Ethernet Wiring for TruVu™ Dual IP Port Controllers

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Important changes are listed in **Document revision history** at the end of this document.

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Introduction

The Carrier TruVu™ controllers that have dual IP ports support several Ethernet network configurations. In addition to increased speed, many of these configurations offer advantages over serial networks, such as redundancy and fail-safe mechanisms. These aspects provide more options when designing controller networks and help to more quickly identify a failed controller or physical break in the network.

The features of the TruVu™ controllers that have dual IP ports include:

- Local access to the controllers' IP and BACnet settings over USB
- An Ethernet fail-safe relay mechanism
- Wireless service adapter support (part# USB-W)
- Methods to configure IP addresses of all the controllers on a subnet from a single location (such as the AddressIT app or through local access).

Supported Ethernet network configurations:

- Ring network (requires RSTP-enabled switch)
- Daisy chain
- Home run
- Hybrid (combination of the above)

Ethernet cable wiring specifications

The controller's Eth0/Eth1 ports communicate at 10/100 megabits per second, requiring Cat5e or greater cabling for connections. Between controllers, the total cable distance should not exceed 164 ft (50 m.). This ensures that if a single controller is powered off for any reason, the failover switch on the controller connects the two ports and allows the network to continue without exceeding the Ethernet limit of 328 ft (100 m.). If controllers are installed in a home run configuration, with each controller directly connected to a switch, the distance between each controller and the switch should not exceed 328 ft (100 m.).

NOTES

- Custom-made patch cables must use either the T568A or T568B wiring standard and you must use the same standard on both ends.
- Crossover cables (a cable using both standards, one at either end) can be used with these controllers, but are not required.

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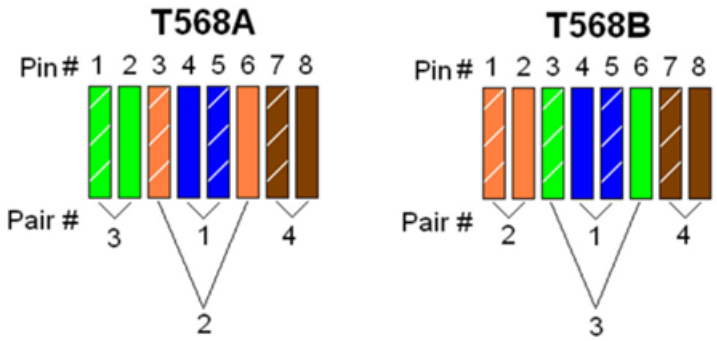
Wiring Standards for RJ45 connectors

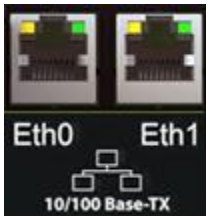


Fail-safe Ethernet network relay

TruVu™ controllers with dual IP ports have a fail-safe Ethernet relay that bypasses a controller in the event of an internal disruption, such as a power loss. When a failure occurs and the relay is bypassing a controller, the network connection on both sides of the controller are electrically connected, which extends the signal and passes it to the next controller.

Ports Eth0 and Eth1

When the controller is on, Eth0 and Eth1 act as a Layer-2 switch. When the controller is off, Eth0 and Eth1 are electrically connected with relays.



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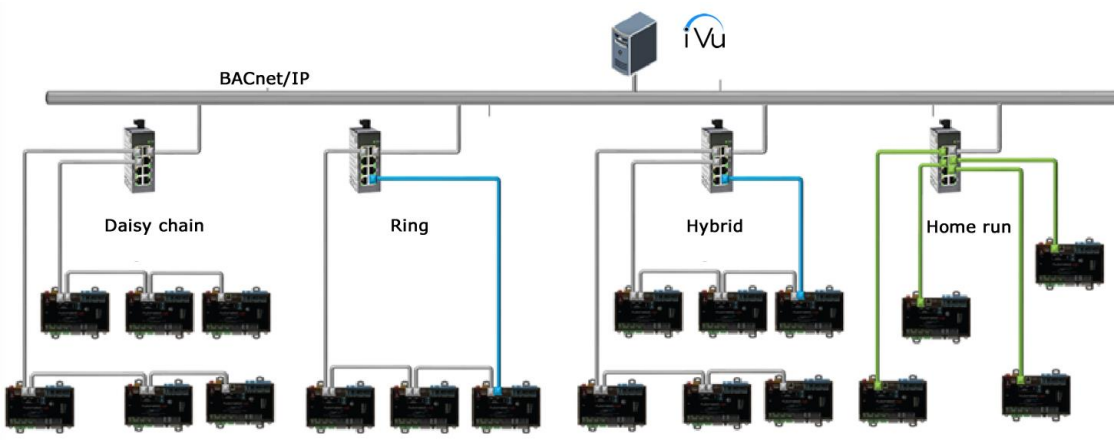
Understanding and selecting the best configuration for your system

The following network configurations are supported by TruVu™ dual-IP controllers:

- Home run
- Daisy chain
- Ring
- Hybrid (combination of the above)



Advantages and disadvantages

Configuration	About	When to use	Advantages	Disadvantages
Daisy chain	Controllers are connected in a ”chain”, with the first controller connected to the switch. The controllers in the middle are connected to each of their neighbors. The last controller in the chain is left open.	• If the distance between each connected controller is less then 164 ft (50 m.). • If the majority of controllers are farther than 328 ft (100 m.) away from the switch **NOTE** This would negate using the home run configuration.	• Occupies a single port on a network switch • Fail-safe Ethernet relay in controller bypasses a controller in case of power loss or failure • Permits connecting up to 50 controllers per chain	If there is a physical failure of one of the cables or sequential controllers fail so that the total cable distance between the nearest working controllers exceeds 328 ft (100 m.), then all controllers on the far side of the failure from the switch lose communication.

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Configuration	About	When to use	Advantages	Disadvantages
Ring **(requires RSTP-configured switch)**	Same as daisy chain configuration, except the last controller is connected back to the switch	If the conditions for daisy chain are met and the last controller on the chain is less than 328 ft (100 m.) from the switch	• Occupies two ports on a network switch • Fail-safe Ethernet relay in controller bypasses a controller in case of controller failure • Allows more controllers to remain online in the event of a wiring failure or more than one sequential controller losing power • Permits connecting up to 50 controllers per ring	• Requires an RSTP-capable switch • An extra cable is required, and the last controller must be within 328 ft (100 m.) of the switch.
Home run	Each controller is directly connected to the network switch	If all controllers are within 328 ft (100 m.) of the switch	• Easier to troubleshoot and detect problems on the network • If a connection to any controller breaks, it does not affect communication with the other controllers.	• Each controller must be within 328 ft (100 m.) of the switch. • More cabling is needed since you connect each controller to the switch. • Number of connected controllers limited to size of switch
Hybrid	Combination of ring, home run, and/or daisy chain configurations	When aspects of the other methods are desirable but a “one-size-fits-all” solution is either not possible or desirable	You can design it to use the best features of various configurations.	• Same disadvantages as other configurations • Additional documentation about the network is required.

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Configuration comparison

Configurations	Node limits	Troubleshooting	Installation	Cost of wiring	Switch setup
Daisy chain	50	Moderate	Easy	Low	Low
Ring	50	Moderate (permits some self-healing)	Moderate	Moderate	High
Home run	Number of ports on network switch	Easy	Easy	High	Low
Hybrid	Depends on chosen configurations				

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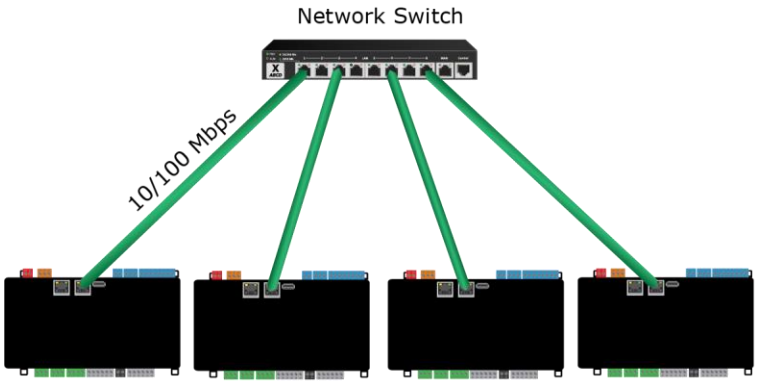
Wiring network configurations

To wire a home run configuration

When wiring a home run configuration, connect an Ethernet cable directly from each controller to a switch. This configuration requires a physical port on an IP network switch, individual cabling to each controller, and does not have limits on the number of controllers in a network. The maximum distance between each controller and the switch is 328 ft (100 m.).

NOTE In this configuration, the failover switch on the controller is not used.

Home run configuration



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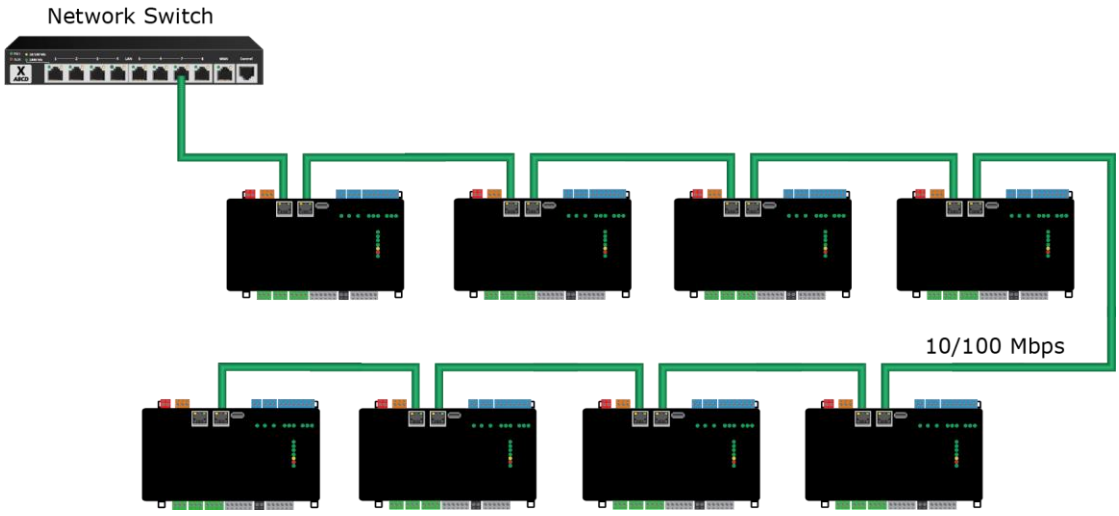
To wire a daisy chain configuration

When wiring a daisy chain configuration, connect an Ethernet cable directly from the first controller to a network switch. From that controller, connect each subsequent controller in a series. When connected in this way, the number of controllers per chain is limited to 50.

We recommend the length of Ethernet cable between controllers not to exceed 164 ft (50 m.). If one of the controllers in the chain is powered off or fails, the remaining controllers stay connected in a chain, because the total distance between the controllers does not exceed 328 ft (100 m.).

NOTE Does not support additional switches between controllers.

Daisy chain configuration



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To wire a ring configuration

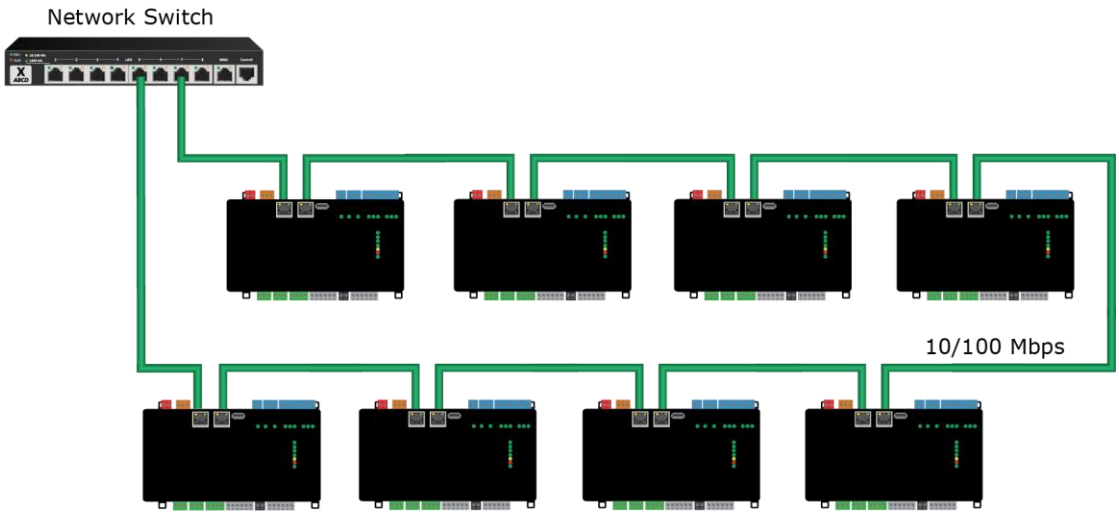
Wiring controllers in a ring configuration is identical to wiring them in a daisy chain, but with an added connection from the last controller in the chain back to the switch. You can only use this configuration if the switch is enabled for RSTP (Rapid Spanning Tree Protocol). The number of controllers per ring is limited to 50.

We recommend the length of Ethernet cable between controllers not to exceed 164 ft (50 m.). If one of the controllers in the chain is powered off or fails, the remaining controllers stay connected in a chain, because the total distance between the controllers does not exceed 328 ft (100 m.).

The ring configuration differs from the daisy chain configuration. If a break or network length greater than 328 ft (100 m.) occurs due to controllers going offline, the network switch registers the “break” and enables the second IP port. This creates a second chain automatically, without breaking connectivity to the other controllers.

NOTE Does not support additional switches between controllers.

Ring network configuration



RSTP

RSTP (Rapid Spanning Tree Protocol) is a technology that allows network controllers to map the location of other controllers relative to their own position in the network. In the case of a ring configuration, a switch that is enabled for RSTP recognizes the ring and enables only one of the ports. If the switch senses a break in the ring (due to multiple sequential controllers powering off, controller failures, or cable breaks), the switch enables the second port, creating a second chain. This protection maintains connectivity in the case of a “break” in the network, caused by either a cable failure or the distance between controllers exceeding 328 ft (100 m.) after power losses of sequential controllers. See *Troubleshooting* (page 10) for more detail.

TruVu™ dual IP controllers respond to RSTP mapping requests directed to their address, but they do not create or store these messages or the maps that result from them.

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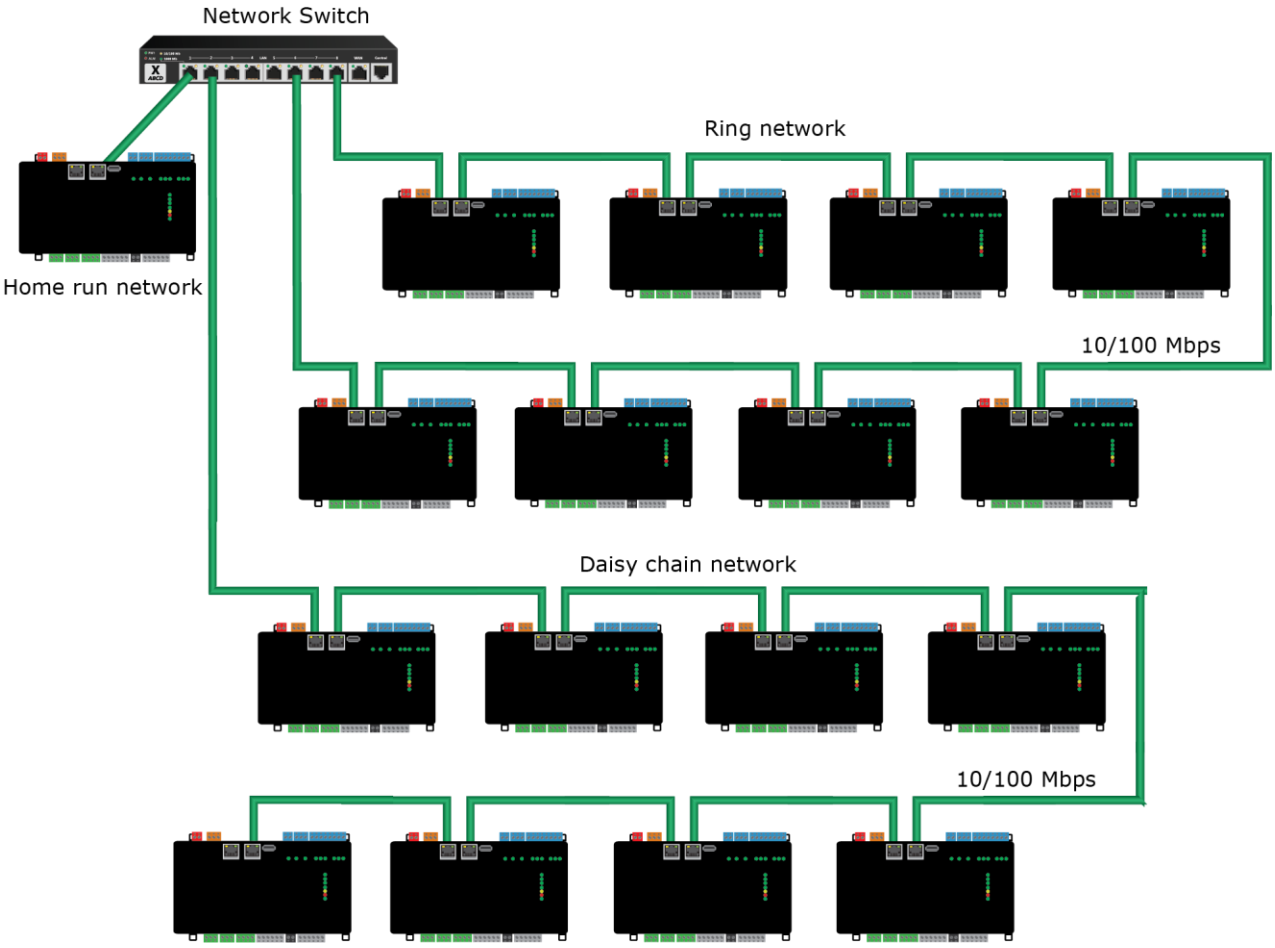
To wire a hybrid configuration

Hybrid network configuration is a combination of any two or three home run, daisy chain, or ring networks. Configure each network as described above in this document.

NOTE Each daisy chain and ring network support up to 50 controllers.

Hybrid configuration



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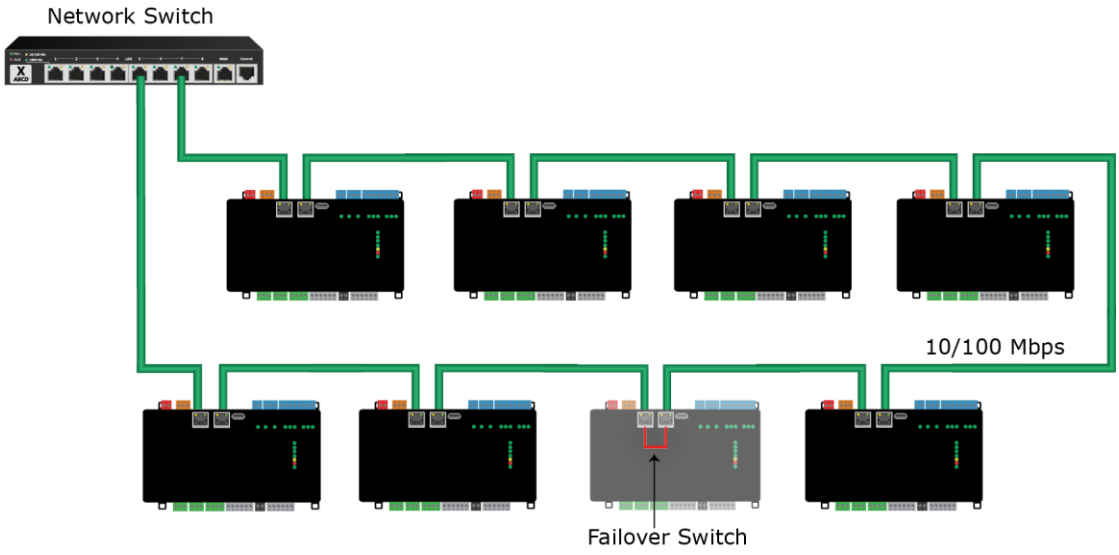
Troubleshooting failures in a ring network

See details below on possible issues and the consequences to your network.

A single powered off controller

If controller 6 is powered off, controllers 5 and 7 are now physically connected over the failover switch in controller 6.

NOTE If the distance between controllers 5 and 7 exceeds 328 ft (100 meters), it may result in two daisy chain networks.



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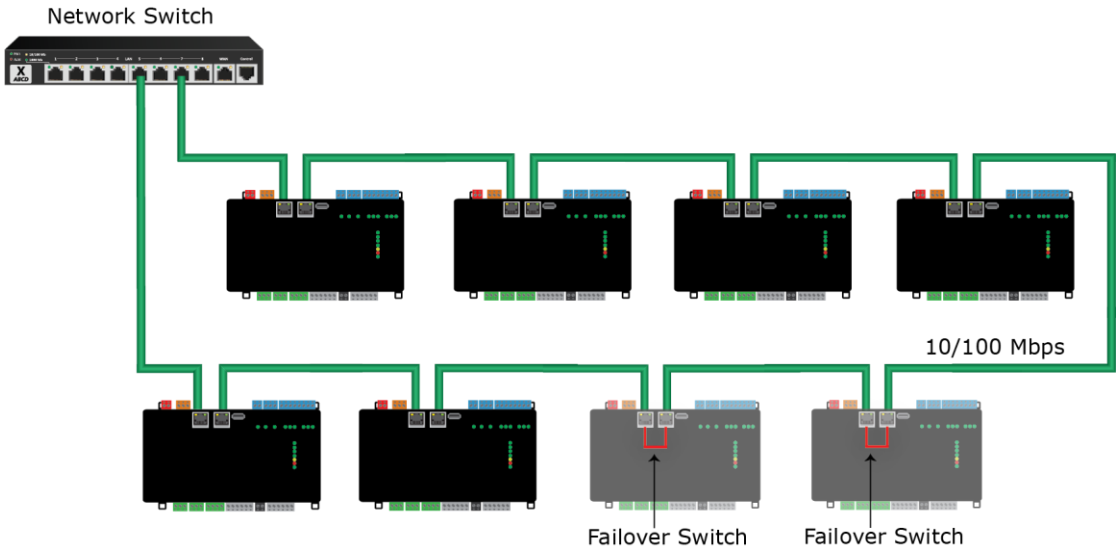
Two adjacent controllers powered off or in failure mode

If controller 5 and 6 are powered off or in failure mode, controllers 4 and 7 are now physically connected over the failover switches in 5 and 6.

NOTE If the cabling from controller 4 to 7 is greater than 328 ft (100 meters), it may result in two daisy chain networks.



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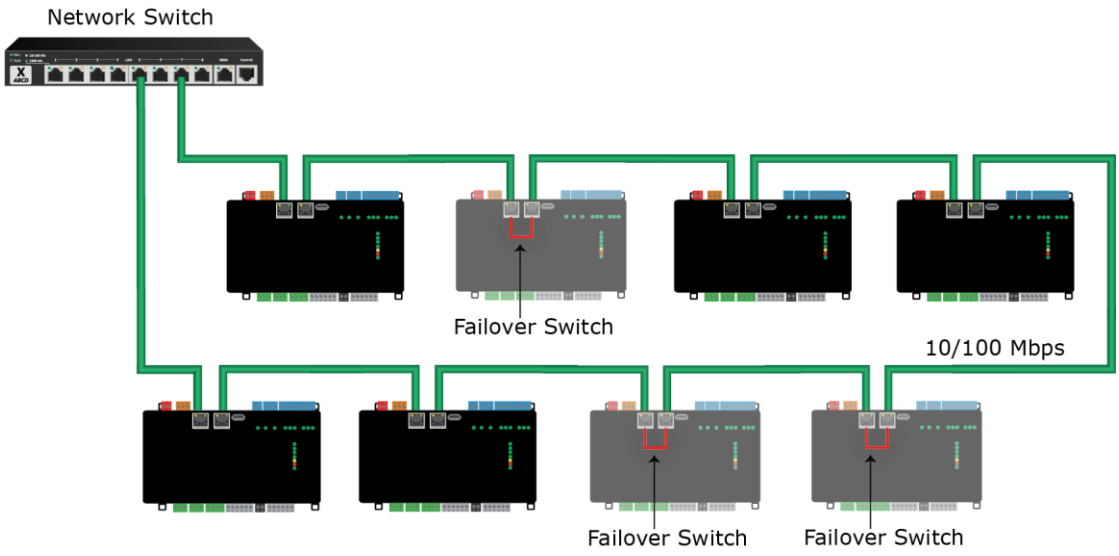
Three controllers in different locations powered off or in failure mode

If controllers 2, 5, and 6 are powered off or in failure mode, they are bypassed and the signal passes from 1 to 3 and from 4 to 7.

If the distance between controller 4 and 7 is less than 328 ft (100 meters), the daisy chain signal will pass from 4 to 7. If the distance is greater than 328 ft (100 meters), the daisy chain is broken. Because the switch is configured to use RSTP, it will recognize the break and enable the Ethernet port for 8, creating a new chain.



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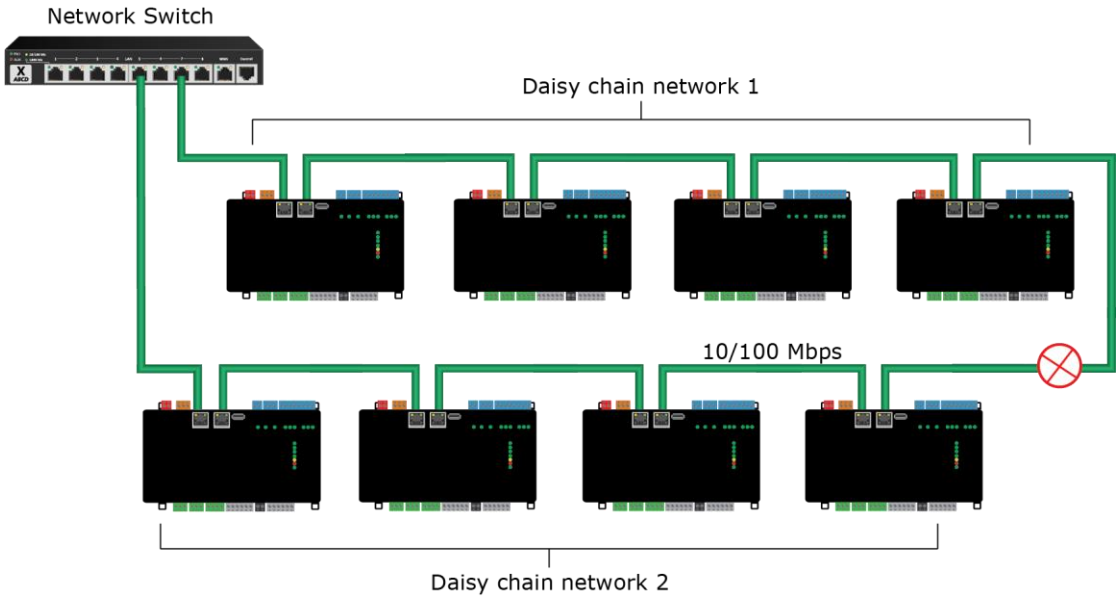
Connection break resulting in two daisy chain networks

If a cable breaks or the Ethernet connector is unplugged from a controller, the fail-safe relay in controllers 4 and 5 have no effect. The RSTP switch will enable the port connected to controller 8, creating a new daisy chain network



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Document revision history

Important changes to this document are listed below. Minor changes such as typographical or formatting errors are not listed.

Date	Topic	Change description	Code*
11/9/21	Ethernet wiring specifications	Corrected typographical error. 28 ft should have been 328 ft.	X-TS-PM-RR-E

* For internal use only

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