power input protection .....MOV suppression and internal fuse
.....Separate PTC thermistor used as a resettable fuse for 24 VAC Out only
Overvoltage category III
Pollution degree.....2

DC input

RP-C-12A, -12B, and -12C models

Nominal voltage.....24 to 30 VDC
Operating voltage range .....21 to 33 VDC
Maximum power consumption ..... 14 W
Power input protection .....MOV suppression and internal fuse

AC output

RP-C-16A model

Type.....Isolated output
Nominal voltage.....24 VAC
Frequency ..... Same frequency as the power supply (50/60 Hz)
Output power rating .....19 VA

Environment

RP-C-12A, -12B, and -12C models

Ambient temperature, operating .....0 to 50 °C (32 to 122 °F) at normal operation
.....-40 to +60 °C (-40 to +140 °F) for rooftop applications, horizontal installation only
Ambient temperature, storage .....-20 to +70 °C (-4 to +158 °F)
Maximum humidity .....95 % RH non-condensing

RP-C-16A model

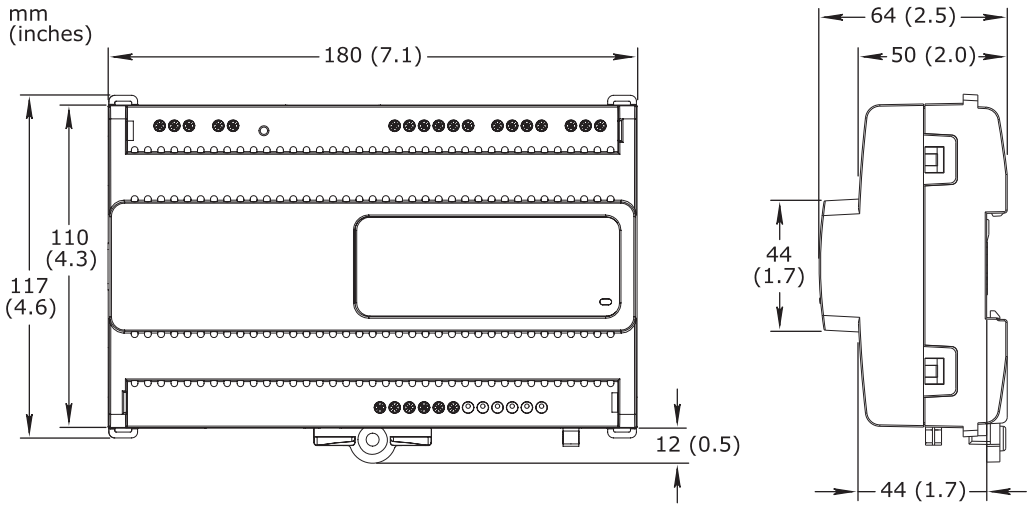
Ambient temperature, operating .....0 to 50 °C (32 to 122 °F)
Ambient temperature, storage .....-20 to +70 °C (-4 to +158 °F)
Maximum humidity .....95 % RH non-condensing

Material

Plastic flame rating.....UL94-5VB
Ingress protection rating .....IP 20

Mechanical

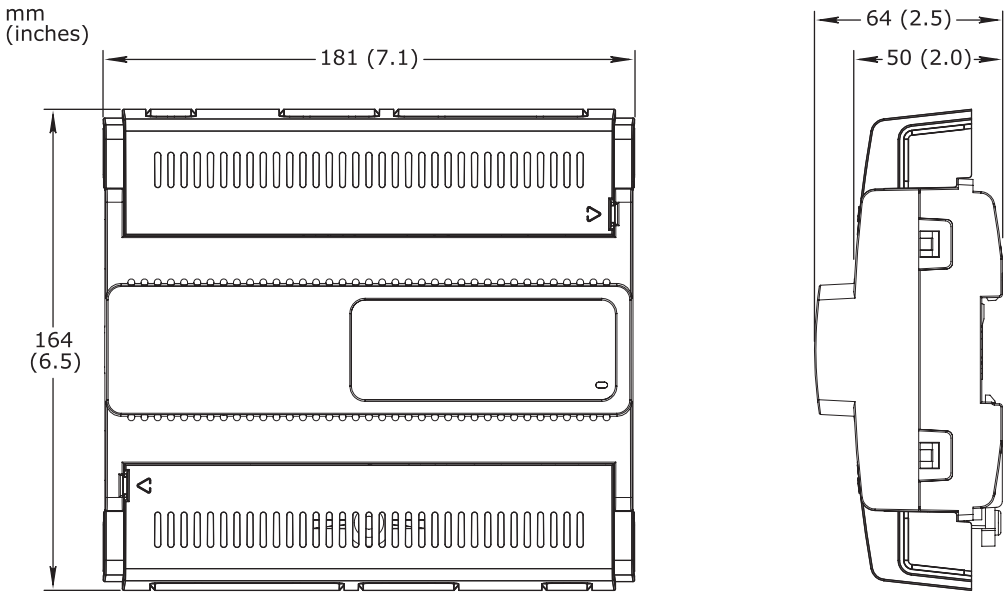
Dimensions ..... 180 W x 110 H x 64 D mm (7.1 W x 4.3 H x 2.5 D in.)



Weight, RP-C-12A model.....0.370 kg (0.816 lb)
Weight, RP-C-12B and -12C models .....0.390 kg (0.860 lb)
Weight, RP-C-16A model.....0.720 kg (1.587 lb)
Weight, optional covers .....0.070 kg (0.154 lb)
Installation .....DIN rail or flat surface
Terminal blocks.....Fixed

Optional covers

Dimensions ..... 181 W x 164 H x 64 D mm (7.1 W x 6.5 H x 2.5 D in.)



Real-time clock

Accuracy, at 25 °C (77 °F) .....+/-1 minute per month
Backup time, at 25 °C (77 °F) .....7 days minimum

Communication ports

Ethernet ..... Dual 10/100BASE-TX (RJ45)

USB .....1 USB 2.0 device port (mini-B)
.....1 USB 2.0 host port (type-A), 5 VDC, 2.5 W

Sensor Bus .....24 VDC, 2 W, RS-485 (RJ45)

Sensor Bus protection .....Transient voltage suppressors on communication and power signals

Room Bus .....24 VDC, 3 W, RS-485 (RJ45)

Room Bus protection .....Transient voltage suppressors on communication and power signals

Communications

BACnet .....BACnet/IP, port configurable, default 47808
.....BTL B-AAC (BACnet Advanced Application Controller)[a]

a) See the BTL Product Catalog for up-to-date details on BTL listed firmware revisions on BACnet International's home page.

Wireless connectivity

Bluetooth Low Energy

Communication protocol .....Bluetooth® 5.0 Low Energy compliant

Frequency.....2.402 to 2.480 GHz

Maximum output power.....10 dBm

Maximum communication distance .....Line-of-sight: 100 m (328 ft)

Antenna ..... Integrated antenna

RF connector for optional external antenna .....SMA connector

External antenna (optional)..Restricted to the approved antenna type listed below (used in certification)

Manufacturer	Model (Part number)	Gain	Type	Impedance
Linx Technologies	ANT-2.4-WRT-MON-SMA	0.8 dBi	Monopole	50 ohm

CPU

Frequency ..... 500 MHz

Type .....ARM Cortex-A7 single-core

Internal SRAM .....6 MB

NOR flash memory .....32 MB

Memory backup .....128 kB, FRAM, non-volatile

3.1.19 Internal Configuration

The RP-C internal configuration with regards to the signal ground is shown in the following figures.

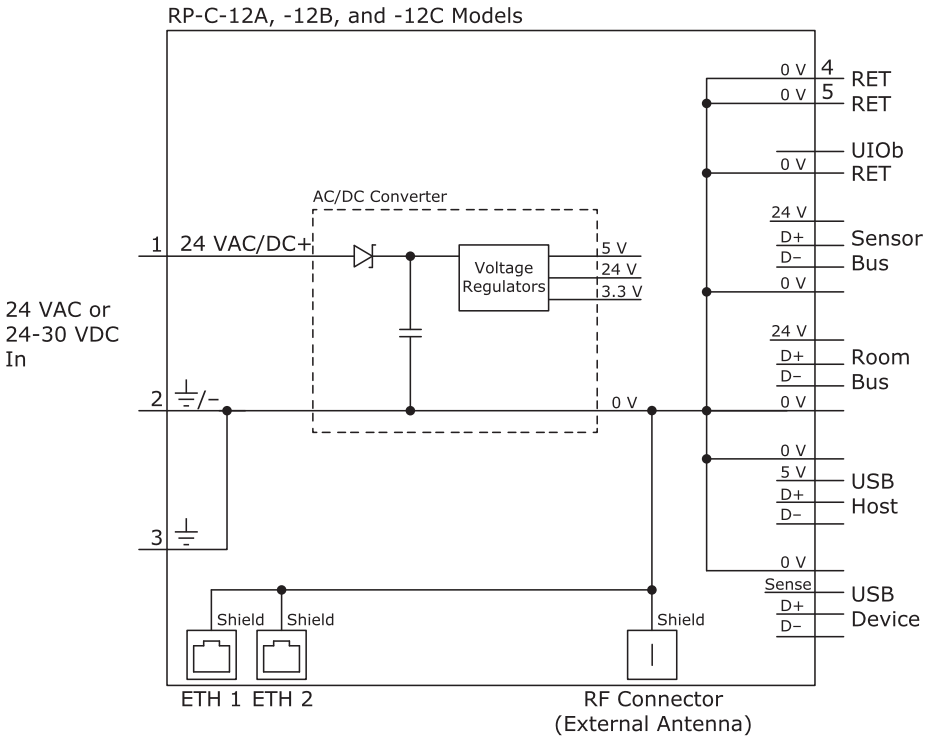


Figure: RP-C-12A, -12B, and -12C models, internal configuration

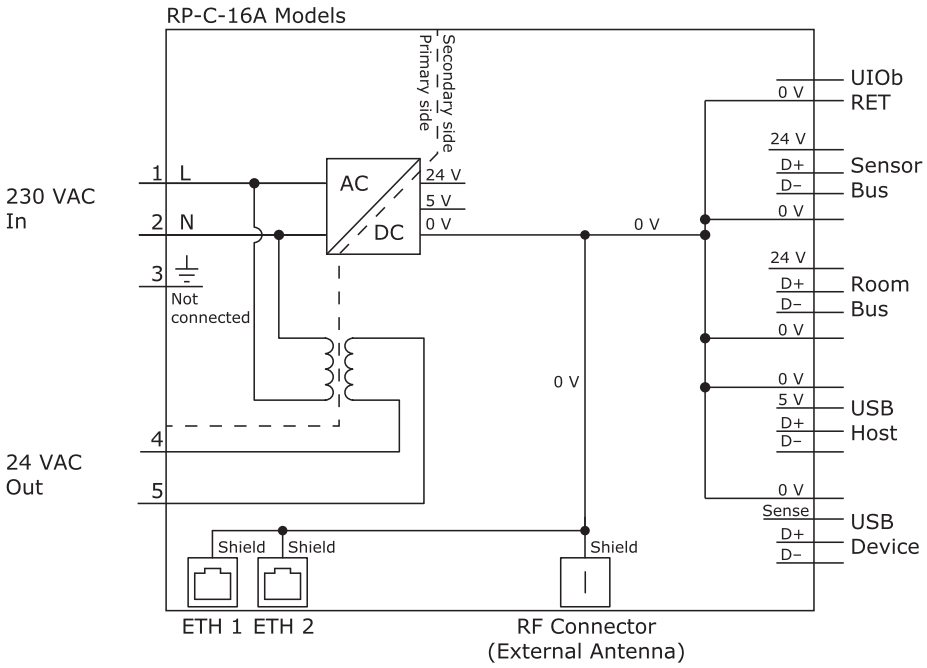


Figure: RP-C-16A model, internal configuration

3.2 RP-C Models

The RP-C comes in four different models, which offer four different sets of I/O point types, named 12A, 12B, 12C, and 16A.

The RP-C-12A, -12B, and -12C models support 24 VAC/DC input power, whereas the RP-C-16A model supports 230 VAC input power.

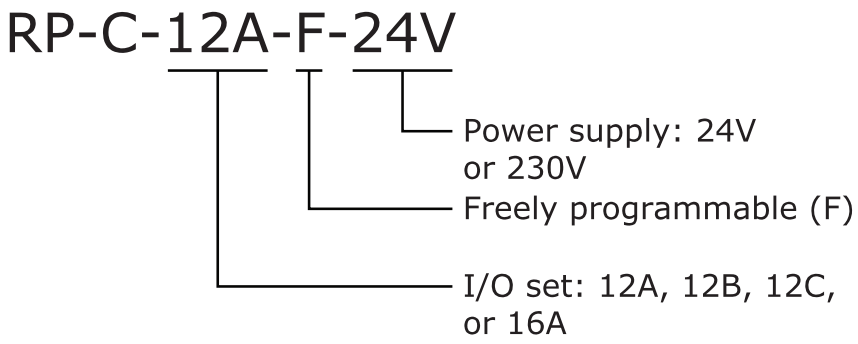


Figure: RP-C model number structure

Model	I/O Set	Input Power
RP-C-12A-F-24V	12A	24 VAC at 50/60 Hz or 24 to 30 VDC
RP-C-12B-F-24V	12B	24 VAC at 50/60 Hz or 24 to 30 VDC
RP-C-12C-F-24V	12C	24 VAC at 50/60 Hz or 24 to 30 VDC
RP-C-16A-F-230V	16A	230 VAC at 50/60 Hz

For more information, see section 3.3 “RP-C Onboard I/O” on page 34.

For more information, see section 3.4 “RP-C Built-in Power Supply” on page 36.

All RP-C models have the same small footprint.

3.3 RP-C Onboard I/O

The RP-C-12A, -12B, -12C, and -16A models provide 12 or 16 I/O points, consisting of four different sets of I/O point types. The versatile mix of I/O point types match a wide variety of applications. The universal inputs/outputs are highly flexible and can be configured as either inputs or outputs.

Table: I/O Point Types by RP-C Models

I/O Point Types	RP-C-12A model	RP-C-12B model	RP-C-12C model	RP-C-16A model
Universal I/O Type Ub	8	8	4	8
Solid-state relay outputs (MOSFET)	4	-	4	4
Relay outputs Form A	-	3	3	3
High power relay outputs Form C	-	1	1	1

By utilizing its onboard I/O with connected field devices, such as sensors and actuators, the RP-C controls and supervises equipment that can be used to suit a wide range of HVAC applications.

3.3.1 Universal Inputs/Outputs

The universal inputs/outputs are ideal for any mix of temperature, pressure, flow, status points, and similar point types in a building control system.

For more information, see section 3.28.3 “” on page 91.

3.3.2 Solid-state Relay (SSR) Outputs

The solid-state relay (SSR) outputs can be used in many applications to switch 24 VAC or 24 VDC on or off for external loads such as actuators, relays, or indicators. SSRs are silent and are not adversely affected by relay contact wear.

For more information, see section 3.29.2 “” on page 94.

3.3.3 Relay Outputs

The relay outputs support digital Form A point types. The Form A relays are designed for direct load applications.

For more information, see section 3.30.2 “” on page 96.

3.3.4 High Power Relay Outputs

The main application of the high power relay output is to power an electrical heating element directly.

For more information, see section 3.31.2 “” on page 98.

3.4 RP-C Built-in Power Supply

The RP-C-12A, -12B, and -12C models have a built-in power supply designed to accommodate a nominal operating voltage of 24 VAC at 50/60 Hz or 24 to 30 VDC input power. The RP-C-16A model's power supply is designed for a nominal operating voltage of 230 VAC at 50/60 Hz.

3.4.1 RP-C-12A, -12B, and -12C Models (24 VAC/DC)

The built-in power supply is based on a half-wave rectified, non-isolated design, which is complemented with electronic protection components for transient protection, overload protection, and EMC compliance.

To power the controller, you can use a transformer or a DC power supply:

- Class 2 (EN 60742) transformer supplying a nominal 24 VAC at 50/60 Hz
- DC power supply supplying a nominal 24 to 30 VDC with the required output power

For more information, see section 3.1.18 “” on page 28.

NOTICE
CONTROLLER DEVICE DAMAGE Do not power the SmartX IP Controller device with a 24 VAC transformer that is used to power devices that contain non-isolated full-wave rectifier power supplies. **Failure to follow these instructions can result in equipment damage.**

3.4.2 RP-C-16A Model (230 VAC)

The built-in power supply is based on a full-wave rectified, isolated design, which is complemented with electronic protection components for transient protection, overload protection, and EMC compliance.

With the 230 VAC input (L and N) galvanically isolated from the electronics, the risk of damage due to earth ground currents is reduced and allows the input power to be wired without concern for polarity matching.

3.5 SmartX IP Controller Device Memory

SmartX IP Controller devices have three types of memory:

- Flash memory: for boot loader, operating system, application software, and configuration storage
- RAM: for runtime operation
- FRAM non-volatile memory: for data retention in the case of power outage

You can manually back up or restore SmartX IP Controller devices to a storage location on a PC or network. For more information, see the *BACnet Backup and Restore* topic on WebHelp.

When SmartX IP Controller devices are part of an EcoStruxure BMS, the configuration data automatically resides in the parent EcoStruxure BMS server. The EcoStruxure Building Operation database and the SmartX IP Controller device database are synchronized to help ensure there is always one backup available that can be used to restore the SmartX IP Controller device memory. Scheduled backups can provide additional protection against application and data loss. In addition, device-specific values (for example, AHU or heat pump data) are duplicated in the parent server to facilitate device replacement scenarios.

3.6 SmartX IP Controller Supported Building Standards

One of the cornerstones of the EcoStruxure BMS is support for open standards. As a result, the SmartX IP controller complies with the BACnet open standard, one of the most popular standards for buildings.

The SmartX IP controller can natively communicate with BACnet/IP networks. When the SmartX IP controller is part of an EcoStruxure BMS, the BACnet protocol is used for communication between the device and its parent EcoStruxure BMS server and other BACnet devices on the IP network, including SmartX IP controllers. As a native BACnet/IP device, the SmartX IP controller supports BACnet services such as trends, schedules, and alarms, and the controller can communicate with other BACnet devices on a BACnet/IP network. The SmartX IP controller conforms to the BACnet Advanced Application Controller (B-AAC) device profile.

3.7 RP-C Wireless Connectivity

RP-C is a Bluetooth Low Energy (BLE) enabled product. You can use this wireless connectivity option for connecting a smartphone or tablet running the eCommission SmartX Controllers mobile application to the RP-C.

RP-C has an integrated antenna. An optional external antenna can be connected to the RF connector to improve the reception quality, for example, when the controller is installed inside a metal cabinet. The RF connector is an SMA female connector.

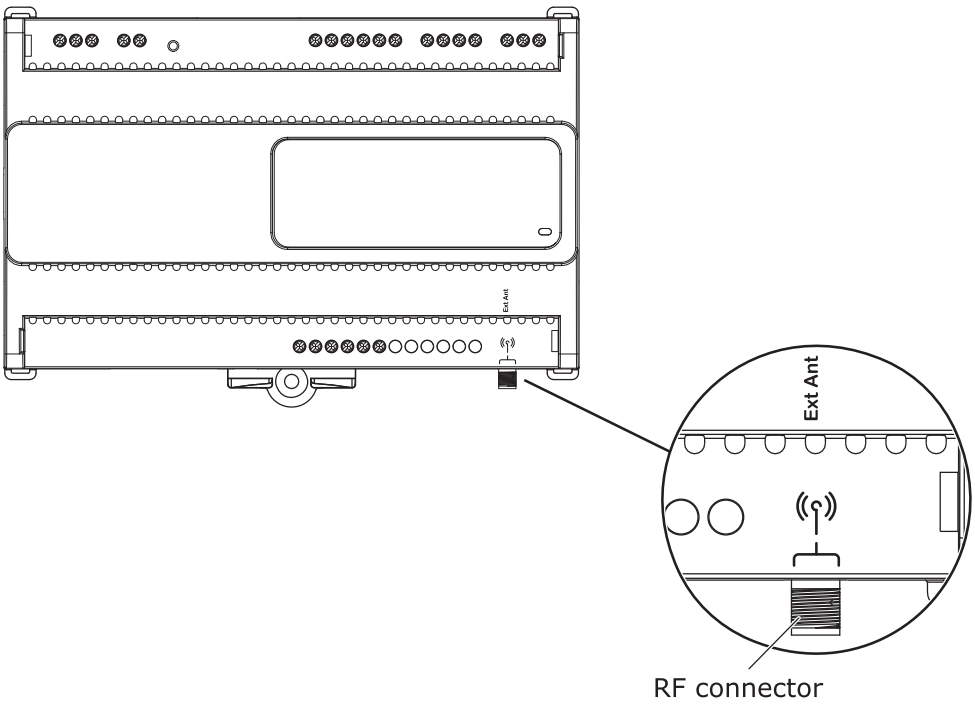


Figure: RF connector for connection of an optional external antenna

In addition to the integrated antenna, the RP-C controllers have also been approved to operate with the external antenna type listed below with the maximum permissible gain and required antenna impedance for the antenna type indicated. Antenna types not included in this list that have a gain greater than the maximum gain indicated for that type, are prohibited for use with the controllers.

Manufacturer	Model (Part number)	Gain	Type	Impedance
Linx Technologies	ANT-2.4-WRT-MON-SMA	0.8 dBi	Monopole	50 ohm

The RP-C controller (with its integrated antenna) and the optional external antenna must be professionally installed to comply with the following rules and regulations:

- Part 15 of the Federal Communications Commission (FCC) rules
- Innovation, Science and Economic Development Canada (ISED) licence-exempt Radio Standards Specifications (RSSs)

- 2014/53/EU Radio Equipment Directive (RED) of the European Union (EU)

For more information, see section 3.32 “RP-C Regulatory Compliance and Approvals” on page 100.

3.8 RP-C Communication Ports

The RP-C contains a combination of Ethernet, USB, SmartX Sensor, and Connected Room Solution communication ports.

This combination includes the following ports:

- Two 10/100 Ethernet ports
- One USB host port
- One USB device port
- One Sensor bus port
- One Room bus port

When both Ethernet ports are enabled, they function as an onboard Ethernet switch. Disabling the second Ethernet port disables the switching function. The switching function enables flexible network topologies. For more information, see the *SmartX IP Controller Network Topologies* topic on WebHelp. The second port also provides a connection point for a laptop running the eCommission SmartX Controllers mobile application.

The two USB ports are reserved for future use.

The Sensor bus port is designed for connection of SmartX Sensors. For more information, see section 3.9 “SmartX IP Controller Sensor Bus” on page 42.

The Room bus port is for future support of devices for connected room solutions that include equipment for control of electric lights, and window blinds. For more information, see section 3.11 “RP-C Room Bus” on page 48.

3.9 SmartX IP Controller Sensor Bus

The SmartX IP controller provides a sensor bus, which allows SmartX Sensors to be connected to the controller.

The sensor bus is a proprietary RS-485 bus, which provides both 24 VDC power supply (2 W) and communications for the sensors.

The maximum total length of the sensor bus is 61 m (200 ft). The sensor bus uses a Cat 5 (or higher) unshielded, straight-through wired cable with eight conductors (four twisted pairs) and RJ45 connectors. The wire size (cross-sectional area) should be 22 to 26 AWG (0.34 to 0.14 mm²). When the SmartX IP controller is installed in a space that handles conditioned air or return air, the sensor bus cables and IP network cables frequently must be plenum-rated to meet applicable building codes. For more information, see section 4.1 “Wiring” on page 105.

NOTICE

LOSS OF COMMUNICATION

- Ensure that the total length of the sensor bus does not exceed 61 m (200 ft).
- Use a Cat 5 or higher unshielded twisted pair cable with eight conductors (four twisted pairs), a cross-sectional area of 22 to 26 AWG (0.34 to 0.14 mm^2), and a rating that meets the requirements of the target environment.

Failure to follow these instructions can result in loss of communication.

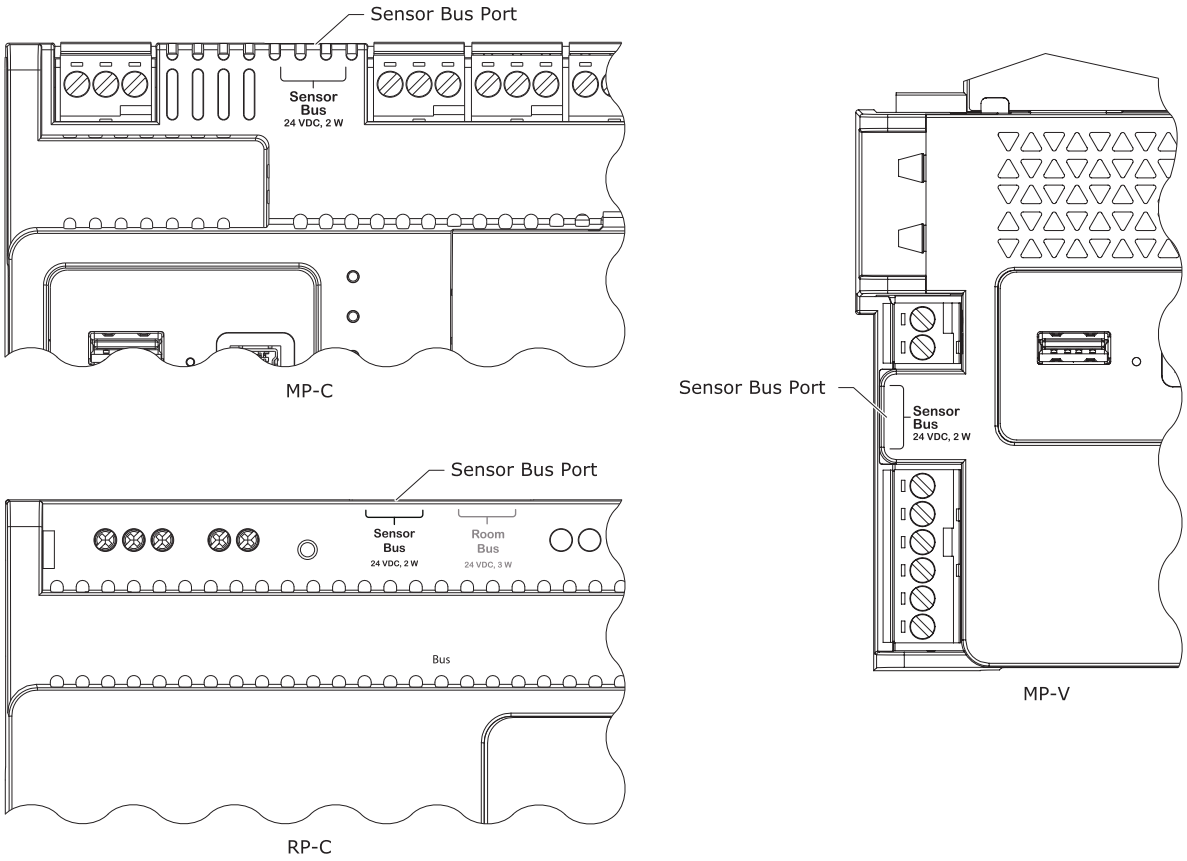


Figure: Location of the Sensor Bus port on different SmartX IP controllers

You can connect a single SmartX Sensor to the SmartX IP controller sensor bus port, or you can connect two to four SmartX Sensors in a daisy-chain configuration. The maximum number of SmartX Sensors that can be connected to a SmartX IP controller is variable depending on the power consumption for the selected SmartX Sensor model and the combination of cover and sensor base type.

When calculating the power consumption to validate your sensor bus configuration, ensure that you add the power consumption (mW) for all SmartX Sensor models, sensor bases, and covers used on the sensor bus to determine the total power consumption. The sensor bus can supply maximum 2000 mW. SmartX Sensor combinations totalling more than 2000 mW are not supported. The following table can be used for calculating the total power consumption.

Description	Model Number	Power (mW)
Sensor base with temperature sensor	SXWSBTXXXSXX	90
Sensor base with temperature and humidity sensors	SXWSBTHXXSXX	90
Sensor base with temperature and CO_2 sensors	SXWSBTXCXSXX	490

Continued

Description	Model Number	Power (mW)
Sensor base with temperature, humidity, and CO_2 sensors	SXWSBTHCXSXX	490
Blank cover	SXWSCBXSELXX	0
Blank cover with occupancy sensor	SXWSCBPSELXX	20
3-button cover (buttons for override and setpoint control)	SXWSC3XSELXX	190
3-button cover (buttons for override and setpoint control) with occupancy sensor	SXWSC3PSELXX	210
Touchscreen display cover	SXWSCDXSELXX	190
Touchscreen display cover with occupancy sensor	SXWSCDPSELXX	210
Complete SmartX Sensor model with temperature sensor, buttons for override and setpoint control, and LCD display cover	SXWSATXXXSLX	80
Complete non-communicating[a] SmartX Sensor model with resistive temperature sensor (10 kohm type 3 thermistor) and blank cover	SXWSATXXXRXX	0
eCommission Bluetooth Adapter[b]	SXWBTAECXX10001	300

a) The SmartX resistive temperature sensor (SXWSATXXXRXX) is not designed to be connected to the sensor bus, but instead is connected to I/O points/terminals on the SmartX IP controller using a two-wire connection.
b) Connect the eCommission Bluetooth Adapter to the SmartX Sensor for temporary commissioning and servicing only.

To summarize the power conditions, the sensor bus supports the following key SmartX Sensor combinations:

- Blank covers: Up to four sensors of any combination of sensor base types
- 3-button and touchscreen covers:
  - Up to two sensor bases with CO_2 option
  - Up to four sensor bases without CO_2 option
- SmartX LCD temperature sensors: Up to four sensors are supported

Each SmartX Sensor has two 2-position DIP switches, which are used to give the sensor a unique address on the sensor bus. An incorrectly configured or improper DIP switch can cause two sensors to have the same address on the sensor bus, which means that both sensors will be offline. For more information, see the *SmartX Sensors* topic on WebHelp.

NOTICE

LOSS OF COMMUNICATION

Ensure that the address DIP switches on the SmartX Sensor are configured to give the sensor a unique address on the sensor bus.

Failure to follow these instructions can result in loss of communication.

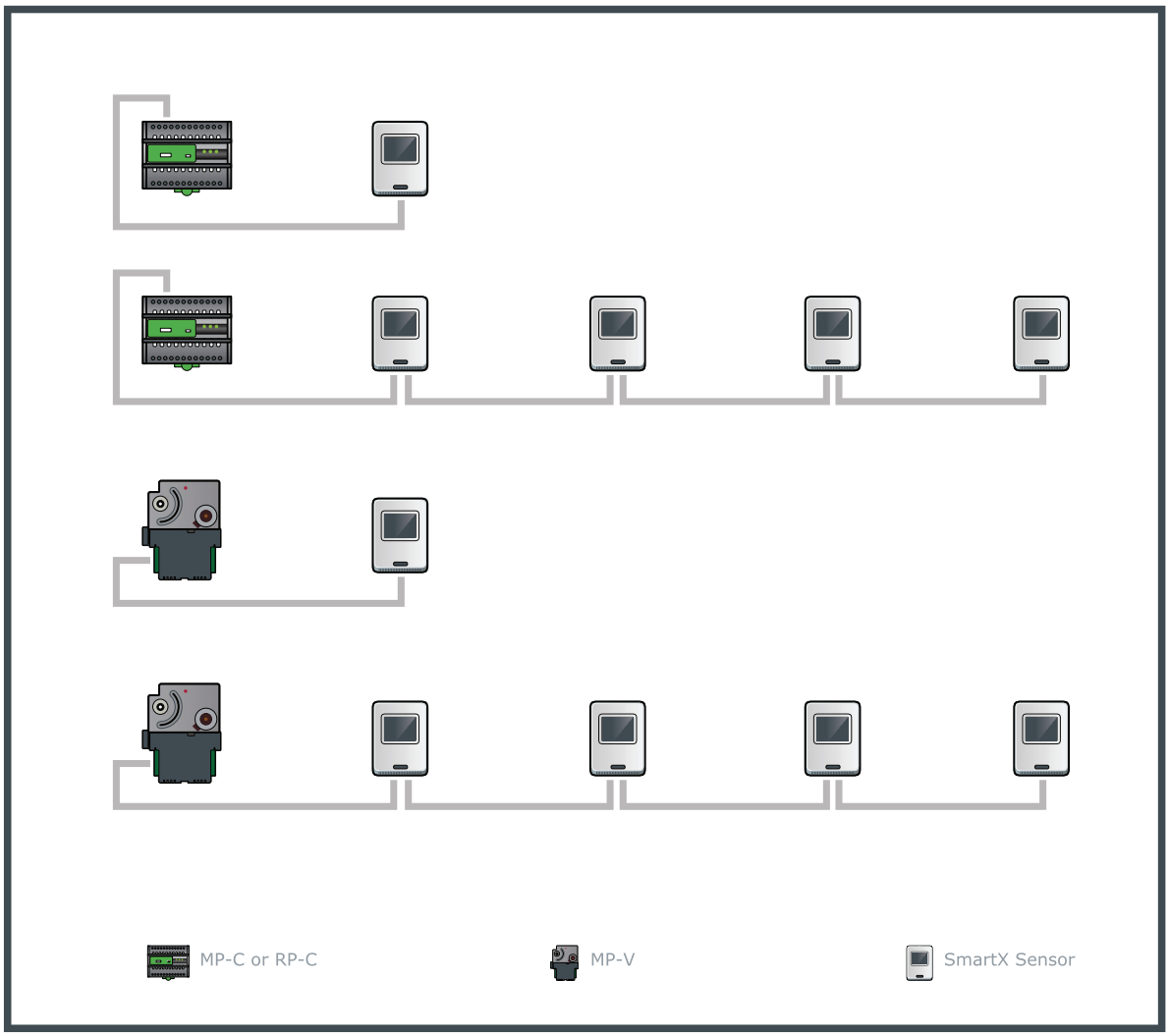


Figure: Examples with one SmartX Sensor and four SmartX Sensors connected to an SmartX IP controller in a daisy-chain configuration

3.10 Connecting SmartX Sensors to an RP-C Controller

You connect SmartX Sensors to an RP-C controller to provide the sensors with power and communication from the controller.

For more information, see section 3.9 “SmartX IP Controller Sensor Bus” on page 42.

NOTICE
LOSS OF COMMUNICATION Locate the sensor bus wiring away from external electromagnetic noise sources such as high voltage cables and Variable Frequency Drives (VFDs) for AC motors. **Failure to follow these instructions can result in loss of communication.**

NOTICE
EQUIPMENT DAMAGE Do not connect an Ethernet cable from the controller's Sensor Bus port directly to an external Ethernet switch or router. **Failure to follow these instructions can result in equipment damage.**

To connect SmartX Sensors to an RP-C controller

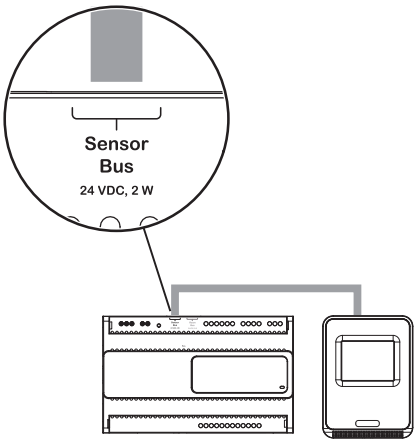
1. Install the SmartX Sensor and connect a Cat 5 (or higher) unshielded, straight-through wired cable with eight conductors (four twisted pairs) to one of the two RJ45 receptacles on the sensor. Use a cable with the wire size (cross-sectional area) 22 to 26 AWG (0.34 to 0.14 mm²).

   For more information, see *SmartX Living Space Sensor Base Installation Instructions*

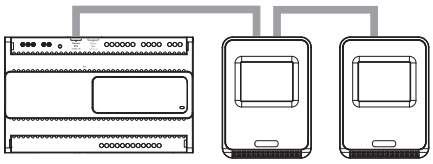
   For more information, see *SmartX Living Space LCD Temperature Sensor Installation Instructions*

Continued on next page

2. Connect the other end of the cable to the **Sensor Bus** port on the RP-C controller.



3. When an additional SmartX Sensor is needed, install the sensor and connect the other end of the cable to the unused RJ45 receptacle on the previous sensor.



4. Repeat step 3 to install a third and fourth SmartX Sensor, if the power constraints of the sensor bus allow this for the selected combination of cover and sensor base type.

5. Ensure that the two 2-position address DIP switches on each SmartX Sensor are configured to give the sensor a unique address on the sensor bus.

   For more information, see *SmartX Living Space Sensor Base Installation Instructions*

   For more information, see *SmartX Living Space LCD Temperature Sensor Installation Instructions*

   For more information, see the *Configuring a SmartX Sensor* topic on WebHelp.

3.11 RP-C Room Bus

The Room bus means the RP-C is hardware-prepared for future support of Connected Room Solution (CRS) devices for control of electric lights and window blinds.

The Room bus is a proprietary RS-485 bus, which is designed to provide both 24 VDC power supply (3 W) and communications for the connected equipment.

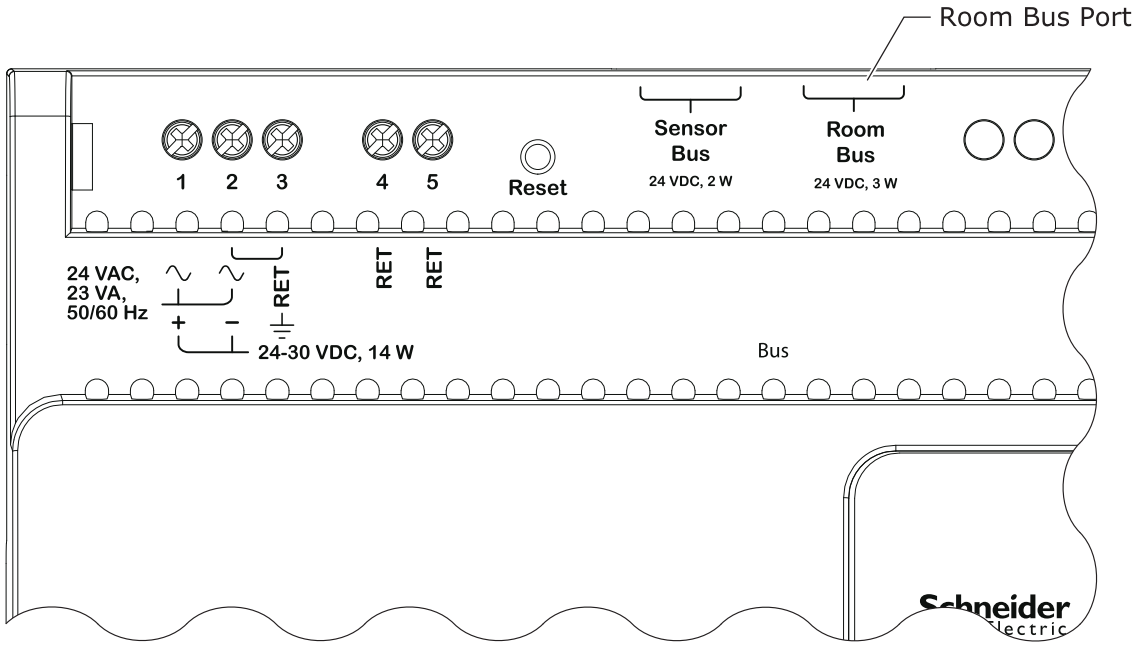


Figure: Location of the Room Bus port on the RP-C

3.12 RP-C Screw Terminals

The RP-C has fixed screw terminals for the power input, SSR outputs, relay outputs, high power relay outputs, and universal inputs/outputs.

The wiring recommendations are provided separately. For more information, see section 4.1 “Wiring” on page 105.

3.12.1 RP-C-12A Screw Terminals

The RP-C-12A model has 12 I/O points and the controller is equipped with 23 fixed screw terminals.

For more information, see section 3.13 “RP-C-12A Screw Terminals” on page 50.

3.12.2 RP-C-12B Screw Terminals

The RP-C-12B model has 12 I/O points and the controller is equipped with 24 fixed screw terminals.

For more information, see section 3.14 “RP-C-12B Screw Terminals” on page 53.

3.12.3 RP-C-12C Screw Terminals

The RP-C-12C model has 12 I/O points and the controller is equipped with 24 fixed screw terminals.

For more information, see section 3.15 “RP-C-12C Screw Terminals” on page 56.

3.12.4 RP-C-16A Screw Terminals

The RP-C-16A model has 16 I/O points and the controller is equipped with 30 fixed screw terminals.

For more information, see section 3.16 “RP-C-16A Screw Terminals” on page 59.

3.13 RP-C-12A Screw Terminals

The RP-C-12A model has 12 I/O points and the controller is equipped with 23 fixed screw terminals.

⚠⚠DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

Disconnect the power supply and other high voltage equipment before wiring.

Failure to follow these instructions will result in death or serious injury.

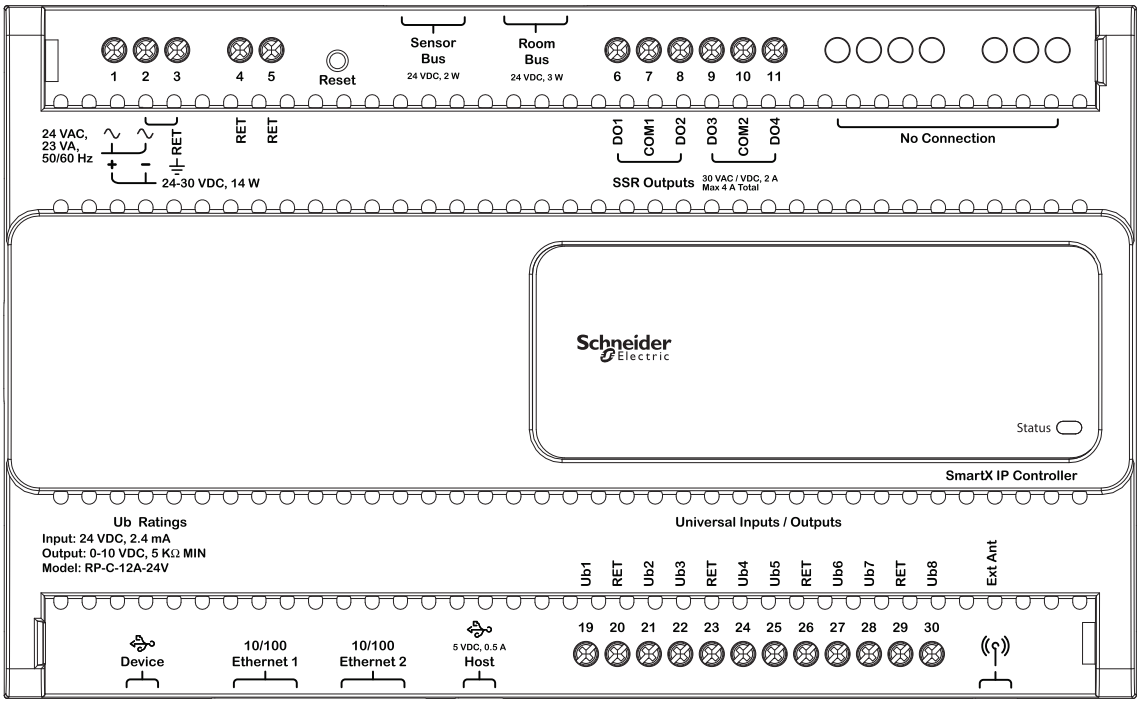


Figure: Screw terminals and other connectors, RP-C-12A model

The 23 screw terminals are used as follows:

- Three screw terminals for the power input
- Two screw terminals for the return (RET) terminals 4 and 5
- Six screw terminals for the four solid-state relay (SSR) outputs
- 12 screw terminals for the eight universal inputs/outputs of type Ub

Table: Screw Terminals, RP-C-12A Model

Terminal number	Designation	Usage
Power input		
1	∿/+	24 VAC, 50/60 Hz, 23 VA Positive lead (+) when operating the device from 24-30 VDC, 14 W

Continued

Terminal number	Designation	Usage
2	∿/–	Earth ground lead of 24 VAC transformer connects to terminal 2. Terminals 2 and 3 are internally connected. Negative (–) lead when operating the device from 24-30 VDC, 14 W
3	RET ⏚	Terminal 3 is provided for convenience to connect to protective earth ground (optional). Terminals 2 and 3 are internally connected.
Return terminals		
4	RET	Internally connected to all earth ground and RET terminals
5	RET	Internally connected to all earth ground and RET terminals
Solid-state relay (SSR) outputs		
6	DO1	SSR output
7	COM1	Common connection for DO1 and DO2 The COM terminal can be connected to 0 to 24 VAC or -30 VDC to +30 VDC.
8	DO2	SSR output
9	DO3	SSR output
10	COM2	Common connection for DO3 and DO4 The COM terminal can be connected to 0 to 24 VAC or -30 VDC to +30 VDC.
11	DO4	SSR output
Universal inputs/outputs		
19	Ub1	Universal input/output, type Ub

Continued

Terminal number	Designation	Usage
20	RET	Internally connected to all earth ground and RET terminals
21	Ub2	Universal input/output, type Ub
22	Ub3	Universal input/output, type Ub
23	RET	Internally connected to all earth ground and RET terminals
24	Ub4	Universal input/output, type Ub
25	Ub5	Universal input/output, type Ub
26	RET	Internally connected to all earth ground and RET terminals
27	Ub6	Universal input/output, type Ub
28	Ub7	Universal input/output, type Ub
29	RET	Internally connected to all earth ground and RET terminals
30	Ub8	Universal input/output, type Ub

3.14 RP-C-12B Screw Terminals

The RP-C-12B model has 12 I/O points and the controller is equipped with 24 fixed screw terminals.

⚠⚠DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

Disconnect the power supply and other high voltage equipment before wiring.

Failure to follow these instructions will result in death or serious injury.

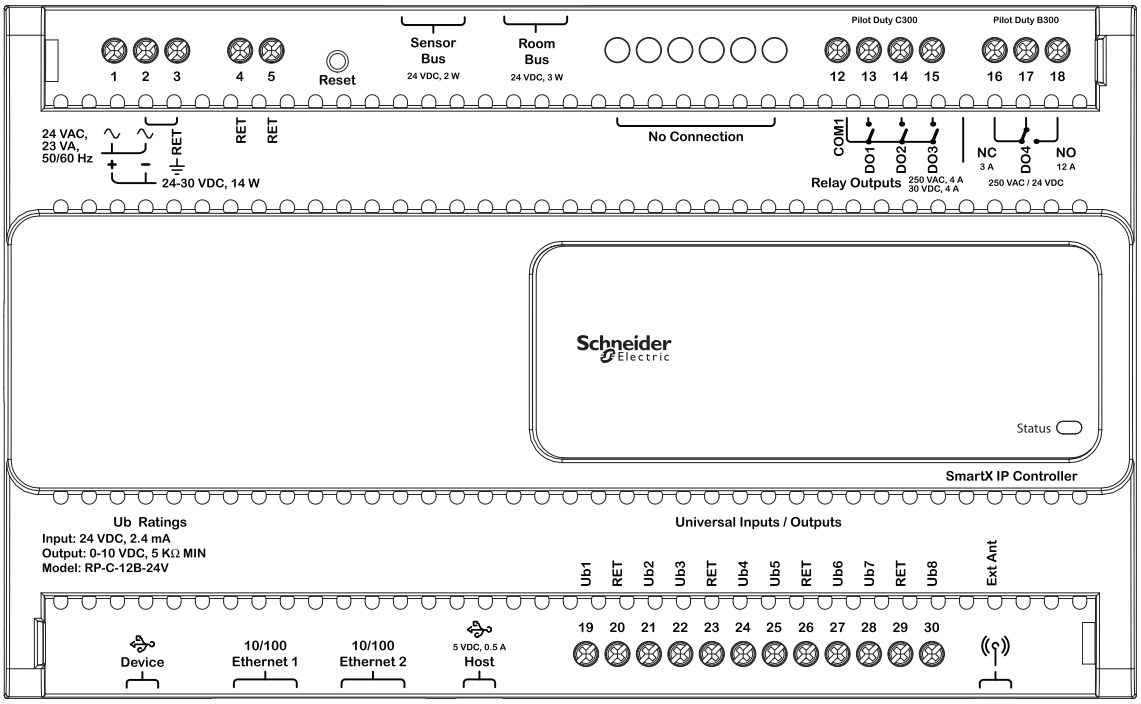


Figure: Screw terminals and other connectors, RP-C-12B model

The 24 screw terminals are used as follows:

- Three screw terminals for the power input
- Two screw terminals for the return (RET) terminals 4 and 5
- Four screw terminals for the three relay outputs
- Three screw terminals for the high power relay output
- 12 screw terminals for the eight universal inputs/outputs of type Ub

Table: Screw Terminals, RP-C-12B Model

Terminal number	Designation	Usage
Power input		

Continued

Terminal number	Designation	Usage
1	∿/+	24 VAC, 50/60 Hz, 23 VA Positive lead (+) when operating the device from 24-30 VDC, 14 W
2	∿/–	Earth ground lead of 24 VAC transformer connects to terminal 2. Terminals 2 and 3 are internally connected. Negative (–) lead when operating the device from 24-30 VDC, 14 W
3	RET ⏚	Terminal 3 is provided for convenience to connect to protective earth ground (optional). Terminals 2 and 3 are internally connected.
Return terminals		
4	RET	Internally connected to all earth ground and RET terminals
5	RET	Internally connected to all earth ground and RET terminals
Relay outputs		
12	COM1	Common connection for DO1, DO2, and DO3
13	DO1	Relay output, type Form A
14	DO2	Relay output, type Form A
15	DO3	Relay output, type Form A
High power relay outputs		
16	NC	Normally Closed terminal. High power relay output, type Form C.
17	DO4	Common terminal. High power relay output, type Form C.
18	NO	Normally Open terminal. High power relay output, type Form C.

Continued

Terminal number	Designation	Usage
Universal inputs/outputs		
19	Ub1	Universal input/output, type Ub
20	RET	Internally connected to all earth ground and RET terminals
21	Ub2	Universal input/output, type Ub
22	Ub3	Universal input/output, type Ub
23	RET	Internally connected to all earth ground and RET terminals
24	Ub4	Universal input/output, type Ub
25	Ub5	Universal input/output, type Ub
26	RET	Internally connected to all earth ground and RET terminals
27	Ub6	Universal input/output, type Ub
28	Ub7	Universal input/output, type Ub
29	RET	Internally connected to all earth ground and RET terminals
30	Ub8	Universal input/output, type Ub

3.15 RP-C-12C Screw Terminals

The RP-C-12C model has 12 I/O points and the controller is equipped with 24 fixed screw terminals.

⚠⚠DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

Disconnect the power supply and other high voltage equipment before wiring.

Failure to follow these instructions will result in death or serious injury.

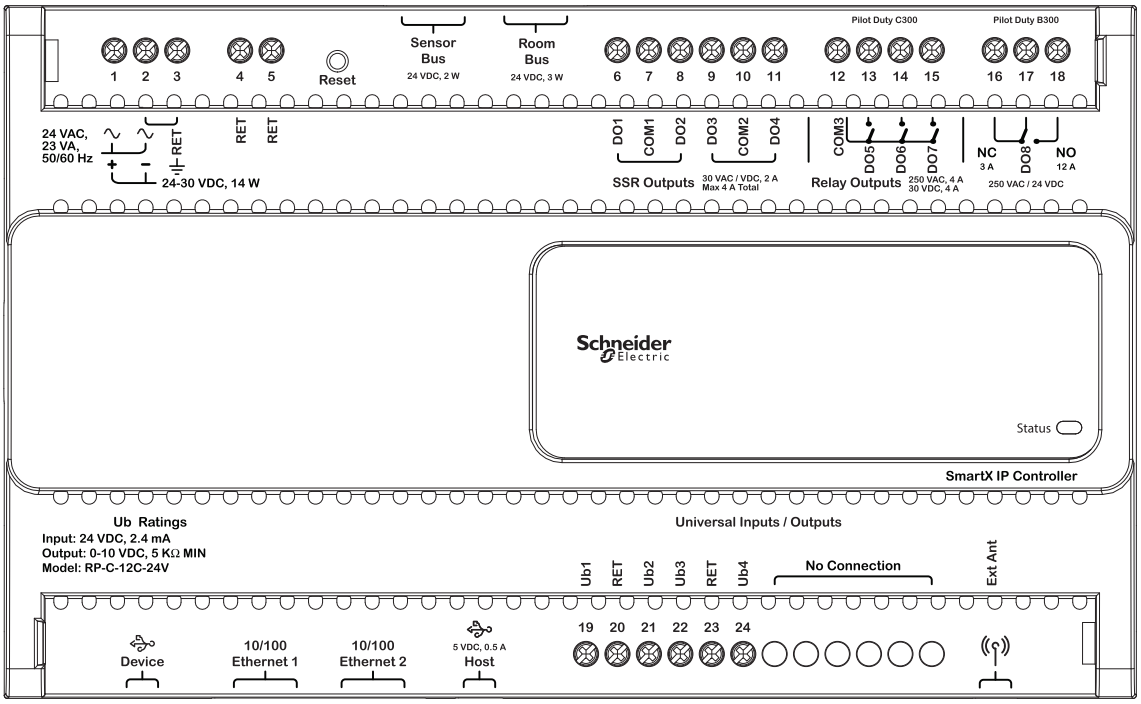


Figure: Screw terminals and other connectors, RP-C-12C model

The 24 screw terminals are used as follows:

- Three screw terminals for the power input
- Two screw terminals for the return (RET) terminals 4 and 5
- Six screw terminals for the four solid-state relay (SSR) outputs
- Four screw terminals for the three relay outputs
- Three screw terminals for the high power relay output
- Six screw terminals for the four universal inputs/outputs of type Ub

Table: Screw Terminals, RP-C-12C Model

Terminal number	Designation	Usage
Power input		

Continued

Terminal number	Designation	Usage
1	∿/+	24 VAC, 50/60 Hz, 23 VA Positive lead (+) when operating the device from 24-30 VDC, 14 W
2	∿/–	Earth ground lead of 24 VAC transformer connects to terminal 2. Terminals 2 and 3 are internally connected. Negative (–) lead when operating the device from 24-30 VDC, 14 W
3	RET ⏚	Terminal 3 is provided for convenience to connect to protective earth ground (optional). Terminals 2 and 3 are internally connected.
Return terminals		
4	RET	Internally connected to all earth ground and RET terminals
5	RET	Internally connected to all earth ground and RET terminals
Solid-state relay (SSR) outputs		
6	DO1	SSR output
7	COM1	Common connection for DO1 and DO2 The COM terminal can be connected to 0 to 24 VAC or -30 VDC to +30 VDC.
8	DO2	SSR output
9	DO3	SSR output
10	COM2	Common connection for DO3 and DO4 The COM terminal can be connected to 0 to 24 VAC or -30 VDC to +30 VDC.
11	DO4	SSR output
Relay outputs		

Continued

Terminal number	Designation	Usage
12	COM3	Common connection for DO1, DO2, and DO3
13	DO1	Relay output, type Form A
14	DO2	Relay output, type Form A
15	DO3	Relay output, type Form A
High power relay outputs		
16	NC	Normally Closed terminal. High power relay output, type Form C.
17	DO4	Common terminal. High power relay output, type Form C.
18	NO	Normally Open terminal. High power relay output, type Form C.
Universal inputs/outputs		
19	Ub1	Universal input/output, type Ub
20	RET	Internally connected to all earth ground and RET terminals
21	Ub2	Universal input/output, type Ub
22	Ub3	Universal input/output, type Ub
23	RET	Internally connected to all earth ground and RET terminals
24	Ub4	Universal input/output, type Ub

3.16 RP-C-16A Screw Terminals

The RP-C-16A model has 16 I/O points and the controller is equipped with 30 fixed screw terminals.

⚠⚠DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

Disconnect the power supply and other high voltage equipment before wiring.

Failure to follow these instructions will result in death or serious injury.

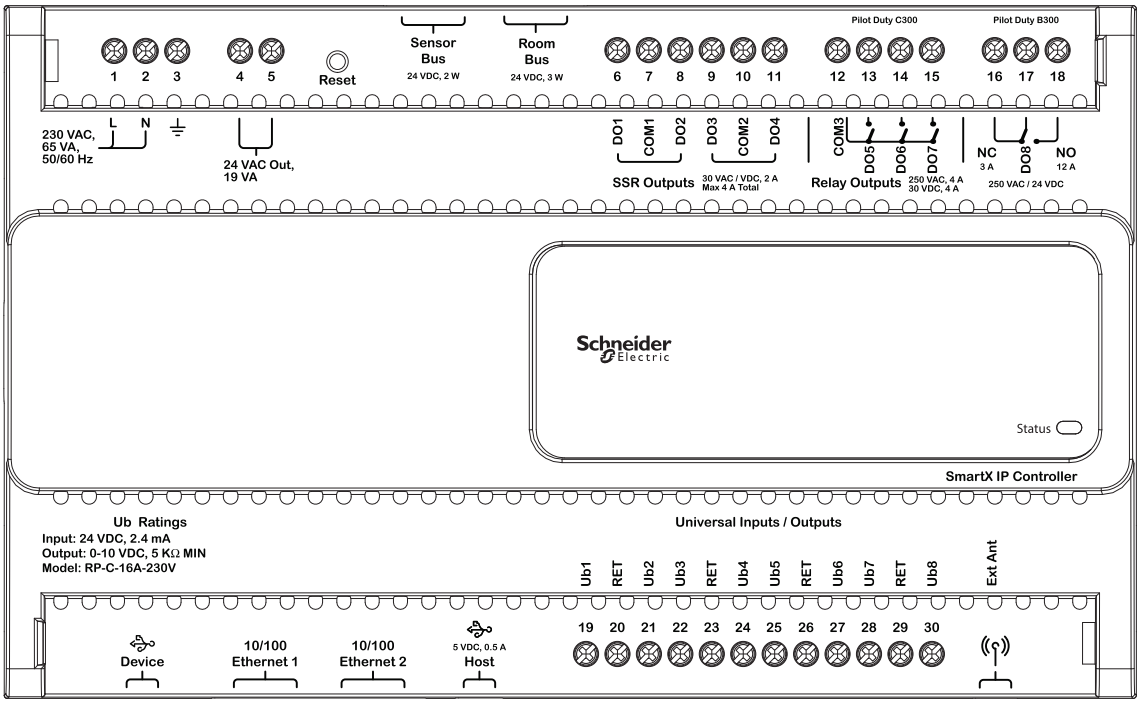


Figure: Screw terminals and other connectors, RP-C-16A model

The 30 screw terminals are used as follows:

- Three screw terminals for the power input
- Two screw terminals for the 24 VAC output
- Six screw terminals for the four solid-state relay (SSR) outputs
- Four screw terminals for the three relay outputs
- Three screw terminals for the high power relay output
- 12 screw terminals for the eight universal inputs/outputs of type Ub

Table: Screw Terminals, RP-C-16A Model

Terminal number	Designation	Usage
Power input		

Continued

Terminal number	Designation	Usage
1	L	Line (L) lead, 230 VAC, 50/60 Hz, 65 VA
2	N	Neutral (N) lead, 230 VAC, 50/60 Hz, 65 VA
3	⏚	Not connected internally
24 VAC output		
4	24 VAC Out	24 VAC, 19 VA, isolated output For more information, see section 3.27 “24 VAC Output on the RP-C-16A Controller” on page 83.
5	24 VAC Out	24 VAC, 19 VA, isolated output For more information, see section 3.27 “24 VAC Output on the RP-C-16A Controller” on page 83.
Solid-state relay (SSR) outputs		
6	DO1	SSR output
7	COM1	Common connection for DO1 and DO2 The COM terminal can be connected to 0 to 24 VAC or -30 VDC to +30 VDC.
8	DO2	SSR output
9	DO3	SSR output
10	COM2	Common connection for DO3 and DO4 The COM terminal can be connected to 0 to 24 VAC or -30 VDC to +30 VDC.
11	DO4	SSR output
Relay outputs		
12	COM3	Common connection for DO1, DO2, and DO3
13	DO1	Relay output, type Form A
14	DO2	Relay output, type Form A

Continued

Terminal number	Designation	Usage
15	DO3	Relay output, type Form A
High power relay outputs		
16	NC	Normally Closed terminal. High power relay output, type Form C.
17	DO4	Common terminal. High power relay output, type Form C.
18	NO	Normally Open terminal. High power relay output, type Form C.
Universal inputs/outputs		
19	Ub1	Universal input/output, type Ub
20	RET	Internally connected to all RET terminals
21	Ub2	Universal input/output, type Ub
22	Ub3	Universal input/output, type Ub
23	RET	Internally connected to all RET terminals
24	Ub4	Universal input/output, type Ub
25	Ub5	Universal input/output, type Ub
26	RET	Internally connected to all RET terminals
27	Ub6	Universal input/output, type Ub
28	Ub7	Universal input/output, type Ub
29	RET	Internally connected to all RET terminals
30	Ub8	Universal input/output, type Ub

3.17 RP-C LEDs

There is one LED on the front panel of the RP-C.

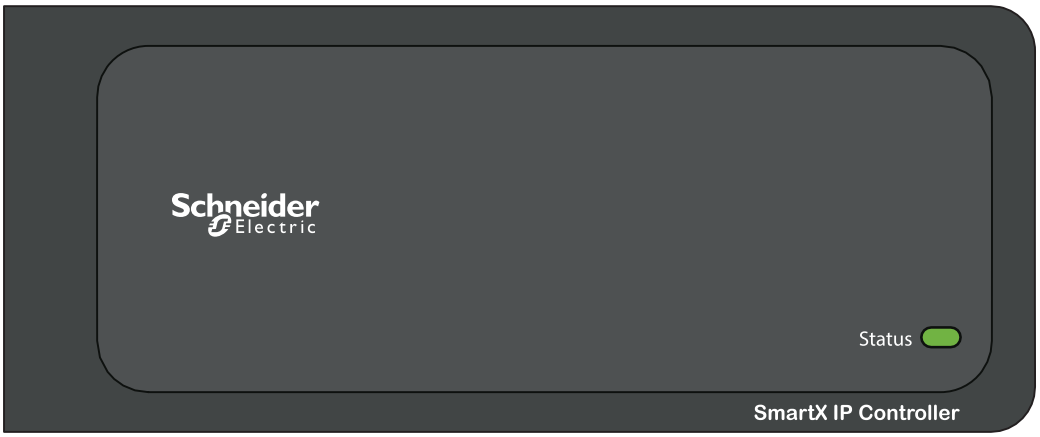


Figure: RP-C LEDs

Table: RP-C LEDs

Function	Color
Status	Red, Green, Blue (and combinations)

3.17.1 Status LED

The RP-C Status LED indicates the condition of the device.

Table: RP-C Status LED Patterns

LED Patterns	Condition
Green, constant	Normal operation, status OK RP-C controller firmware application running No Bluetooth activity
Blue, constant	Normal operation, status OK RP-C controller firmware application running Bluetooth connection is active
Blue/green, flashing (~1 Hz)	Normal operation, status OK RP-C controller firmware application running Bluetooth advertising is active
Green, flashing (~1 Hz)	Device restarting, wait RP-C controller firmware application running

Continued

LED Patterns	Condition
Red, constant	Detected error, attention required
Red, flashing (~1 Hz)	Device operates, but a problem needs attention
Red/green, flashing (~1 Hz)	RP-C I/O board receiving software upgrade, wait
Amber, constant	RP-C controller firmware boot applet running
Amber, flash	Device restarting, wait RP-C controller firmware boot applet started

3.18 RP Series Controller Reset Modes

You can reset and restart the RP Series controllers in different ways depending on how long you press the reset button. The resets and restarts can affect the retention of values after restart based on the retain levels configured for the variables.

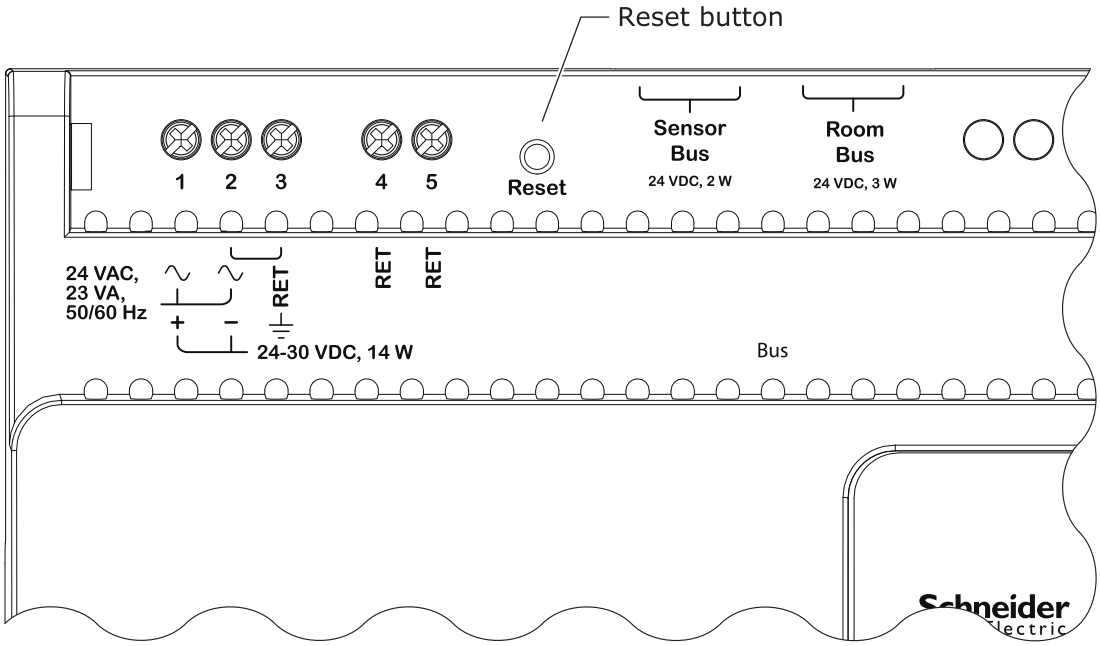


Figure: Location on the reset button on an RP Series controller

You can use a straightened segment of a paper clip or a similar tool to press the reset button.

Table: Reset Modes

Mode	Description
Warm start	Press and release the reset button in less than 5 seconds. Performing a power cycle in a SmartX IP controller is analogous to a hardware warm start.
Cold start	Press and hold the reset button for more than 5 seconds but less than 9 seconds.
Network reset	Press and hold the reset button for 10 to 19 seconds. Perform a network reset in WorkStation in order to reset the IP address settings to DHCP with a failover to Auto-IP.

Continued

Mode	Description
Factory reset	Press and hold the reset button for 20 to 29 seconds. Consult the following Factory Reset subsection for more details.
Erase database	Press and hold the reset button for 30 to 39 seconds.
Cancel reset action	Press and hold the reset button for more than 40 seconds and then release the button. Performing this action cancels the reset request that would be initiated by any of the shorter button press durations.

3.18.1 Factory Reset

In WorkStation, if your SmartX IP controller device seems completely unresponsive, perform a factory reset to restore the device to a state where it can be successfully commissioned. After you release the reset button, a factory reset may take up to 30 seconds to process. All diagnostic logs and the database are erased during a factory reset. By contrast, controller firmware does not revert and remains at the same active level.

3.18.2 Retain Levels for Variables

Variables have a configurable retain level, which controls if the value of the variable is retained after a restart of the RP Series controller. There are three retain levels:

- No
- Warm start
- Cold start

The following table lists what is retained after a warm start or cold start based on the configured retain level.

Table: Retained Variable Values Depending on Restart Mode and Retain Level

Restart mode	Retain level: No	Retain level: Warm start	Retain level: Cold start
Warm start	Default value[a] Values configured by a user or application are lost.	Variable retains last value configured by a user. Values configured by an application are retained.	Variable retains last value configured by a user. Values configured by an application are retained.

Continued

Restart mode	**Retain level:** **No**	**Retain level:** **Warm start**	**Retain level:** **Cold start**
Cold start	Default value[a] Values configured by a user or application are lost.	Variable loses last value configured by a user. Values configured by an application are lost.	Variable retains last value configured by a user. Values configured by an application are retained.

[a] Default value is the value the variable gets when it is created.

For more information, see the *Retain Level* topic on WebHelp.

NOTICE
Although variable values in SmartX IP controllers are retained in accordance with this matrix, SmartX server retention behaves differently. As a result, variable values retained in the server that are not retained in the controller may be restored to the controller during a download command. For more information, see the *Retain Level* topic on WebHelp.

3.19 RP-C Device Installation

The RP-C can be installed on a DIN rail or flat surface.

The RP-C must be professionally installed to comply with the following rules and regulations:

- Part 15 of the Federal Communications Commission (FCC) rules
- Innovation, Science and Economic Development Canada (ISED) licence-exempt Radio Standards Specifications (RSSs)
- 2014/53/EU Radio Equipment Directive (RED) of the European Union (EU).

For more information, see section 3.32 “RP-C Regulatory Compliance and Approvals” on page 100.

The RP-C and its antenna(s) must be installed to provide a separation distance of at least 20 cm (8 in.) from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter.

A DIN rail is a common and convenient technique for installing the RP-C along with other associated control and monitoring devices. The most efficient ventilation is achieved with the wall-mounted DIN rail oriented horizontally and with adequate space provided between the RP-C rail and adjacent rails or other devices. Information on recommended RF exposure limits can be obtained from Health Canada's website, www.canada.ca/en/health-canada.

The RP-C is typically installed horizontally (on a DIN rail going from left to right), with the device label text in the upright position reading left to right.

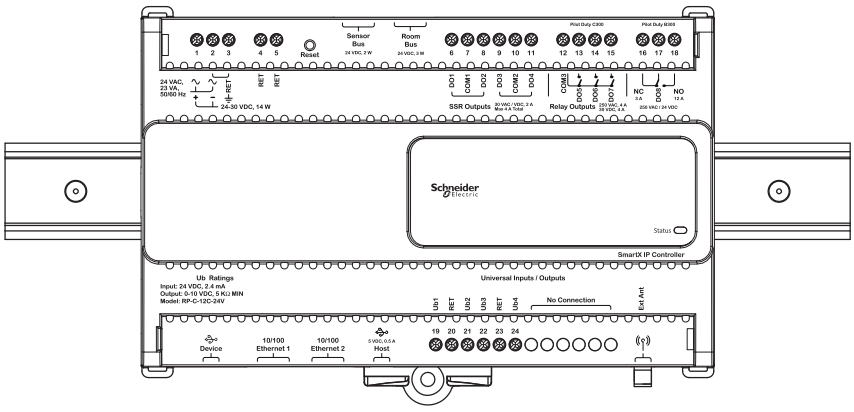


Figure: RP-C installed on a horizontal DIN rail

NOTICE

CONTROLLER DEVICE DAMAGE

Follow the installation orientation restrictions that apply to the specific SmartX IP Controller device model.

Failure to follow these instructions can result in equipment damage.

Under normal operating conditions, 0 to 50 °C (32 to 122 °F), the RP-C-12A, -12B, and -12C models can also be installed vertically (on a DIN rail going from top to bottom), which means that the device is rotated +90 degrees or -90 degrees from the horizontal position. Installing the RP-C-12A, -12B, and -12C models face down from a ceiling or face up on a horizontal surface is also

supported. The only installation orientation that is not supported is when the device is rotated 180 degrees from the horizontal position, that is, with device label text up and down. In the up and down position, the controller's thermal specifications may be exceeded, which can damage the controller.

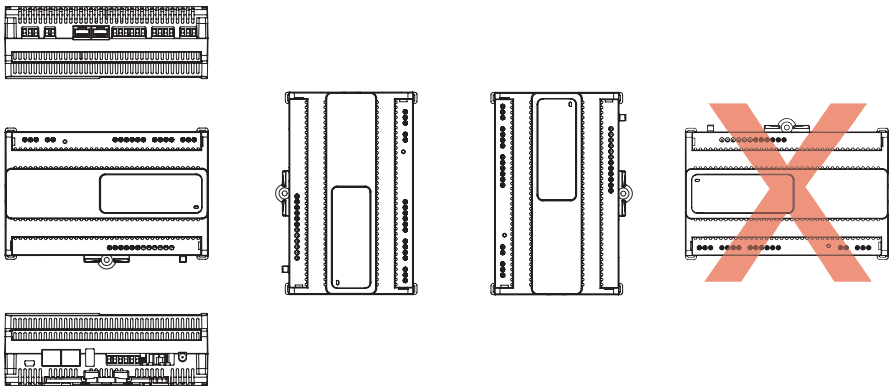


Figure: Installation orientation restrictions for RP-C-12A, -12B, and -12C models operated in normal conditions, 0 to 50 °C (32 to 122 °F)

When the RP-C-12A, -12B, and -12C models are used for rooftop applications, -40 to +60 °C (-40 to +140 °F), the device should be installed horizontally, with the device label text in the upright position reading left to right. Any other installation orientation may exceed the controller's thermal specifications, which can damage the controller.

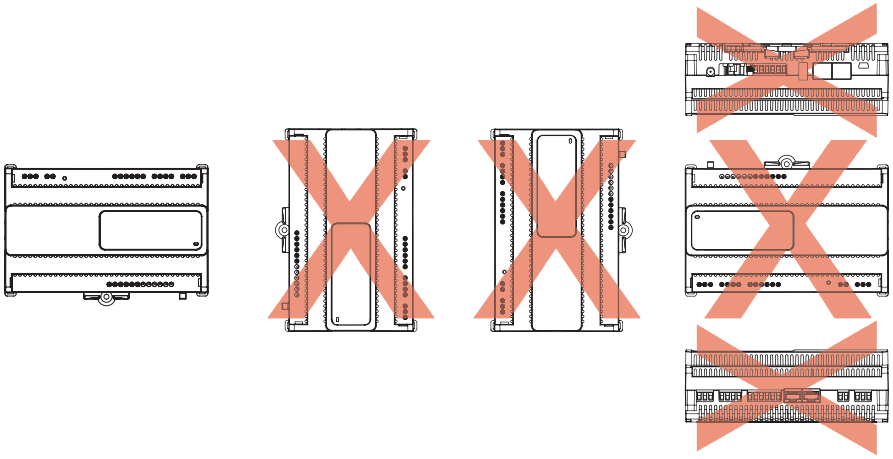


Figure: Installation orientation restrictions for RP-C-12A, -12B, and -12C models operated at -40 to +60 °C (-40 to +140 °F)

Under normal operating conditions, 0 to 50 °C (32 to 122 °F), the RP-C-16A model can also be installed vertically, that is, with the device is rotated +90 degrees or -90 degrees from the horizontal position. Installing the RP-C-16A model rotated 180 degrees from the horizontal position or face up on a horizontal surface is not supported. Installing the RP-C-16A model face down from a ceiling is only supported in the operating temperature range 0 to 40 °C (32 to 104 °F), but not in the temperature range 0 to 50 °C (32 to 122 °F). Installing the controller in an orientation that is not supported may cause the controller's thermal specifications to be exceeded, which can damage the controller.

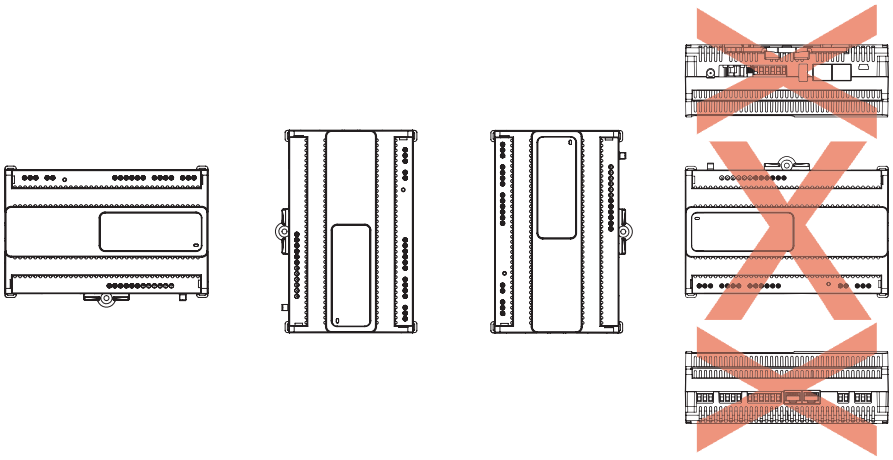


Figure: Installation orientation restrictions for RP-C-16A model operated in normal conditions, 0 to 50 °C (32 to 122 °F)

When installing RP-Cs in a cabinet, it is recommended to provide ample space between the DIN rails and controllers for sufficient ventilation.

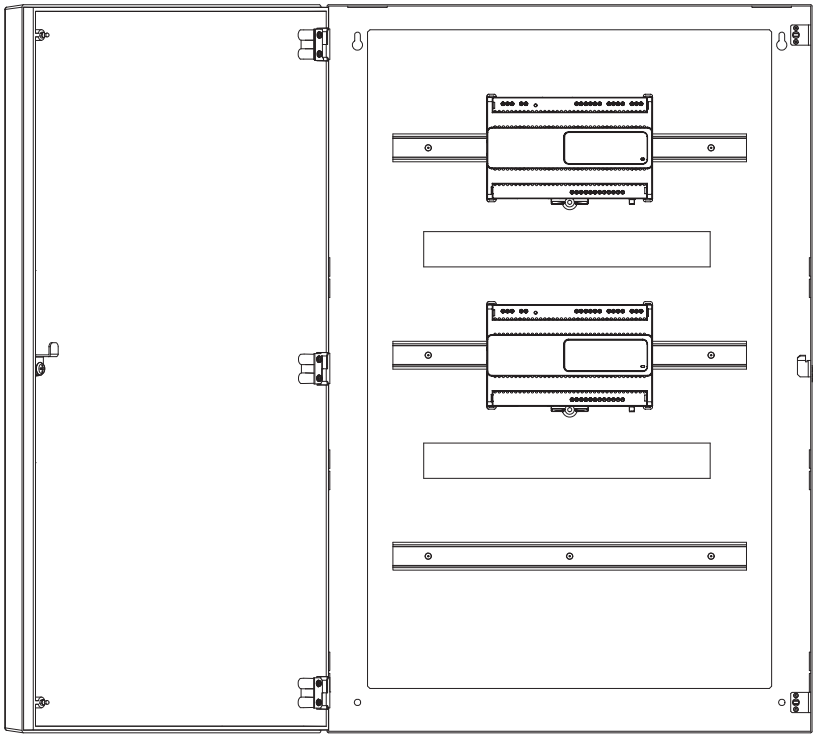


Figure: RP-Cs installed on horizontal DIN rails in a cabinet

To help prevent the device from sliding down or sideways on the DIN rail, install an end clip for DIN 35 (part number SXWDINEND10001) tightly against the bottom or rightmost device on the rail. The end clip is easily removed if you bend the snap lock open with a screwdriver.

NOTICE

CONTROLLER DEVICE DAMAGE

Use an end clip (part number SXWDINEND10001) when you install the SmartX IP Controller device on a vertical DIN rail.

Failure to follow these instructions can result in equipment damage.

Figure: End clip for DIN 35 fixed across the DIN rail

All RP-C models have fixed screw terminals.

The RP-C has four anchor points that can be used to fasten cable ties or other accessories for bundling wires.

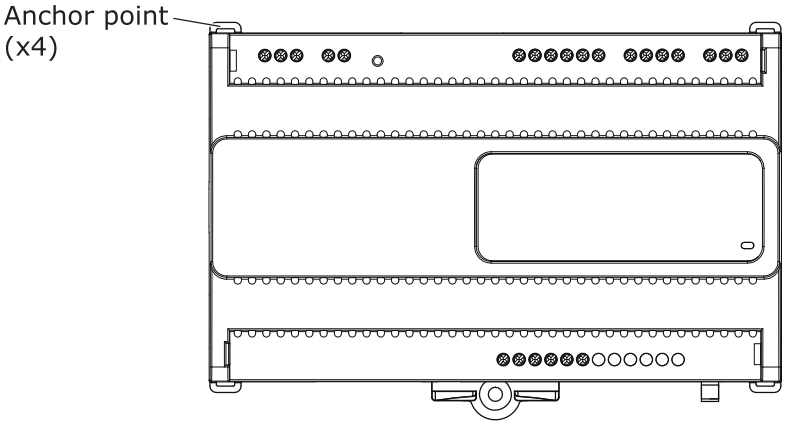


Figure: Anchor points for cable ties

All RP-C models can be equipped with optional covers to reduce access to the screw terminals and wires if desired.

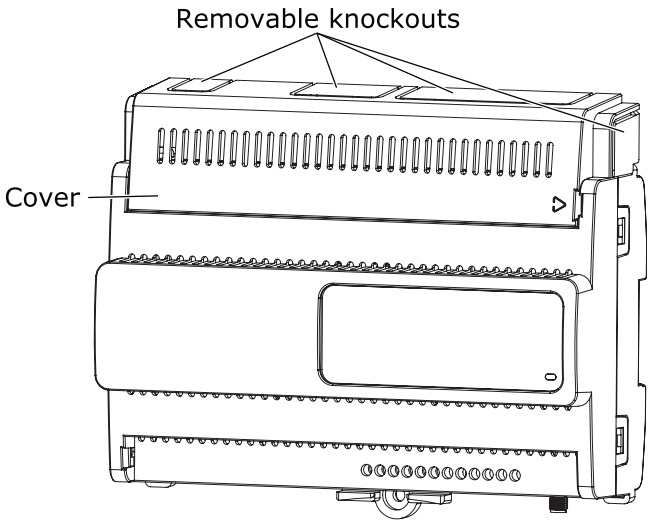


Figure: Optional cover

3.20 Installing RP-C on a DIN Rail

You install RP-C on a DIN rail to properly fasten the device and to allow for sufficient ventilation.

For more information, see section 3.19 “RP-C Device Installation” on page 67.

⚠ CAUTION

RADIO FREQUENCY (RF) EXPOSURE

- Install the controller and its antenna at least 20 cm (8 in.) from all persons.
- Do not install the controller and its antenna near any other antenna or radio transmitter.

Failure to follow these instructions can result in minor or moderate injury.

NOTICE

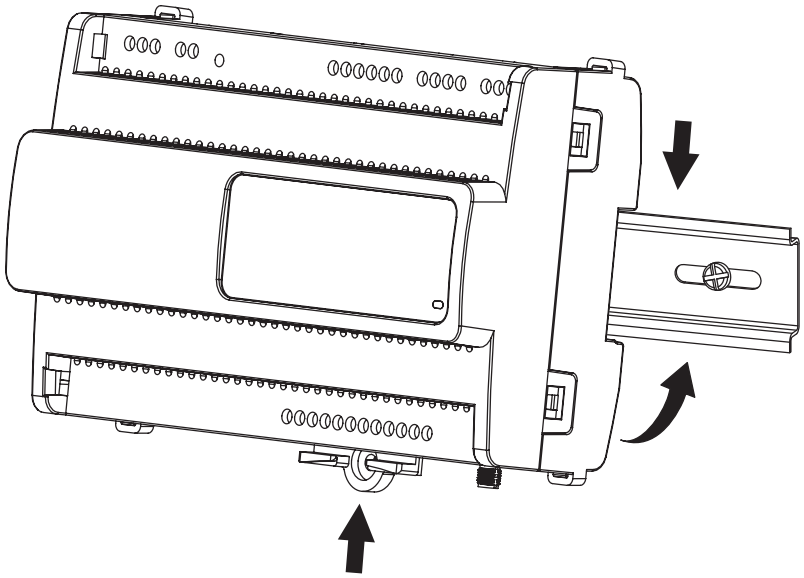
CONTROLLER DEVICE DAMAGE

Use an end clip (part number SXWDINEND10001) when you install the SmartX IP Controller device on a vertical DIN rail.

Failure to follow these instructions can result in equipment damage.

To install RP-C on a DIN rail

1. Push the DIN rail clip.



2. Hook the device onto the top of the DIN rail.
3. Push the device fully onto the DIN rail.
4. Release the DIN rail clip.
5. For a vertical DIN rail, install an end clip (stop) below the device.

3.21 Installing RP-C on a Flat Surface

You install RP-C on a flat surface to properly fasten the device and to allow for sufficient ventilation.

For more information, see section 3.19 “RP-C Device Installation” on page 67.

⚠CAUTION

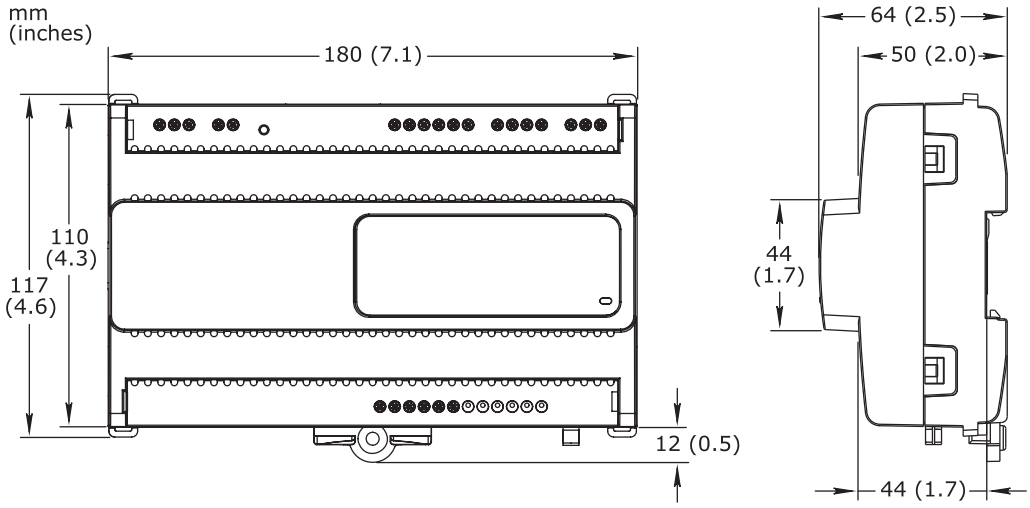
RADIO FREQUENCY (RF) EXPOSURE

- Install the controller and its antenna at least 20 cm (8 in.) from all persons.
- Do not install the controller and its antenna near any other antenna or radio transmitter.

Failure to follow these instructions can result in minor or moderate injury.

To install RP-C on a flat surface

1. Refer to the dimensional drawing before installing the RP-C.

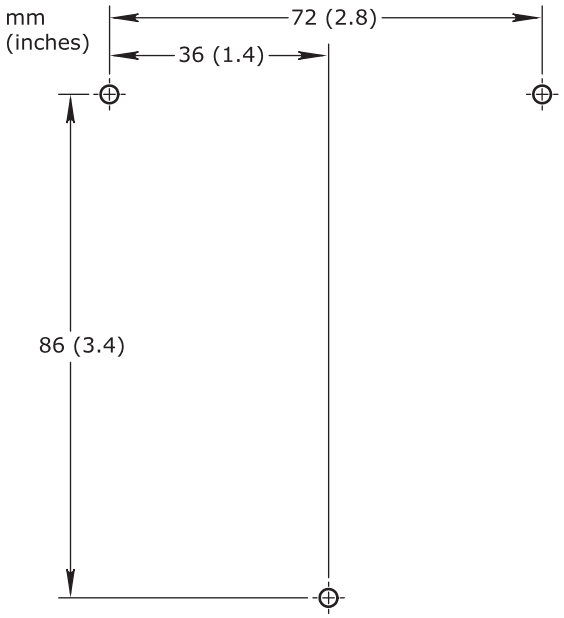


2. Ensure that you have the proper mounting hardware and anchoring system.
3. Check the weight-bearing load before choosing your mounting hardware.
4. Find a suitable location and surface on which to mount the RP-C.

Continued on next page

5. Drill three mounting holes that fit number 8 or M4 screws (or anchors):
   - Two holes for the top two screws on which you hang the RP-C
   - One hole for the screw at the bottom that helps prevent the device from being lifted off the top two screws

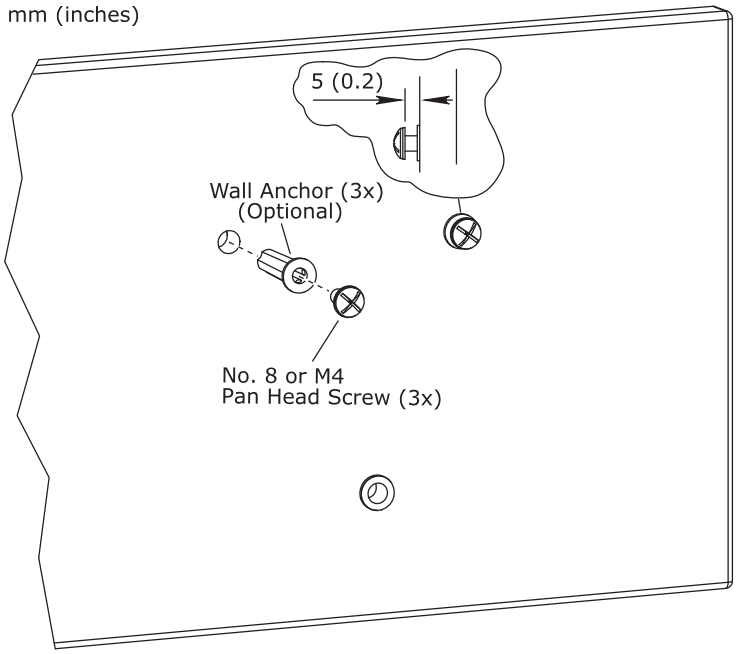
   Use the following drawing to measure out the location of the three holes for the RP-C.



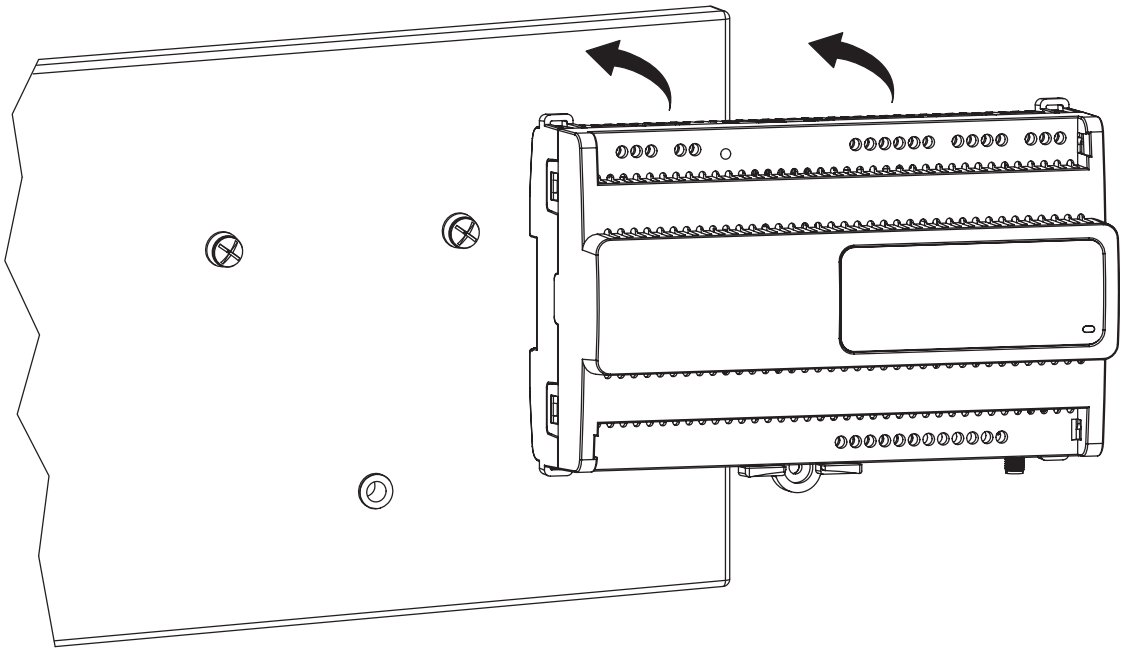
   You can also use the 1:1 drill template in the installation sheet that comes with each controller.

Continued on next page

6. Install number 8 or M4 pan head screws (or anchors) in the two top holes, leaving approximately 5 mm (0.2 inch) space between the head of the screw (or anchor) and the flat surface to accommodate the RP-C material thickness.

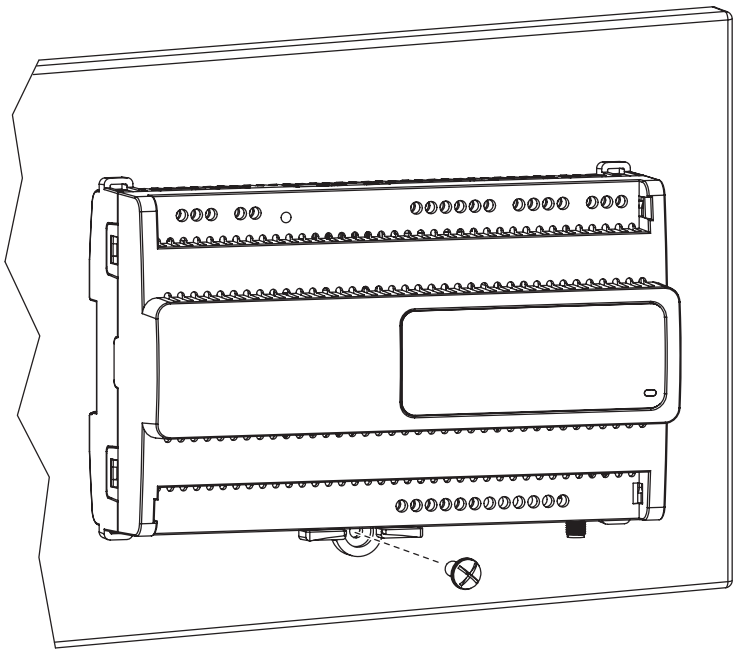


7. Fit the two keyhole slots on the back of the RP-C enclosure to the heads of the mounted screws (or anchors) and then slide the RP-C down in place on the screws (or anchors).



Continued on next page

8. Fit the bottom screw (or anchor) to the hole at the bottom of the RP-C and tighten the screw (or anchor).



3.22 Wiring a Screw Terminal on RP-C

You wire the screw terminals on the RP-C to connect I/O devices and power. Always use the recommended wires (or wires with larger cross-sectional area).

For more information, see section 3.19 “RP-C Device Installation” on page 67.

For more information, see section 4.1 “Wiring” on page 105.

⚠⚠DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

Disconnect the power supply and other high voltage equipment before wiring.

Failure to follow these instructions will result in death or serious injury.

To wire a screw terminal on RP-C

1. Disconnect the power supply and other high voltage equipment connected to the controller.
2. Loosen the screw of the terminal.
3. Strip approximately 7 mm (0.3 inches) of the insulation from the end of each wire.
4. Insert the end of the wire fully into its intended terminal. Ensure that no bare wire strands extend from the terminal.
5. Tighten the screw using a small flat-blade screwdriver. Ensure that the screw is fully tightened.
6. Use appropriate cable strain relief methods, especially for wires that carry 30 VAC or 42.4 VDC or above, to help prevent any load applied to the cable from being transferred to conductor terminations.

   You can use the anchor points on the controller enclosure and cable ties to fasten and fix the cables.

3.23 Powering Up an RP-C-12A, -12B, or -12C Controller

You perform the following steps to power up an RP-C-12A, RP-C-12B, or RP-C-12C controller.

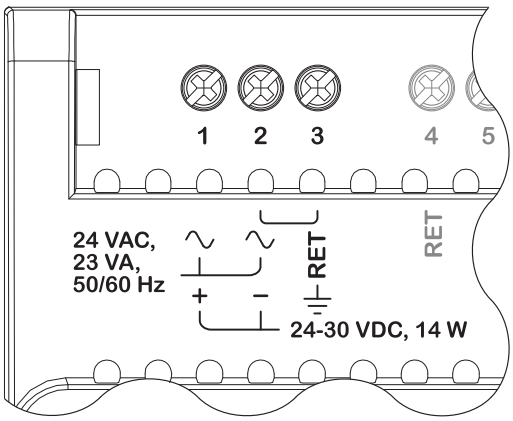
For more information, see section 3.19 “RP-C Device Installation” on page 67.

NOTICE
CONTROLLER DEVICE DAMAGE • Ensure that the input power polarity is correct and that the voltage level meets the specifications of the SmartX IP Controller device. • Ensure that earth ground is properly connected to the SmartX IP Controller device. **Failure to follow these instructions can result in equipment damage.**

To power up an RP-C-12A, -12B, or -12C controller

1. Check that all wiring is correct.
2. Ensure that appropriate cable strain relief is provided, especially for wires that carry 30 VAC or 42.4 VDC or above.

   You can use the anchor points on the controller enclosure and cable ties to fasten and fix the cables.
3. Ensure that the 24 VAC at 50/60 Hz or 24-30 VDC power is supplied to terminals 1 and 2.



4. Ensure that the ground cable is connected to terminal number 3.
5. After powering up, check that the Status LED changes as follows:
   - Bluetooth interface enabled (default): Flashing blue/green light (Normal operation, Bluetooth advertising)
   - Bluetooth interface disabled: Constant green light, after about a minute (Normal operation, No Bluetooth activity)

   For more information, see section 3.17 “RP-C LEDs” on page 62.

3.24 Powering Up an RP-C-16A Controller

You perform the following steps to power up an RP-C-16A controller.

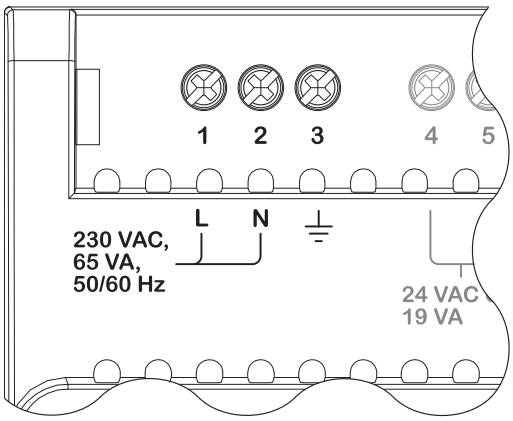
For more information, see section 3.19 “RP-C Device Installation” on page 67.

NOTICE
CONTROLLER DEVICE DAMAGE Ensure that the input power voltage level meets the specifications of the SmartX IP Controller device. **Failure to follow these instructions can result in equipment damage.**

To power up an RP-C-16A controller

1. Check that all wiring is correct.
2. Ensure that appropriate cable strain relief is provided, especially for wires that carry 30 VAC or 42.4 VDC or above.

   You can use the anchor points on the controller enclosure and cable ties to fasten and fix the cables.
3. Ensure that the 230 VAC at 50/60 Hz is supplied to terminals 1 (Line lead) and 2 (Neutral lead).



4. After powering up, check that the Status LED changes as follows:
   - Bluetooth interface enabled (default): Flashing blue/green light (Normal operation, Bluetooth advertising)
   - Bluetooth interface disabled: Constant green light, after about a minute (Normal operation, No Bluetooth activity)

   For more information, see section 3.17 “RP-C LEDs” on page 62.

3.25 Installing the Optional Covers on the RP-C

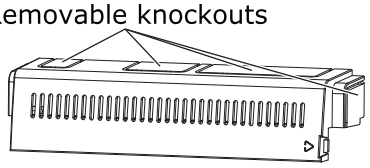
You can install optional covers to the RP-C to reduce access to screw terminals and wires.

For more information, see section 3.19 “RP-C Device Installation” on page 67.

To install the optional covers on the RP-C

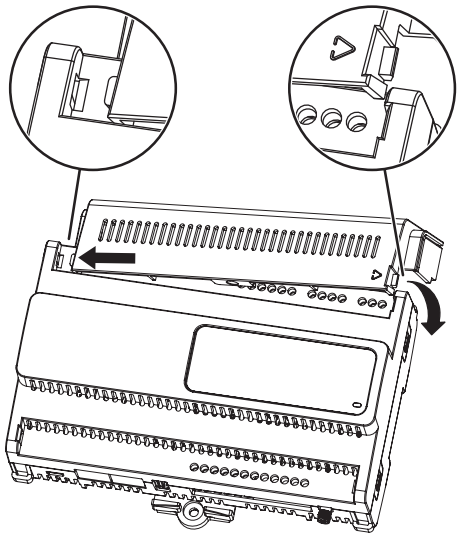
1. Prior to installing the optional cover, you can break and/or cut the knockouts with pliers to provide an opening for wires to exit.

   Removable knockouts

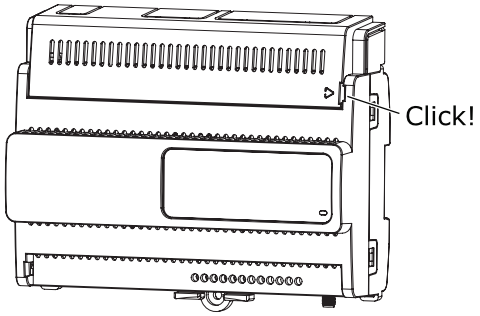
2. Insert the tab as shown into the slot and gently press the optional cover down to engage the clip on the opposite side of the RP-C device.

   The clip is marked by an arrow.

Continued on next page

3. Continue to press the cover down until the clip snaps into place and you hear an audible click sound, which indicates that the cover is fully engaged with the RP-C device.



4. Repeat steps 1 to 3 to install the second cover.

3.26 Removing an Optional Cover from the RP-C

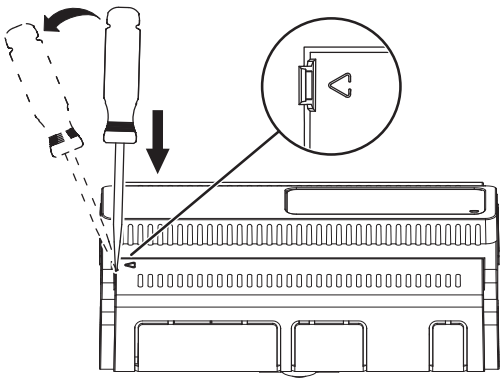
You remove an optional cover from the RP-C when you want to gain access to the screw terminals and wiring.

For more information, see section 3.19 “RP-C Device Installation” on page 67.

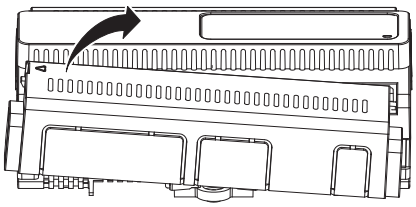
To remove an optional cover from the RP-C

1. Insert a small, flat-blade screwdriver into the slot and gently pry the cover up as shown below.

   The clip is marked by an arrow.



2. Remove the cover from the RP-C.



3.27 24 VAC Output on the RP-C-16A Controller

The RP-C-16A model has a 24 VAC (19 VA) output that can be used to power external loads such as actuators, relays, or indicators. The external loads can be controlled using the controller's solid-state relay (SSR) or relay outputs.

The RP-C-16A controller uses an internal transformer to convert 230 VAC from the power input (terminals 1 and 2) to 24 VAC (terminals 4 and 5). The transformer provides galvanic isolation between the 24 VAC output and the 230 VAC power input as well as the controller electronics.

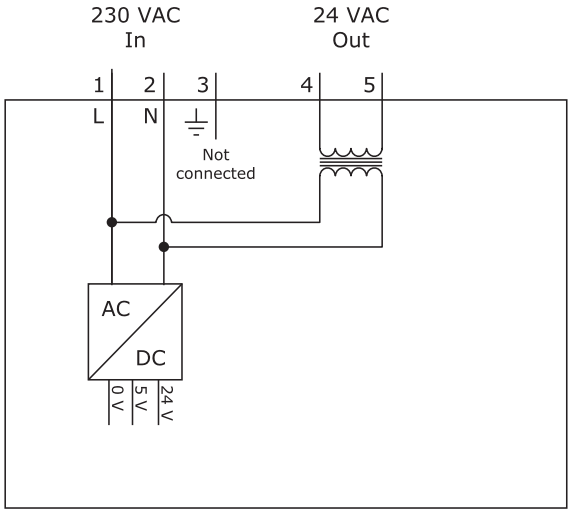


Figure: 24 VAC isolated output

The following wiring example shows how an actuator can be connected to the controller's 24 VAC output and one of the SSR outputs. The example also shows how the 24 VAC output terminals 4 and 5 are connected to terminals G0 and G on a transmitter, for which the terminal M is connected to one of the RET terminals of the controller's Universal Inputs/Outputs. G0 and M of the transmitter may be interconnected internally or by a separate wire, which can introduce disturbances. Sometimes there is only one common ground connection G0/M, and this node must be connected to one of the 24 VAC output terminals and to a RET terminal. In the example below, the transmitter can be replaced by a voltage controlled actuator.

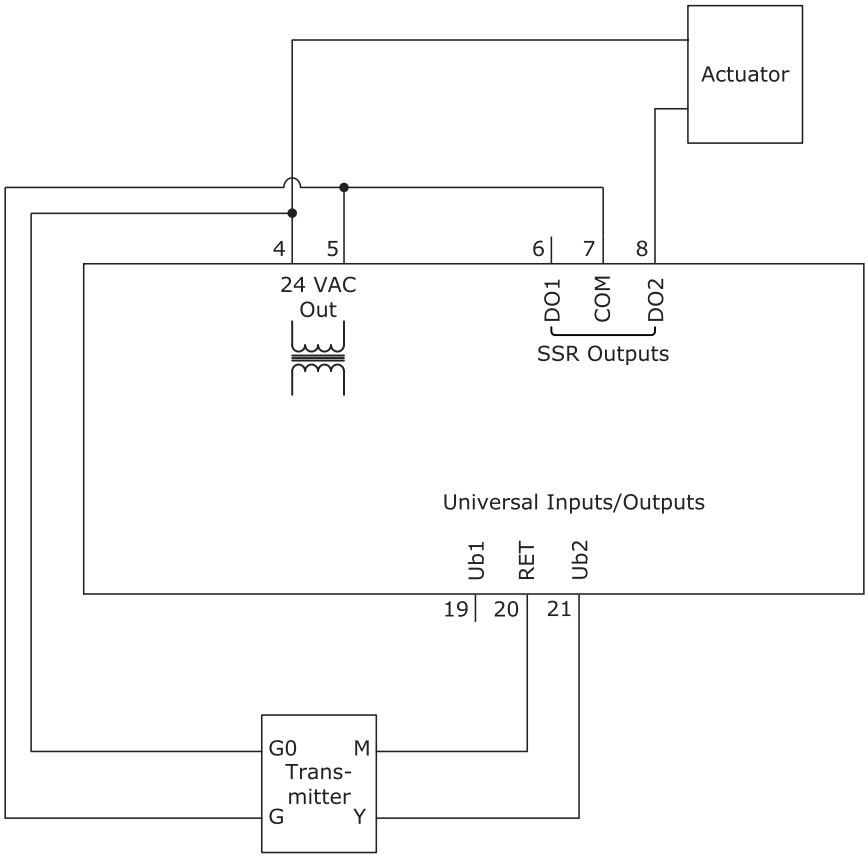


Figure: 24 VAC output, wiring example

The polarity of the 24 VAC output terminals 4 and 5 is unknown, which means that the phase of the output relative to the input of the transformer is also unknown. For example, if you interconnect terminals 4 of two different controllers, a phase difference can result in a voltage difference of 0 VAC to 48 VAC between terminals 5 of the controllers. The primary side of the transformer has a PTC thermistor, which acts as a resettable fuse and turns off the voltage to the transformer in case of over current on the secondary side. However, the PTC thermistor does not provide any protection for external equipment from being exposed to 48 VAC.

NOTICE
EQUIPMENT DAMAGE Never connect the controller's 24 VAC output in parallel with another controller. **Failure to follow these instructions can result in equipment damage.**

3.28 Universal Inputs/Outputs

The universal inputs/outputs are ideal for any mix of temperature, pressure, flow, status points, and similar point types in a building control system.

As counter inputs, the universal inputs/outputs are commonly used in energy metering applications. As RTD inputs, they are ideal for temperature points in a building control system. As supervised inputs, they are used for security applications where it is critical to know whether or not a wire has been cut or shorted. These events provide a separate indication of alarms and trouble conditions to the system.

The universal inputs/outputs are capable of supporting analog outputs of type voltage outputs. Therefore, the universal inputs/outputs support a wide range of devices, such as actuators.

The RP-C-12A, -12B, -12C, and -16A models have universal inputs/outputs of type Ub.

3.28.1 Inputs

The universal inputs/outputs can be configured to read several different types of inputs:

- Digital
- Counter
- Supervised
- Voltage
- Current
- Temperature
- Resistive
- 2-Wire RTD temperature

Digital inputs

The external connection of a digital input is shown in the following figure.

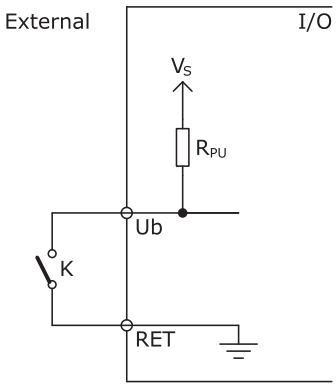


Figure: Digital input external connection

K is the monitored external switch.

V_S = 24 V

R_{PU} = 10 kohm

Counter inputs

A counter input uses the same hardware configuration as the digital input that is shown in the figure above.

Supervised inputs

Supervised inputs are contact closing inputs supplemented with the supervision of the field wiring integrity. This supervision is a required feature in many security system applications. The supervised inputs provide the ability to detect specific forms of tampering or trouble with the wire connections to the field contacts. The supervision is achieved with a combination of 1 or 2 resistors attached to the contact in the field. The resistor combination creates continuous current flow through the field contact loop and presents a defined set of expected resistance values for each of the defined conditions. If someone is attempting to defeat the monitoring of the field contact by short circuiting the wire with a jumper or cutting the wire, the objective is to detect and indicate such a condition. The resistors need to be located at the end of the cable close to the field contact, so that the point where there is a risk that the circuit is defeated is between the resistors and the I/O.

Three different types of supervised input connections are supported:

- Series only
- Parallel only
- Series and parallel

Each type of supervised input connection provides a different capability in regards to what form of tamper/trouble can be detected regardless of switch contact open or closed condition.

Series only: A single resistor, which is connected in series with the switch, can only detect tamper/trouble in the form of a short circuit across the wire pair. A single series resistor supervision is frequently configured with a normally closed field contact. This provides for the short circuit to be detected and a cut wire will show as an alarm condition. The external connection of a series only supervised input connection is shown in the following figure.

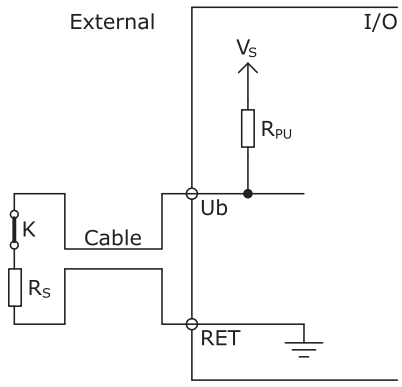


Figure: Series only external connection

K is the monitored external switch.

R_S = 1 to 10 kohm

V_S = 5 V

R_{PU} = 10 kohm

Parallel only: A single resistor, which is connected in parallel with the switch, can only detect tamper/trouble in the form of an open circuit in the field wiring loop. With single parallel resistor supervision and use of a normally open switch in the field, the opened wiring shows as a detected fault and the shorted wiring shows as an alarm condition. The external connection of a parallel only supervised input connection is shown in the following figure.

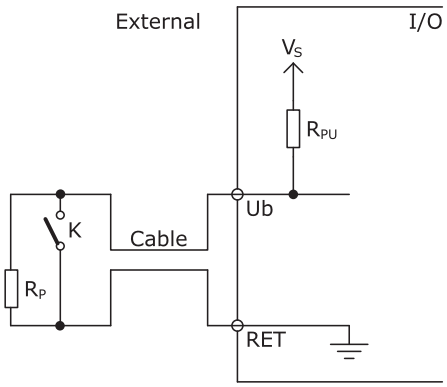


Figure: Parallel only external connection

K is the monitored external switch.

R_P = 1 to 10 kohm

V_S = 5 V

R_{PU} = 10 kohm

Series and parallel: Two resistors, where one is connected in series with the switch and one is connected in parallel with the switch, can detect tamper/trouble conditions in the form of both an open and a shorted circuit. The external connection of a series and parallel supervised input connection is shown in the following figure.

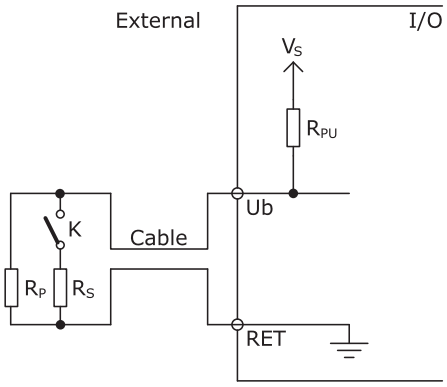


Figure: Series and parallel external connection

K is the monitored external switch.

$R_P = R_S \pm 5$ %, 1 to 10 kohm

V_S = 5 V

R_{PU} = 10 kohm

Voltage inputs

The external connection of a voltage input is shown in the following figure.

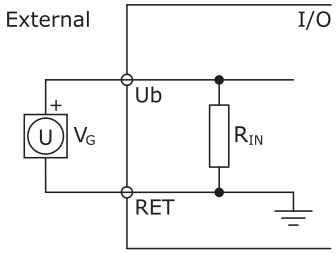


Figure: Voltage input external connection

V_G is the monitored external voltage (0 to 10 VDC).

R_{IN} = 100 kohm

Current inputs

The external connection of a current input is shown in the following figure.

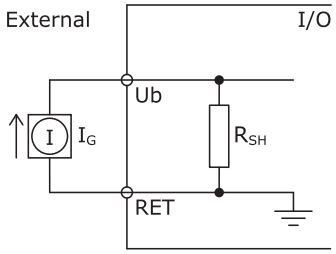


Figure: Current input external connection

I_G is the monitored external current (0 to 20 mA).

R_{SH} = 47 ohm

In the internal configuration of the current input, there is a current limit circuit in order to help protect the shunt resistor from over load. The input current is limited to 60 mA with a serial connected FET transistor. If this limit is reached for 0.5 seconds, the transistor is turned off. When 5 seconds have elapsed, the transistor is turned on again to make a new start attempt.

Temperature inputs

The external connection of a temperature input is shown in the following figure.

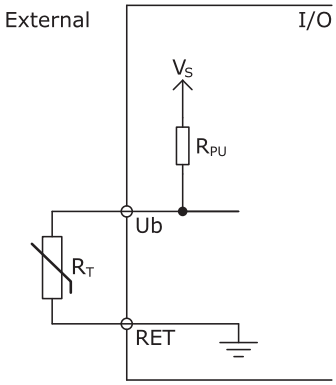


Figure: Temperature input external connection

R_T is the monitored external thermistor.

When a universal input is used as a temperature input, V_S and R_{PU} in the internal configuration of the universal input are used according to the following table.

Thermistor type	**V_S**	**R_{PU}**
20 kohm	5 V	10 kohm
10 kohm	5 V	10 kohm
2.2 kohm	1 V	1.5 kohm
1.8 kohm	1 V	1.5 kohm
1 kohm	1 V	1.5 kohm

The resulting voltage across the thermistor is measured and a temperature is calculated dependent on the selected thermistor type.

Resistive inputs

The external connection of a resistive input is shown in the following figure.

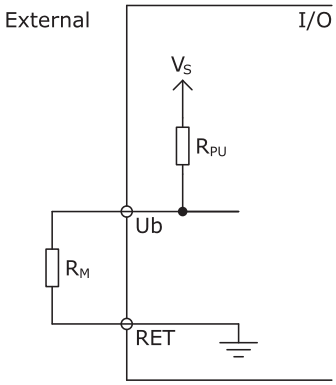


Figure: Resistive input external connection

R_M is the monitored external resistance.

V_S = 5 V

R_{PU} = 10 kohm

2-wire RTD temperature inputs

The external connection of a 2-wire RTD temperature input is shown in the following figure.

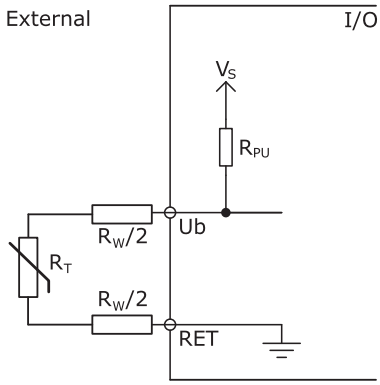


Figure: 2-wire temperature input external connection

R_T is the monitored external RTD.

R_W is the wiring resistance.

V_S = 1 V

R_{PU} = 1.5 kohm

When an input is used as a 2-wire RTD temperature input, you need to specify the wiring resistance in the software.

The input is measuring the total resulting voltage and the voltage across the RTD is calculated. The voltage across the RTD is then converted to a raw resistance value.

3.28.2 Outputs

Voltage outputs

The universal inputs/outputs can be configured as voltage outputs.

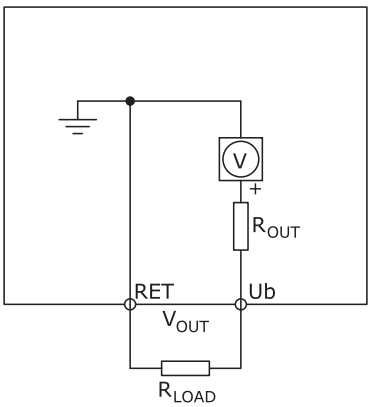


Figure: Voltage output internal configuration and connection of external resistive load

R_{OUT} is approximately equal to 10 ohm.

V_{OUT} range is 0 to 10 VDC.

R_{LOAD} minimum is 5 kohm.

3.28.3 Specifications

Channels, RP-C-12A model ..... 8 Ub, Ub1 to Ub8
Channels, RP-C-12B model ..... 8 Ub, Ub1 to Ub8
Channels, RP-C-12C model ..... 4 Ub, Ub1 to Ub4
Channels, RP-C-16A model ..... 8 Ub, Ub1 to Ub8
Absolute maximum ratings ..... -0.5 to +24 VDC
A/D converter resolution ..... 16 bits
Universal input/output protection ..... Transient voltage suppressor on each universal input/output

Digital inputs

Range . Dry contact switch closure or open collector/open drain, 24 VDC, typical wetting current 2.4 mA
Minimum pulse width ..... 150 ms

Counter inputs

Range . Dry contact switch closure or open collector/open drain, 24 VDC, typical wetting current 2.4 mA
Minimum pulse width ..... 20 ms
Maximum frequency ..... 25 Hz

Supervised inputs

5 V circuit, 1 or 2 resistors
Monitored switch combinations ..... Series only, parallel only, and series and parallel
Resistor range ..... 1 to 10 kohm
For a 2-resistor configuration, each resistor must have the same value +/- 5 %

Voltage inputs

Range ..... 0 to 10 VDC
Accuracy ..... +/-(7 mV + 0.2 % of reading)
Resolution ..... 1.0 mV
Impedance ..... 100 kohm

Current inputs

Range ..... 0 to 20 mA
Accuracy ..... +/-(0.01 mA + 0.4 % of reading)
Resolution ..... 1 µA
Impedance ..... 47 ohm

Resistive inputs

10 ohm to 10 kohm accuracy ..... $+/-(7 + 4 \times 10^{-3} \times R)$ ohm
R = Resistance in ohm
10 kohm to 60 kohm accuracy ..... $+/-(4 \times 10^{-3} \times R + 7 \times 10^{-8} \times R^2)$ ohm

R = Resistance in ohm

Temperature inputs (thermistors)

Range.....-50 to +150 °C (-58 to +302 °F)

Supported thermistors

Honeywell .....20 kohm
Type I (Continuum) .....10 kohm
Type II (I/NET).....10 kohm
Type III (Satchwell) .....10 kohm
Type IV (FD) ..... 10 kohm
Type V (FD w/ 11k shunt) .....Linearized 10 kohm
Satchwell D?T.....Linearized 10 kohm
Johnson Controls .....2.2 kohm
Xenta.....1.8 kohm
Balco.....1 kohm

Measurement accuracy

20 kohm.....-50 to -30 °C: +/-1.5 °C (-58 to -22 °F: +/-2.7 °F)
.....-30 to 0 °C: +/-0.5 °C (-22 to +32 °F: +/-0.9 °F)
..... 0 to 100 °C: +/-0.2 °C (32 to 212 °F: +/-0.4 °F)
.....100 to 150 °C: +/-0.5 °C (212 to 302 °F: +/-0.9 °F)

10 kohm, 2.2 kohm, and 1.8 kohm .....-50 to -30 °C: +/-0.75 °C (-58 to -22 °F: +/-1.35 °F)
.....-30 to +100 °C: +/-0.2 °C (-22 to +212 °F: +/-0.4 °F)
.....100 to 150 °C: +/-0.5 °C (212 to 302 °F: +/-0.9 °F)

Linearized 10 kohm .....-50 to -30 °C: +/-2.0 °C (-58 to -22 °F: +/-3.6 °F)
.....-30 to 0 °C: +/-0.75 °C (-22 to +32 °F: +/-1.35 °F)
..... 0 to 100 °C: +/-0.2 °C (32 to 212 °F: +/-0.4 °F)
.....100 to 150 °C: +/-0.5 °C (212 to 302 °F: +/-0.9 °F)

1 kohm .....-50 to +150 °C: +/-1.0 °C (-58 to +302° F: +/-1.8 °F)

RTD temperature inputs

Supported RTDs .....Pt1000, Ni1000, and LG-Ni1000

Pt1000

Sensor range.....-50 to +150 °C (-58 to +302 °F)

SmartX IP Controller device environment	Sensor range	Measurement accuracy
0 to 50 °C (32 to 122 °F)	-50 to +70 °C (-58 to +158 °F)	+/-0.5 °C (+/-0.9 °F)
0 to 50 °C (32 to 122 °F)	70 to 150 °C (158 to 302 °F)	+/-0.7 °C (+/-1.3 °F)
-40 to +60 °C (-40 to +140 °F)	-50 to +150 °C (-58 to +302 °F)	+/-1.0 °C (+/-1.8 °F)

Ni1000

Sensor range.....-50 to +150 °C (-58 to +302 °F)

Continued

SmartX IP Controller device environment	Sensor range	Measurement accuracy
0 to 50 °C (32 to 122 °F)	-50 to +150 °C (-58 to +302 °F)	+/-0.5 °C (+/-0.9 °F)
-40 to +60 °C (-40 to +140 °F)	-50 to +150 °C (-58 to +302 °F)	+/-0.5 °C (+/-0.9 °F)

LG-Ni1000

Sensor range.....-50 to +150 °C (-58 to +302 °F)

SmartX IP Controller device environment	Sensor range	Measurement accuracy
0 to 50 °C (32 to 122 °F)	-50 to +150 °C (-58 to +302 °F)	+/-0.5 °C (+/-0.9 °F)
-40 to +60 °C (-40 to +140 °F)	-50 to +150 °C (-58 to +302 °F)	+/-0.5 °C (+/-0.9 °F)

RTD temperature wiring

Maximum wire resistance.....20 ohm/wire (40 ohm total)

Maximum wire capacitance.....60 nF
The wire resistance and capacitance typically corresponds to a 200 m wire.

Voltage outputs

Range.....0 to 10 VDC

Accuracy.....+/-60 mV

Resolution.....10 mV

Minimum load resistance.....5 kohm

Load range.....-1 to +2 mA

3.29 Solid-state Relay (SSR) Outputs

The solid-state relay (SSR) outputs can be used in many applications to switch 24 VAC or 24 VDC on or off for external loads such as actuators, relays, or indicators. SSRs are silent and are not adversely affected by relay contact wear.

The outputs can be configured as one of the following types:

- Digital output
- Digital pulsed output
- Pulse width modulated output
- Tristate output
- Tristate pulsed output

3.29.1 Outputs

The DO SSR outputs are Form A digital outputs, which means the outputs are normally open contacts with one common terminal and one normally open terminal. Each pair of SSR outputs share a common terminal but the outputs can be controlled independently.

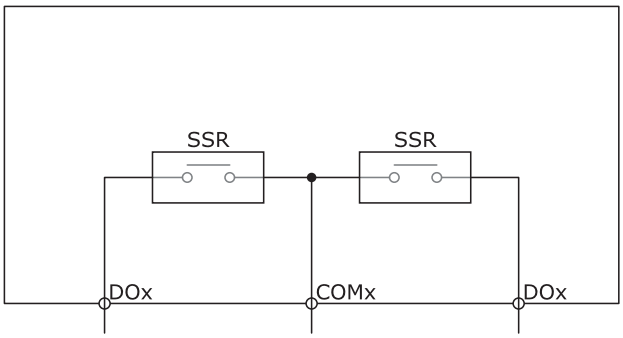


Figure: SSR digital output internal configuration

3.29.2 Specifications

Channels, RP-C-12A model ..... 4, DO1 to DO4
Channels, RP-C-12B model.....0
Channels, RP-C-12C model ..... 4, DO1 to DO4
Channels, RP-C-16A model ..... 4, DO1 to DO4
Output rating .....Max. 2 A load per output
.....Max. 4 A total load for the 4 outputs
AC voltage range .....24 VAC +/-20 %
DC voltage range .....Max. 30 VDC
Commons.....COM1 for DO1 and DO2 (on RP-C-12A, -12C, and -16A models)
.....COM2 for DO3 and DO4 (on RP-C-12A, -12C, and -16A models)

When the SSR outputs are used to switch AC, the common terminals can be connected to 0 to 30 VAC. When the SSR outputs are used to switch DC, the common terminals can be connected to -30 VDC to +30 VDC.

Common voltage range (AC).....0 to 30 VAC

Common voltage range (DC).....-30 to +30 VDC

Minimum pulse width .....100 ms

Solid-state relay output protection .....Transient voltage suppressor across each solid-state relay (SSR) output

3.30 Relay Outputs

The relay outputs support digital Form A point types. The Form A relays are designed for direct load applications.

The outputs can be configured as one of the following types:

- Digital output
- Digital pulsed output
- Pulse width modulated output
- Tristate output
- Tristate pulsed output

Consider the expected number of operation cycles specified for the relay output (cycle life rating) when configuring the period for a pulse width modulated (PWM) output point.

3.30.1 Outputs

The DO relay outputs are Form A digital outputs, which means the outputs are normally open contacts with one common terminal (C) and one normally open terminal (NO). The terminals are isolated from other circuits of the device and from signal ground.

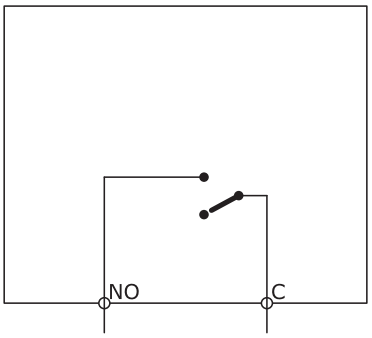


Figure: Form A digital output internal configuration

Three Form A relays share a common terminal but the outputs can be controlled independently.

3.30.2 Specifications

Channels, RP-C-12A model.....0
Channels, RP-C-12B model ..... 3, DO1 to DO3
Channels, RP-C-12C model.....3, DO5 to DO7
Channels, RP-C-16A model .....3, DO5 to DO7
Contact rating .....Pilot Duty (C300)
.....Resistive load: 250 VAC/30 VDC, 4 A (cos phi = 1)
.....Inductive load: 250 VAC/30 VDC, 4 A (cos phi = 0.4)
Switch type.....Form A Relay

.....Single Pole Single Throw
.....Normally Open

Commons.....COM1 for DO1, DO2, and DO3 (on RP-C-12B model)
.....COM3 for DO5, DO6, and DO7 (on RP-C-12C and RP-C-16A models)

Isolation contact to system ground.....3,000 VAC

Cycle life.....At least 100,000 cycles

Minimum pulse width .....100 ms

3.31 High Power Relay Outputs

The main application of the high power relay output is to power an electrical heating element directly.

The outputs can be configured as one of the following types:

- Digital output
- Digital pulsed output
- Pulse width modulated output

Consider the expected number of operation cycles specified for the relay output (cycle life rating) when configuring the period for a pulse width modulated (PWM) output point.

3.31.1 Outputs

The DO high power relay outputs are Form C digital outputs, which means the outputs are switching contacts with one common terminal (C), one normally-open terminal (NO), and one normally-closed terminal (NC). The terminals are isolated from other circuits of the device and from signal ground.

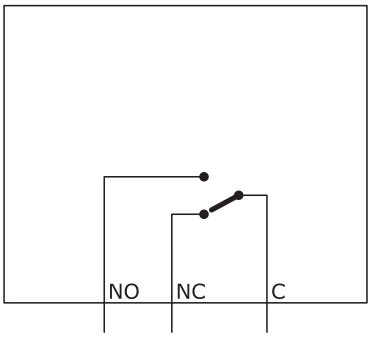


Figure: Form C digital output internal configuration

3.31.2 Specifications

Channels, RP-C-12A model.....0

Channels, RP-C-12B model 1, DO4

Channels, RP-C-12C model 1, DO8

Channels, RP-C-16A model 1, DO8

Contact rating .....Pilot Duty (B300)
.....Min. current: 100 mA (5 VDC)
.....Normally Open contact, resistive load: 250 VAC/24 VDC, 12 A (cos phi = 1)
.....Normally Closed contact, inductive load: 250 VAC/24 VDC, 3 A (cos phi = 0.4)

Switch type.....Form C Relay
.....Single Pole Double Throw
.....Normally Open and Normally Closed

Isolation contact to system ground.....5,000 VAC

Cycle life.....At least 100,000 cycles

Minimum pulse width ....100 ms

3.32 RP-C Regulatory Compliance and Approvals

This section provides information on regulatory compliance and approvals for the RP-C controllers.

3.32.1 CE - European Union (EU)

RP-C-12A, -12B, -12C, and -16A controller models bear the CE mark and comply with the following EU directives:

- 2014/53/EU Radio Equipment Directive (RED)
- 2014/30/EU Electromagnetic Compatibility Directive
- 2014/35/EU Low Voltage Directive
- 2015/863/EU Restriction of Hazardous Substances (RoHS) Directive

3.32.2 Federal Communications Commission (FCC)

For the RP-C-12A, -12B, and -12C controller models (FCC ID: DVE-RPC24), the following statements apply.

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

- This device may not cause harmful interference.
- This device must accept any interference received, including interference that may cause undesired operation.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

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.

This device, and the antenna used with the device, must be professionaly installed. This device may be operated only with the antenna with which it is authorized (see list below). Any antenna that is of the same type and of equal or less directional gain as the antenna that is authorized with the device may be used with the device.

Antenna	Manufacturer	Model (Part number)	Gain	Type	Impedance
Integrated	NA	NA	1.0 dBi	Inverted-F	50 ohm
External	Linx Technologies	ANT-2.4-WRT-MON-SMA	0.8 dBi	Monopole	50 ohm

3.32.3 Innovation, Science and Economic Development Canada (ISED)

For the RP-C-12A, -12B, and -12C controller models (ISED certification number: 24775-RPC24), the following statements apply.

This digital apparatus does not exceed the Class B limits for radio-noise emissions from digital apparatus as set out in the Radio Interference Regulations of the Canadian Department of Communications (ICES-3).

Cet appareil numérique ne dépasse pas les limites de la classe B pour les émissions radio bruit des appareils numériques, tel qu'énoncé dans le Règlement sur le brouillage radioélectrique du ministère des Communications du Canada (NMB-3).

This device contains licence-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's licence-exempt RSS(s). Operation is subject to the following two conditions:

- This device may not cause interference.
- This device must accept any interference, including interference that may cause undesired operation of the device.

L'émetteur/récepteur exempt de licence contenu dans le présent appareil est conforme aux CNR d'Innovation, Sciences et Développement économique Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes:

- L'appareil ne doit pas produire de brouillage;
- L'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

This radio transmitter (24775-RPC24) has been approved by Innovation, Science and Economic Development Canada to operate with the antenna types listed below, with the maximum permissible gain indicated. Antenna types not included in this list that have a gain greater than the maximum gain indicated for any type listed are strictly prohibited for use with this device.

Le présent émetteur radio (24775-RPC24) a été approuvé par Innovation, Sciences et Développement économique Canada pour fonctionner avec les types d'antenne énumérés ci-dessous et ayant un gain admissible maximal. Les types d'antenne non inclus dans cette liste, et dont le gain est supérieur au gain maximal indiqué pour tout type figurant sur la liste, sont strictement interdits pour l'exploitation de l'émetteur.

Antenna	Manufacturer	Model (Part number)	Gain	Type	Impedance
Integrated	NA	NA	1.0 dBi	Inverted-F	50 ohm
External	Linx Technologies	ANT-2.4-WRT-MON-SMA	0.8 dBi	Monopole	50 ohm

4 Wiring

Topics

4.1 Wiring

The wiring recommendations provide guidance regarding wiring of the I/O modules, SmartX servers, and SmartX IP Controller devices.

4.1.1 I/O Wiring

The I/O wiring recommendations provide guidance on what type of wires should be used for the different I/O modules, SmartX AS-B server onboard I/O, and SmartX IP Controller device onboard I/O, how to perform grounding, and how to connect different external devices to the inputs and outputs. Always use the recommended cables and wires.

For more information, see section 4.2 “I/O Wiring” on page 106.

4.1.2 Communication Port Wiring

The wiring recommendations for the communication ports on the SmartX servers and SmartX IP Controller devices apply to wires and cables used for RS-485 communications, LonWorks communications, USB connections, Ethernet connections, and Sensor Bus connections. Always use the recommended cables and wires.

For more information, see section 4.10 “Communication Port Wiring” on page 123.

4.2 I/O Wiring

The I/O wiring recommendations provide guidance on what type of wires should be used for the different I/O modules, SmartX AS-B server onboard I/O, and SmartX IP Controller device onboard I/O, how to perform grounding, and how to connect different external devices to the inputs and outputs. Always use the recommended cables and wires.

For the I/O modules, most of the wiring is made to the terminal base, and can be done before the electronics module is installed.

For the SmartX AS-B server onboard I/O, MP Series controller onboard I/O, and IP-IO modules, the wiring is made to the removable terminal blocks, and can be done before the SmartX AS-B server, MP Series controller, and IP-IO module are installed on the DIN rail.

For the RP-C controller onboard I/O, the wiring is made to fixed terminal blocks.

Some relay output terminals, I/O modules, or terminal bases may carry lethal voltages. Always disconnect the power supply and other high voltage equipment connected to the device before wiring.

⚠⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

Disconnect the power supply and other high voltage equipment before wiring.

Failure to follow these instructions will result in death or serious injury.

4.2.1 Shielded Wires

For digital inputs and outputs, you can use shielded or unshielded wire. Unshielded wires are usually sufficient.

For analog inputs and outputs, you can use shielded or unshielded wire. Shielded wires are recommended if the wiring is placed in a noisy electrical environment. Connect the shield to ground only at a RET terminal.

If the wiring is placed in a noisy electrical environment, shielded wires are recommended for RTD-DI-16 I/O modules, SmartX AS-B server onboard I/Os, and SmartX IP Controller device onboard I/Os that have the following external connections:

- RTD temperature input
- RTD resistive input
- Resistive input

4.2.2 Grounding and Power

It is important to perform the grounding correctly for the following reasons:

- To design a system that is not harmed by detected minor connection errors.
- To design a system that works well and is resistant to EMI.

- To minimize the effects of ground currents that can cause unstable measurements.

For more information, see section 4.3 “Grounding and Power” on page 108.

4.2.3 External Device Connections

There are many different kinds of external devices from different vendors that can be connected to an EcoStruxure BMS.

For more information, see section 4.6 “External Device Connections” on page 113.

4.2.4 Wire Sizes and Lengths

This section provides recommendations on minimum wire sizes (cross-sectional areas) and maximum wire lengths for the wires connected to the screw terminals of I/O modules, SmartX AS-B servers, and SmartX IP Controller devices. The recommendations are for guidance only. Other wire sizes and lengths may be used, depending on wiring rules and when appropriate.

For more information, see section 4.7 “Wire Sizes and Lengths” on page 118.

4.3 Grounding and Power

It is important to perform the grounding correctly for the following reasons:

- To design a system that is not harmed by detected minor connection errors.
- To design a system that works well and is resistant to EMI.
- To minimize the effects of ground currents that can cause unstable measurements.

The following sections provide recommendations for designing a good working system.

4.3.1 Grounding and Power for Systems with I/O Modules and PS-24V Units

This section provides grounding and power recommendations for system configurations with I/O modules and PS-24V units.

For more information, see the *Grounding and Power for Systems with I/O Modules and PS-24V Units* topic on WebHelp.

4.3.2 Grounding and Power for Systems with SmartX AS-B Servers

This section provides grounding and power recommendations for system configurations with SmartX AS-B servers.

For more information, see the *Grounding and Power for Systems with SmartX AS-B Servers* topic on WebHelp.

4.3.3 Grounding and Power for Systems with MP Series Controllers

This section provides grounding and power recommendations for system configurations with MP Series controllers.

For more information, see the *Grounding and Power for Systems with MP Series Controllers* topic on WebHelp.

4.3.4 Grounding and Power for Systems with IP-IO Modules

This section provides grounding and power recommendations for system configurations with IP-IO modules.

For more information, see the *Grounding and Power for Systems with IP-IO Modules* topic on WebHelp.

4.3.5 Grounding and Power for Systems with RP-C-12A, -12B, or -12C Controllers

This section provides grounding and power recommendations for system configurations with the RP-C controller models RP-C-12A, -12B, or -12C, which are models that support 24 VAC/DC input power.

For more information, see section 4.4 “Grounding and Power for Systems with RP-C-12A, -12B, or -12C Controllers” on page 110.

4.3.6 Grounding and Power for Systems with RP-C-16A Controller

This section provides grounding and power recommendations for system configurations with the RP-C controller model RP-C-16A, which is a model that supports 230 VAC input power.

For more information, see section 4.5 “Grounding and Power for Systems with RP-C-16A Controller” on page 112.

4.4 Grounding and Power for Systems with RP-C-12A, -12B, or -12C Controllers

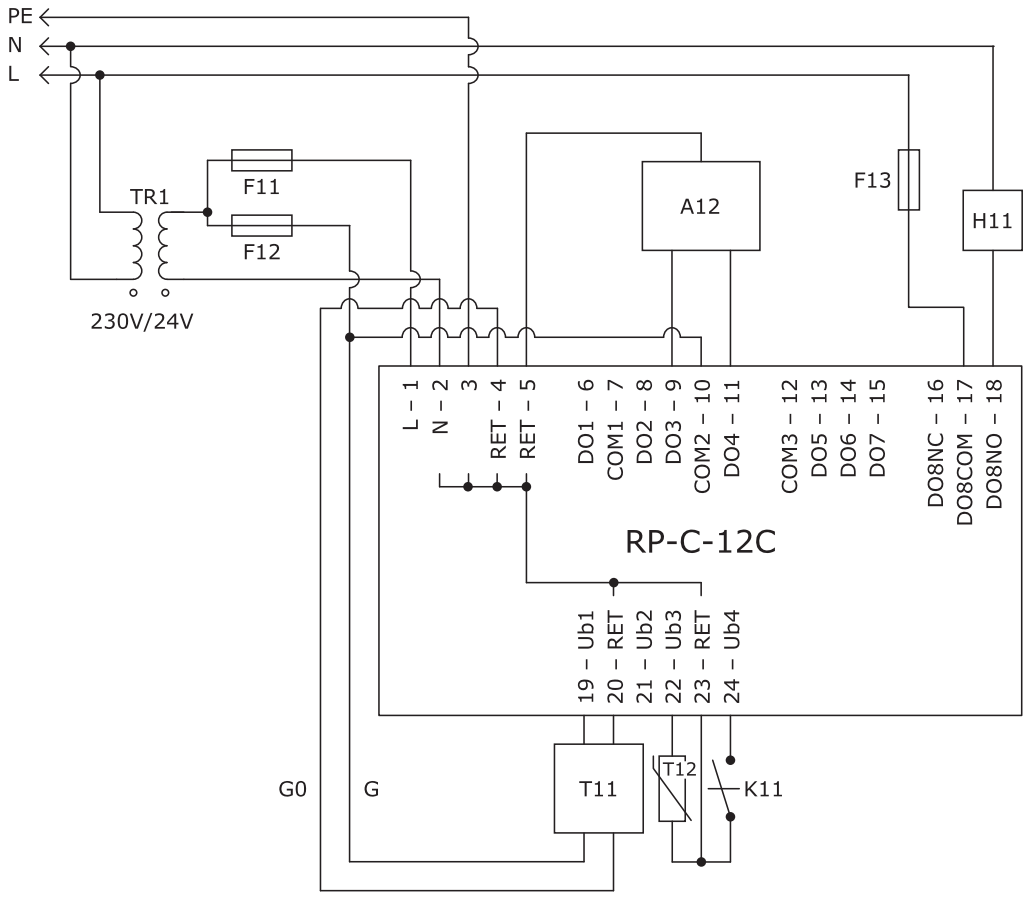
This section provides grounding and power recommendations for system configurations with the RP-C controller models RP-C-12A, -12B, or -12C, which are models that support 24 VAC/DC input power.

System with a local transformer

You can use one local transformer for each RP-C controller (with its connected devices) to minimize any problems with ground loops and disturbances.

Use the following recommendations to design a good working system:

- Select any of terminals 4 or 5 to be used as G0 (Power Ground/Common).
- G0 (terminal 4 or 5) can be connected to RET. Avoid this if not necessary.
- The fuse (circuit breaker) F11 must be rated 3 A or higher.



A12 – Actuator, increase/decrease
F11 – Fuse or circuit breaker
F12 – Fuse or circuit breaker
F13 – Fuse or circuit breaker
G – Power supply connection on external field devices
G0 – Power ground connection on external field devices
H11 – Heater
K11 – Switch
PE – Protective earth ground
T11 – Transmitter (or actuator with voltage control)
T12 – Thermistor
TR1 – Transformer (230 VAC to 24 VAC)

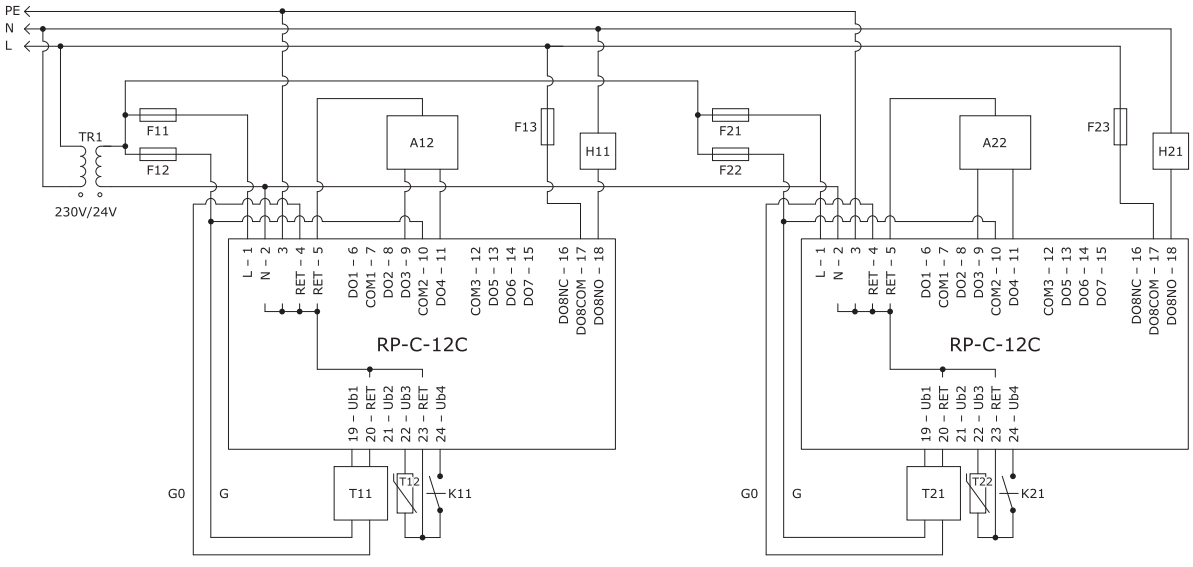
Figure: System configuration with a RP-C-12C controller powered by a local transformer

System with a common transformer

You can use a common transformer to power several RP-C controllers to save costs.

Use the following recommendations to design a good working system:

- Use the same recommendations regarding G0, terminals 4 and 5, and fuse (circuit breaker) ratings, as provided for a system with a local transformer above.
- Do not interconnect the RP-C controllers and their groups of connected devices, such as actuators and transmitters, beyond what is shown in the figure below to minimize potential problems with ground loops.
- It is recommended to use separate fuses (circuit breakers), F11 and F21, for the power supply to each RP-C controller so that a problem with one RP-C controller does not affect another RP-C controller.
  If you use a common fuse (circuit breaker) for two RP-C controllers, and there is a problem with one of the controllers, the troubleshooting may be more difficult than if there is a problem only with one actuator or transmitter.
- It is recommended to use separate fuses (circuit breakers), F12 and F22, for the power supply to actuators and transmitters connected to different RP-C controllers so that a problem with an actuator or transmitter connected to one RP-C controller does not affect an actuator or transmitter connected to another RP-C controller.
- It is recommended to use separate fuses (circuit breakers), F13 and F23, for the power supply to heaters connected to different RP-C controllers so that a problem with a heater connected to one RP-C controller does not affect a heater connected to another RP-C controller.



A12, A22 – Actuator, increase/decrease
F11, F21 – Fuse or circuit breaker
F12, F22 – Fuse or circuit breaker
F13, F23 – Fuse or circuit breaker
G – Power supply connection on external field devices
G0 – Power ground connection on external field devices
H11, H21 – Heater
K11, K21 – Switch
PE – Protective earth ground
T11, T21 – Transmitter (or actuator with voltage control)
T12, T22 – Thermistor
TR1 – Transformer (230 VAC to 24 VAC)

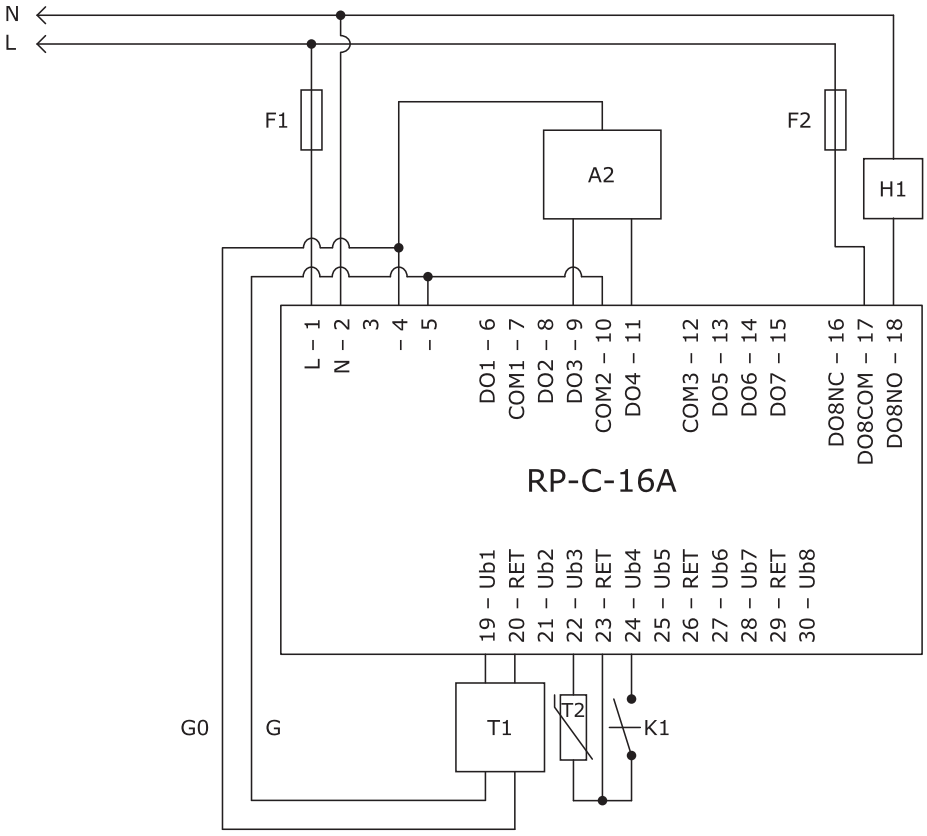
Figure: . System configuration with two RP-C-12C controllers powered by a common transformer

4.5 Grounding and Power for Systems with RP-C-16A Controller

This section provides grounding and power recommendations for system configurations with the RP-C controller model RP-C-16A, which is a model that supports 230 VAC input power.

Use the following recommendations to design a good working system:

- Select any of terminals 4 or 5 to be used as G0 (Power Ground/Common).
- G0 (terminal 4 or 5) can be connected to RET. Avoid this if not necessary.
- G0 and/or RET can be connected to protective earth ground (PE).
- The fuse (circuit breaker) F1 must be rated 3 A or higher.



A2 – Actuator, increase/decrease
F1 – Fuse or circuit breaker
F2 – Fuse or circuit breaker
G – Power supply connection on external field devices
G0 – Power ground connection on external field devices
H1 – Heater
K1 – Switch
T1 – Transmitter (or actuator with voltage control)
T2 – Thermistor

Figure: System configuration with RP-C-16A controller

4.6 External Device Connections

There are many different kinds of external devices from different vendors that can be connected to an EcoStruxure BMS.

It is important to know how different external devices cooperate with the devices in the EcoStruxure BMS, so we present some different principles for those external devices here. As a rule of thumb, try to avoid direct connections between RET and G0 external to the control panel. As discussed below, if a signal ground rail (SGR) is used, one RET pin on each I/O module and SmartX IP Controller device should be wired to the SGR in the control panel using 1.3 mm² (16 AWG) or larger wire. For SmartX AS-B servers, the RET terminals 4 and/or 5 can be used for connection of the SGR. For good performance, use as short and large wires as possible.

4.6.1 Thermistors

Thermistors are connected directly between a universal input terminal and the corresponding RET terminal.

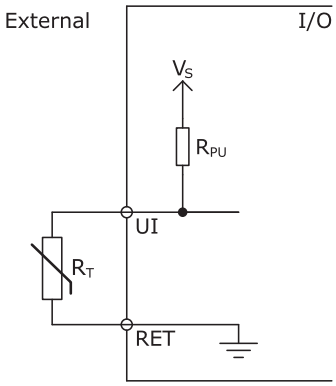


Figure: Temperature input

4.6.2 Contacts

Digital inputs are controlled by contact closings to RET. The digital inputs are normally quite immune to disturbance signals, so they can also detect contact closings directly to the signal ground rail or G0. Even though RET is connected to the signal ground rail, there might be a small voltage difference that could impact results on analog inputs. Such small voltage differences are not enough to impact digital inputs though.

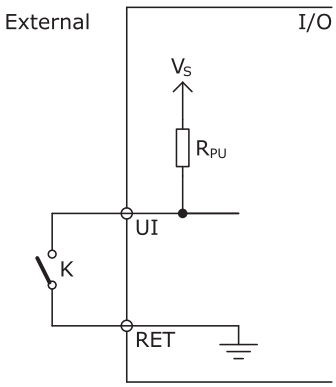


Figure: Digital input

4.6.3 Actuators

Actuators are divided into two types: isolated and non-isolated control voltage actuators. The non-isolated actuators are more commonly used. The two actuator types work mostly in the same way, but the non-isolated actuators have the signal ground M internally connected to power ground G0. In some cases, they have only three terminals with one common terminal for M and G0.

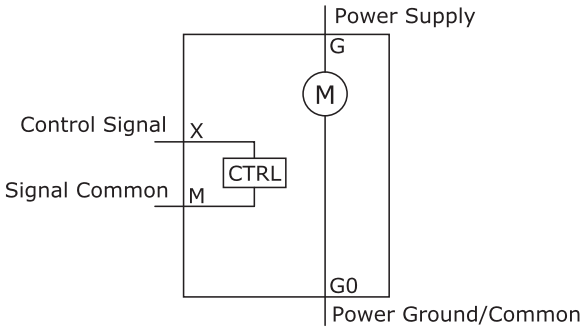


Figure: Isolated actuator

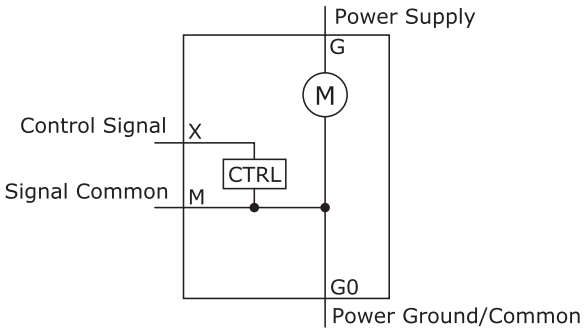


Figure: Non-isolated actuator

Non-isolated actuators can be more sensitive to different kinds of disturbances, and it is sometimes easier to design a more stable system using isolated actuators. When the system uses a non-isolated actuator, care must be taken in properly wiring the neutral wire back to the supply neutral for each actuator rather than daisy chaining to help prevent large voltage drops that can affect input signal accuracy.

Some actuator control signal inputs may be designed with a high impedance differential input which helps prevent AC/DC supply currents from being shared in the signal return path. Such actuators are as good as isolated actuators with respect to disturbances and ground currents, so they can be connected as isolated actuators.

The disturbance can be of two kinds: AC disturbance causing the actuator to move quickly back and forth, and DC disturbance causing an offset. Both AC and DC issues occur as a result of currents in the connection from M to RET.

The DC issue is a less severe problem because a DC error can be compensated by the control loop as long as the error is quite small. If the DC error is big, the actuator may not be able to turn off or on completely. Normally the actuator starts to open when the control voltage is a few hundred millivolt, so a DC offset of 100 mV is probably not an issue.

The AC issue can be a more severe problem. If an AC disturbance is added to the control signal, the actuator starts to travel back and forth and its dependability may be affected.

If it is unknown whether an actuator is isolated or non-isolated, it should be treated as non-isolated.

For non-isolated actuators, difficult problems with disturbances can sometimes be solved by introducing a separate isolated transformer for the actuator. In this way, you can obtain an isolated system with a non-isolated actuator.

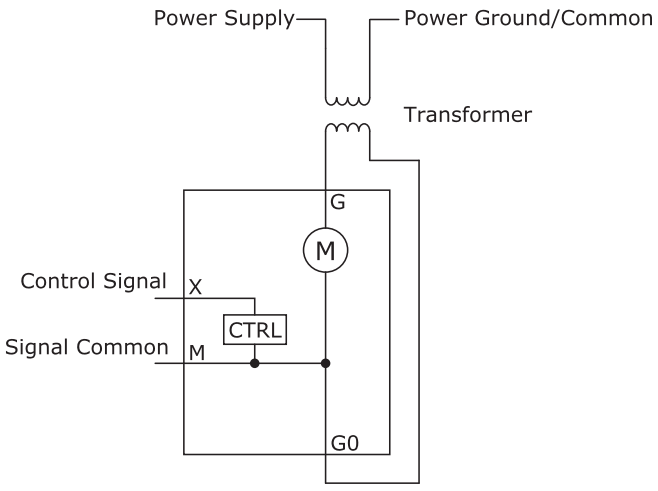


Figure: Non-isolated actuator with separate power transformer

4.6.4 Transmitters

Transmitters are used to convert signals from sensors that cannot be connected directly to an I/O module, SmartX AS-B server, or SmartX IP Controller device. Transmitters are divided into two types: isolated and non-isolated transmitters.

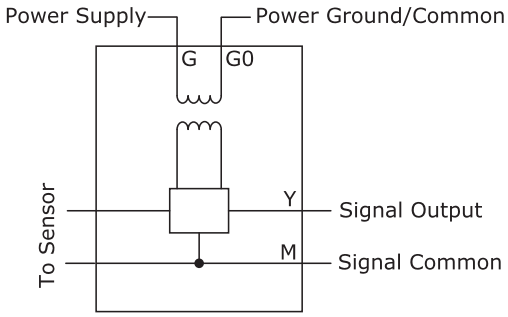


Figure: Isolated transmitter

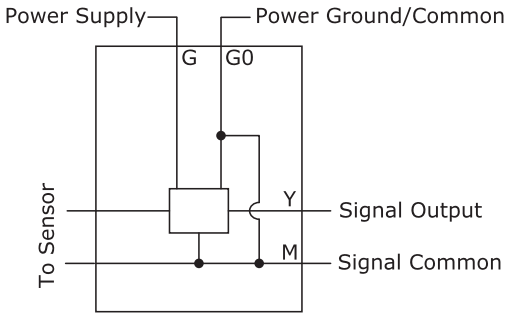


Figure: Non-isolated transmitter

When the system uses a non-isolated transmitter, AC and DC bias issues may occur.

The DC error from a voltage transmitter can never be compensated for by a feedback loop. So, a DC current in the M conductor causes a DC error in the reading value if the current and the resistance are large enough to cause a non-negligible voltage drop, thus creating an error. An AC voltage drop caused by an AC current in the conductor between M and RET results in unstable measurements.

Selecting isolated transmitters solves the AC and DC bias issues, but the issues can also be limited by good system design. For more information, see section 4.3 “Grounding and Power” on page 108.

In isolated transmitters, the sensors are normally not isolated from the M conductor, they are only isolated from the power supply of the transmitter. This is not an issue, because the sensors are not connected to anything but the transmitters.

Transmitters may have differential outputs. Transmitters with differential outputs can be connected as isolated external devices.

If it is unknown whether a transmitter is isolated or non-isolated, it should be treated as a non-isolated transmitter.

The use of current (4-20 mA) transmitters (instead of voltage output) avoids error from DC voltage drop in the common M to RET return wiring and assists in reducing signal reading instability from AC current in the return path.

For non-isolated transmitters, difficult problems with disturbances can sometimes be solved by introducing a separate isolated transformer for the transmitter. In this way, you can obtain an isolated system with a non-isolated transmitter.

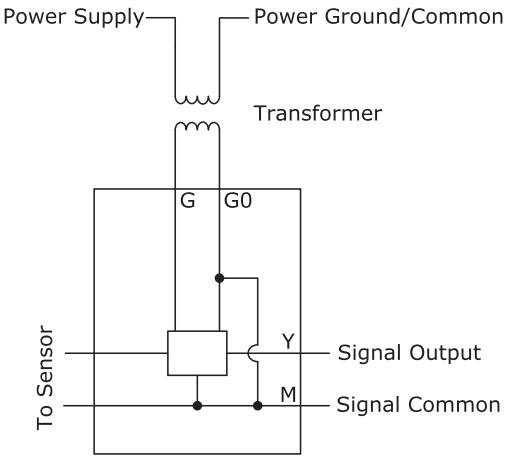


Figure: Non-isolated transmitter with separate transformer

4.6.5 Loads Such as Relays

Relay outputs are isolated from the signal ground. Therefore, no special care must be taken with respect to grounding in this case.

4.7 Wire Sizes and Lengths

This section provides recommendations on minimum wire sizes (cross-sectional areas) and maximum wire lengths for the wires connected to the screw terminals of I/O modules, SmartX AS-B servers, and SmartX IP Controller devices. The recommendations are for guidance only. Other wire sizes and lengths may be used, depending on wiring rules and when appropriate.

4.7.1 Wire Sizes and Lengths for the RP-C-12A, -12B, and -12C Controllers

This section provides recommendations on wire sizes and lengths for the RP-C controller models RP-C-12A, -12B, and -12C.

For more information, see section 4.8 “Wire Sizes and Lengths for the RP-C-12A, -12B, and -12C Controllers” on page 119.

4.7.2 Wire Sizes and Lengths for the RP-C-16 Controller

This section provides recommendations on wires sizes and lengths for the RP-C controller model RP-C-16A.

For more information, see section 4.9 “Wire Sizes and Lengths for the RP-C-16A Controller” on page 121.

4.8 Wire Sizes and Lengths for the RP-C-12A, -12B, and -12C Controllers

This section provides recommendations on wire sizes and lengths for the RP-C controller models RP-C-12A, -12B, and -12C.

The recommendations are for guidance only. Other wire sizes and lengths may be used, depending on wiring rules and when appropriate.

Table: Wire Sizes and Lengths for the RP-C-12A, -12B, and -12C Controllers

Terminals	Minimum Cross-sectional Area	Maximum Cable Length
Power input terminals (1, 2)	0.5 mm² (20 AWG)	No limit
Earth ground terminal (3)	0.75 mm² (18 AWG)	No limit
Return (RET) terminals (4, 5), connected to ground rail	1.3 mm² (16 AWG)	0.5 m (1.6 ft)
Universal inputs/outputs as digital[a] inputs	0.25 mm² (22 AWG)	200 m (650 ft)
Universal inputs/outputs as analog[b] inputs	0.25 mm² (22 AWG)	100 m (330 ft)
Universal inputs/outputs as temperature (thermistor) inputs, up to 75 °C (167 °F)	0.75 mm² (18 AWG)	75 m (250 ft)
Universal inputs/outputs as temperature (thermistor) inputs, up to 75 °C (167 °F)	1.5 mm² (15 AWG)	150 m (500 ft)
Universal inputs/outputs as temperature (thermistor) inputs, up to 150 °C (302 °F)	1.5 mm² (15 AWG)	75 m (250 ft)
Universal inputs/outputs, for actuators and transmitters powered from the same transformer as the RP-C	0.75 mm² (18 AWG)	20 m (65 ft)
Universal inputs/outputs, for actuators and transmitters powered from their own transformer (external or internal)	0.25 mm² (22 AWG)	200 m (650 ft)
Universal inputs/outputs as voltage outputs, for actuators powered from their own transformer (external or internal) or when the outputs have isolated converters	0.25 mm² (22 AWG)	200 m (650 ft)
Relay outputs	0.75 mm² (18 AWG)	No limit
High power relay output	0.75 mm² (18 AWG)	No limit
Solid-state relay (SSR) outputs	0.5 mm² (20 AWG)	No limit

a) Digital or counter inputs.
b) Supervised, voltage, current, resistive, or 2-wire RTD temperature inputs.

4.9 Wire Sizes and Lengths for the RP-C-16A Controller

This section provides recommendations on wires sizes and lengths for the RP-C controller model RP-C-16A.

The recommendations are for guidance only. Other wire sizes and lengths may be used, depending on wiring rules and when appropriate.

Table: Wire Sizes and Lengths for the RP-C-16A Controller

Terminals	**Minimum Cross-sectional Area**	**Maximum Cable Length**
Power input terminals (1, 2)	0.75 mm² (18 AWG)	No limit
Earth ground terminal (3)[a]	NA[a]	NA[a]
24 VAC output terminals (4, 5)	0.5 mm² (20 AWG)	No limit
Universal inputs/outputs as digital[b] inputs	0.25 mm² (22 AWG)	200 m (650 ft)
Universal inputs/outputs as analog[c] inputs	0.25 mm² (22 AWG)	100 m (330 ft)
Universal inputs/outputs as temperature (thermistor) inputs, up to 75 °C (167 °F)	0.75 mm² (18 AWG)	75 m (250 ft)
Universal inputs/outputs as temperature (thermistor) inputs, up to 75 °C (167 °F)	1.5 mm² (15 AWG)	150 m (500 ft)
Universal inputs/outputs as temperature (thermistor) inputs, up to 150 °C (302 °F)	1.5 mm² (15 AWG)	75 m (250 ft)
Universal inputs/outputs, for actuators and transmitters powered from the same transformer as the RP-C	0.75 mm² (18 AWG)	20 m (65 ft)
Universal inputs/outputs, for actuators and transmitters powered from their own transformer (external or internal)	0.25 mm² (22 AWG)	200 m (650 ft)
Universal inputs/outputs as voltage outputs, for actuators powered via their own transformer (external or internal) or when the outputs have isolated converters	0.25 mm² (22 AWG)	200 m (650 ft)
Relay outputs	0.75 mm² (18 AWG)	No limit
High power relay output	0.75 mm² (18 AWG)	No limit
Solid-state relay (SSR) outputs	0.5 mm² (20 AWG)	No limit

a) Not internally connected.

b) Digital or counter inputs.
c) Supervised, voltage, current, resistive, or 2-wire RTD temperature inputs.

4.10 Communication Port Wiring

The wiring recommendations for the communication ports on the SmartX servers and SmartX IP Controller devices apply to wires and cables used for RS-485 communications, LonWorks communications, USB connections, Ethernet connections, and Sensor Bus connections. Always use the recommended cables and wires.

For Automation Servers, the LonWorks wiring is made to the terminal base and can be done before the electronics module is fitted. The connections for RS-485 are made to the removable terminal blocks, and the connections for Ethernet and USB are made to the electronics module.

For SmartX AS-P servers, the LonWorks wiring is made to the removable terminal blocks. The connections for RS-485 are made to the removable terminal blocks, and the connections for Ethernet and USB are made to the electronics module.

For SmartX AS-B servers, the connections for RS-485 are made to the removable terminal blocks and can be done before the SmartX AS-B server is installed on the DIN rail. The connections for Ethernet and USB are made directly to the device.

SmartX IP Controller – MP Series controllers have communication ports for Ethernet, USB, and Sensor Bus. All connections are made directly to the device.

SmartX IP Controller – IP-IO modules have communication ports for Ethernet and USB. All connections are made directly to the device.

SmartX IP Controller – RP-C controllers have communication ports for Ethernet, USB, Sensor Bus, and Room Bus. All connections are made directly to the device.

4.10.1 RS-485 Communications

The information in this section provides recommendations for the RS-485 interface port configuration between the SmartX server and RS-485 network devices. This information is intended to supplement existing guides for the SmartX server and for the various RS-485 network devices.

For more information, see the *RS-485 Communications* topic on WebHelp.

4.10.2 LonWorks Communications

Twisted pair cables should be used between the FTT-10 interface on the Automation Server or SmartX AS-P server terminal base and the TP/FT-10 LonWorks network. The cables should conform to the standard EN 50173-1.

4.10.3 USB Connections

Standard USB cables should be used for connection to the USB host and device ports on the SmartX server and SmartX IP Controller device. The recommended maximum cable length is 3 m (10 ft).

4.10.4 Ethernet Connections

Standard Ethernet cables with RJ45 connectors should be used for connection to the Ethernet 10/100 port(s) on the SmartX server and SmartX IP Controller device.

Unshielded cables

Standard UTP Ethernet cables are recommended for the network connections.

Shielded cables

Shielded network cables can be used on cable sections extending through noisy electrical environments. However, shielded network cables cause ground loops. The grounded RJ45 network connector passes the local ground from a device to the shield of the cable, which in turn passes to the ground of the subsequent device. The devices can be SmartX servers, SmartX IP Controller devices, or third party IP controllers, interface devices, network switches or routers, or telecom switch equipment.

Shield-induced ground loops can cause the following problems:

- Degraded performance on communications network
- Interruption of communication-dependent process control execution
- Unstable operation and/or restart of the two devices
- Damage to one or both devices

NOTICE

EQUIPMENT DAMAGE OR LOSS OF COMMUNICATION

- Ensure adequate electrical bonding is provided between the grounds serving the two device locations to achieve and maintain equal potentials (0 V) between the two devices.
- Confirm equal potential is maintained when equipment in both areas has power applied and actively functioning.

Failure to follow these instructions can result in equipment damage or loss of communication.

The objective is to minimize the potential problems created with ground loops in the facility. The effects and risks with ground loops are reduced when the devices are served from the same AC power distribution panel and the devices are in the same general area of the facilities' metal and grounding structure.

4.10.5 Sensor Bus Connections

Cat 5 (or higher) cables with eight conductors (four twisted pairs) and RJ45 connectors should be used for connection to the Sensor Bus port on the SmartX IP controller and the RJ45 port(s) on the SmartX Sensors. The wire size (cross-sectional area) should be 22 to 26 AWG (0.34 to 0.14 mm²). The sensor bus cables should be rated for the target environment. For example, when the SmartX IP controller is installed in space handling conditioned air or return air,

the cables must be plenum-rated to meet rigorous fire safety standards. The cables should be located away from external electrical noise sources such as high voltage cables or signal cables, which can cause data communication problems. The maximum total length of the sensor bus is 61 m (200 ft).

Unshielded cables

UTP (unshielded twisted pair) cables are recommended for the sensor bus.

Shielded cables

Shielded cables are not useful to use for the sensor bus, because the RJ45 receptacles on the SmartX IP controllers and SmartX Sensors do not support grounding of the shield.

4.10.6 Room Bus Connections

The Room bus means the RP-C is hardware-prepared for future support of Connected Room Solution (CRS) devices for control of electric lights and window blinds.