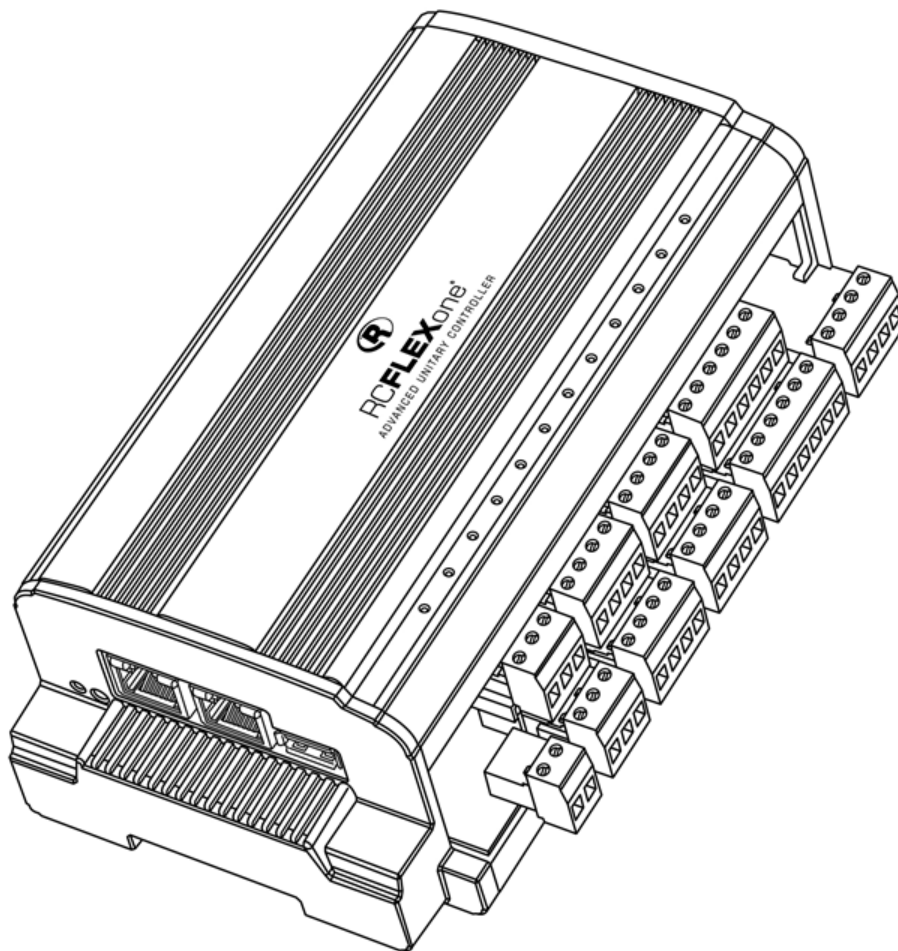


RCFLEXone®

Advanced Unitary Controller



Better by design™

User Guide

Reliable
controls

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Compliance

This device complies with FCC Rules, Part 15 and Industry Canada's ICES-003 for a Class B Digital Device.

Operation is subject to two conditions:

1. This device may not cause harmful interference, and
2. This device must accept any interference that may cause undesired operation.

Cet Appareil numerique de la Classe B respecte toutes les exigences du Reglement sur le material brouilleur du Canada.

Open source software components

To obtain a copy of the source code being made publicly available by Reliable Controls Corporation related to software used in this RC-FLEX product, you can send a request in writing by email to opensource@reliablecontrols.com.

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RC-FLEXone overview

One controller, thousands of applications. With a multicore processor, a massive database, and options for Ethernet or MS/TP connectivity in a compact shell, the RC-FLEXone® advanced unitary BACnet Building Controller from Reliable Controls is designed to effortlessly handle a wide variety of equipment and room control applications. The RC-FLEXone features innovative FLEX I/O universal input/output technology that lets facility professionals customize its inputs and outputs to meet the unique demands of any building.

RC-FLEXone models and accessories

For the most complete, up-to-date information, click your product on the [Products](#) page to access the submittal sheet.

RCFO-242

- RC-FLEXone controller with dual Ethernet and USB communications, two universal inputs, four FLEX I/O, and two FLEX outputs.

RCFO-M-242

- RC-FLEXone controller with MS/TP and USB communications, two universal inputs, four FLEX I/O, and two FLEX outputs.

RCFO-444

- RC-FLEXone controller with dual Ethernet and USB communications, four universal inputs, four FLEX I/O, and four FLEX outputs.

RCFO-M-444

- RC-FLEXone controller with MS/TP and USB communications, four universal inputs, four FLEX I/O, and four FLEX outputs.

RCFO-646

- RC-FLEXone controller with dual Ethernet and USB communications, six universal inputs, four FLEX I/O, and six FLEX outputs.

RCFO-M-646

- RC-FLEXone controller with MS/TP and USB communications, six universal inputs, four FLEX I/O, and six FLEX outputs.

RCFO-848

- RC-FLEXone controller with dual Ethernet and USB communications, eight universal inputs, four FLEX I/O, and eight FLEX outputs.

RCFO-M-848

- RC-FLEXone controller with MS/TP and USB communications, eight universal inputs, four FLEX I/O, and eight FLEX outputs.

Accessories

Options

- -H adds Hand/Off/Auto (HOA) switch.
- -C adds real-time clock with capacitor backup.

Build your order

To create the order number, add your options to the base model. For example, RCFO-646-C-H is the order number for an RC-FLEXone with six universal inputs, four FLEX I/O, and six FLEX outputs, real-time clock with capacitor backup, and Hand/Off/Auto (HOA) switch.

Related information

RC-FLEXone specifications81

RC-FLEXone features

For the most complete, up-to-date information, click your product on the [Products](#) page to access the submittal sheet.

For a comparison of features across Reliable Controls products, refer to the product features documentation, available in the [Support Center](#) under the Engineer tab.

Database? More like *database*

- With tons of nonvolatile memory, the RC-FLEXone has enough space to handle the most challenging applications now and in the future. It automatically logs all input, output, value, calendar, loop, and schedule objects, which each stores more than 2,000 records. That's enough for over 1 million data points. It also has space for 64 control programs, each large enough to run advanced energy sequencing, integrated fault detection and diagnostics, and much more.

Backward compatible, future ready

- Reliable Controls tests every product it manufactures to ensure compatibility with previous-generation controllers. The RC-FLEXone is no different. You can add it to networks that host previous-generation controllers without the need to purchase costly third-party gateways or accessories. To further future-proof your investment, the RC-FLEXone features an open-source Linux operating system, renowned for its cybersecurity resilience and global community of programming support.

Ultimate flexibility

- FLEX I/O universal input/output technology takes the legendary Reliable Controls flexibility to a new level. Change each FLEX I/O terminal from an input to an output remotely. Interact with many signal and output types including pulse counting, milliamp, voltage, and more. Gone are the days when a job site change means a new order and a delay—transforming your system is just a click away.

Better by design

- RC-FLEX controllers are equipped with a versatile USB application port that provides convenient access to a technician today and extended capabilities tomorrow. You can power the controller via USB from a laptop to permit configuration, firmware updates, programming, and graphics creation. You can also use the USB port to access the entire BACnet network.
- All input, output, and communication ports are hardware-protected against transient surges and spikes, which hardens the controller against field-wiring mistakes and improves resilience.

Sustainable hardware

- Reliable Controls rigorously engineers its products to minimize their impact on the environment and provide years of dependable, high-performance service. Products are manufactured in an ISO 9001- and 14001-certified facility and feature an industry-recognized 5-year warranty. Made from highly recyclable materials, they also comply with RoHS 3, WEEE, and R2 directives to ensure easy, clean disposal at the end of their useful life.

Network resilience

- To improve Ethernet network resilience and safeguard against common failures, all RC-FLEX family controllers come standard with Copper Switch™ technology and support for Rapid Spanning Tree Protocol (RSTP). Copper Switch ensures that data still passes through if a controller loses power, maintaining uptime. RSTP lets you connect controllers in a ring topology, which provides inherent redundancy with a duplicate network path; controllers maintain communications even if one part of the ring is severed.

Certifications

- BTL Listed (B-BC) pending.
- CE.
- CFR 47 Part 15/B Class B.
- UL 60730-1 Open Energy Management.
- WEEE.
- EN 60730-1.
- Canada ICES-003(B)/NMB-003(B).

Certification details

- Purpose and action of control: Type 1 Operating Control.
- Pollution degree: 2.
- Impulse voltage: 330 V.

Standard applications

Standard applications for Reliable Controls products are available in the **Engineer** tab in the [Reliable Controls Support Center](#).

Each standard application contains the elements needed to deploy an application, such as:

- Control-BASIC code.
- Panel Files.
- System Groups.
- Annotated sequences of operation.

Standard applications can also serve as useful learning tools to increase your knowledge of different product applications and Control-BASIC programming.

Search the library of existing standard applications or use the Standard App Builder to find a standard application that meets your section criteria. If you cannot find a standard application that suits your needs in the Standard App Builder, you can request it by clicking the **Submit a request** button.

Download and install the standard application and modify as necessary for your specific implementation.

RC-FLEXone applications

The RC-FLEXone adds flexibility and value to your building control and management system. Some of the benefits include:

- Support for a variety of hardware communications ports, methods, and protocols.
- FLEX I/O ports, an innovative feature that enables you to use FLEX I/O as a universal input, universal output or solid-state relay output, depending on how you configure the I/O port in software.

Dual Ethernet model RC-FLEXone application

This application diagram shows the dual Ethernet RC-FLEXone supporting a network of SMART-Net devices. The network contains RC-FLEXone controllers managed by a router-model controller that provides the primary data connection to a workstation running RC-Studio and other Reliable Controls software. If the router-model host controller includes an onboard web server, you can configure system information to view in a browser.

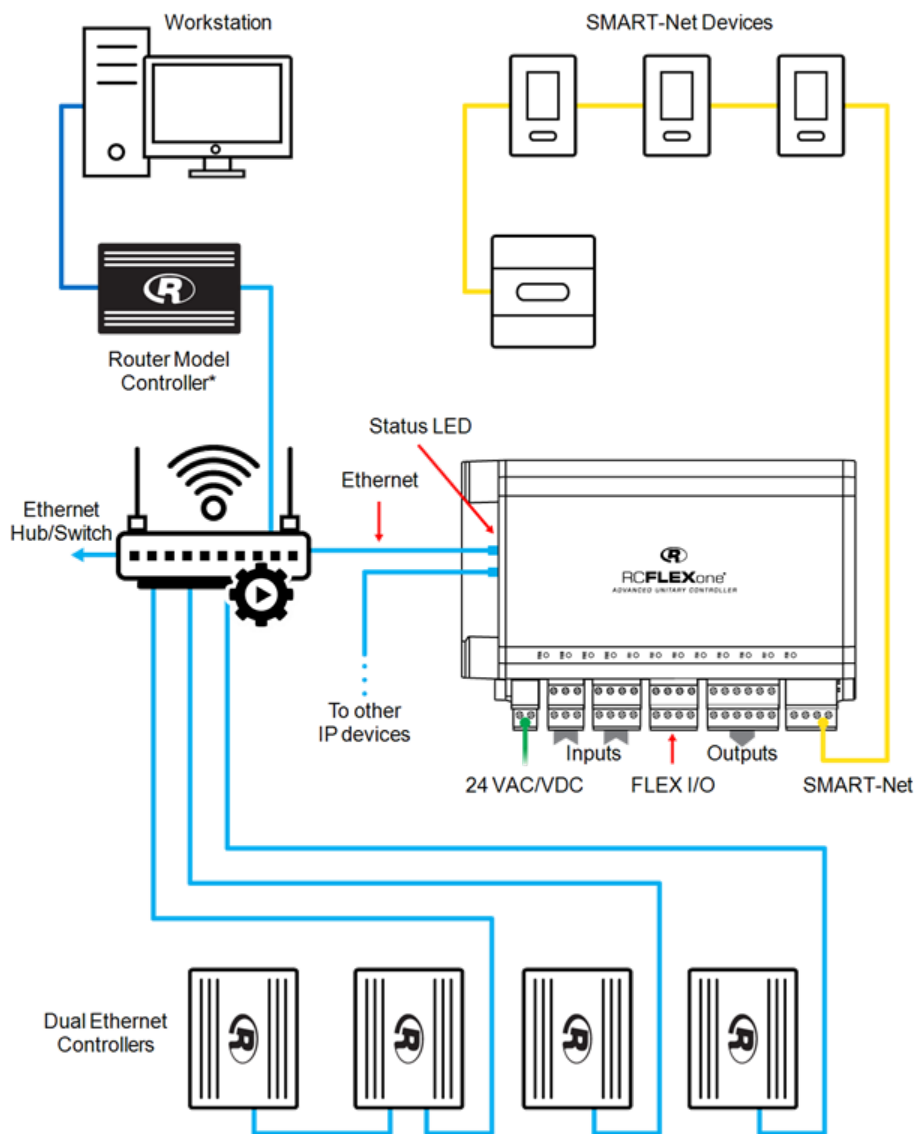


Figure 1: RC-FLEXone Ethernet network topology

* Router-model controllers can be MACH-Pro(Web)Com/Sys or MACH-ProView -R models.

MS/TP model RC-FLEXone (-M) application

This application diagram shows the MS/TP model RC-FLEXone (RCFO-M) supporting a network of SMART-Net devices. A router-model host controller manages the RC-FLEXone-M and all the other

controllers connected on the same MS/TP communications bus. The host controller provides the primary data connection to the workstation running RC-Studio and other Reliable Controls software.

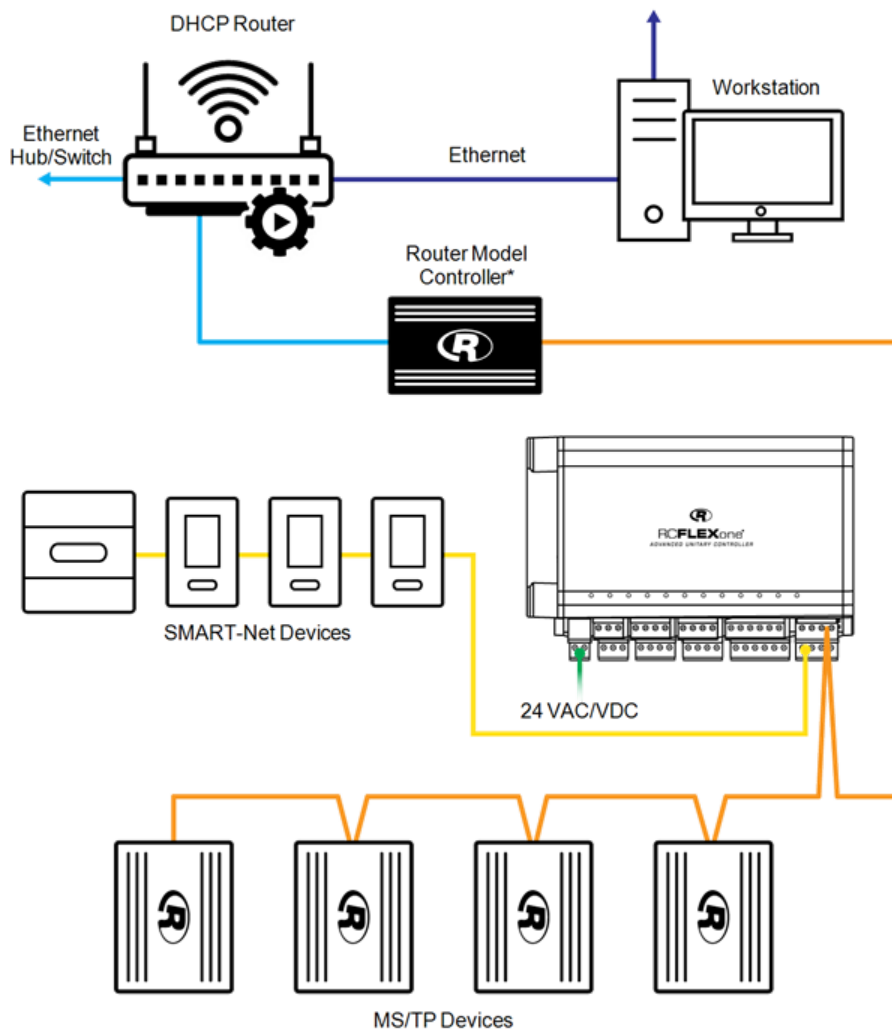


Figure 2: RC-FLEXone (-M) MS/TP network topology

* Router-model controllers can be MACH-Pro(Web)Com/Sys or MACH-ProView -R models.

RC-FLEXone flexibility

The FLEX I/O ports allow you to change the total number of inputs and outputs available on the RC-FLEXone. For example, you can add up to four inputs to the standard universal inputs or up to four outputs to the FLEX outputs by configuring the FLEX I/O as an input or output.

RC-FLEXone hardware overview

The RC-FLEXone has communication ports and I/O options.

Depending on the model, the RC-FLEXone has dual Ethernet ports, or a single EIA-485 MS/TP port:

Dual Ethernet model RC-FLEXone

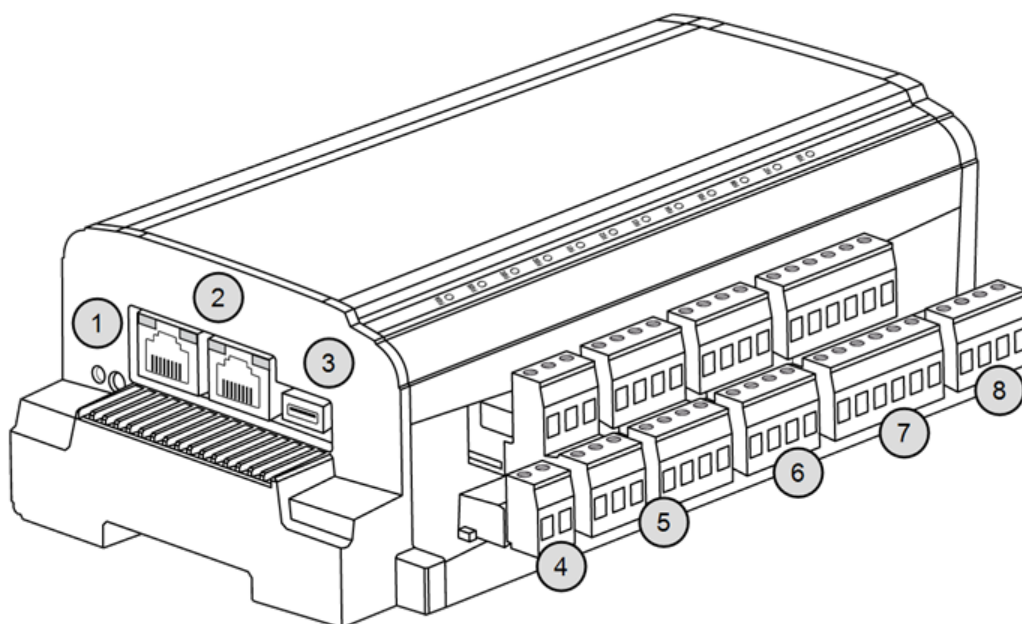


Figure 3: RC-FLEXone dual Ethernet model with eight universal inputs, four FLEX I/O, and eight FLEX outputs (RCFO-848)

- ① Status LED and access to reset button
- ② Ethernet ports with two status LEDs
- ③ USB port
- ④ Power
- ⑤ FLEX outputs
- ⑥ FLEX I/O
- ⑦ Inputs
- ⑧ SMART-Net

MS/TP model RC-FLEXone (-M)

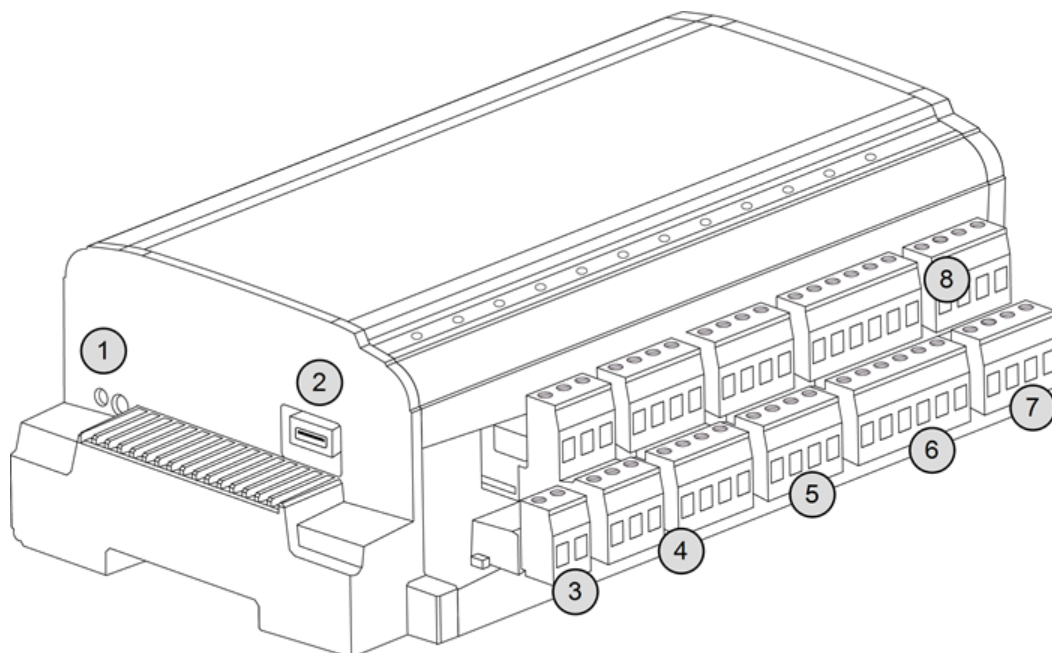


Figure 4: RC-FLEXone MS/TP model with eight universal inputs, four FLEX I/O, and eight FLEX outputs (RCFO-M-848)

- ① Status LED and access to reset button
- ② USB port
- ③ Power
- ④ FLEX outputs
- ⑤ FLEX I/O
- ⑥ Inputs
- ⑦ SMART-Net
- ⑧ MS/TP port (EIA-485) and MS/TP LED (red/green), and EOL LED (amber)

RC-FLEXone with optional Hand/Off/Auto (-H) internal detail

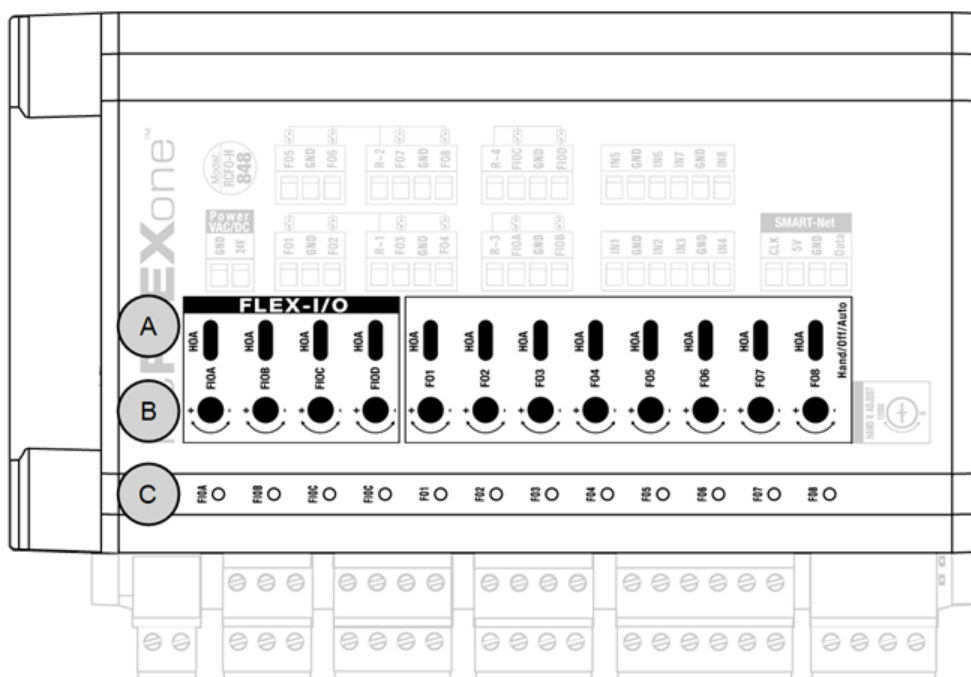


Figure 5: Internal view of RC-FLEXone with eight inputs, four FLEX I/O, eight FLEX outputs, and optional Hand/Off/Auto (HOA) switches (RCFO-848-H)

- A** Hand/Off/Auto (HOA) switches
- B** Output potentiometers
- C** FLEX I/O and Output LEDs

Terminal layout

The following table summarizes the terminal connector layout for the universal inputs, FLEX I/O, and FLEX outputs.

Model	Connector Orientation
RCFO-848	F05 GND F06 GND R-2 F07 GND F08 R-4 F0C GND F0D IN5 GND IN6 GND IN7 GND IN8 GND REF B+ A-

Additional resources

Additional resources are available on the [Reliable Controls Support Center](#).

Click any of the following in the menu bar:

Products

View all product documentation, manuals, and marketing material.

Technical

View Release Notes, Bulletins, Product and Security Alerts, and the DDC (Direct Digital Control) Glossary.

eHelpDesk

Click the eHelpDesk link in the Support Center banner and search or browse solutions, application support articles, and the community forum, or create a support ticket to connect with an agent.

Training

Use the Learning Center to view and register for training courses, access eLearning courses and videos, view webcasts, and download manuals.

RC-FLEXone wiring and installation

The wiring and installation section describes how to connect the power, inputs and outputs of your controller as well as the overall installation process and important considerations.

For more information about wiring and installing Reliable Controls products, refer to the product documentation and the *Hardware Installation Manual*, available in the [Reliable Controls Support Center](#).

For more information about best practices and recommendations for Ethernet networks, refer to the *Ethernet Best Practices Guide*, available in the [Reliable Controls Support Center](#).

Installation considerations

All Reliable Controls devices must be installed in accordance with the National Electrical Code (NFPA 70), the Canadian Electric Code Part 1 (CSA C22.1-12), or the International Electrical Code (IEC 60730-1) as applicable and in a manner acceptable to the local authority having jurisdiction.

This device is for use in UL Class 2 and Class 3 ELV circuits only.

Follow these guidelines when you install Reliable Controls products:

- Ground yourself before you touch any electronics by touching a grounded metal surface to discharge static electricity.
- Use copper conductors only.
- Choose wires and cables appropriate for your application or installation requirements, for example, plenum-rated material.

RC-FLEXone power

Your RC-FLEXone must be correctly wired to an appropriate power supply.

Supply Voltages

- 24 VAC $\pm 10\%$ 40 VA maximum, 50/60 Hz.
- 24 VDC $\pm 10\%$ 28 W maximum.

Wiring Terminals

- 16–24 AWG (1.31–0.21 mm²).
- Stranded or solid core.
- Copper conductors only.

To determine the size of the AC transformer or DC power supply required for your installation, use the power calculator at reliablecontrols.com/support/engineer/calculator.php.

Grounded power

Follow these guidelines when you select and wire the grounded power supply:

- Use a UL Class 2 or Class 3 ELV 24 VAC/VDC power supply for the controller.
- Ensure that all controllers are connected to earth ground.

- To determine the size of the AC transformer or DC power supply required for your installation, use the power calculator at reliablecontrols.com/support/engineer/calculator.php.

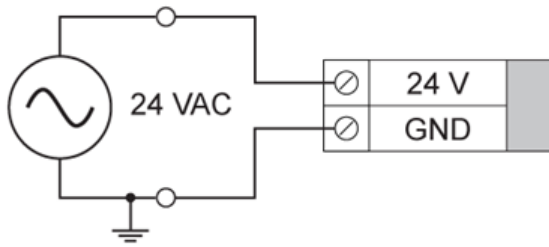


Figure 6: 24 VAC grounded power supply wiring

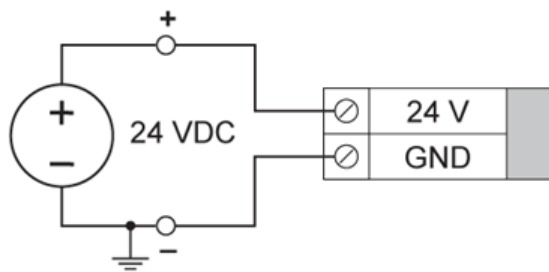


Figure 7: 24 VDC grounded power supply wiring

RC-FLEX device Status LED

The controller has an LED to indicate its operating status.

Status LED	Status
One flash per second	Normal operation.
Two quick flashes on and one second off	Controller is in Quick Connect mode.
Off	Unpowered. Controller is not operational.
On solid	No operation. Defective controller.

RC-FLEXone Ethernet

The RC-FLEXone dual Ethernet model has two Ethernet ports to allow for easy network connection.

Ethernet Communications

The RC-FLEXone is a nonrouting, unitary controller that requires a network host controller.

- Two IEEE 802.3 Ethernet 10/100BASE-T ports, with a maximum distance of 50 m (164 ft) between Ethernet connections using Category 5, 5e, or 6 cabling. Each device uses one IP address. The second Ethernet port is a switched port; use it to line-connect additional devices.
- Automatic hardware coupling of Ethernet dual ports when controller loses power.
- Routing host controllers support up to 74 additional BACnet/IP-connected devices.
- RSTP: Rapid Spanning Tree Protocol.
 - Allows ring topology for up to 40 devices isolated by a managed network switch.
- LLDP: Link Layer Discovery Protocol.
 - Provides details of up to five of the most recently discovered neighboring devices.

The controller cannot route between two separate Ethernet networks. The second port functions as an Ethernet switch for connecting additional devices to the network. This is an active switch. The controller must be powered for network connections.

Use a star or straight-line Ethernet network topology. The controller supports an Ethernet ring or loop topology for an isolated network whose traffic is controlled by a properly configured managed switch.

The controller automatically internally corrects for crossover and straight-through connections, so you can use either cable for network connections.

Refer to the *Ethernet Best Practices Guide*, available from the Reliable Controls Support Center, for Ethernet network examples, recommended topologies, network and device numbering conventions, and troubleshooting.

Related information

Connect to an existing BACnet/IP network 47

Ethernet connections

Your controller only supports one IP address and cannot route between two separate Ethernet networks. The second port functions as an Ethernet switch for connecting additional devices to the network. To maintain network operation, if the controller loses power or goes offline, the Ethernet ports bridge to make the Ethernet network segments before and after the controller into one continuous Ethernet network segment.

Your controller is intended for installation in a new or existing BACnet/IP network with a host controller, but you can also directly connect to the controller over Ethernet or USB. Your controller ships as a DHCP client by default and requires a DHCP server to automatically acquire an IP address. Networks require at least one router-model controller such as a MACH-ProCom located on the same local area network. You can have up to 74 devices per BACnet/IP network in addition to the router-model controller.

Your controller supports star and straight-line Ethernet topologies. Your controller automatically internally corrects for crossover and straight-through connections, so you can use either cable for

network connections. Your controller also supports ring or network loop topologies when the network is correctly configured and rapid spanning tree protocol (RSTP) is enabled.

Important: Ring topologies require a specific procedure for wiring the network and enabling RSTP. Failure to follow this procedure causes loss of Ethernet network communications.

Use a line topology to provide a longer Ethernet network with controllers located at increasing distances from the Ethernet switch. This topology allows you to span longer distances but is less robust as the loss of one controller connection can affect other controller network connections.

Use a star topology to provide a robust Ethernet network that does not create network loops. If you connect each controller to the Ethernet switch instead of using a daisy chain, if one controller loses its network connection, it does not affect the other Ethernet devices.

Use an Ethernet ring or loop topology to create a managed network loop for improved network resilience.

Refer to the *Ethernet Best Practices Guide*, available from the Reliable Controls Support Center, for Ethernet network examples, recommended topologies, network and device numbering conventions, and troubleshooting.

Ethernet line network topology

Use a line topology—similar to the daisy-chain architecture used in MS/TP networks—to create an Ethernet network, as shown below.

Because each device is connected to only the previous device, this topology can cause your network to be taken offline by a single faulty segment. Reliable Controls recommends you add a network recovery link to line topologies.

Note: Do not connect the network recovery link on a working network. It creates an unsupported ring topology and causes network communications to fail. Connect the network recovery link on a broken network to help recover from the bad connection.

Note: RC-FLEX controllers ship with DHCP enabled. To use DHCP, the network where the device is installed requires a DHCP server.

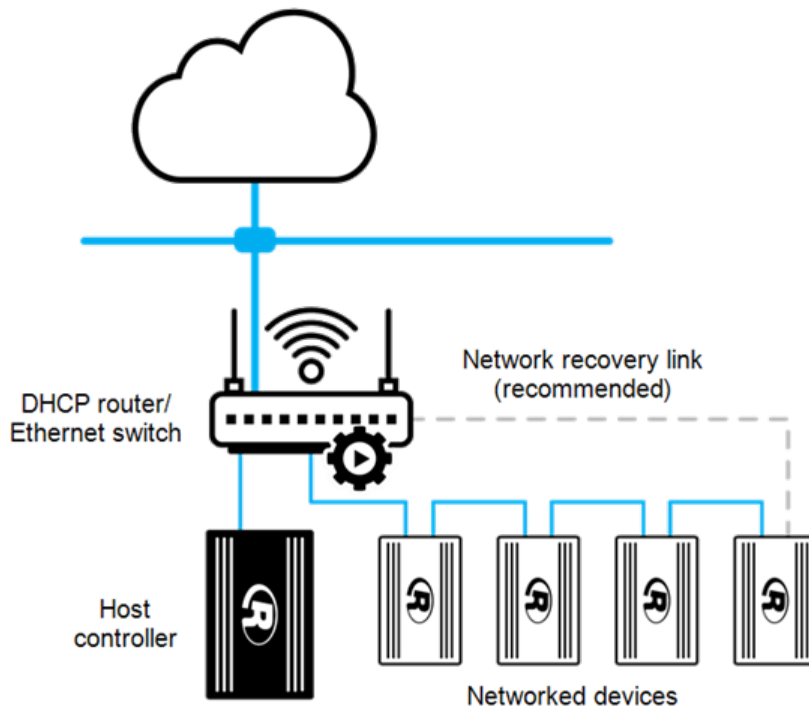


Figure 8: Line network topology

Note: Make sure the network recovery link does not exceed the maximum Ethernet segment length. Consider using a line topology with alternating connections if that is more suited to your installation.

Ethernet star network topology

In an Ethernet star topology, each controller is individually connected to a dedicated Ethernet port, as shown below.

This topology helps prevent your network being taken offline by a single faulty device.

Note: RC-FLEX controllers ship with DHCP enabled. To use DHCP, the network where the device is installed requires a DHCP server.

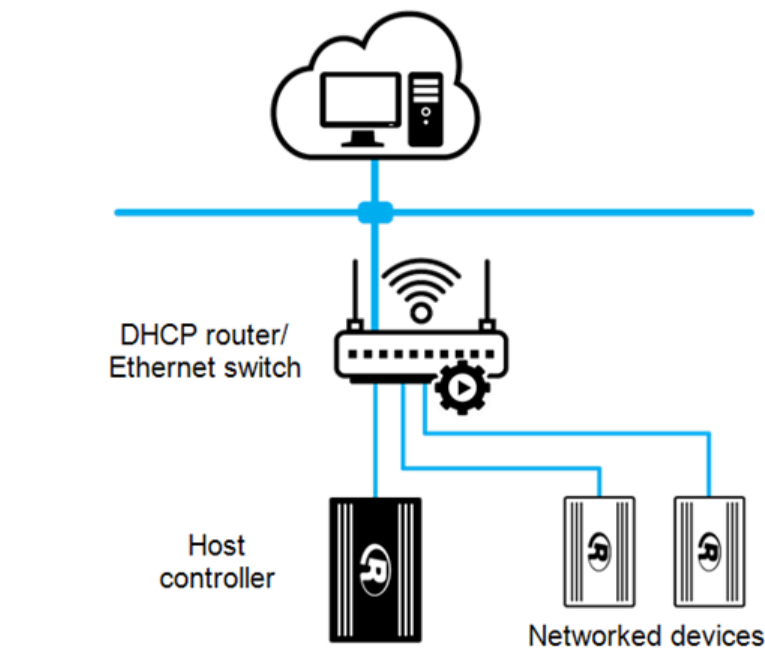


Figure 9: Star network topology

Ethernet ring or loop topology

An Ethernet ring or loop topology is where the last Ethernet device on a straight-line Ethernet topology connects back to the dedicated managed network switch, to improve network resilience.

An Ethernet ring can contain up to 40 devices, in addition to the managed switch.

Requirements:

- The Ethernet ring network must be isolated by a dedicated managed network switch.
- The dedicated managed network switch must be configured to isolate ring bridge protocol data unit (BPDU) traffic from the rest of the network.
- All Ethernet devices must support rapid spanning tree protocol (RSTP). RSTP must be enabled for each device using RC-Toolkit.

Follow the specified process to implement an operating Ethernet ring topology to avoid the loss of Ethernet communications.

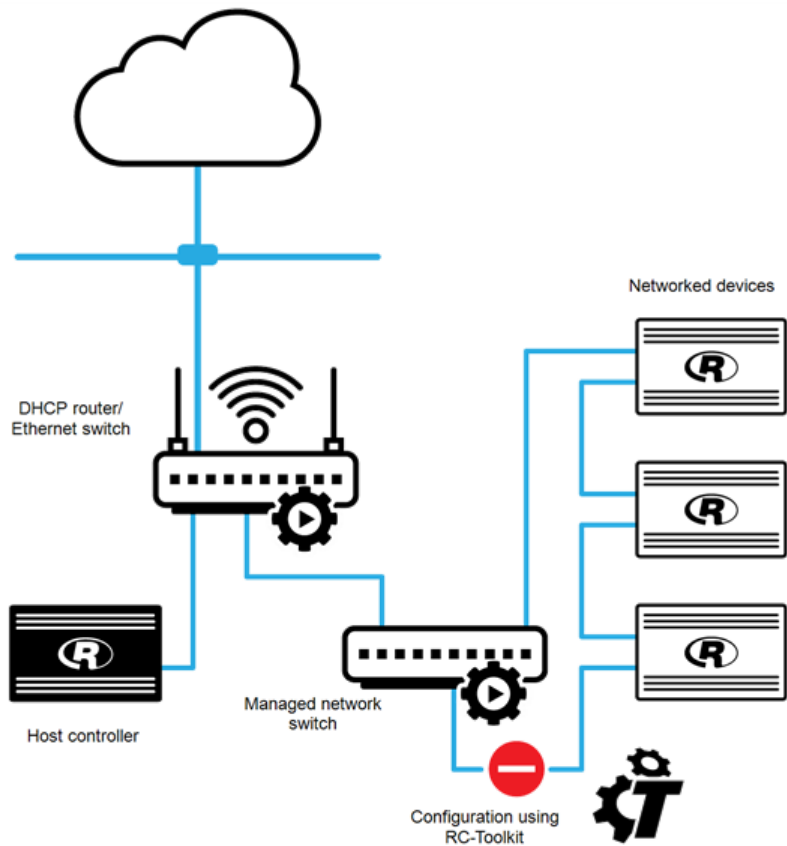


Figure 10: Ethernet ring or loop topology

Related information	
Set up an Ethernet ring with RSTP.....	48

Dual Ethernet port

The RC-FLEX controller's dual Ethernet ports allow you to use either straight-through or crossover Ethernet cables interchangeably.

Reliable Controls recommends you consistently use Ethernet standard TIA/EIA-568A or TIA/EIA-568B terminated cables.

Do not exceed 50 m (164 ft) Ethernet segment length between any two RC-FLEX Ethernet network nodes.

RC-FLEX Ethernet Copper Switch

If the controller loses power, Copper Switch technology helps maintain Ethernet communications by internally connecting the dual Ethernet ports to bypass the controller.

Copper Switch is a physical hardware component of the dual Ethernet ports on RC-FLEX controllers, and does not require configuration. It is supported on all RC-FLEX dual Ethernet controllers that are revision D or later. The revision level is indicated by the fifth character in the serial number.

To maintain the maximum Ethernet network segment length specification of 100 m (328 ft), the recommended maximum segment length between networked RC-FLEX controllers with the Copper Switch is 50 m (164 ft).

Do not exceed 50 m (164 ft) Ethernet segment length between any two RC-FLEX Ethernet network nodes.

The following Ethernet line topology network diagrams show before and after a controller loses power. After the power loss, the controller's Copper Switch connects the dual Ethernet ports, preventing loss of communications on the Ethernet network:

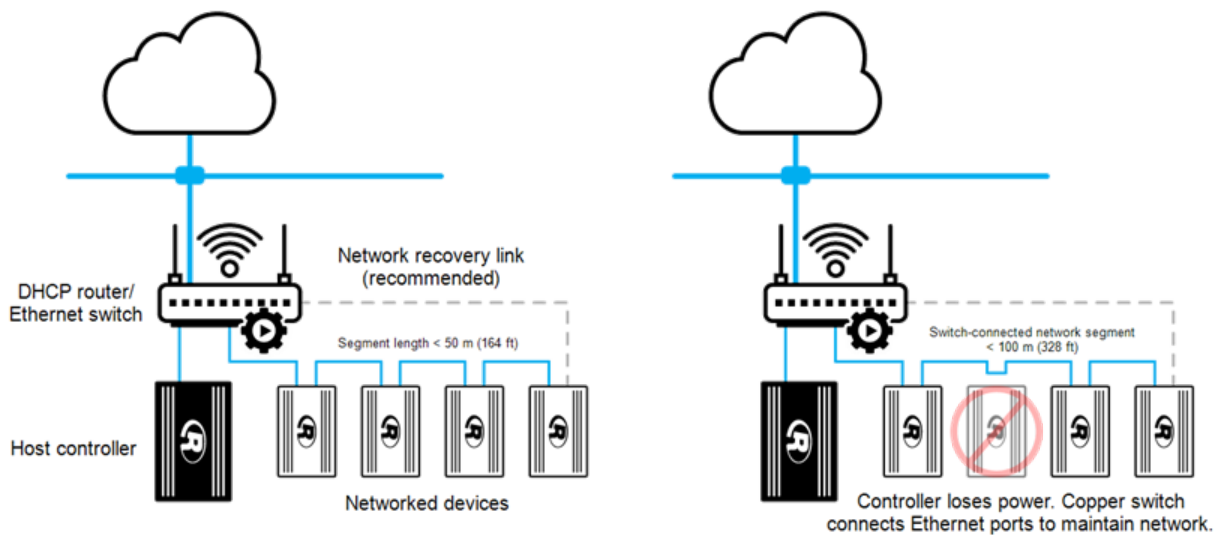


Figure 11: Before and after Copper Switch operation

Ethernet status LEDs

The controller has two Ethernet status LEDs, **Act** and **Link**, located next to the Ethernet port.

Act: The Act (activity) LED illuminates when the controller is actively transmitting over Ethernet.

Link: The Link LED illuminates when there is a physical connection between the controller and a valid, powered switch, hub, or controller. This LED indicates only a physical connection, not communication or configuration status.

RC-FLEXone EIA-485 (-M model only)

The RC-FLEXone -M model has one EIA-485 three-pole terminal block you can use to connect to a BACnet MS/TP network that is typically hosted by a router-model controller.

MS/TP Communications (-M Models)

The RC-FLEXone is a non-routing, unitary controller that requires a network host controller.

- One EIA-485 port that supports a baud rate up to 76.8 kbps
- Auto-baud detection.
- 24 VAC overvoltage protection with built in resettable fuses.
- Software switched End of Line termination (EOL) with amber LED indicator.
- Status LED illuminates green to indicate MS/TP network operation and red to indicate miswired MS/TP.

Connect MS/TP devices only in a straight-line (daisy-chain) topology. Methods such as star or T topologies are not supported and will cause communication problems.

Wiring Terminals

- 16–24 AWG (1.31–0.21 mm²).
- Stranded or solid core.
- Copper conductors only.

EIA-485 wiring for grounded controllers

The grounded controller's EIA-485 port is a two- or three-pole terminal block used for BACnet MS/TP communication. The EIA-485 transceiver is non-isolated and internally references the controller's power ground. The ground connection helps keep all networked devices at the same reference to each other which works to improve communications by making sure that signals are at the same level at all nodes throughout a distributed system.

All devices on the same EIA-485 network must communicate using the same protocol and baud rate, and each node must have a unique address. EIA-485 devices are connected using a line topology.

Note: Maximum EIA-485 segment length: 1,220 m (4,000 ft).

The grounded controller's EIA-485 terminal block has either two terminals: A(-) and B(+), or three terminals: A(-), B(+), and REF. To connect multiple grounded controllers, use the EIA-485 connector to wire terminal A(-) to A(-), and B(+) to B(+). Connect the bare shield wires at each junction to help suppress noise along the cable length.

The REF terminal is internally connected to the controller's power ground and can be used to connect isolated devices that use a three-wire MS/TP network.

Installation guidelines:

- Use a good quality, low-impedance, twisted two-conductor shielded communications cable with capacitance less than 82 pF/m (25 pF/ft).
- EIA-485 cable shields should be continuous, electrically connected, and grounded at one end only.
- End-of-Line (EOL) must be set to on for the two devices located at the physical extremities.
- REF terminal is intended to connect isolated devices that use a three-wire MS/TP network.

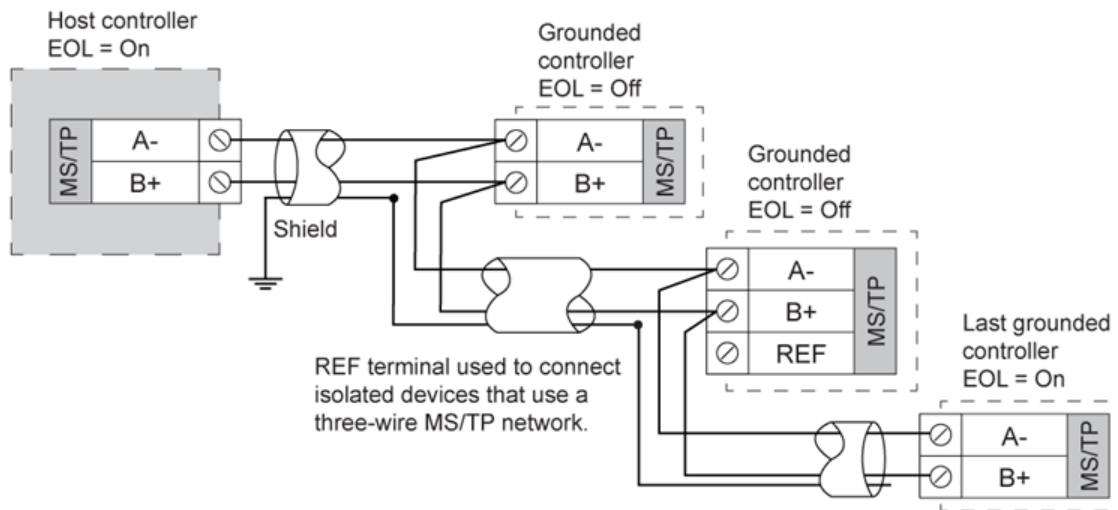


Figure 12: EIA-485 wiring for grounded controllers

MS/TP-Net LED and protection

The MS/TP-NET LED on the MS/TP (-M) model RC-FLEX device provides the following information for its EIA-485 communications port:

MS/TP-Net LED behavior	Status description
Off	Device unpowered or is not communicating.
Green Flicker	Normal MS/TP communications.
Green On 0.5 sec / Off 0.5 sec	MS/TP configured but not communicating.
Green On 1 sec / Off 1 sec	Device has factory default settings. Configure device using RC-Toolkit MSet tool or SMART-Sensor EPD in MSet Mode.
Red On solid	EIA-485 network issue detected. Common EIA-485 issues are: - Power polarity (24 VAC/VDC and ground) have been reversed. - Floating ground or different ground potential between two network devices. - Device is not connected to earth ground. 24 VAC/VDC incorrectly applied to the EIA-485 network.

EIA-485 protection

The controller uses automatically resetting polyfuses for EIA-485 network protection.

End-of-Line (EOL) switch and LED

The End-of-Line (EOL) switch for the two devices located at the physical extremities of the EIA-485 cable run must be set to On, and all other devices on this network must be set to Off. This is to provide proper biasing for the EIA-485 network.

Proper biasing optimizes communications performance by bringing the network voltage to a known value if communications are idle. This prevents communications problems such as signal reflections that might occur when networked controllers are improperly terminated.

The End-of-Line switch for the MS/TP RC-FLEX device (-M model) is a soft switch you can set using one of the following methods:

- Connect the SETUP-Tool (or a SMART-Sensor EPD in MSet Mode) to the controller, then set **Last Panel** to Yes if the controller is the last device on the network. Otherwise, make sure **Last Panel** is set to No.
- Use the RC-Toolkit MSet screen and toggle the switch On or Off by clicking the End-of-Line cell for the device.
- Press the controller reset button twice in quick succession on a powered controller to toggle the End-of-Line switch.

If the device at the end of the line is not a Reliable Controls controller, you can install an End of Line terminator (NA-EOL), available from [eBusiness](#) at the Reliable Controls Support Center website.

EOL LED

The yellow EOL LED indicates the End-of-Line status of the device:

- EOL LED on: End-of-Line on
- EOL LED off: End-of-Line off

RC-FLEXone USB

The RC-FLEXone controller has a USB-A port for Direct Connect communications.

USB

- USB-A port with maximum cable length of 5 m (16.4 ft).

Connect a local workstation's USB-A port to the controller's USB-A port to temporarily access the controller and BACnet networked devices without impact to existing network connections and functions.

Important: Always route USB connections through a USB hub with a good quality USB cable to help protect equipment and resolve protocol differences.

You can make a connection from your workstation to provide both power and communications to configure the device using the RC-Toolkit MSet tool. USB-powered controllers cannot power outputs and inputs. Do not use a USB connection to power a networked controller.

Important: The USB connection is for short-term configuration or troubleshooting. Leaving the USB connected to the workstation can cause network issues.

Related information

Set up a new RC-FLEX controller using USB.....45

RC-FLEXone SMART-Net

Your controller has a SMART-Net four-pin terminal block to support a network of SMART-Net devices.

SMART-Net Communications

- SMART-Net port with four-wire terminal block supports up to eight devices.

Wiring Terminals

- 16–24 AWG (1.31–0.21 mm²).
- Stranded or solid core.
- Copper conductors only.
- 5 mm (0.20") rising-cage screw terminal blocks.

The maximum tested SMART-Net cable length from the host controller to the last SMART-Net device on the SMART-Net bus is 45 m (147 ft). With an externally powered SMART-Net Expansion Board or SMART-Sensor Expansion Board located at the network midpoint, the maximum tested SMART-Net cable length from the host controller to the last SMART-Net device on the SMART-Net bus is 75 m (246 ft).

SMART-Net four-pin terminal

Use the removable SMART-Net four-pin terminal block to wire and connect a network of SMART-Net devices.

Note: The maximum tested SMART-Net cable length from the host controller to the last SMART-Net device on the SMART-Net bus is 45 m (147 ft). With an externally powered SMART-Net Expansion Board or SMART-Sensor Expansion Board located at the network midpoint, the maximum tested SMART-Net cable length from the host controller to the last SMART-Net device on the SMART-Net bus is 75 m (246 ft).

The SMART-Net network provides power and communications for SMART-Net devices. Reliable Controls recommends 24 AWG (0.21 mm²), low capacitance < 82 pF/m (25 pF/f), solid core minimum Category 3 cabling for SMART-Net networks.

Directly connect the SMART-Net four-pin terminals from the controller to the four-pin terminal block on a SMART-Net device, matching the terminals.

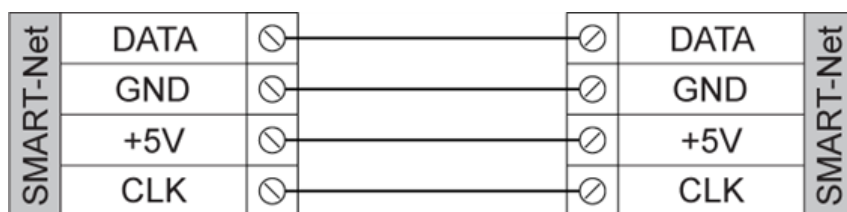


Figure 13: SMART-Net four-pin connection

For detailed information about SMART-Net networks, sensors, and controllers, refer to the SMART-Net device documentation available in the [Reliable Controls Support Center](#).

RC-FLEXone inputs, FLEX outputs, and FLEX I/O

Your controller is equipped with inputs, FLEX outputs, and FLEX I/O:

- **Inputs:** A physical connection that operates as a universal input. It is set to thermistor/dry contact by default.
- **FLEX Outputs:** A physical output connection that is software-configurable to operate as a universal output or a solid-state relay. It is disabled by default and will not operate until it is configured in RC-Studio.
- **FLEX I/O:** A physical input/output connection that is software-configurable to operate as a universal input, universal output, or solid-state relay. It is disabled by default and will not operate until it is configured as an input or output using RC-Studio.

Wiring Terminals

- 16–24 AWG (1.31–0.21 mm²).
- Stranded or solid core.
- Copper conductors only.

Important: Make sure the physical wiring to FLEX output and FLEX I/O connectors matches the intended use of input, output, or solid-state relay. Record the physical wiring and intended configuration, and back up the controller's Panel File once you have configured the inputs and outputs using RC-Studio.

Input characteristics

Universal Inputs

- Standard 16-bit A/D converter.
- Software selectable 0–10 VDC, 4–20 mA, thermistor/dry-contact.
- Impedance:
 - 3 M Ω on 0–10 VDC range.
 - 249 Ω on 4–20 mA range.
 - 20 k Ω on thermistor range.
- Pulse counting up to 150 Hz. Supports flow meters.
- 24 VAC overvoltage protection.

Analog inputs promptly detect faults when you set the D column in the Inputs worksheet to Y, or decommissioned; otherwise, fault detection is slightly delayed to help prevent false alarms caused when a user presses a button on a connected SPACE-Sensor Temperature.

FLEX output characteristics

When the controller is power-cycled, the outputs go to zero, then return to their normal values and programs resume operation when power is restored. Universal outputs can sink or source current for light dimming applications. Do not mix sinking and sourcing on the same output.

Universal Outputs

- 16-bit D/A converter.
- Analog: 0–12 VDC.
- Binary: Software configurable between 0–12 VDC.
- Output power: 75 mA at 12 VDC source, -10 mA sink.
- 24 VAC overvoltage and short protection.

Solid-State Relay Output

- Switch 24 VAC/VDC.
- 500 mA maximum.

FLEX Outputs

- Use software to select as universal or solid-state relay.

FLEX I/O characteristics

FLEX I/O inputs can be configured with a Sensor Type designed for S0 pulse counting compliance. It is recommended that you use FLEX I/O inputs for pulse-counting applications.

FLEX I/O

- Software selectable universal input, universal output, or solid-state relay.
- Inputs can be configured for S0 pulse counting applications.

Wire the RC-FLEX controller inputs or FLEX I/O (FIO) inputs

Wire the RC-FLEXone universal inputs as dry contact, thermistor, 4-20 mA analog sensor, or 0-10 VDC transmitter.

You can configure your controller's FLEX I/O (FIO) terminals to operate as a universal input. FLEX I/O inputs support pulse counting settings.

Note: Use dry-contact digital input wiring connections for pulse-counting applications such as flow and energy meters.

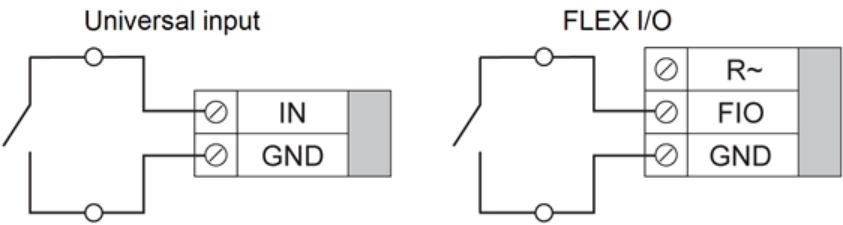


Figure 14: Dry-contact digital input wiring

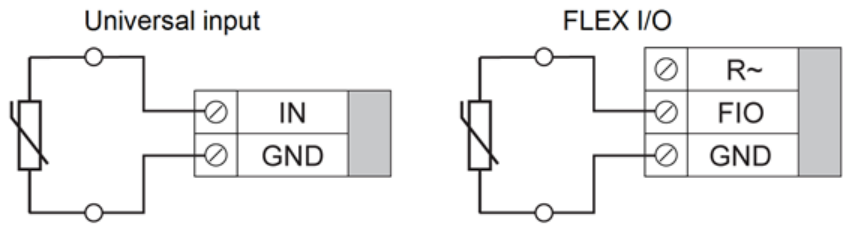


Figure 15: Thermistor wiring

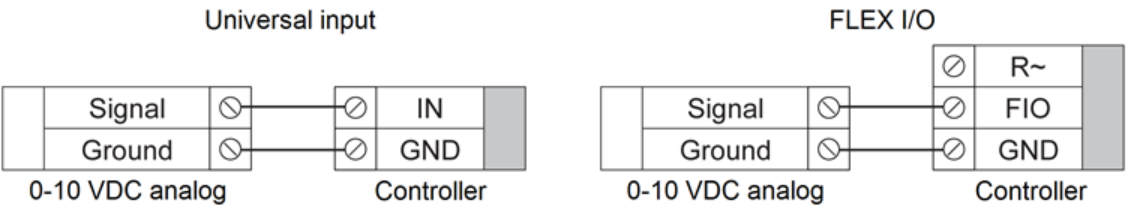


Figure 16: 0-10 VDC analog input wiring

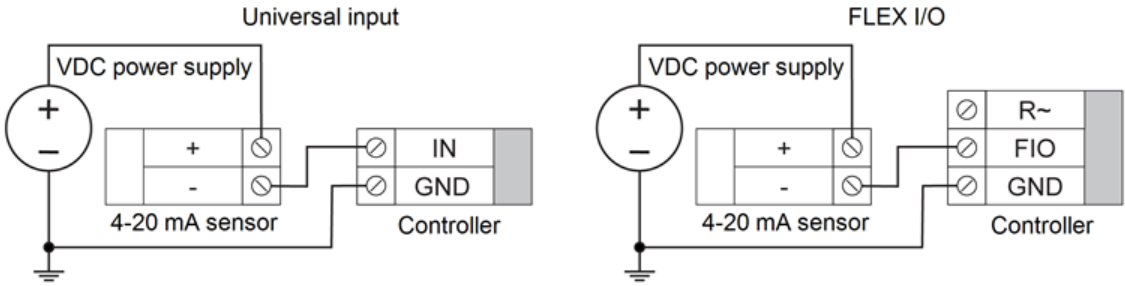


Figure 17: 4-20 mA analog input with external DC power supply wiring

Note: 4-20 mA loop-powered sensors require a DC voltage power supply to operate. The controller converts this input to a 1-5 VDC signal. If you scale this input in RC-Studio, the input range of the table is 1-5 VDC.

Wire the RC-FLEX controller FLEX outputs (FO) or FLEX I/O (FIO) outputs

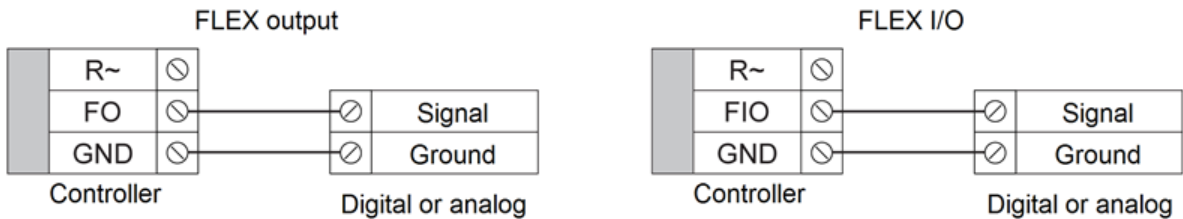
FLEX outputs can control a low-voltage DC load or a relay.

You can configure FLEX outputs and FLEX I/O to operate as a universal output or solid-state relay.

Universal outputs

Connect a relay, digital, or analog output device to your controller's output terminals.

Use software to configure universal outputs as digital or analog outputs.



Solid-state relay outputs

The voltage supplied at the R~ terminal by the external power source is transferred to the FO or FIO terminals to power the output load. The R~ terminal on each output terminal block must be connected to power the FIO or FO terminals on that terminal block.

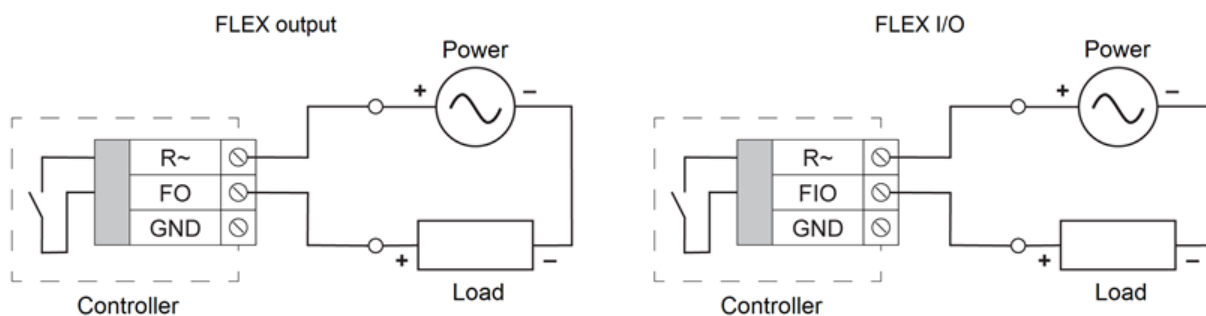


Figure 18: Solid-state relay wiring

Related information

Configure FLEX I/O using RC-Studio..... 68

Hand/Off/Auto (HOA) switches

The optional HOA switch can override the controller's Auto setting to force the output to the Hand or Off setting.

For FLEX I/O, the HOA switch functions only if the FLEX I/O is configured as an output in RC-Studio.

In RC-Studio, the optional HOA switch setting is shown in the Switch column on the controller's Outputs worksheet. It displays Auto if there is no switch or the HOA switch is set to Auto.

Note: The output status LED always reflects the output state, even when the output is controlled by the HOA switch.

Hand (H)

The output is on, and the output voltage is set by the potentiometer.

Off (O)

The output is off.

Auto (A)

The output state is determined by the device's configuration and programs.

Note: Use proprietary BACnet property HOA_Switch (:1119) to read the switch position: Hand = 2, Off = 0, or Auto = 1.

Output override potentiometer

Each output on your device has a potentiometer that controls the output's voltage when the Hand/Off/Auto (HOA) switch is set to Hand (H).

This is available only on controllers that have the optional HOA switch.

To decrease the output voltage, turn the potentiometer counterclockwise. To increase the output voltage, turn the potentiometer clockwise.

The output potentiometer does not affect the output when the HOA switch is set to Off (O) or Auto (A). Devices are shipped from the factory with the output potentiometers set at their full voltage.

Adjust the output voltage

Use the output's potentiometer to vary the output voltage potential when the output's Hand/Off/Auto (HOA) switch is set to Hand (H).

This is available only on controllers that have the optional HOA switch.

To adjust the output voltage potential with a voltmeter and a small screwdriver:

1. Open the controller cover to access the internal circuit board.
2. Set the HOA switch to H.
3. Set the voltmeter to measure DC voltage, and connect its leads to the output terminals.
4. While viewing the voltmeter reading, use the screwdriver to rotate the output potentiometer counterclockwise to decrease the voltage, or clockwise to increase the voltage, until the desired output voltage reading is displayed.
5. Disconnect the voltmeter.
6. Set the HOA switch to A.
7. Close the controller cover.

Output and FLEX I/O LEDs

LEDs indicate the output voltage level for outputs and FLEX I/O configured in software as outputs.

The output LED brightness increases with the voltage potential between the output and ground or common. If the voltage is zero, the LED is off. At maximum potential, the LED is at its brightest. The LED brightness varies between those two states.

If the FLEX I/O is configured as an input, set the optional HOA switch to Auto to prevent LED issues.

RC-FLEXone communications

This section describes how to connect to and communicate with your RC-FLEX device, from initial connection at factory-default state to when the device is configured and integrated into your building's BACnet network.

Reliable Controls offers dedicated training exercises in the [Support Center](#) to help you set up communications for your RC-FLEX device.

RC-Toolkit and your controller

Use RC-Toolkit to configure your controller's communications features and to upgrade controller firmware.

Upgrade RC-Toolkit to the latest release to support new features, improvements, and fixes.

RC-Toolkit has several tools for basic controller setup and troubleshooting:

- **MSet:** Use to set your controller's network and communication parameters.
- **OS Send:** Use to update your controller's firmware.
- **Network Diagnostics:** Use to view diagnostics for your controller to troubleshoot network issues.

RC-Toolkit includes the Panel File Utility, a separate program used to read and edit Panel Files and to rapidly duplicate and modify Panel Files to load to your controller.

Default user access settings

The factory-default user access settings used to log in to the system are stored in the host controller:

- **User:** longview.
- **Password:** Empty, no entry.

For BACnet network security best practices, refer to the *Reliable Controls Hardening Guide*, available in the Engineer tab in the [Reliable Controls Support Center](#).

Default communications settings

This topic summarizes the factory-default communications settings and properties for RC-FLEX devices.

Default Ethernet settings

The controller ships with the following default Ethernet settings:

- **DHCP:** Enabled.
- **Device ID:** Unconfigured.

If no DHCP server is available, the controller assigns itself a link-local address using the standard link-local range of 169.254.0.0 to 169.254.255.255 with a subnet mask of 255.255.0.0.

Default MS/TP settings

The controller ships with the following default EIA-485 MS/TP settings:

- **BACnet device ID:** Not set.
- **EIA-485 baud rate:** Auto-detect.
- **End-of-Line switch:** Off.

Default USB settings

The controller ships with the following default USB port properties:

- **Quick Connect mode:** Enabled for Direct Connect connection using USB-A male-to-male cable.
- **USB driver:** Microsoft Windows Network Control Mode (NCM) driver.

Unconfigured RC-FLEX device discovery

When you connect unconfigured RC-FLEX controllers to existing networks, RC-Toolkit discovers them and applies a teal, or greenish-blue row highlight in Network view in MSet. The highlight allows you to quickly identify all discovered unconfigured RC-FLEX devices on the network.

Note: Unconfigured RC-FLEX controllers that are Direct Connect connected to the computer using a USB-A male-to-male cable are automatically put into Quick Connect mode, indicated by an orange row highlight in MSet.

When RC-Toolkit discovers unconfigured RC-FLEX controllers, the controllers display in the Local Network node and also in compatible networks in the System Tree, for example a BACnet/IP network for an Ethernet-connected RC-FLEX controller. You can then configure their Device ID and other network properties as applicable.

RC-Toolkit software version 3.4.2 and later can discover unconfigured RC-FLEX controllers running version 1.5 or later using remote connection methods such as RC-RemoteAccess. Otherwise, a local BACnet/IP connection is required to discover unconfigured RC-FLEX controllers.

Set up a new controller using RC-Toolkit

Upgrade to the latest version of RC-Toolkit to take advantage of new software features and improvements.

To set up the unconfigured RC-FLEX controller:

1. Connect the RC-FLEX controller to your network.
2. Run RC-Toolkit and connect to your network.
3. Click **MSet**  to highlight the MSet tool, then click the network in the System Tree to select it and display the MSet network view worksheet.
Unconfigured controllers have a teal, or greenish-blue row highlight in the MSet network view worksheet.
4. Enter the required information in the MSet network view worksheet to configure the controller.
For detailed descriptions of all the MSet settings, refer to the "MSet network view worksheet" topic.

Table 1: MS/TP configuration settings

Address	Enter a unique address for the controller.
Device ID	Automatically filled if the Device ID Auto Fill check box is selected, otherwise enter a unique device ID.
End-of-Line	If this controller is the last physical device on the EIA-485 bus, set it to On . Otherwise, leave it in the default Off setting.
Device Name	You have the option to enter a more descriptive name for the controller.

Table 2: BACnet/IP configuration settings

IP Address	Enter the assigned static IP address if the network does not use DHCP. You must set DHCP to No to enter a static IP address.
DHCP	Select Yes if the network has a DHCP server assigning IP addresses. Select No if you are assigning a static IP address.
RSTP	Select No , unless you are adding the controller to an existing RSTP network.
Device ID	Enter a unique device ID.
Device Name	You have the option to enter a more descriptive name for the controller.
BACnet/IP Settings	Enter the host controller's B/IP network settings.

- Click Send  to save the device settings.
- Wait until the save operation is complete before closing the **Device Configuration** dialog box.
- Click or rediscover the network node to view the newly-configured RC-FLEX controllers. They are highlighted orange to indicate they are in Quick Connect mode, which allows you to reconfigure the devices if necessary. Quick Connect mode times out after 10 minutes.

Tip: You can print the MSet network view worksheet to get a complete list of devices and connection information for future network maintenance and troubleshooting.

MSet network view worksheet

Use the MSet network view worksheet to discover, view, and configure MS/TP- and BACnet/IP-networked devices in network mode.

To open the MSet network view worksheet, select the network node for a BACnet/IP or MS/TP network in the System tree.

Clicking a non-router controller in the system tree opens a version of this worksheet that shows only that single device.

The MSet network view worksheet has different options for IP-based and MS/TP networks:

- "IP-based network MSet worksheet" below
- "MS/TP network MSet worksheet" on page 42

IP-based network MSet worksheet

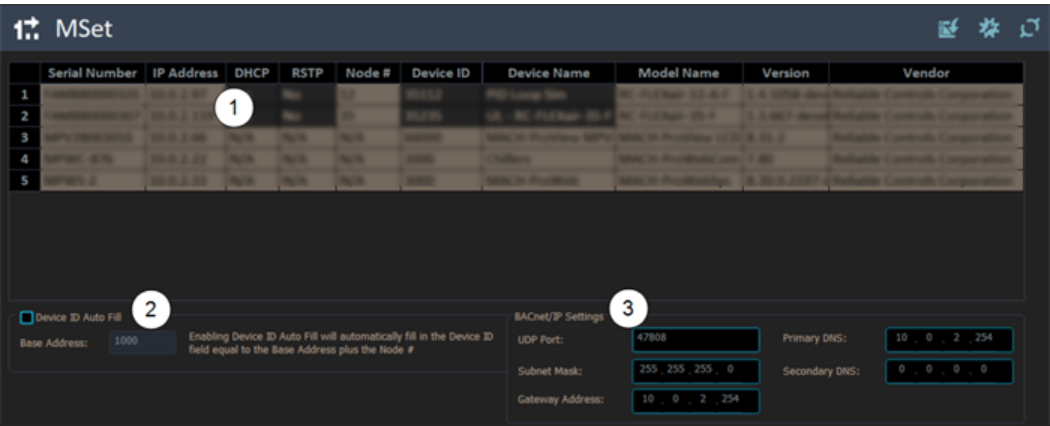


Figure 19: MSet network view worksheet for an IP-based network

Click the non-router controller in the System tree to open a version of this worksheet that shows only that single device.

⚙️ Actions

Print

Prints the IP network configuration worksheet to a document or printer.

Clear Device ID

Changes the device network state to Unconfigured by clearing its saved Device ID and Address information. This option is available only when a single device is selected in the System tree.

Network Configuration

Opens the BACnet Network Configuration dialog box.

Broadcast Host Number to Subnetwork

Opens the Broadcast Host Number to Subnetwork dialog box, where you enter the host number and destination subnetwork.

Set Master Password

Changes the default master password stored in all Reliable Controls system controllers. This option is only available when you sign on with the Master Password.

1 IP-based network devices

Serial number

The device serial number. This is for information only and cannot be configured.

IP address

The version 4 IP address that RC-Toolkit reads from the device. If the IP address is configurable in the MSet network view worksheet, this is the local IP address of the device. If the IP address is not configurable, go to the device's specific MSet configuration screen to confirm the device's local IP address. Because of technical limitations, devices on networks that communicate via methods other than BACnet/IP or MS/TP may display incorrect information in the IP Address column. This includes devices on BACnet Ethernet networks hosted by router-model controllers. The IP address can be a manually entered static IP address or dynamically assigned if DHCP is supported on the network and enabled for that device.

DHCP

Displays whether Dynamic Host Configuration Protocol (DHCP) is enabled or disabled and can be configured in the MSet network view worksheet for some devices. If enabled, the LAN's DHCP server automatically sets the device's IP address, subnet mask, gateway, and DNS information. If there is no DHCP server, the controller retains its last known assigned address or assigns itself a link-local address.

Note: You can use DHCP for IP-connected devices that are not configured as BBMDs.

RSTP

Displays whether Rapid Spanning Tree Protocol (RSTP) is enabled or disabled on the Ethernet port. RSTP must be disabled for Ethernet line or star topologies. There is a specific process to wire and configure Ethernet loop topologies where RSTP is enabled. Refer to the device user guide or the *Ethernet Best Practices Guide*, available in the [User Guides](#) page on the [Reliable Controls Dealer Support Center](#), for requirements and instructions.

Node #

The setup address of an RC-FLEX device, ranging from 1 to 255. If the controller is not configured with a value in the Device ID column and you select **Device ID Auto Fill** and edit the Node # column, RC-Toolkit generates the Device ID using the value in the Node # column and the value entered in the Base Address box. Use Node # and Device ID Auto fill to generate sequential device IDs for the BACnet/IP terminal devices hosted on a single network. This property is not applicable to other IP-based network devices.

Device ID

The BACnet device ID must be a unique number on the BACnet internetwork, limited to between 1 and 4,194,302, and is configurable in the MSet network view worksheet for some devices. If the controller is not configured with a value in the Device ID column and you select **Device ID Auto Fill** and edit the Node # column, RC-Toolkit generates the device ID using the value in the Node # column and the value entered in the Base Address box. Delete the device ID on a configured controller to put the controller in an unconfigured state and enable the default configuration port.

Note: Do not use device ID 0. Using zero can cause issues with older BACnet software and zero is not supported by RC-Studio.

Device Name

The name of the device. This is the device model name by default; you can edit it to be more descriptive.

Model Name

The device model name. This is for information only and cannot be configured.

Version

The version of firmware currently running on the device. This is for information only and cannot be configured. Use OS Send to upgrade Reliable Controls device firmware.

Vendor

The BACnet device vendor. Use RC-Toolkit to configure Reliable Controls devices only.

2 Device ID Auto Fill

To assign automatic device IDs to your controllers, select **Device ID Auto Fill**, and change the value in the Base Address box from the default value. Edit the value in the Node # column for an IP-based network device to automatically generate the device ID.

Base Address

Enter the base address used to automatically generate device IDs.

3 BACnet/IP Settings

The BACnet/IP Settings area is displayed when you select an IP-based network that contains devices that are configurable using MSet network view. Click a network node to display and configure the devices on that network and assign device IDs. Once a device is given a device ID in network mode, you can open it in single device mode from the System Tree.

The following settings are by default, from the first configured device read on the network. To configure a single device, click on it in the System Tree.

Use the following options to configure the network settings:

Important: RC-Toolkit sends the updated BACnet/IP network settings only to devices that are configurable using MSet network view and have a Device ID.

UDP Port

The network BACnet/IP UDP port. Every BACnet/IP network requires a unique port number.

Subnet Mask

Defines the range of IP addresses used in the BACnet/IP network. A common subnet mask value is 255.255.255.0.

Gateway Address

The internal IP address of the router used by the BACnet/IP network to connect to other networks or the internet. This is required if the controller is configured on a wide-area network across multiple subnetworks. If all devices are on the same subnet, Gateway Address can be left blank.

Primary DNS

The IP address of a valid DNS accessible to the BACnet/IP network. A DNS allows you to use domain names instead of IP addresses.

Secondary DNS

The IP address of a valid DNS accessible to the BACnet/IP network, used if the primary DNS is not available.

MS/TP network MSet worksheet

	Serial Number	Address	Device ID	End-of-Line	Device Name	Model Name	Version	Vendor
1	1	7001	7001	Y	VM021	Reliable Controls MPT-30	7.00	Reliable Controls Corporation
2	2	7002	7002	Y	VM022	Reliable Controls MPT-30	7.00	Reliable Controls Corporation
3	3	7003	7003	Y	VM023	Reliable Controls MPT-30	7.00	Reliable Controls Corporation
4	4	7004	7004	Y	VM024	Reliable Controls MPT-30	7.00	Reliable Controls Corporation
5	5	7005	7005	Y	VM025	Reliable Controls MPT-30	7.00	Reliable Controls Corporation
6	6	7006	7006	Y	VM026	Reliable Controls MPT-30	7.00	Reliable Controls Corporation
7	7	7007	7007	Y	VM027	Reliable Controls MPT-30	7.00	Reliable Controls Corporation
8	8	7008	7008	Y	VM028	Reliable Controls MPT-30	7.00	Reliable Controls Corporation
9	9	7009	7009	Y	VM029	Reliable Controls MPT-30	7.00	Reliable Controls Corporation
10	10	7010	7010	Y	VM030	Reliable Controls MPT-30	7.00	Reliable Controls Corporation
11	11	7011	7011	Y	VM031	Reliable Controls MPT-30	7.00	Reliable Controls Corporation

☒ Device ID Auto Fill
 Base Address: 7000
 Enabling Device ID Auto Fill will automatically fill in the Device ID field equal to the Base Address plus the Address

Figure 20: MSet network view worksheet for a BACnet MS/TP network

Click the non-router controller in the System tree to open a version of this worksheet that shows only that single device.

Actions

Print

Prints the IP network configuration worksheet to a document or printer.

Clear Device ID

Changes the device network state to Unconfigured by clearing its saved Device ID and Address information. This option is available only when a single device is selected in the System tree.

Network Configuration

Opens the BACnet Network Configuration dialog box.

Broadcast Host Number to Subnetwork

Opens the Broadcast Host Number to Subnetwork dialog box, where you enter the host number and destination subnetwork.

Set Master Password

Changes the default master password stored in all Reliable Controls system controllers. This option is only available when you sign on with the Master Password.

1 MS/TP networked devices

Serial number

The device serial number. This is for information only and cannot be configured.

Address

The MS/TP address, also referred to as the MAC #, of the device on the network. The address must be unique for each device on the MS/TP network and range from 1 to 127, except for the SMART-Space Controller, where the range is 1–254. Devices that do not have an assigned address temporarily use the value entered in the Configuration MAC box.

Device ID

The BACnet device ID must be a unique number on the BACnet internetwork, limited to between 1 and 4,194,302. When you select **Device ID Auto Fill**, the device ID defaults to the base address plus the address.

Note: Do not use device ID 0. Using zero can cause issues with older BACnet software and zero is not supported by RC-Studio.

End-of-Line (EOL switch)

Displays the status of the device's End-of-Line (EOL) switch. The EOL switch for all devices communicating on the same MS/TP network should be Off, except for the last device at the physical end of the EIA-485 network—that device's EOL switch should be the only one that is On. For RC-FLEX MS/TP devices, click the End-of-Line cell to toggle the switch On or Off. N/A indicates the End-of-Line property for that device is unknown or not available.

Device Name

By default, the device name is the device model name. You can change the device name to be more useful for your implementation. For example, name the device according to the building area or room number where it is located.

Model Name

The device model name. This is for information only and cannot be configured.

Version

The version of firmware currently running on the device. This is for information only and cannot be configured. Use OS Send to upgrade Reliable Controls device firmware.

Vendor

The BACnet device vendor. Use RC-Toolkit to configure Reliable Controls devices only.

2 Device ID Auto Fill

For controllers not configured with a value in the Device ID column, if you select **Device ID Auto Fill**, RC-Toolkit generates the device ID based on the value in the Address column and the value entered in the Base Address box.

Base Address

Enter the base address used to automatically generate device IDs.

Direct Connect with B/IP (USB/Ethernet)

Connect your RC-FLEX device directly to a computer port using a USB-A male-to-male cable or an Ethernet cable. Direct Connect B/IP (USB/Ethernet) is intended as a temporary connection method—for example, to configure an unconfigured RC-FLEX device in RC-Toolkit, or to troubleshoot a configured RC-FLEX device.

Direct Connect B/IP (USB/Ethernet) uses the default configuration port to establish connection between the computer and the RC-FLEX device. This configuration port is enabled by default on unconfigured RC-FLEX controllers. For configured RC-FLEX controllers, you can temporarily enable the default configuration port by putting the controller in Quick Connect mode. Controllers in Quick Connect mode display in orange highlight on the RC-Toolkit MSet screen.

The recommended Direct Connect B/IP (USB/Ethernet) method for RC-Toolkit is to use a USB-A male-to-male cable, as it provides a fast local connection when you have easy access to the physical RC-FLEX device. RC-Toolkit immediately connects to the device, whether it is configured or unconfigured.

To make a Direct Connect B/IP (USB/Ethernet) connection to a controller:

1. Connect the computer to the unconfigured RC-FLEX device. If the RC-FLEX device is already configured, put it in Quick Connect mode.
2. Start RC-Toolkit or RC-Studio.
3. In the Systems List toolbar, click **Direct Connect** , then click **BIP (USB/Ethernet)** to make the Direct Connect with BIP (USB/Ethernet) connection.

Default USB settings

The controller ships with the following default USB port properties:

- **Quick Connect mode:** Enabled for Direct Connect connection using USB-A male-to-male cable.
- **USB driver:** Microsoft Windows Network Control Mode (NCM) driver.

USB connections in RC-Toolkit

Quick Connect mode is automatically set on the RC-FLEX device when you connect its USB-A port to a USB-A port on the computer running RC-Toolkit.

Note: This feature is available on RC-FLEX controllers with firmware version 1.5 or later and RC-Toolkit software version 3.4.2 or later.

The USB-connected device is highlighted orange in MSet Network view to indicate it is in Quick Connect mode. The device remains in Quick Connect mode as long as the USB cable is connected.

Quick Connect mode and the highlight remain active for a few minutes after you disconnect the USB cable, then the highlight and Quick Connect mode turn off.

After you connect the USB cable between the RC-FLEX controller and the computer, start RC-Toolkit, click the **Direct Connect**  icon, then click **B/IP (USB/Ethernet)**.

Unconfigured RC-FLEX controller

An unconfigured USB direct-connected RC-FLEX controller displays by itself in the Local Network node and also in all available networks in the System Tree.

Note: This behavior is unique for unconfigured RC-FLEX devices using the Direct Connect USB connection method.

Configured RC-FLEX controller

RC-Toolkit displays the MSet Network view where the configured USB direct-connected RC-FLEX controller resides. The network is expanded in the System Tree with the USB direct-connected RC-FLEX icon automatically selected. If you click **Local Network**, RC-Toolkit automatically selects the USB direct-connected RC-FLEX controller and displays it in its home network in the MSet Network view.

Set up a new RC-FLEX controller using USB

This describes how to use the USB-A port of a computer running RC-Toolkit to configure the network settings for a brand-new, factory-default RC-FLEX controller. Quick Connect mode is automatically set on the RC-FLEX device when its USB-A port is connected to the computer's USB-A port.

Important: The USB connection is for short-term configuration or troubleshooting. Leaving the USB connected to the workstation can cause network issues.

To configure a new RC-FLEX controller:

1. Connect the computer's USB-A port to the RC-FLEX controller's USB-A port using a USB-A cables and a USB-A hub.

Important: Always route USB connections through a USB hub with a good quality USB cable to help protect equipment and resolve protocol differences.

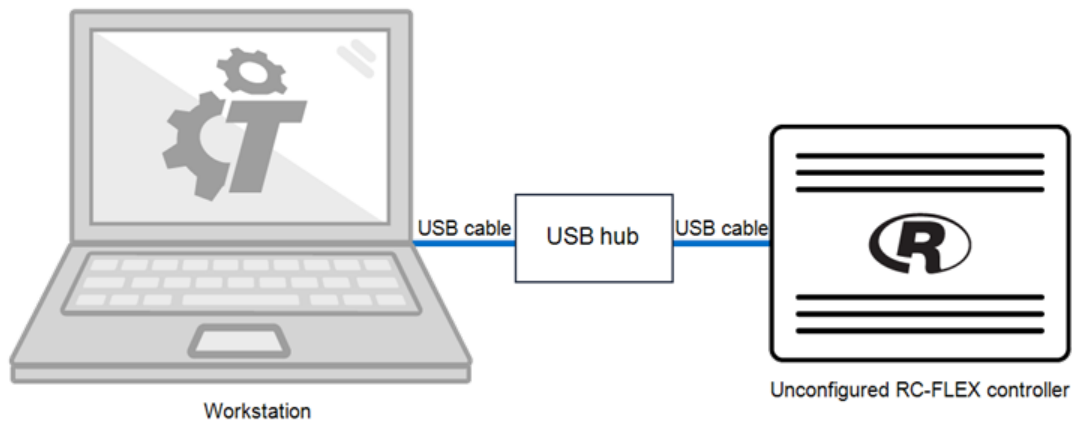


Figure 21: Typical USB direct connection from workstation to RC-FLEX controller

2. Start RC-Toolkit.
3. Click **Direct Connect**  then click **B/IP (USB/Ethernet)**.
The RC-FLEX controller displays by itself in the Local Network node. The controller is highlighted orange to indicate it is in Quick Connect mode.
4. Configure the controller's communications settings:
 - For the dual Ethernet model RC-FLEX controller, enter a unique device ID in the **Device ID** column, then fill in the Ethernet communications settings under **BACnet/IP Settings**.
 - For the MS/TP only (-M) model RC-FLEX controller, enter a unique device ID in the **Device ID** column.
5. Click Send .

Related information

RC-FLEXone USB 28

RC-FLEX USB driver information

The required USB driver is defined by the controller's firmware version:

- Firmware version 1.5 or later: The controller's USB port uses the Microsoft Windows Network Control Mode (NCM) driver. NCM is included in Windows 10 version 1903 (build 18362) or later, and Windows 11 version 21H2 (build 22000) or later.
- RC-FLEXair firmware versions 1.4.1 or earlier: The controller's USB port driver uses the Remote Network Driver Interface Specification (RNDIS) driver. Refer to the "USB support for older firmware" topic for instructions on how to download and install this driver.

Note: For optimum USB support we recommend you update the controller to the latest firmware.

Dual Ethernet model RC-FLEXone communications

This section describes how to connect to and communicate with the dual-Ethernet model RC-FLEX controller.

The controller ships from the factory unconfigured, with default settings designed for easy BACnet/IP network installation. To configure the controller, enter a unique device ID for the controller and the BACnet network's UDP port number. By default the controller ships with DHCP enabled, but can be configured with a static IP address.

Refer to the *Ethernet Best Practices Guide*, available from the Reliable Controls Support Center, for Ethernet network examples, recommended topologies, network and device numbering conventions, and troubleshooting.

Ethernet network requirements

Unitary dual Ethernet RC-FLEX devices are designed to be installed on a BACnet/IP network hosted by a router-model controller such as a MACH-ProCom, not as standalone Ethernet devices.

The controller ships with DHCP enabled by default for easy installation into a local area network with a DHCP server. The RC-FLEX device must be hosted on a BACnet/IP network managed by a router-model host controller such as a MACH-ProCom. You can also manually enter a static IP address if needed.

You cannot configure the RC-FLEXair or RC-FLEXone as a BACnet Broadcast Management Device (BBMD).

You must use a local BACnet/IP connection to make the initial connection to a factory-default RC-FLEX controller.

Default Ethernet settings

The controller ships with the following default Ethernet settings:

- **DHCP:** Enabled.
- **Device ID:** Unconfigured.

If no DHCP server is available, the controller assigns itself a link-local address using the standard link-local range of 169.254.0.0 to 169.254.255.255 with a subnet mask of 255.255.0.0.

Connect to an existing BACnet/IP network

This procedure describes how to use RC-Toolkit to discover the RC-FLEX controller by connecting it to an existing BACnet/IP network.

1. Connect the RC-FLEX controller's Ethernet port to the local BACnet/IP network.
2. Run RC-Toolkit and connect to the system.
3. Click **MSet**  to highlight the MSet tool, then click the network in the System Tree to select it and display the MSet network view worksheet.
 - If the RC-FLEX controller is unconfigured, it appears with a teal, or greenish-blue highlight in the network view worksheet. The highlighting does not turn off until after the controller is configured.

- If the RC-FLEX controller is already configured and does not appear in RC-Toolkit, place the controller in Quick Connect mode, then rediscover the network. RC-FLEX controllers in Quick Connect mode appear with an orange highlight in the network view worksheet. Quick Connect mode and the highlighting automatically turns off after 10 minutes.
4. Use the **MSet 1**  tool to select the controller and configure its communications settings.
 5. Click **Send**  to save the changes to the controller.

You can now connect to your controller using RC-Studio to manage, program, and view your controller information.

Related information

RC-FLEXone Ethernet 19

Set up an Ethernet ring with RSTP

Rapid spanning tree protocol (RSTP) allows devices in a managed Ethernet network to be connected in a ring or loop topology. This communications methodology provides Ethernet redundancy, so if one device in the Ethernet ring loses communication, all other devices before or after that lost device maintain Ethernet communications.

The Ethernet ring network can contain up to a maximum of 40 RC-FLEX devices, in addition to the dedicated managed network switch.

Required equipment: A dedicated managed network switch to isolate the ring bridge protocol data unit (BPDU) traffic from the rest of the Ethernet network.

1. Identify and label the managed switch ports to be used for uplink port, ring port 1, and ring port 2.
2. Connect the managed switch uplink port to the DHCP router or switch that links to the rest of the Ethernet network.
3. Connect ring port 1 to the first Ethernet ring network device, then connect the rest of the Ethernet ring network devices in a straight-line topology.

Note: Do not connect ring port 2 until you have configured all the networked devices in the Ethernet ring.

4. Configure the managed network switch ports. Refer to "Set up the managed network switch" for more information:
 - Uplink port: Block ring BPDU traffic.
 - Ring ports: RSTP/STP.
5. Configure all the Ethernet ring networked devices using the MSet tool in RC-Toolkit:
 - a. Select the network that contains the Ethernet ring.
 - b. Set the RSTP cell on all devices in the Ethernet ring to **Yes**. Double-click the RSTP cell for the

controller to toggle between Yes (RSTP enabled) or No (RSTP disabled).

- 6. Connect the other end of the Ethernet network ring to the managed switch ring port 2.

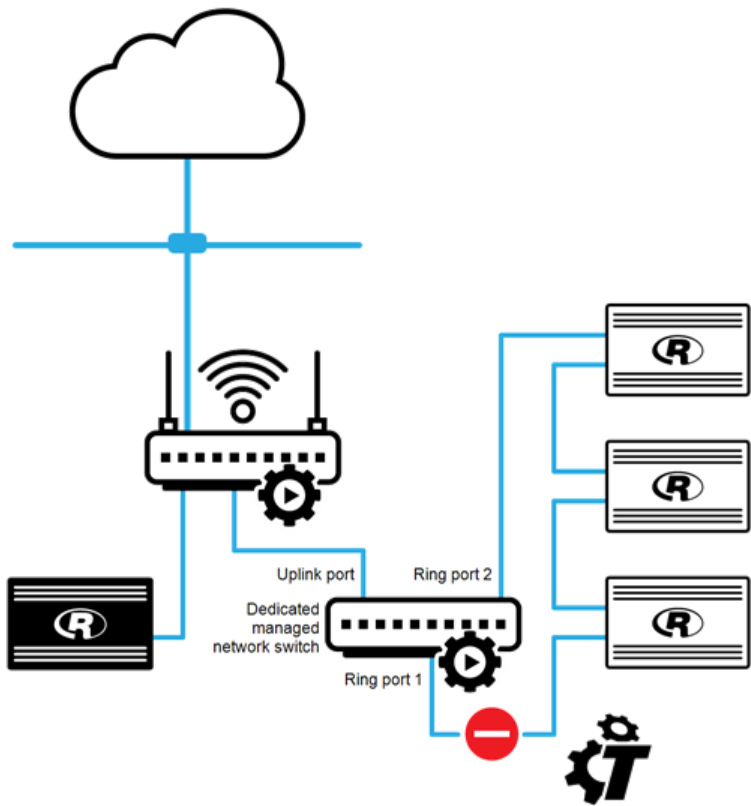


Figure 22: Ethernet ring topology with a dedicated managed network switch

Related information

Ethernet ring or loop topology..... 23

RSTP and RC-FLEX controllers

Enable rapid spanning tree protocol (RSTP) to configure RC-FLEX controllers in an Ethernet ring topology.

The Ethernet ring topology improves network resilience by providing connection redundancy. Because each Ethernet port is connected into the ring, if the ring is broken in one location, the controller can access the network through the other part of the ring.

You must follow the specific process to implement an operating Ethernet ring topology network, which involves configuring the Ethernet devices using RC-Toolkit. If you do not follow the correct process, you will lose Ethernet communications.

Each Ethernet ring can support 40 RC-FLEX controllers in addition to the managed network switch. The managed network switch is critical to isolate the RSTP network's ring bridge protocol data unit (BPDU) traffic from the rest of the network.

Neighbor detection, or link layer discovery, is part of the RSTP implementation on RC-FLEX controllers. Network tools used by IT specialists can access this information to identify broken links or device offline issues without needing knowledge of BACnet.

IT specialists can use third-party network troubleshooting tools to identify broken link or device offline issues

RC-FLEX controllers have additional proprietary BACnet properties you can use in a System Group to manage, maintain and troubleshoot your network. These properties include the RC-FLEX controller's Ethernet ports status and information about neighboring devices.

Set up the managed network switch

For an Ethernet network ring, you must have a dedicated managed network switch to isolate ring BPDU traffic from the rest of the network.

Many managed network switches perform this function.

Reliable Controls does not recommend a specific managed network switch. Contact the Application Engineering team for information about managed network switches that they have successfully implemented in the field.

To configure the dedicated managed network switch:

1. Select STP switching.
2. Enable two ports, one for ring port 1 and one for ring port 2.
3. Disable all other outgoing ports.
4. Enter the following Classic Spanning Tree (CST) protocol settings:
 - **Bridge Priority:** 0
 - **Bridge Max Age (secs):** 40
 - **Bridge Forward Delay (secs):** 30
 - **Spanning Tree Max Hops:** 40
5. Enter the following Spanning Tree Protocol (STP) settings:
 - **Spanning Tree State:** Enable
 - **STP Operation Mode:** RSTP

Example for reference only

Reliable Controls used this example to configure a Netgear GS308T managed switch. This process is intended to only provide guidance when configuring managed network switches. Consult the manufacturer's documentation for setup instructions for your managed network switch.

1. Connect to the Netgear switch configuration webpage.
[Refer to Netgear switch STP configuration.](#)
2. Select **Switching > STP** in the top menu tabs.
3. Select **Advanced > CST Port Configuration** is the left-hand **STP** menu.
4. Enable the two physical ports used for ring port 1 and ring port 2.
5. Disable all other ports.

6. Click **Apply**.
7. Select **Advanced > CST Configuration** in the left-hand **STP** menu.
8. Enter the following settings in the **CST Configuration** screen and click **Apply**:
Refer to Netgear switch CST configuration.
 - **Bridge Priority:** 0
 - **Bridge Max Age (secs):** 40
 - **Bridge Forward Delay (secs):** 30
 - **Spanning Tree Max Hops:** 40
9. Select **Advanced > STP Configuration** in the left-hand **STP** menu.
10. Enter the following settings in the **Global Settings** area, and click **Apply**:
Refer to Netgear switch Global Settings configuration.
 - **Spanning Tree State:** Enable
 - **STP Operation Mode:** RSTP
 - **Forward BPDU while STP Disabled:** Disable

STP configuration

Configuration screens may display differently for different products and product revisions.

NETGEAR

S350 Series 8-Port Gigabit Ethernet Smart Managed Pro Switch

Auto Welcome admin

System Switching QoS Security Monitoring Maintenance Help Index

Ports LAG VLAN Auto-Vo STP Multicast Address Table L2 Loop Protection

Cancel Apply Refresh

Go To Interface Go

STP

Port Configuration

1 LAG All

Go To Interface Go

Interface	STP Status	Fast Link	BPDU Forwarding	Auto Edge	Port State	Path Cost	Priority	External Port Path Cost	Port ID	Hello Timer
☒ g1	Enable	Disable	Enable	Enable	Forwarding	200000	128	200000	128.1	2
☒ g2	Enable	Disable	Enable	Enable	Forwarding	200000	128	200000	128.2	2
☐ g3	Disable	Disable	Disable	Enable	Disabled	0	128	0	128.3	2
☐ g4	Disable	Disable	Disable	Enable	Disabled	0	128	0	128.4	2
☐ g5	Disable	Disable	Disable	Enable	Disabled	0	128	0	128.5	2
☐ g6	Disable	Disable	Disable	Enable	Disabled	0	128	0	128.6	2
☐ g7	Disable	Disable	Disable	Enable	Disabled	0	128	0	128.7	2
☐ g8	Disable	Disable	Disable	Enable	Manual Forwarding	20000	128	20000	128.8	2

1 LAG All

Go To Interface Go

CST configuration

Configuration screens may display differently for different products and product revisions.

NETGEAR®

S350 Series 8-Port Gigabit Ethernet Smart Managed Pro Switch

Auto Welcome admin

System Switching QoS Security Monitoring Maintenance Help Index

Ports LAG VLAN Auto-VoIP STP Multicast Address Table L2 Loop Protection

Cancel Apply Refresh

STP CST Configuration

- Basic
- Advanced
 - STP Configuration
 - CST Configuration**
 - CST Port Configuration
 - CST Port Status
 - RSTP
 - MST Configuration
 - MST Port Configuration
 - STP Statistics

Bridge Priority: 0 (0 to 61440)

Bridge Max Age (secs): 40 (6 to 40)

Bridge Hello Time (secs): 2

Bridge Forward Delay (secs): 30 (4 to 30)

Spanning Tree Max Hops: 40 (6 to 40)

MSTP Status

MST ID	VID	FID
0	1-2,4089	1-2,4089

Global settings configuration

Configuration screens may display differently for different products and product revisions.

NETGEAR®

S350 Series 8-Port Gigabit Ethernet Smart Managed Pro Switch

Auto Welcome admin

System Switching QoS Security Monitoring Maintenance Help Index

Ports LAG VLAN Auto-VoIP STP Multicast Address Table L2 Loop Protection

Cancel Apply Refresh

STP Global Settings

- Basic
- Advanced
 - STP Configuration
 - CST Configuration**
 - CST Port Configuration
 - CST Port Status
 - RSTP
 - MST Configuration
 - MST Port Configuration
 - STP Statistics

Spanning Tree State: ☐ Disable ☒ Enable

STP Operation Mode: ☐ STP ☒ RSTP ☐ MSTP

Configuration Name: C8-9E-43-AA-4C-20

Configuration Revision Level: 0 (0 to 65535)

Configuration Digest Key: 0xac36177f50283cd4b83821d8ab26de62

Forward BPDUs while STP Disabled: ☒ Disable ☐ Enable

STP Status

Bridge Identifier	Time Since Transition
00:00:C8:9E:43:AA:4C:20	0 days 0 hr 1 min 26 sec

RC-FLEX Ethernet ring alarms

All devices with Rapid Spanning Tree Protocol (RSTP) enabled in a managed Ethernet ring monitor the network for communications problems such as an unplugged or broken cable in the Ethernet ring. When this happens, RC-Studio triggers an alert about the broken communications link.

The following examples show how RSTP monitors the state of the Ethernet network:

Example 1: RSTP normal operation

The System Group below shows the normal state of the Ethernet ports, where 1 = working properly and 2 = blocked by RSTP:

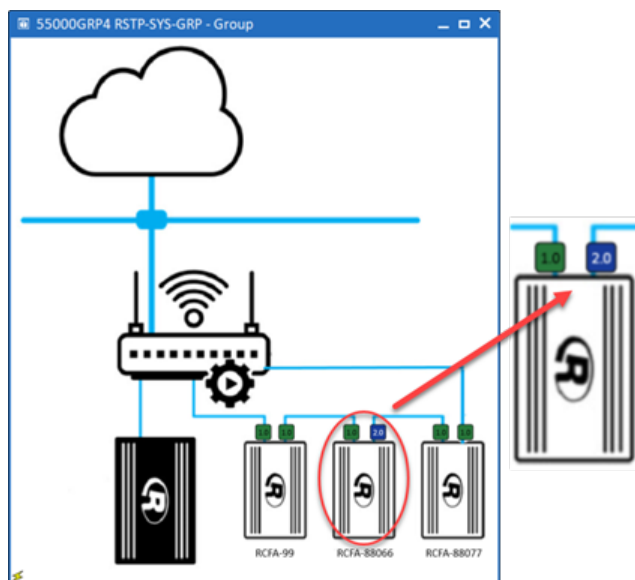


Figure 23: RC-Studio System Group with RSTP blocked state

Example 2: Ethernet cable unplugged or broken

The System Group below shows the states of the Ethernet ports when the cable that connects the first and second RC-FLEX devices is disconnected or broken, as indicated by port state 0 = Ethernet port is down or communications link is not working:

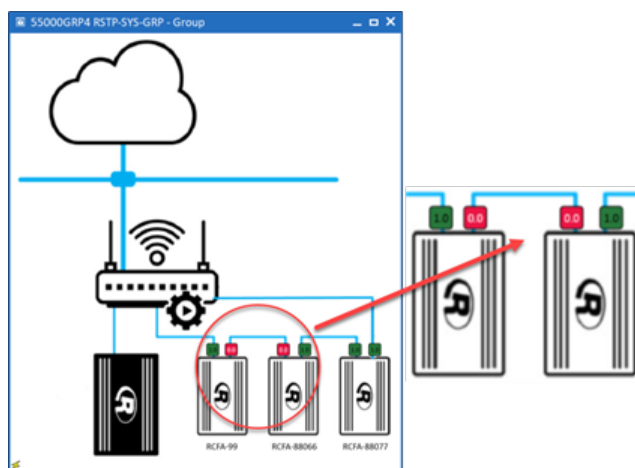


Figure 24: RC-Studio System Group with a broken Ethernet link

The RC-FLEX devices alert the system about the broken communications link status and send alarms. In this example, the first device reports its Ethernet port 2 has lost communications, and the second device reports its Ethernet port 1 has lost communications:

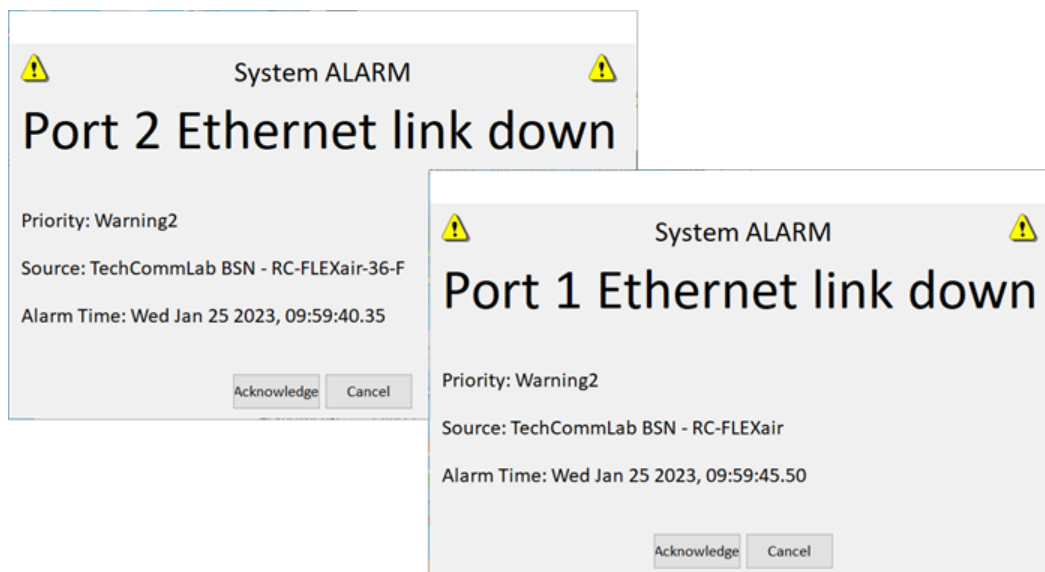


Figure 25: RC-Studio alarm messages show device and Ethernet port information for the broken link

MS/TP (-M) model RC-FLEXone communications

This section describes how to connect and communicate with the MS/TP model RC-FLEXone (-M) controller.

The MS/TP model RC-FLEXone controller uses BACnet protocol to communicate over its EIA-485 port. The controller ships from the factory unconfigured. Use one of the following connection methods to configure the controller:

- A computer running RC-Toolkit.
- SETUP-Tool or a SMART-Sensor EPD in MSet mode.

EIA-485 networking requirements

MS/TP (-M) model RC-FLEX devices and other BACnet MS/TP devices are designed to be wired to the EIA-485 port of a router-model controller such as a MACH-ProCom, which hosts and manages all BACnet communications on its MS/TP-Net port..

Default MS/TP settings

The controller ships with the following default EIA-485 MS/TP settings:

- **BACnet device ID:** Not set.
- **EIA-485 baud rate:** Auto-detect.
- **End-of-Line switch:** Off.

Baud rate configuration

The controller is factory-set with the baud rate set to auto-detect so you can easily add it to an existing MS/TP network.

When you configure your controller over an MS/TP network, part of that configuration should include setting a fixed baud rate. Use the MSet tool in RC-Toolkit to set the baud rate for all devices on the network. Some devices allow you to set the baud rate on each device individually.

Note: You cannot set the baud rate on an individual MS/TP-only controller; instead you must use the MSet tool in RC-Toolkit to set the baud rate for all devices on the MS/TP-Net network.

How auto-detect works

When the controller powers up in auto-detect mode, it listens on the default baud rate of 76800 for valid MS/TP communication.

- If the controller detects a valid MS/TP frame, which indicates an active, functioning MS/TP network, it starts normal MS/TP communications at that baud rate.
- If the controller detects invalid network activity, it waits for a period of time, then goes back through the auto-detect process of listening on the different baud rates for valid MS/TP network communications.
- If the controller does not detect valid MS/TP communications, the controller goes to the next lowest baud rate to listen for valid MS/TP communications.
 - If the controller cycles through all the baud rates and does not detect any valid MS/TP communication, it returns to the default baud rate and listens to determine its next action.
 - If the controller does not detect any network activity for a set period of time, it assumes it is the only manager on the network. The controller generates its own token and communicates over MS/TP at the default baud rate.

Why set a fixed baud rate?

If you have a simple MS/TP network, with short cable runs and devices with similar power-up durations that operate at the default baud rate of 76800, you may not have any issues with leaving your device's baud rate in auto-detect.

If you have a complex MS/TP network, with subnetworks, long cable runs, and devices with different power-up durations from different manufacturers that do not operate at the default baud rate of 76800, setting a fixed baud rate helps your MS/TP network recover from a power cycle or reset.

Auto-detect can cause MS/TP network issues if the following conditions are present:

- If the device that defines the network's baud rate—the baud manager—has a long power-up duration, during the delay the other devices on the network define the network's baud rate and start communicating. If the baud rates are different, the baud manager can't communicate on the MS/TP network.
- If the network has long and noisy cable runs, devices in auto-baud always detect network errors. This can put auto-baud devices in a condition where they continuously cycle through the different baud rates, but because they do not find any valid MS/TP communications, they cannot detect the correct network baud rate.

For more information, refer to *Application Notice 14, EIA-485 Wiring Types*, and *Application Notice 20, Troubleshooting EIA-485 Networking Problems*, available on the [Reliable Controls Support Center](#).

For these reasons, Reliable Controls recommends setting a specific baud rate on all MS/TP networked devices.

Note: Use RC-Toolkit to send a network configuration message that sets the baud rate for all devices on the MS/TP network.

Identify and troubleshoot auto-detect baud rate issues

Observe the controller's status LED. If it is flickering green, it is communicating normally on the MS/TP network. If it is green and blinking on/off, there is a network communication issue.

Connect an MSet Tool to the controller to view the current baud rate.

Connect to your network using RC-Toolkit, select an MS/TP device, and select the Network Diagnostics tool. In the Network Diagnostics tool, click **Advanced**, and select **MS/TP** to view information about the MS/TP network. The following list of values can help you identify issues related to auto-detect baud rate settings:

- **Link speed:** The baud rate, which should be the same value for all devices on the MS/TP network.
- **Baud changes :** The number of times the baud rate has changed. If this value is increasing, it could indicate an auto-detect race condition.
- **Total UART errors:** The total number of UART errors. If this value is increasing, it could indicate data at other baud rates on the network.

Refer to RC-Toolkit online help for detailed information about the Network Diagnostics tool.

Connect to an existing MS/TP network

This procedure describes how to use RC-Toolkit to discover the new controller after connecting it to the MS/TP port of a host controller in an existing BACnet MS/TP network.

The following features let you add one or more new controllers to an existing MS/TP network without causing network conflicts:

- **Auto-Baud:** The controller senses the network baud rate and automatically configures itself to communicate at the same rate.
- **Undefined device ID:** The controller ships with undefined BACnet device ID and MAC, so you can add new units to an MS/TP network without creating address conflicts.

To connect to the new controller:

1. Run RC-Toolkit, and connect to the BACnet network that contains the host controller.
2. In the System Tree, right-click the top node, then click **Rediscover Network**.
Any new devices are populated as nodes in the System Tree.
3. Use the **MSet 17** tool to select the controller and configure its communications settings.
4. Click **Send**  to save the changes to your controller.

You can now connect to your controller using RC-Studio to manage, program, and view your controller information.

Set up MS/TP communications using the SMART-Sensor MSet Tool

Use the SETUP-Tool or a SMART-Sensor EPD (SS3-E) in MSet Tool mode to configure communications on a Reliable Controls controller.

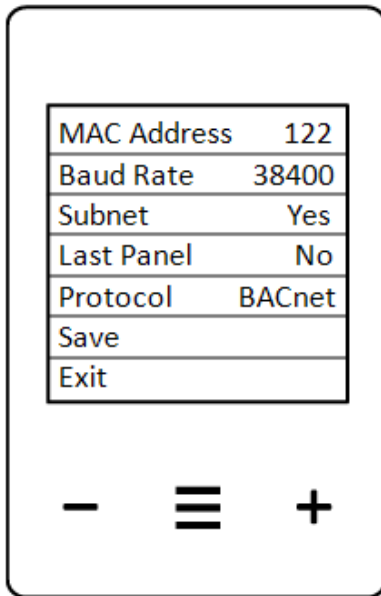


Figure 26: SMART-Sensor EPD in MSet Tool mode

To put a SMART-Sensor EPD in MSet Tool mode and configure your controller:

1. Connect the SMART-Sensor to the controller's SMART-Net port.
2. Hold **—** and **+** for 5 seconds and then release.
3. Wait for 2 seconds.
4. Tap **—**.
The Dealer Menu appears.
5. In the Dealer Menu, use **list** **≡** to select the **MSet** row.
6. Tap **+** to enter the MSet Tool menu.
7. In the MSet Tool menu, tap **list** **≡** to select the next configurable parameter. Use **—** and **+** to modify parameters.
8. Tap **list** **≡** to select the **Save** row.
9. Tap **+**.
The SMART-Sensor sends the modified parameters to the controller.
10. Tap **list** **≡** to select the **Exit** row.
11. Tap **+** to return the SMART-Sensor to normal operation.

Note: For more information about the SMART-Sensor and MSet Tool, see the SMART-Sensor product documentation, available from the Reliable Controls Support Center.

Direct connect to controller using X-Port-2

Use the X-Port-2™ Converter to establish MS/TP-Net communications between a workstation running Reliable Controls software and the controller.



Figure 27: Computer connection to the controller's SMART-Net and MS/TP ports using the X-Port-2

1. Determine the cable you need, based on the type of SMART-Net port available on your controller:

Controller SMART-Net port type	eBusiness part #	Controller connections
RJ11 socket	SS-VC-C	RJ11 connector to the controller's SMART-Net RJ11 socket
5.0 mm 4-pin terminal socket	CC-MULTI-XP2	2-wire 5.0 mm connector to the controller's MS/TP-Net 2-pin terminal socket 4-wire 5.0 mm connector to the controller's SMART-Net 4-pin terminal socket
3.5 mm 4-pin terminal socket	CC-MULTI-XP2	2-wire 3.5 mm connector to the controller's MS/TP-Net 2-pin terminal socket 4-wire 3.5 mm connector to the controller's SMART-Net 4-pin terminal socket

2. Insert the cable's RJ11 plug to the X-Port-2 Converter's SMART-Net port, then connect the other end to the controller.
The Network Status LED flashes.
3. Wait until the PC/Modem Status LED on the X-Port-2 flashes once per second.
This indicates the communications connection from controller to X-Port-2 is established.
4. Connect the workstation's USB port to the X-Port-2 Converter's PC/Modem port using the CNV-USB-232 (USB to DB9) adapter cable, CC-C1-B (DB9 to RJ11) adapter base and CC-C1-C (RJ45 data) cable.

5. Open Microsoft Windows Device Manager and identify the COM port number corresponding to the USB port that is connected to the adapter cable.
6. Open RC-Toolkit, click **Options > Communications Preferences**.
7. Under Direct set the **Port** to the same COM port number as above.
8. Click Direct Connect  to initiate communications between RC-Toolkit and the controller.

Note: You can purchase adapters, cables and accessories from [eBusiness](#).

Reset button

To prevent unintended activation, the reset button is recessed within a small opening in the controller's housing. Use a small screwdriver to reach the reset button.

The reset button:

- Clears the controller database, or clears the controller database and resets the controller network settings to factory defaults.
- Places the controller in Quick Connect mode.
- Turns on or turns off the End-of-Line function on the MS/TP (-M model) RC-FLEX controller.
- Identifies the controller with an orange highlight in the RC-Toolkit MSet network view.

Reset the controller

Use the reset button to clear the controller database or reset the controller to its original factory default settings:

- Clearing the database: Deletes the controller's Panel File and stored database information, such as trend log data, alarm buffers, Net Ins and Net Outs and programs. Controller network settings, such as device ID, are retained.
- Resetting the controller to factory defaults: In addition to deleting the controller's database, all network configuration for the controller are deleted and reset to factory defaults.

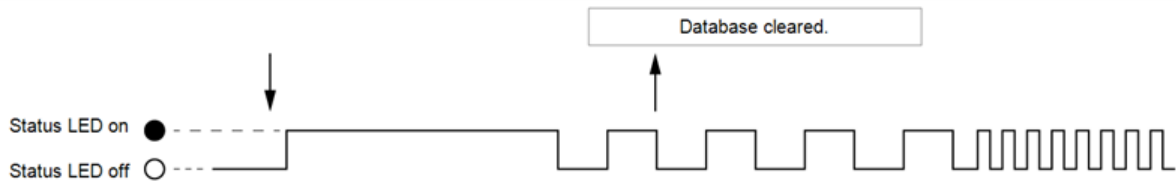
The controller's firmware is not affected by resets.

Important: Before you begin, back up the controller's Panel File. If resetting the controller to factory defaults, make note of the controller's network settings or print the controller's MSet setting in RC-Toolkit.

Clear the controller database

1. Disconnect or remove power from the controller.
2. Press and hold the reset button.
3. Keep holding the reset button while you reconnect power to the controller.
The Status LED lights up.

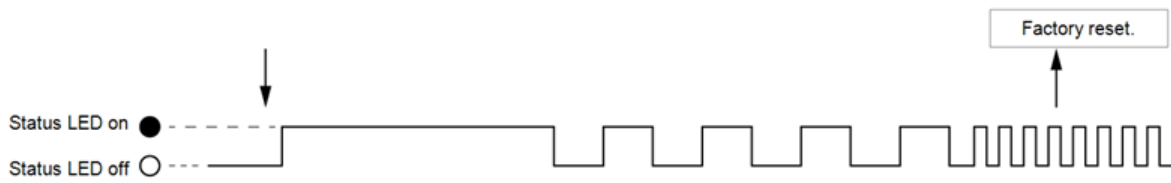
- Continue holding the reset button and observe the Status LED behavior change from solid on to a slow two-seconds on and two-seconds off blink pattern: this indicates that the controller database has been cleared. The blink pattern transition can occur anytime between approximately 10 to 25 seconds.



- Release the reset button.

Reset to factory default settings

- Disconnect or remove power from the controller.
- Press and hold the reset button.
- Keep holding the reset button while you reconnect power to the controller.
The Status LED lights up.
- Continue holding the reset button and observe the Status LED behavior change from solid on to a slow two-seconds on and two-seconds off blink pattern. Keep holding the reset button.
- Observe the Status LED behavior change to a rapid two flashes per second pattern: this indicates that the controller has been reset to factory defaults. This could take over 35 seconds.



- Release the reset button.

Quick Connect mode using the reset button

You can use the RC-FLEX controller reset button to place the controller in Quick Connect mode for 10 minutes:

- Confirm the controller is powered on and the status LED indicates normal operation.
- Press and hold the reset button on the powered controller for at least three seconds.
- Release the reset button when the LED blink pattern changes to two rapid flashes every two

seconds. This flash pattern indicates the controller is in Quick Connect mode.



While in Quick Connect mode, the controller appears with an orange highlight in the RC-Toolkit MSet network view. Quick Connect mode and the orange highlighting turns off after 10 minutes.

See the "Quick Connect mode" topic for a detailed description of this feature.

Turn on or turn off the End-of-Line function

The End-of-Line function controls a soft switch that connects or disconnects a biasing resistor across the EIA-485 terminals. The EOL LED is on if the biasing resistor is connected, and off if the resistor is not connected.

If the MS/TP (-M model) controller is the last physical device on the EIA-485 network, turn End-of-Line on. You can use RC-Toolkit, a SETUP-Tool, a SMART-Sensor in MSet mode, or the controller's reset button to turn End-of-Line on or off. The default setting for End-of-Line is off.

To turn on End-of-Line using the reset button:

1. Ensure the controller is powered on.
2. Insert a small screwdriver in the hole where the recessed reset button is located.
3. Double-press the reset button.
4. Confirm the EOL LED illuminates to indicate that End-of-Line is on.

Use this same procedure to turn off End-of-Line and confirm that the EOL LED is off.

Identify an RC-FLEX controller using RC-Toolkit

You can temporarily highlight a controller in the RC-Toolkit MSet network view worksheet with a short press of the reset button. This feature can help troubleshoot or validate the physical location of a networked RC-FLEX controller. The orange highlight turns off after 10 minutes.

Note: This procedure does not enable Quick Connect mode.

1. Connect to the system with RC-Toolkit.
2. Select the appropriate network to display the MSet network view worksheet.
3. Go to the physical RC-FLEX controller.
4. Confirm that the controller is powered on.
5. With the controller powered, press the RC-FLEX controller reset button with a single, quick one-second press and release.

This applies an orange highlight to that controller in the RC-Toolkit MSet network view worksheet for 10 minutes.

Quick Connect mode

Quick Connect mode enables an additional factory-default communication port on the controller's Ethernet and USB ports. This allows you to connect to the controller without needing to disconnect the controller's Ethernet or MS/TP network connections.

When Quick Connect mode is enabled, the controller's status LED shows the Quick Connect blink pattern (two blinks per second), and the controller appears with an orange highlight in the RC-Toolkit MSet network view worksheet. The LED blink pattern and orange highlighting continues as long as the controller is in Quick Connect mode.

The Quick Connect mode duration depends on how it is enabled:

Quick Connect activation method	Quick Connect duration
Reset button is pressed and held for three seconds.	10 minutes.
RC-FLEX controller transitions from unconfigured to configured state.	10 minutes.
RC-FLEX controller is connected to the computer USB port using a USB-A male-to-male cable.	While the USB cable is connected.

Note: Quick Connect through a USB direct connection applies to RC-FLEX controllers running firmware 1.5.1 or later, and RC-Toolkit version 3.4.2 or later.

Disable Quick Connect mode

For security hardening, it may be necessary to disable Quick Connect mode on your controller.

The BACnet device property Allow_Quick_Connect_Mode (:1329) controls whether or not you are allowed to put the RC-FLEX controller into Quick Connect mode. By default, Quick Connect mode is allowed (Allow_Quick_Connect_Mode (:1329) is set to **True**).

Set the BACnet device property Allow_Quick_Connect_Mode (:1329) to **False** to disable Quick Connect mode:

1. In RC-Studio, go to **Main > Data > Read/Write BACnet Properties** to open the Read/Write BACnet Properties dialog box.
2. Enter the controller information to enable or disable the Quick Connect operation:
 - **Device ID:** Device ID
 - **Object:** 8 (device)
 - **Instance:** Device ID
 - **Property:** 1329

3. Click **Read Property**.

4. To disable Quick Connect, set the value to **False**, then click **Write Property**.

To allow Quick Connect mode, repeat the procedure, set the value to **True**, then click **Write Property**.

Connect to a configured RC-FLEX controller

Connect to a configured RC-FLEX controller using a Systems List connection or Direct Connect > B/IP (USB/Ethernet).

Systems List connection

To make a Systems List connection, you must know the connection details to access your BACnet/IP network, such as the host controller's IP address and device ID, and the BACnet UDP port. You must also know the network access username and password. To communicate to a specific controller on the hosted BACnet/IP network, you need to know its device ID and subnet. If you know the IP address, enter that information to make a Systems List connection for that controller.

Systems List connections allow you to consistently connect to all devices on the BACnet network and allow for routing over RC-RemoteAccess B/SN connections. The Systems List on your workstation is used by both RC-Toolkit and RC-Studio.

To connect using the Systems List, run RC-Toolkit or RC-Studio, select a Systems List entry, click **Connect**, and enter network access credentials.

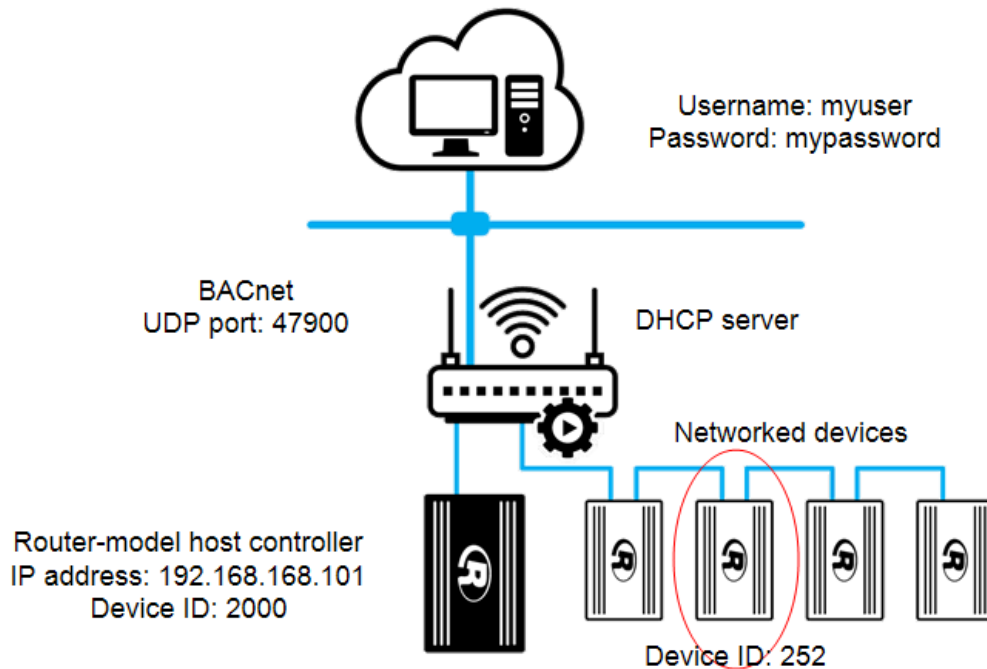


Figure 28: Systems List connection to host controller and its networked devices

Direct Connect connection

To make a Direct Connect connection, you need local access to an RC-FLEX controller in Quick Connect mode. Quick Connect opens a default configuration port on the controller to communicate without affecting existing connections.

For a Direct Connect connection, you do not need connection information such as IP addresses or network access credentials.

You can use USB or Ethernet to make a Direct Connect connection.

USB connection

Connect to the RC-FLEX controller's USB port to automatically put the controller in Quick Connect mode.

Important: Always route USB connections through a USB hub with a good quality USB cable to help protect equipment and resolve protocol differences.

Important: The USB connection is for short-term configuration or troubleshooting. Leaving the USB connected to the workstation can cause network issues.

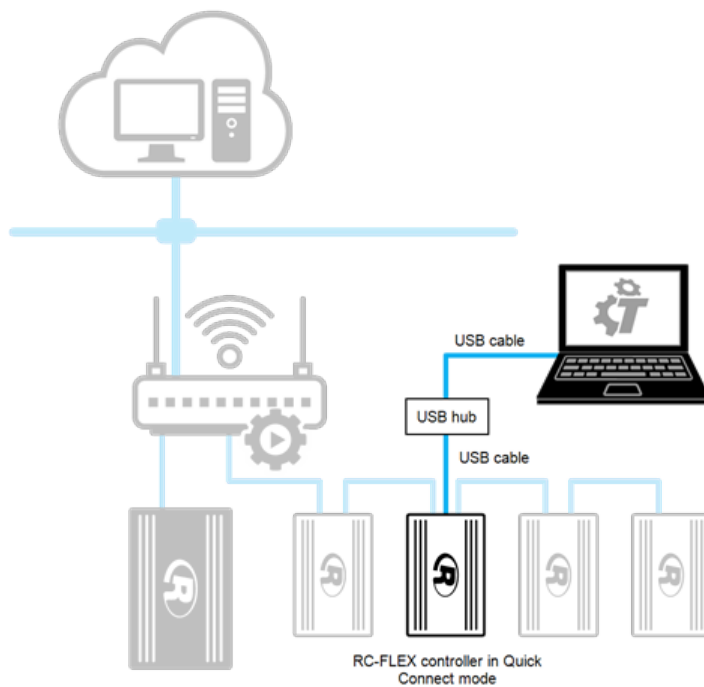


Figure 29: Direct USB connection to temporarily verify or troubleshoot a networked RC-FLEX controller

Ethernet connection

Press the reset button on a powered RC-FLEX controller for more than 3 seconds to put the controller in Quick Connect mode for 10 minutes. Connect the Ethernet ports of the RC-FLEX controller and a workstation to the local network switch.

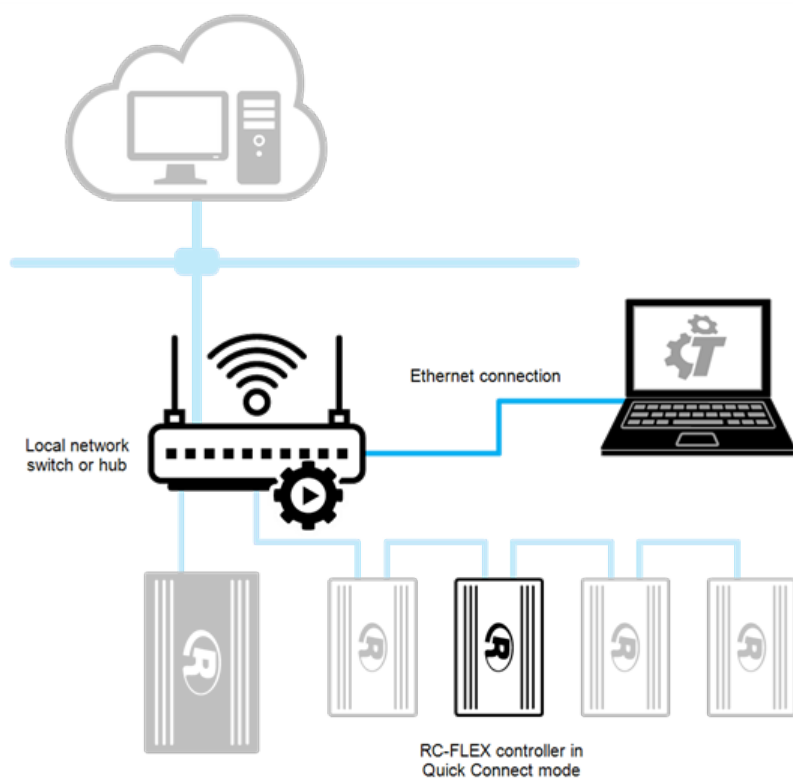


Figure 30: Ethernet connection to detect an RC-FLEX controller in Quick Connect mode

Once you have made the physical connections, run RC-Toolkit or RC-Studio on your local workstation and click **Direct Connect > B/IP(USB/Ethernet)** to connect to the RC-FLEX controller in Quick Connect mode.

Configure and program the RC-FLEXone

Use RC-Studio to configure the operation of your controller.

RC-Studio and your controller

Use RC-Studio to configure the functions available on your controller. Upgrade to the latest software release for new features, improvements, and fixes.

Use the worksheets in RC-Studio to configure your controller's input and output characteristics and any connected SMART-Net devices. You can also define the controller's objects, such as values, trend logs, loops, and calendars, in RC-Studio worksheets. Create System Groups and write programs in the software to provide a graphical interface to your Reliable Controls system.

The RC-Studio System Tree includes a Network Status worksheet for each network that displays controller information, including the firmware version and available memory.

For more information, refer to the RC-Studio online help. eLearning courses are available through the Reliable Controls Learning Center.

FLEX I/O

Your controller has FLEX I/O terminal connections that are configured through software to operate as either an input or an output.

The FLEX I/O wiring terminals are indicated by a letter instead of a number. The object mnemonics are numbered based on their potential input or output row. For example, in an RC-FLEX controller with four inputs (IN1-IN4), four FLEX outputs (FO1-FO4), and four FLEX I/O connections (FIOA-FIOD), the fifth input and output are reserved for the first FLEX I/O (FIOA).

In RC-Studio the FLEX I/O has assigned rows in the Inputs and Outputs worksheets but are only active and editable in the worksheet that corresponds to its configuration type. If a FLEX I/O is configured as an output, the associated row in the Inputs worksheet is grayed out and the **Range** is Unavailable.

Name	Value	Auto/Man	Range	Sensor Type	Calibration	Average	D	Alarm	Description	On Time	Today	Object	Trend Log
1 DUCT 40	0.0	Auto	Unused	RTD	0.00 1	Y						AI1	---
2 DUCT 60	0.0	Auto	Unused	RTD	0.00 1	Y						AI2	---
3 Room Temp	0.0	Auto	Unused	Thermistor	0.00 1	Y						AI3	---
4													
5													
6													
7													
8													
9 (A) Flex input	15.0	Manual	Unused	Thermistor	0.00 1	Y						AI9	---
10 (B) FLEX I/O in use as Output			Unavailable										---
11 (C)													
12 (D)													

Name	Value	Auto/Man	Switch	Range	Type	ON	100%	Min. Off	Min. On	S	D	Alarm	Description	Program	In Service	On Time	Today	Object	Trend Log
1 AH10 SF	Off	Auto	Auto	Off/On	Relay							Y	Supply Fan Sta		Yes	0000:00	0	BO1	---
2 AH10 MAD	Off	Auto	Auto	Off/On	Relay							Y	Mixed Air Dam		Yes	0000:00	0	BO2	---
3																			
4																			
5																			
6																			
7																			
8																			
9 (A) FLEX I/O in use as Input				Unavailable	Relay							Y			Yes	0000:00	0	BO10	---
10 (B) Flex output																			
11 (C)																			
12 (D)																			

Configure FLEX I/O using RC-Studio

Set your controller's FLEX I/O using the controller's Inputs and Outputs worksheets in RC-Studio. The FLEX I/O does not function until you configure it in RC-Studio.

Important: When you configure a FLEX I/O, make sure it matches the wiring of the physical terminals.

To configure a FLEX I/O:

1. Connect to your controller using RC-Studio.
2. Open the Inputs worksheet.
3. Configure the FLEX I/O connections that are physically connected to input devices.
4. Open the Outputs worksheet.
5. Configure the FLEX I/O connections that are physically connected to output devices.

To clear a FLEX I/O configuration, select the row and click **Edit > Delete object**. You can now configure the FLEX I/O an input or output.

Related information

Wire the RC-FLEX controller FLEX outputs (FO) or FLEX I/O (FIO) outputs..... 33

Configure pulse counting inputs

Use the Inputs worksheet in RC-Studio to configure inputs for pulse counting applications. This feature is supported on controllers with firmware version 1.4 and later.

The controller firmware includes algorithms that can improve pulse counting accuracy with filtering options and an anticipated input pulse profile.

In addition, FLEX I/O features improved input hardware to help detect pulses and debounce mechanical switch inputs to reduce false readings. If your controller supports FLEX I/O, we recommend you configure the FLEX I/O as an input and use it for your pulse counting application.

Note: The original pulse counting **Range** of **0-2³²** has been renamed to **Pulse Count**.

To configure pulse counting inputs in RC-Studio 3.9.2 or later:

1. Open the Inputs worksheet for your controller.
2. Select the input being used for pulse counting.

3. Select a **Range** that matches your pulse counting application. We recommend you set the Range and Unit to **Pulse Count S0** or **Pulse per Minute S0**.
An **S0 Range** counts pulses based on the following input profile:
 - Minimum off time: 30 ms
 - Minimum on time (pulse width): 30 ms
 - Frequency: 16 Hz
4. Set **Sensor Type** to **Pulse Counting** if you are using FLEX I/O as pulse counting inputs. Otherwise, **Sensor Type** is automatically set to **Thermistor**.

Note: For S0 compliant pulse counting, use a FLEX I/O input configured with **Sensor Type** as **Pulse Counting** and an **S0 Range**.

Use these **Range** and **Sensor Type** settings in the Inputs worksheet for the following pulse counting applications:

Application	Range	Sensor Type
Fast CT flow meter with fast pulse rate.	Pulse Count	0-10 V
Dry contact with fast pulse rate. Susceptible to electrical noise, which might affect accuracy.	Pulse Count	Thermistor
Slow pulse rate with ambient noise.	Pulse Count S0	Thermistor
Slow pulse rate with noisy switch (FLEX I/O inputs only).	Pulse Count S0	Pulse Counting*
Fast pulse rate with ambient noise (FLEX I/O inputs only).	Pulse Count Filtered	Pulse Counting*
Fast CT flow meter with slow pulse rate.	Pulse Count Filtered	0-10 V
*The Pulse Counting Sensor Type is only available on FLEX I/O inputs.		

Automatic trend logs

The controller automatically creates Single-point Trend Logs for the following primary BACnet objects:

- Inputs, outputs, and values
- Loops
- Schedules and calendars

The controller generates the log name for an automatically created Single-point Trend Log by adding -TL or -RTL to the object's name. You cannot delete an automatically created Single-point Trend Log or change the associated object.

The automatically created Single-point Trend Log is the object BACnet property Auto_Log_Reference (:1330). You can use this BACnet property to access the object's automatic trend log in a System Group instead of specifying the Single-point Trend Log instance.

If you change the object's name or type, the controller updates the automatically created Single-point Trend Log to reflect the change. If you delete the object, the controller automatically deletes the trend log.

If you configure the controllers using Panel File Templates, Single-Point Trend Log instances may vary from controller to controller to prevent overwriting the automatic Single-Point Trend Logs.

Automatically created Single-point Trend Logs for binary and multistate objects, and calendars have the following default configuration:

- Name: Object name-RTL. Example: AH1-HCP-**RTL**
- Log Type: COV (change of value)
- Length: 1,000 records
- Increment: 1

Automatically created Single-point Trend Logs for calendars have the following default configuration:

- Name: Object name-RTL. Example: AH1-HCP-**TL**
- Log Type: COV (change of value)
- Length: 1,000 records
- Increment: 1

Automatically created Single-point Trend Logs for schedules have the following configuration:

- Name: Object name-RTL. Example: AH1-SCHED1-**TL**
- Log Type: COV (change of value)
- Length: 1,000 records
- Increment: 0.0001

Automatically created Single-point Trend Logs for analog objects and loops have the following default configuration:

- Name: Object name-TL. Example: AH1-MAD-**TL**
- Log Type: Polled
- Length: 1000 records
- Interval: 00:05:00 (5 minutes)

Advanced settings for these logs have the following default configuration:

- Always Start: Selected
- Never Stop: Selected
- Stop When Full: Not selected
- Clear Log Data: Not selected

Supported Control-BASIC statements and functions

The RC-FLEX controller supports a subset of the Control-BASIC statements and functions. Reliable Controls protocol (RCP) statements and functions are not supported.

Note: If the controller's runtime interpreter encounters a statement or function it does not support, the program exits at that line and sets the Exit status for that program to Yes.

Supported Control-BASIC statements

The controller supports the following Control-BASIC statements:

Alarm/Print	Execution control	Point command	Miscellaneous
ALARM	END	CLEAR	REM
ALARM-TYPE	FOR	CLOSE	
DALARM	IF / IF+ / IF-	ENABLE / DISABLE	
ON-ALARM	GOSUB	IDLE	
	GOTO	LET	
	NEXT	OPEN	
	ON	RELINQUISH	
	RETURN	SET-PRIORITY	
	CALL	START	
	DECLARE	STOP	
		WRITE	

The controller does not support the following Control-BASIC statements:

Alarm/print	Point command
APDIAL	
HANGUP	
ON-ERROR	
PHONE	
PRINT	
PRINT-AT	
SET-PRINTER	

The controller does not support the following RCP statements and functions:

STATUS	UNACK
USER-A	USER-B
WS-ON	WS-OFF

Supported Control-BASIC functions

The controller supports the following Control-BASIC functions:

Math		System access	Time
ABS	LSEL	CONPROP	DOM
ARCCOS	MAX	CONRATE	DOW
ARCSIN	MAX-ITEM	CONRESET	DOY
ARCTAN	MIN	POWER-LOSS	INTERVAL
AVG	MIN-ITEM	RAMP	TIME
BIT-SET	SELECT	SCANS	TIME-OFF
BIT-TEST	SIN	SCHED	TIME-ON
COS	SLIDE	SENSOR-OFF	WAIT
ENTHALPY	SQR	SENSOR-ON	
FLOAT	SWITCH	SHARE	
HSEL	TAN	SHARE-NET	
INT	LIMIT	TBL	
LN	LN-1		

Point Status BACnet property

Use the Point Status BACnet property to read an object's status as a number value for Control-BASIC programming. The Reliable Controls proprietary BACnet property piPP_Point_Status (:1338) returns an enumerated value based on the object and the object's state.

Reliable Controls proprietary BACnet properties are available in eForum on the [Reliable Controls Support Center](#).

This property is included on the following version 8 hardware and firmware controllers:

- MACH-ProAir, MACH-ProZone, MACH-ProLight
- MACH-Pro1, MACH-Pro2

- MACH-ProView
- MACH-Pro(Web)Com/Sys
- RC-FLEX controllers

The following table lists the objects and the enumerated values that describe the object state:

Object type	Enumerated values	Notes
Calendar, programs, inputs, loops, schedules	0: Auto 1: Timed override 2: Manual	Write 0 to this property to return the object to automatic mode.
Outputs, values (all types)	0: Auto 1: Timed override 2: Manual 3: Priority override (priority other than 8 or 10) 4: Out of service (outputs only) 5: Overridden HOA off 6: Overridden HOA hand	Write 0 to this property to return the object to automatic mode, clear out of service, and relinquish all priorities except: • 1: Life safety • 6: Minimum off/on time • 10: Auto

Ethernet diagnostics BACnet properties

Additional BACnet properties are available on RC-FLEX devices to help diagnose Ethernet communications problems.

Ethernet diagnostics properties are in the device BACnet object and also available in port instance BACnet objects.

Device object global Ethernet diagnostic properties

The following diagnostic properties apply to all Ethernet ports on the device. Do not enter a value in the **Array Index** field:

- **Object Type:** 8 (Device)
- **Instance:** Same as Device ID

Property name	Property ID	Property type	Supported values or range
Redundancy Alarm Enable	1369	Boolean	False = Link down alarm is disabled. True = Link down alarm is enabled Note: When rapid spanning tree protocol (RSTP) is enabled, the link down alarm is enabled by default.
LLDP Enable	1368	Boolean	This property enables or disables neighbor detection. It is set to 1 (Enabled) by default. 0 = Disabled. No neighbor detection. 1 = Enabled. Device is broadcasting and receiving link layer discover protocol (LLDP) information.

Device object port-specific Ethernet diagnostic properties

The following Ethernet diagnostics properties are available for the device BACnet object:

- **Object Type:** 8 (Device)
- **Instance:** Same as Device ID
- **Array Index:** The assigned value for the physical Ethernet connector on the device, where 1 = port ETH1, and 2 = port ETH2

Property name	Property ID	Property type	Supported values or range
Port State	1364	Enumerated	0 = Down (not working or not connected) 1 = Up (working properly) 2 = Blocked by RSTP
Port Speeds	1366	Real number	10000000.0 = 10 Mbps 100000000 = 100 Mbps 0 = Unknown
Port STP State (STP = Spanning Tree Protocol)	1367	Enumerated	0 = Disabled 1 = Listening 2 = Learning

Property name	Property ID	Property type	Supported values or range
			3 = Forwarding 4 = Blocking
Neighbor Name*	1372	Character string	Object Name property of the neighbor device.
Neighbor ID*	1371	Character string	Device ID of the neighbor device
Neighbor Description*	1376	Character string	For RC-FLEX controllers: "Reliable Controls RC-FLEX Advanced Controller" For other devices, this displays the product identification information.
Neighbor Location*	1373	Character string	Location property of the neighbor device
Neighbor IP Addr*	1374	Character string	IP address property of the neighbor port object
Neighbor MAC Addr*	1375	Character string	MAC address property of the neighbor port object

* The BACnet property LLDP Enabled must be set to 1 (enabled) to read the Ethernet neighbor properties. If multiple neighbors are detected, a comma-separated list of the five most recently detected neighbors is displayed. The last known neighbor data is retained when power or communications is lost. To clear or refresh the neighbor data, perform the Initialize Network function in RC-Studio.

Create Ethernet diagnostic System Groups

Use BACnet Ethernet diagnostic properties to create System Groups on the network's host controller and use the System Groups to monitor the Ethernet network status of your dual Ethernet devices in a ring-topology RSTP network.

This is best used for monitoring ring topology networks that use RSTP as devices remain online and update their values after an initial network break. If a device goes offline its values do not update, so

the System Group appears unchanged but you will get a device offline message. Refer to the instructions to correctly set up a ring-topology RSTP network.

Note: Ethernet diagnostic BACnet properties are available in RC-FLEX firmware version 1.4 or later.

To create Ethernet diagnostic System Groups, you must:

1. Create and program analog values to show the Ethernet port status for each port on each device, as described in "[Create and program port status values:](#)" below.
2. Create a network System Group and add Landing Pads to show each Ethernet port's status, as described in "[Create a System Group with Landing Pads](#)" below.
3. Create System Groups to display information about the neighboring Ethernet devices, as described in "[Create a System Group with neighbor information](#)" on the facing page.

Link the network System Group and the neighbor information System Groups to move between the System Groups and identify issues.

Create and program port status values:

1. Connect to the system using RC-Studio.
2. Open the **Values** worksheet on the host controller.
3. Create analog values for each Ethernet port on each device. Refer to the example.

Important: Analog values retain their last known value; the values are not updated if the devices go offline.

4. Open the **Programs** worksheet on the host controller.
5. Create a new program.
6. Open the new program in the Control-BASIC editor.
7. Program the analog values with the Ethernet Port_Status (:1364) BACnet property. Refer to the example.

A example of analog values and Control-BASIC code for device ID 15101:

- Analog values: RCFA-15101-ETH1, RCFA-15101-ETH2
- Control-BASIC code:

$$10 \text{ RCFA-15101-ETH1} = \{15101\}15101:1364[1] : \text{RCFA-15101-ETH2} = \{15101\}15101:1364[2]$$

Create a System Group with Landing Pads

1. Connect to the system using RC-Studio.
2. Open the **System Groups** worksheet on the host controller.
3. Create a new System Group with a background graphic that shows your dual Ethernet device network.

4. Open the new System Group.
5. Insert one of the Ethernet port status analog values.
6. In the **Edit Object** dialog box:
 - a. Enable **High/Low**.
 - b. Set **High Limit** to 2 and **Low Limit** to 0.
7. In the **Edit Object** dialog box, click **Landing Pad** to open the **Landing Pad** dialog box.
8. In the **Landing Pad** dialog box:
 - a. Enable the Landing Pad by selecting **Enabled**.
 - b. Set the **Background Color** to a color that indicates Ethernet port normal operation, such as green.
 - c. Set the **Width** and **Height** to represent a single Ethernet port on a dual Ethernet device on the System Group background graphic.
 - d. Enable **High/Low**.
 - e. Set the **Background Hi/On Color** to a colour that indicates non-standard but still-functional Ethernet port status, for instance the port being blocked by the RSTP protocol on a ring network.
 - f. Set the **Background Low/Off Color** to a colour that indicates the Ethernet port is not working, such as red.
 - g. Click **OK** to save the Landing Pad settings and return to the **Edit Object** dialog box.
9. Click **OK** to close the Edit Object dialog box.
10. Move the Landing Pad to the Ethernet port location.
11. Insert the rest of the analog values that correspond to an Ethernet port status.

Create a System Group with neighbor information

1. Connect to the system using RC-Studio.
2. Open the **System Groups** worksheet on the host controller.
3. Create a new System Group with a background that shows one or more dual Ethernet devices.
4. Clear the **Auto Update** check box for the new System Group.

Important: Neighbor properties do not display if **Auto Update** is selected.

5. Open the new System Group.
6. Insert a dual Ethernet device into the System Group.
For example, for device ID 15101, enter 15101DEV15101 in the **Insert Point or Keyword** dialog box.

7. In the **Edit Object** dialog box:
 - a. Enter a neighbor property into **Property**.
 - b. Enter **Array Index** of 1 for Ethernet port 1, or 2 for Ethernet port 2.
 - c. Click **OK** to close the **Edit Object** dialog box.
8. Repeat inserting devices into the System Group and setting neighbor properties until all the neighbor information is added to your System Group.

Note: An initialize network operation is required to update neighbor information on the controller. Right-click the network and select **Initialize Network** to update neighbor information.

Net Ins and Net Outs BACnet properties

Use these BACnet properties to monitor and control some aspects of Net Ins and Net Outs.

- **Object Type:** 8 (Device)
- **Instance:** Device ID

These properties are available in firmware version 8.31 or later.

COV_Notification_Mode (:1360)

This property is not available for the MACH-Pro1 and MACH-Pro2.

0: Default Unique Net Outs are created for every local BACnet/IP device that requests that point.

1: Net Outs are consolidated into a single Net Out for local BACnet/IP devices that request that point. This setting is recommended for large RC-FLEX networks.

Net_Ins_Error_Count (:1362)

Returns the number of Net Ins in error. Type: Unsigned integer. Refer to the Control-BASIC example.

Net_Outs_Error_Count (:1363)

Returns the number of Net Outs in error. Type: Unsigned integer. Refer to the Control-BASIC example.

Control-BASIC example

The following Control-BASIC example uses the Net Ins property to generate a delayed alarm when problems occur. Specify a 2-minute (120 second) delay to prevent nuisance alarms that may occur in situations such as system recovery after a power cycle.

```
10 DALARM MYCONTROLLER123:1362 > 0 , 120 , "Error retrieving values on the network"
```

Alarm count BACnet property

A BACnet property is available to count the number of times an input, output or value transitioned from normal to alarm state for diagnostics and reporting.

- **Object Type:** Binary, analog, and multi-state inputs, outputs, and values.
- **Instance:** Enter the row number from the Inputs, Outputs or Values worksheets.

BACnet property	Description
Event_Transition_Count (:1382)	The returned value is the number of times the object has gone into alarm. Write 0 to this property to reset the object alarm count value.

Alarm recurrence delay BACnet property

RC-FLEX controllers firmware version 1.5 and later have a BACnet property that allows you to delay the recurrence of a BACnet intrinsic alarm. An object with this property delays the recurrence of a triggered BACnet intrinsic alarm for a set number of seconds.

- **Object Type:** Binary, analog, and multi-state inputs, outputs, values, and loops.
- **Instance:** Enter the row number from the Inputs, Outputs, Loops, or Values worksheets.

BACnet property	Description
Alarm_Recurrence_Delay (:1390)	Enter the delay period, in seconds, before a BACnet intrinsic alarm can reoccur. The default value is zero, which causes no delay after an alarm is triggered.

Start and Stop Loop BACnet properties

BACnet properties are available to modify the default behavior for Loop objects being commanded by Control-BASIC.

- **Object Type:** 12 (Loop)
- **Instance:** Enter the row number from the Loops worksheet

BACnet property	Setting description
Reset_on_Start (:1378)	True: Default. The internal integral sum is reset. False: The internal integral calculations resume as normal.
Reset_on_Stop (:1379)	True: The internal integral sum is reset, and the Loop Value is set to 0. False: Default. Internal integral calculations are paused.

Loops can now be controlled by changing these BACnet properties. For example:

- To automatically turn off equipment or close a valve when Control-BASIC runs STOP on a loop, change the default setting of Reset_on_Stop (:1379) to **True**.
- To pause and resume a loop without resetting the internal integral sum calculations, change the default setting of Reset_on_Start (:1378) to **False** and make sure Reset_on_Stop (:1379) is set to **False**.

Object instance BACnet property

The Object_Instance (:1395) BACnet property returns the instance number of an object. You can use this property to determine the device number.

This BACnet property is available in firmware version 1.5.1 or later.

This property is available for reference in System Groups, Control-BASIC, and anywhere else that supports BACnet properties.

Note: The SMART-Sensor EPD is limited to displaying values between 1 and 65535.

The following example code stores the device number of the local device in variable A:

```
10 A = DEV4194303:1395
```

RC-FLEXone specifications

For the most complete, up-to-date information, click your product on the [Products](#) page to access the submittal sheet.

Processor and Memory

- Three cores: two 500 MHz high-performance, one 125 MHz, 32-bit embedded microcontroller.
- All nonvolatile flash memory with 10 years of data retention.
- Operating system firmware can be upgraded at any time over network.
- 2 GB database memory available; each trend log supports more than 2,000 records.
- Device status LED indicates operational modes for field service.

Supply Voltages

- 24 VAC $\pm 10\%$ 40 VA maximum, 50/60 Hz.
- 24 VDC $\pm 10\%$ 28 W maximum.

Ethernet Communications

The RC-FLEXone is a nonrouting, unitary controller that requires a network host controller.

- Two IEEE 802.3 Ethernet 10/100BASE-T ports, with a maximum distance of 50 m (164 ft) between Ethernet connections using Category 5, 5e, or 6 cabling. Each device uses one IP address. The second Ethernet port is a switched port; use it to line-connect additional devices.
- Automatic hardware coupling of Ethernet dual ports when controller loses power.
- Routing host controllers support up to 74 additional BACnet/IP-connected devices.
- RSTP: Rapid Spanning Tree Protocol.
 - Allows ring topology for up to 40 devices isolated by a managed network switch.
- LLDP: Link Layer Discovery Protocol.
 - Provides details of up to five of the most recently discovered neighboring devices.

MS/TP Communications (-M Models)

The RC-FLEXone is a non-routing, unitary controller that requires a network host controller.

- One EIA-485 port that supports a baud rate up to 76.8 kbps
- Auto-baud detection.
- 24 VAC overvoltage protection with built in resettable fuses.
- Software switched End of Line termination (EOL) with amber LED indicator.
- Status LED illuminates green to indicate MS/TP network operation and red to indicate miswired MS/TP.

USB

- USB-A port with maximum cable length of 5 m (16.4 ft).

SMART-Net Communications

- SMART-Net port with four-wire terminal block supports up to eight devices.

FLEX I/O

- Software selectable universal input, universal output, or solid-state relay.
- Inputs can be configured for S0 pulse counting applications.

FLEX Outputs

- Use software to select as universal or solid-state relay.

Universal Inputs

- Standard 16-bit A/D converter.
- Software selectable 0–10 VDC, 4–20 mA, thermistor/dry-contact.
- Impedance:
 - 3 M Ω on 0–10 VDC range.
 - 249 Ω on 4–20 mA range.
 - 20 k Ω on thermistor range.
- Pulse counting up to 150 Hz. Supports flow meters.
- 24 VAC overvoltage protection.

Universal Outputs

- 16-bit D/A converter.
- Analog: 0–12 VDC.
- Binary: Software configurable between 0–12 VDC.
- Output power: 75 mA at 12 VDC source, -10 mA sink.
- 24 VAC overvoltage and short protection.

Solid-State Relay Output

- Switch 24 VAC/VDC.
- 500 mA maximum.

Hand/Off/Auto (-H option)

- Hand/Off/Auto switch.
- Hand provides adjustable 0–12 VDC or solid-state on/off.
- LED indicator glows proportionally.

Real-Time Clock (-C option)

- Option adds real-time clock with 72 hours of capacitor backup.

32 System Groups

- Group related objects on one display.
- System Groups accommodate up to 320 objects.
- Host custom user interfaces for integrated fault detection and diagnostics.

32 Loops

- Standard P, PI, or PID controllers for closed loop control.

64 Calendars

- Designate days of the year as holidays.

16 Schedules

- Up to seven on/off cycles for each weekday or exception.

512 Values

- Select standard and custom ranges as well as fixed or program-driven values. Some values are automatically added by firmware.

16 Multipoint Trend Logs

- Store up to eight objects in each trend log.
- Record values by polling or change of value.
- User assigned.

Single-point Trend Logs

- 256 manually defined logs.
- Automatically generated Single-point Trend Logs for all input, output, value, calendar, schedule, and loop objects.

256 Notification Classes

- Specify broadcast destinations.

32 Arrays

- Up to 128 elements in a one-dimensional array.

Custom Units

- Eight analog engineering units.
- Eight binary engineering units.
- Eight multistate units with eight states.

64 Programs

- Freely programmable control strategy in a readable, BASIC-like language.
- 6,400 bytes per program.

Eight Tables

- For creating custom scaling functions.

256 Net Ins

- Maximum number of shares from other devices.

128 Net Outs

- Maximum number of writes to other devices.

Real-Time Clock (-C option)

- Option adds real-time clock with 72 hours of capacitor backup.

Wiring Terminals

- 16–24 AWG (1.31–0.21 mm²).
- Stranded or solid core.
- Copper conductors only.

Dimensions

- 17.7 cm L x 9.1 cm W x 6.0 cm H
(6 15/16" L x 3 1/2" W x 2 1/2" H).

Mounting

- Supplied with 35 mm DIN rail.

Weight

- 0.9 kg (2 lbs).

Ambient Limits

- Operating: -20°C to 55°C (-4°F to 131°F).
- Shipping: -40°C to 60°C (-40°F to 140°F).
- Humidity: 10%–90% RH noncondensing.

Enclosure

- 6063-T6 anodized aluminum extrusion and powder-coated die-cast aluminum end caps.

Certifications

- BTL Listed (B-BC) pending.
- CE.
- CFR 47 Part 15/B Class B.
- UL 60730-1 Open Energy Management.
- WEEE.
- EN 60730-1.
- Canada ICES-003(B)/NMB-003(B).

Certification details

- Purpose and action of control: Type 1 Operating Control.
- Pollution degree: 2.
- Impulse voltage: 330 V.

Warranty

- 5 years.

Related information

RC-FLEXone models and accessories.....	7
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