Honeywell

CIPer™ MODEL 50 CONTROLLER

INSTALLATION & COMMISSIONING INSTRUCTIONS

DECEMBER 2020

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SAFETY INFORMATION

General Safety Information

- When performing any work, all instructions given by the manufacturer and the safety instructions provided in these Installation and Commissioning Instructions are to be observed. Make sure that the local standards and regulations are always observed.
- The CIPer Model 50 System (including the CIPer Model 50 controller, Panel Bus I/O modules, manual disconnect modules, and auxiliary terminal packages) may be installed and mounted only by authorized and trained personnel.
- If the controller housing is damaged or missing, immediately disconnect it from any power.
- If the device is broken or defective, do not attempt to repair it yourself; rather, return it to the manufacturer.
- It is recommended that devices be kept at room temperature for at least 24 hours before applying power. This is to allow any condensation resulting from low shipping / storage temperatures to evaporate.
- The CIPer Model 50 System must be installed in such a manner (e.g., in a lockable cabinet) as to ensure that uncertified persons have no access to the terminals.
- In the case of vertical mounting on DIN rails, the CIPer Model 50 controller should be secured in place using a commercially available stopper.
- If the CIPer Model 50 System is modified in any way, except by the manufacturer, all warranties concerning operation and safety are invalidated.
- Rules regarding electrostatic discharge should be followed.
- Use only accessory equipment which comes from or has been approved by Honeywell.

Information as per EN 60730

Purpose

The purpose of the device is operating control. the CIPer Model 50 controller is a multifunctional non-safety control device intended for HVAC in home (residential, commercial, and light-industrial) environments.

Construction

The CIPer Model 50 controller is an independently mounted electronic control unit with fixed wiring.

Mounting Method

The CIPer Model 50 controller is suitable for mounting as follows:

- In cabinets;
- In fuse boxes conforming with standard DINX3880, and having a slot height of max. 1.77” (45 mm);
- In cabinet front doors (using accessory MVC-80-AC2);
- On walls (using accessory MVC-80-AC1).

Table 1. Information as per EN 60730

Shock protection	Class II
Pollution degree	2
Installation	Class 3
Rated impulse voltage	330 V for SELV, 2500 V for relay outputs
Automatic action	Type 1.C (micro-interruption for the relay outputs)
Software class	Class A
Ball-pressure test temperature	Housing parts >167 °F (75°C) Terminals >257 °F (125°C)

WEEE DIRECTIVE

WEEE: Waste Electrical and Electronic Equipment Directive	
	• At the end of the product life, dispose of the packaging and product in an appropriate recycling center. • Do not dispose of the device with the usual domestic refuse. • Do not burn the device.

Standards and Approvals

Degree of Protection:	IP20 (mounted on walls, with two accessory MVC-80-AC1 covers) IP30 (mounted in cabinet doors, with accessory MVC-80-AC2)
Device meets EN 60730-1, EN 60730-2-9, UL60730, and UL916.	
Refer to Code of Practice standards IEC 61000-5-1 and -2 for guidance.	
The device complies with Ethernet Protocol versions IEEEC 802.3.	
The device supports BACnet IP and BACnet MS/TP communications as per ANSI / ASHRAE 135-2012	

Specifications of Controller

Table 2. CIPer Model 50 specifications

Power supply	19 ... 29 VAC, 50/60 Hz or 20 ... 30 VDC
Power consumption	DC: 7 W (max 9 W) AC: 10 VA (max 12 VA)
Heat dissipation	Max. 9 W at DC power supply Max. 9 W at AC power supply
Current consumption	DC: 300 mA (max. 375 mA) AC: 400 mA (max. 500 mA)
Ambient temperature	32 ... 104 °F (0...40 °C) (wall-mounting) 32 ... 122 °F (0...50 °C) (cabinet/door mounting)
Storage temperature	- 4 ... +158 °F (-20...+70 °C)
Humidity	5 ... 95% rh. non-condensing
Dimensions	See *Figure 21* and *Figure 22*
Degree of protection	IP20 (mounted on walls, with two accessory MVC-80-AC1 covers) IP30 (mounted in cabinet doors, with accessory MVC-80-AC2)
Fire class	V0
Weight	1.33 lb (0.6kg) excl. packaging

System Overview

Overview of Hardware

Table 3. Overview of models (hardware)

Feature	Description	Max. cable length	Order No	
			Without HMI	With HMI
			WEB-EHSERIESNX26ND	WEB-EHSERIESNX26D
UI	NTC10kΩ (Type II) / NTC20kΩ (Type II) / 0...10V / slow BI, 0.4 Hz	1200 ft (366 m)	8	8
	NTC10kΩ (Type II) / NTC20kΩ (Type II) / 0...10V fix pull-up / slow BI, 0.4 Hz	1200 ft (366 m)	2	2
BI	Open = 24 V / closed 2.0 mA / totalizer 15 Hz	1200 ft (366 m)	4	4
AO	0..11 V (max. 1 mA)	1200 ft (366 m)	4	4
BO	Relay N.O. contact: 3 A, 250 VAC, 30 VDC	1200 ft (366 m)	4	4
	Relay N.O. contact (high in-rush): 10 A, 250 VAC, 30 VDC	1200 ft (366 m)	1	1
	Relay N.O. contact with one common: 3 A, 250 VAC, 30 VDC	1200 ft (366 m)	3	3
Total I/Os		--	26	26
Bus interfaces	RS485-1, isolated, BACnet MS/TP, Panel Bus, or Modbus RTU Master or Slave communication	[1)]3600 ft (1097 m)	1	1
	RS485-2, non-isolated, BACnet MS/TP, Panel Bus, or Modbus RTU Master or Slave communication (NOTE: It is imperative that the RS485-2 be powered by a power supply having the proper polarity. Failure to do so will make data transmission impossible.)	[1)]3600 ft (1097 m)	1	1
	Ethernet Interfaces (e-mail communication, browser access, BACnet IP communication, Niagara Network, Modbus TCP)	300 ft (91.44 m)	2	2

	USB 2.0 Device Interface (as Network Interface)	9 ft (2.74 m)	1	1
	USB 2.0 Host Interface (max. 200 mA)	9 ft (2.74 m)	1	1
	RS232 M-Bus communication via 45-feet (15 m)-long PW3 / PW20 / PW60 converters	[1)]3000 ft (914.4 m)	1	1
LEDs	Power LED (green)	--	1	1
	Status LED (red; indicates an active alarm; is controlled by Niagara Alarm System; is configurable)	--	1	1
	LED L1 (yellow; lit = Daemon starting; flashing = station starting; if L2 is also flashing, then the station has started)	--	1	1
	LED L2 (yellow; lit = platform has started / is reachable; flashing = station has started / is reachable)	--	1	1
	Bus status LEDs (for isolated RS485-1 interface)	--	2	2

[1)] Depending upon bit rate. However, in the case of configuration of RS485-2 for Panel Bus, the communication rate is set to 115.2 kbps, and the max. cable length is hence 2400 ft.

System Architecture

A CIPer Model 50 System consists of the CIPer Model 50 controller and various Panel Bus I/O modules. The CIPer Model 50 controller provides interface connections, which allow connection to external systems (e.g., BACnet controllers). Via the IF-LON External Interface, the CIPer Model 50 can also communicate with LONWORKS systems, including Honeywell LONWORKS I/O Modules. For details about system architecture, refer *WEBs N4 System Architecture - 01-00074*.

Auxiliary parts (see section *Additional Parts*, Pg 44) enable special features.

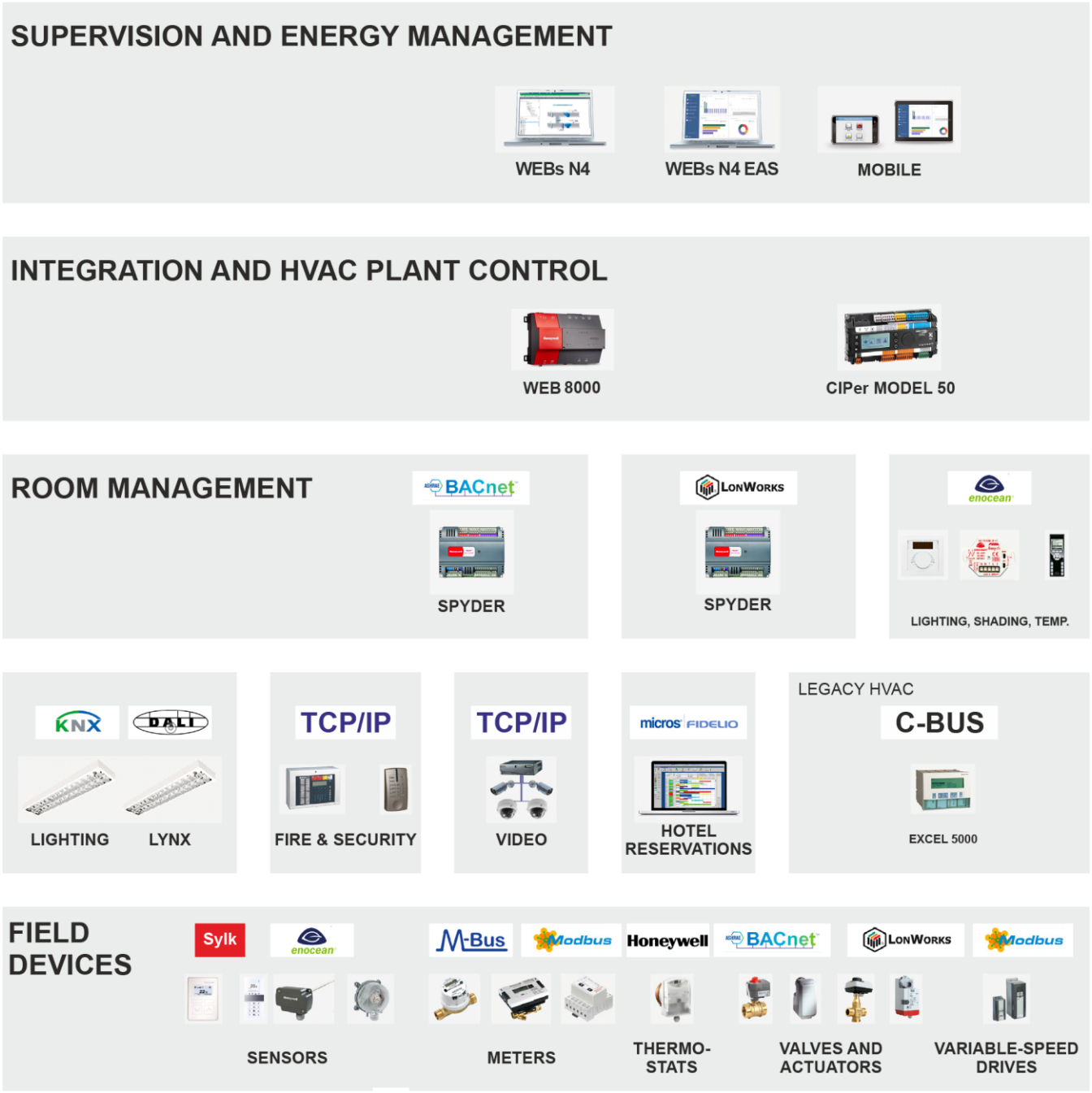


Figure 1: WEBs N4 extended Integrated Building Management architecture

Bus and Port Connections

Overview

⚠ WARNING

Risk of electric shock or equipment damage

- Do not touch any live parts in the cabinet.
- Disconnect the power supply before making connections to or removing connections from terminals of the CIPer Model 50 controller or Panel Bus I/O modules.
- Do not reconnect the power supply until you have completed installation.
- Due to the risk of short-circuiting (see Figure 24), it is strongly recommended that the CIPer Model 50 controller be supplied with power from a dedicated transformer. However, if the CIPer Model 50 controller is to be supplied by the same transformer powering other controllers or devices (e.g., the PW M-Bus Adapter), care must be taken to ensure that correct polarity is observed.
- Observe the rules regarding electrostatic discharge.

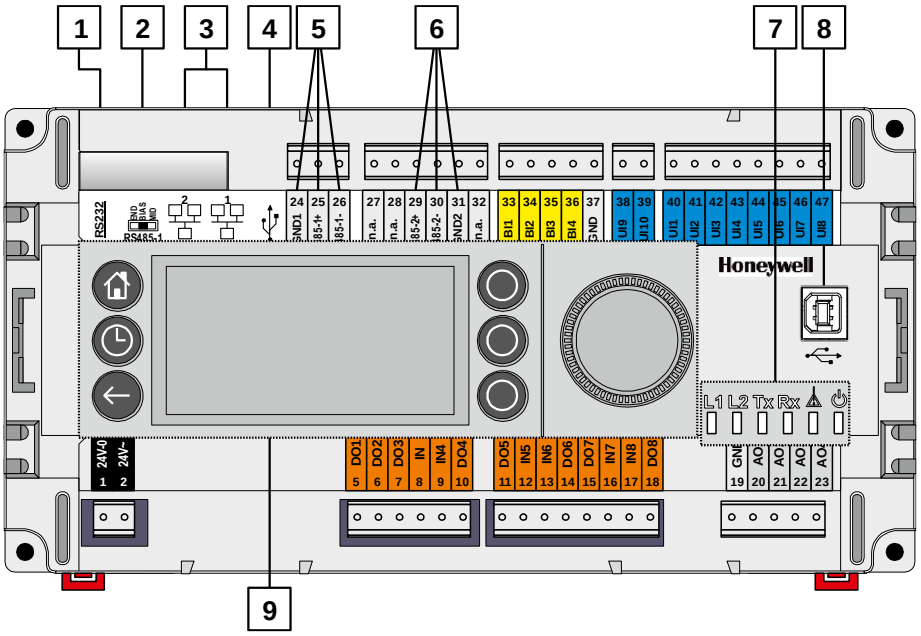


Figure 2: Top view (with HMI and full complement of onboard I/Os)

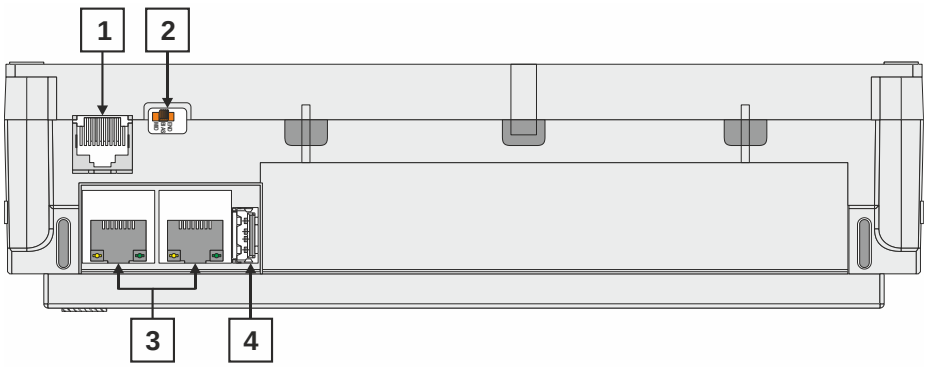


Figure 3: Side view

Legend

1. RS232 / RJ45 socket (for connection of M-Bus and other RS232-based protocols; factory debugging)
2. Three-position slide switch (for setting bias and termination resistance of RS485-1)
3. Two Ethernet / RJ45 sockets (for BACnet IP communication); 10/100 Mbit/s; 1 "link" LED + 1 "activity" LED
4. USB 2.0 Host Interface (for connection of IF-LON2); max. 200 mA, high speed
5. RS485-1* (isolated; for BACnet MS/TP, Panel Bus, Modbus RTU communication, etc.)
6. RS485-2* (non-isolated; for BACnet MS/TP, Panel Bus, Modbus RTU communication, etc.)
7. LEDs
8. USB 2.0 Device Interface (for connection to WEBs N4 web browsers, and 3rd-party touch panels)
9. HMI (or RJ45 socket for connection of portable HMI)

*Modbus RTU Master/Slave communication is possible on the two RS485 interfaces.

⚠ WARNING

Risk of electric shock or equipment damage

It is prohibited to connect any of the RJ45 sockets of the CIPer Model 50 controller to a so-called PoE-enabled device ("Power over Ethernet").

RS232 / RJ45 Socket

Via its RS232 / RJ45 socket, the CIPer Model 50 controller can be connected (using an TECHTOO USB 3.0 and YIOVVOM DB9 Breakout Connector) to a PW M-Bus Adapter and thus to M-Bus networks. See also section "M-Bus Connection"

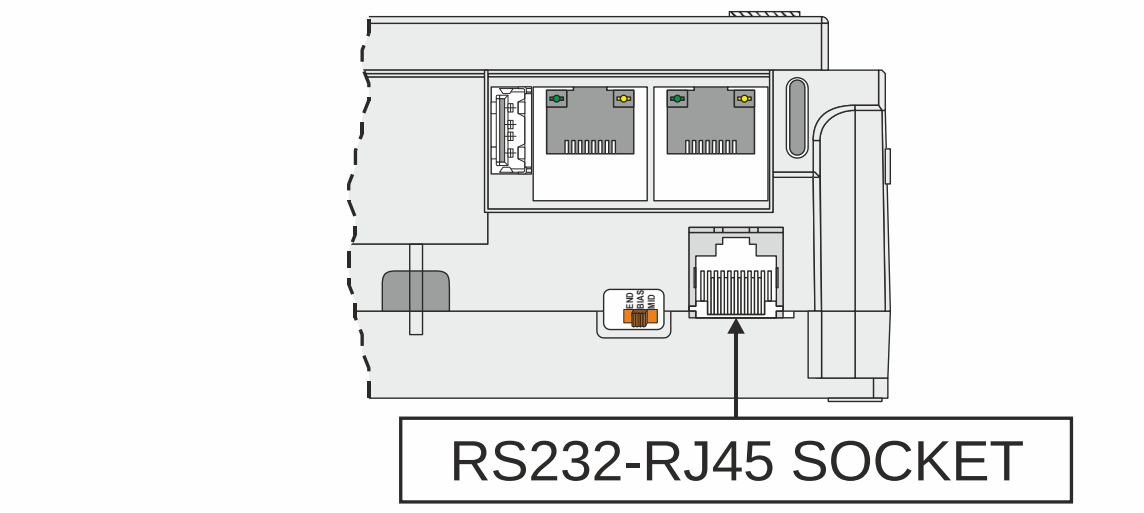


Figure 4: RS232 / RJ45 socket

Configuring the RS232 Interface in WEBs N4

When you configure the RS232 interface (for M-Bus) in WEBs N4, the corresponding Port Name will appear as shown in Figure 5.

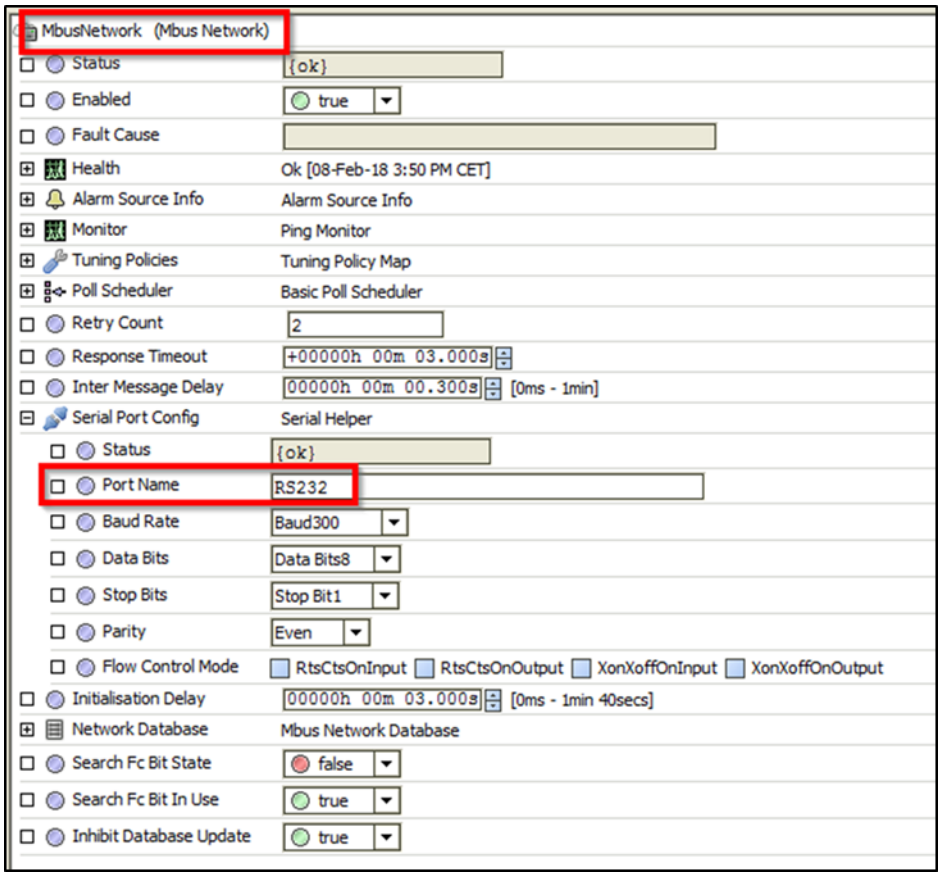


Figure 5: Configuring the RS232 Interface in WEBs N4

USB 2.0 Host Interface

Via its USB 2.0 Host interface, the CIPer Model 50 controller can be connected to, e.g., the IF-LON2 External Interface Adapter and thus to LONWORKS networks. Max. 200 mA, high speed. See also section LonWorks Communications.

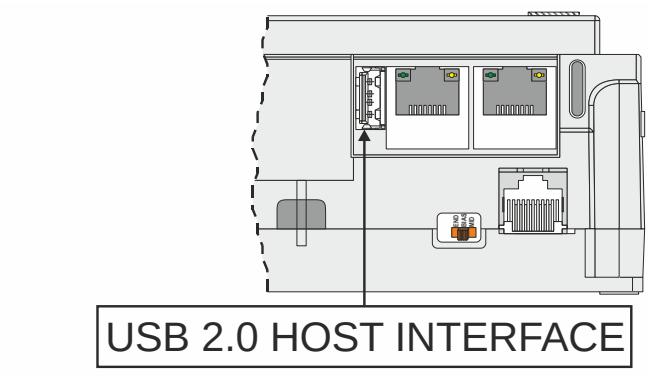


Figure 6: USB 2.0 Host interface

USB 2.0 Device Interface

All models of the CIPer Model 50 controller are equipped with a USB 2.0 Device Interface at the front. This interface is for connection to WEBs N4 and web browsers, or 3rd-party touch panels.

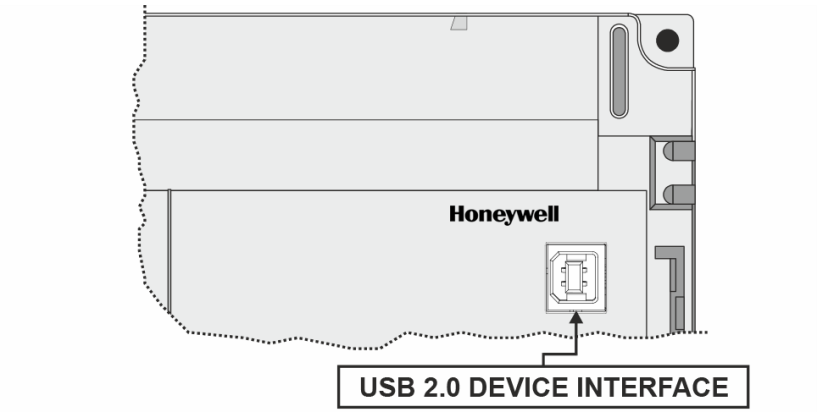


Figure 7: USB 2.0 Device Interface

A standard USB type-B connector can be inserted into this USB 2.0 Device Interface. This USB 2.0 Device Interface is the recommended interface for connection to WEBs N4.

Ethernet / RJ45 Sockets

The CIPer Model 50 controller is equipped with two Ethernet / RJ45 sockets, each featuring two LEDs.

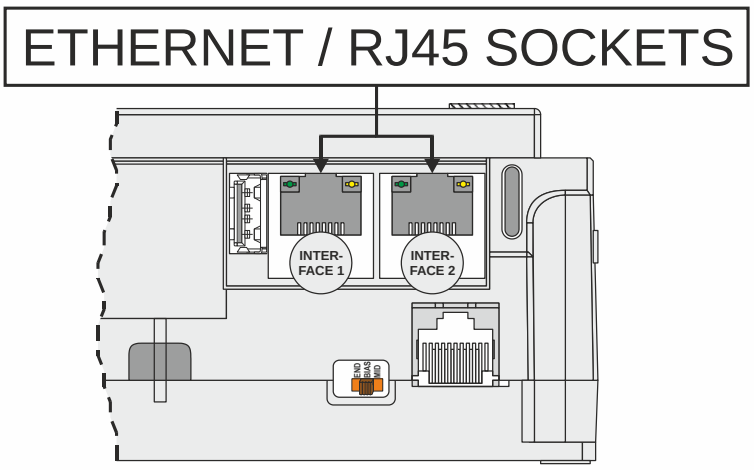


Figure 8: Ethernet / RJ45 sockets

The two Ethernet / RJ45 sockets are 10/100-Mbit/s Ethernet interfaces permitting communication (as per IEEEC 802.3) on any supported IP network, e.g.: BACnet (IP), FOX, etc.

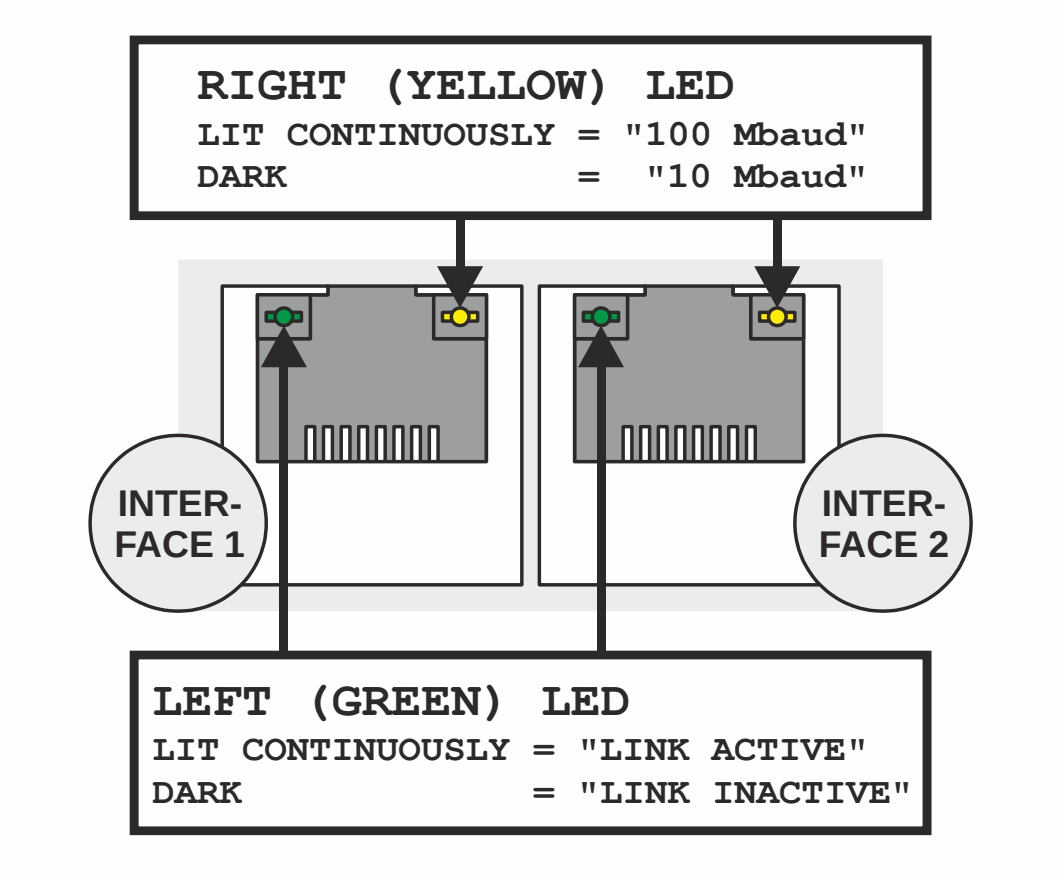


Figure 9: Ethernet / RJ45 sockets

NOTE

The Ethernet / RJ45 sockets are usually earth-grounded. For additional information, see also "Appendix 1: EARTH GROUNDING"

The two Ethernet interfaces can be used in either of two different ways (the corresponding configuration is done in WEBs N4):

- "Separated networks" (factory default).
- "Switch functionality."

  See also the following two sections.

Separated Networks

The "separated networks" scenario is the factory default. In this scenario, each of the two Ethernet interfaces must be activated and located in a different subnet.

Switch Networks

In this scenario, one of the two Ethernet interfaces is deactivated (using WEBs N4 – see section "Disabling an Ethernet Interface" below). The deactivated Ethernet interface will now function in the loop-through (daisy-chain) mode and can therefore be used to continue the data line.
The following limitations apply:

1. Only daisy-chain configurations are allowed
2. A maximum of five Ethernet-capable devices (including CIPer Model 50 controller) are allowed (failure to observe this limitation will result in signal delays and will grade data transmission).
3. The maximum distance between any two of the Ethernet-capable devices in the daisy chain is 328 ft (100 meters).
4. Connect the devices using CAT5 cable or better.

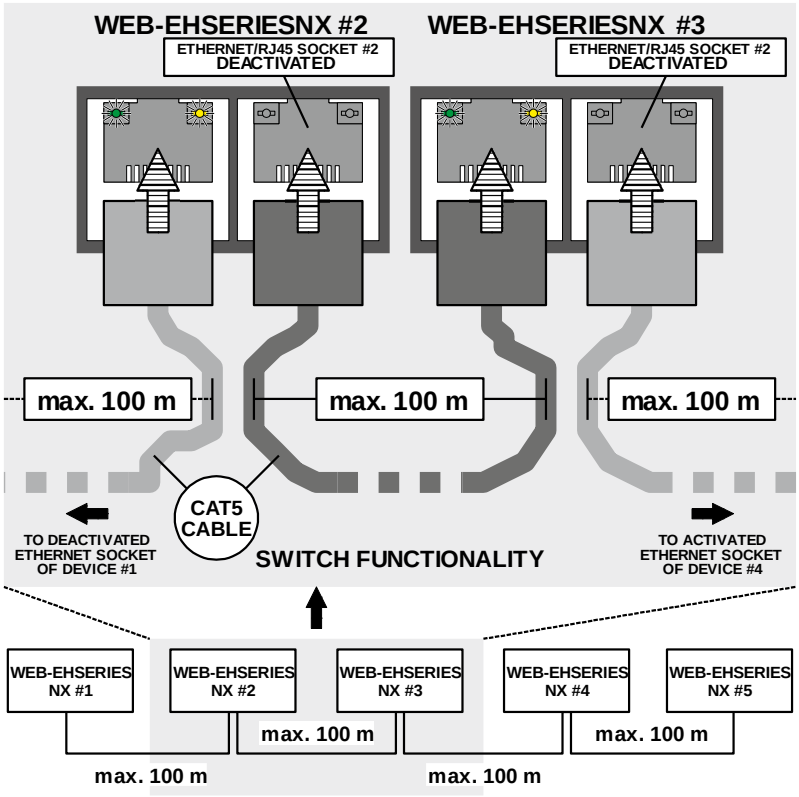


Figure 10: Allowed Ethernet wiring topology (“Switch functionality”)

NOTE

During any power failure of the CIPer Model 50, the switching functionality is inoperative.

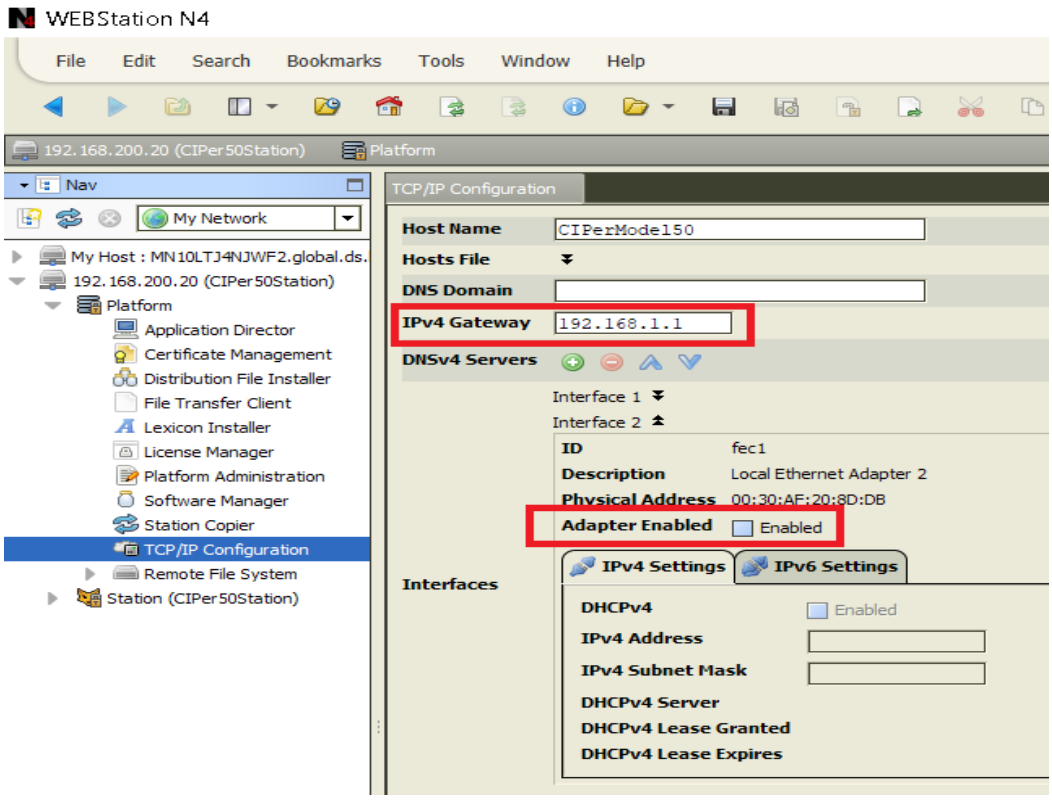


Figure 11: Entering gateway address, disabling one of the two Ethernet interfaces in WEBs N4

To ensure that the discovery of devices, datapoints, schedules, and histories does not fail, you should enter a gateway address. If there is no gateway address physically given by the Network Setting, then enter a gateway address that relates to the IP address of the enabled Ethernet Interface. In Figure 11 the gateway address is 192.168.1.1, hence the IP address of Ethernet adapter 1 must be in the range of 192.168.1.2 to 192.168.1.255.

Default IP Addresses of Ethernet Interfaces 1 and 2

In any case, the default IP address of Ethernet interface 1 is: 192.168.200.20, mask 255.255.255.0

and the default IP address of Ethernet interface 2 is:192.168.201.20, mask 255.255.255.0

LEDs

The CIPer Model 50 controller features the following LEDs:

Figure 12**: CIPer Model 50 controller LEDs**

Table 4. CIPer Model 50 controller LEDs

Symbol	Color	Function Description
L1	Yellow	Lit = Daemon starting; flashing = station starting; if L2 is also flashing, then the station has started.
L2	Yellow	Lit = platform has started / is reachable; flashing = station has started / is reachable.
Tx	Yellow	RS485-1 status LED indicating transmission of communication signals.
Rx	Yellow	RS485-1 status LED indicating reception of communication signals.
⚠	Red	Indicates an active alarm; is controlled by WEBs- Alarm System; is configurable.
⏻	Green	Power LED.

See also section "CIPer Model 50 Controller Troubleshooting, Pg. 67 for a detailed description of the behaviors of the LEDs and their meanings.

RS485 Interfaces

General

The CIPer Model 50 controller features two RS485 interfaces:

RS485-1 (consisting of push-in terminals 24 [GND-1], 25, and 26) is isolated and can be used for any RS485-based communication protocol available within WEBs- Ecosystems, E.g: Panel Bus, BACnet MS/TP, etc.

RS485-2 (consisting of push-in terminals 29, 30, and 31 [GND-2]) is non-isolated (i.e. GND-2 is internally connected with terminal 1 [24V~0]) and can be used for any RS485-based communication protocol available within WEBs- Ecosystems, e.g.: Panel Bus, BACnet MS/TP, etc.

NOTE

It is imperative that the RS485-2 be powered by a power supply having the proper polarity. Failure to do so will make data transmission impossible.

Configuring the RS485 Interfaces in WEBs N4

When you configure the two RS485 interfaces (for Modbus, BACnet MS/TP, or Panel Bus) in WEBs N4, the corresponding Port Names will appear as shown in Figure 13.

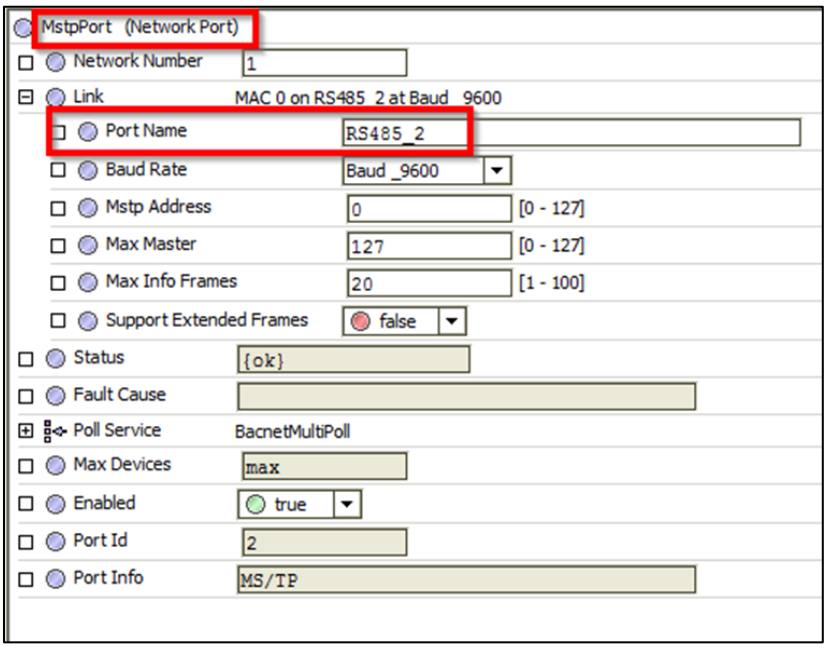


Figure 13: Configuring the RS485 interfaces in WEBs N4

RS485-1 Bias and Termination Resistors

RS485-1 is equipped with a three-position slide switch which can be used to switch its bias resistors OFF (position "MID" – this is the default), ON (position "BIAS"), and ON with an additional 150Ω termination resistor (position "END").

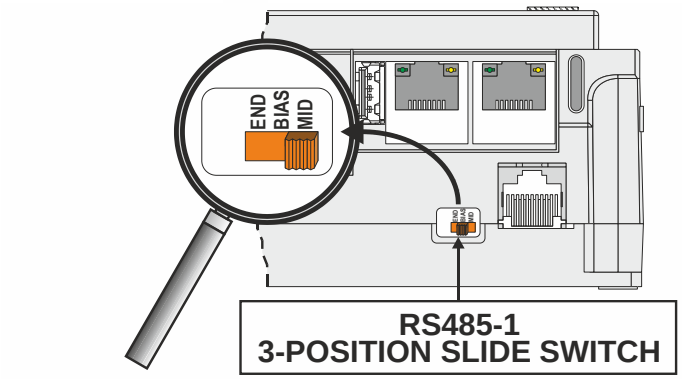


Figure 14: RS485-1 three-position slide switch

The recommended slide switch setting depends upon the location and usage of the given CIPer Model 50 – see Figure 15 through Figure 17 and Table 5; it also depends upon the selected communication protocol (BACnet MS/TP, Panel Bus, or Modbus RTU Master communication, respectively).

Table 5. Recommended slide switch settings

Setting	Remarks
END	Controllers located on either end of bus should have this setting.
BIAS	In small bus networks, a min. of one and a max. of two controllers should have this setting.
MID	All other controllers (not set to "END" or "BIAS") on bus should have this setting (which is the default).

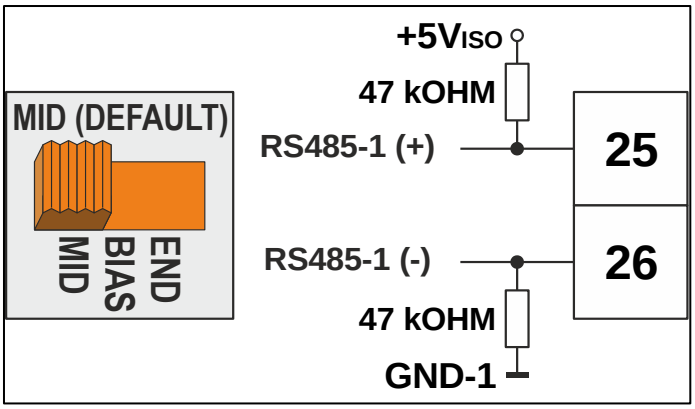


Figure 15: RS485-1 three-position slide switch setting MID

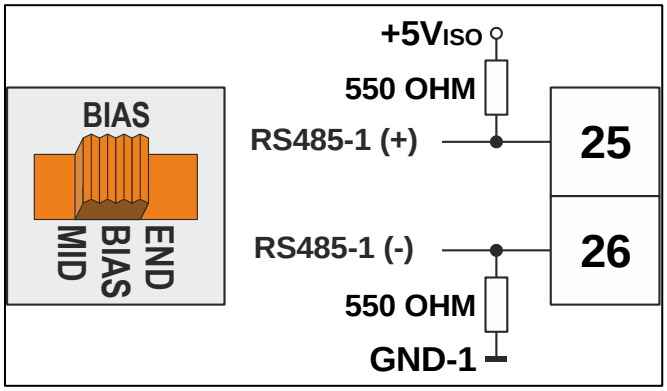


Figure 16: RS485-1 three-position slide switch setting BIAS

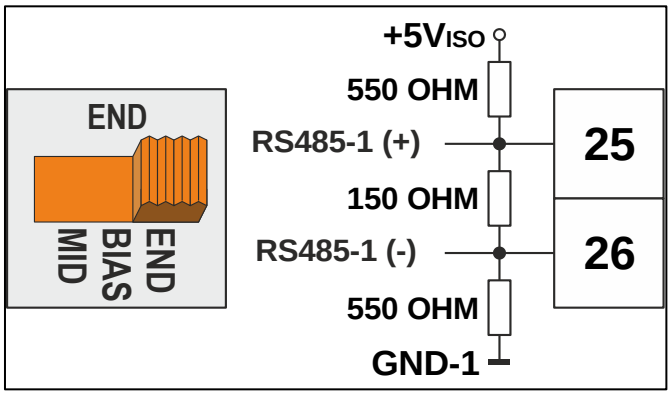


Figure 17: RS485-1 three-position slide switch setting END

NOTE

- All terminals are protected (up to 24 VAC) against short-circuiting and incorrect wiring – except when the 3-position slide switch is set to "END," in which case the terminals of the RS485-1 bus (24, 25, and 26) have no such protection. Higher voltages may damage the device.
- According to BACnet standards, a minimum of one and a maximum of two BACnet devices must have its/their bias resistors switched ON. In the case of the RS485-1 interface of the CIPer Model 50, setting its slide switch to either "BIAS" or "END" fulfills this requirement.

RS485-2 Bias and Termination Resistors

The RS485-2 interface is not affected by the aforementioned three-position slide switch. The 550Ω bias resistors and 130Ω termination resistor of the RS485-2 are thus always ON.

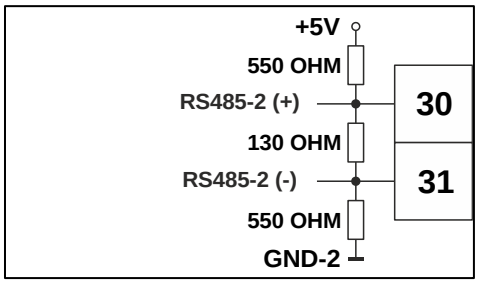


Figure 18: RS485-2 bias and termination resistors

NOTE

GND-2 is internally connected with 24V-0 (terminal 1)

RS485 Standard

According to the RS485 standard (TIA/EIA-485: "Electrical Characteristics of Generators and Receivers for Use in Balanced Digital Multipoint Systems"), only one driver communicating via an RS485 interface may transmit data at a time. Further, according to U.L. requirements, each RS485 interface may be loaded with a max. of 32-unit loads. E.g., WEBs devices have as little as ¼ unit load each, so that up to 128 devices can be connected

BACnet MS/TP connections to the RS485 interfaces must comply with the aforementioned RS485 standard. Thus, it is recommended that each end of every connection be equipped with one termination resistor having a resistance equal to the cable impedance (120 Ω / 0.25 – 0.5 W).

RS485 systems frequently lack a separate signal ground wire. However, the laws of physics still require that a solid ground connection be provided for in order to ensure error-free communication between drivers and receivers – unless all of the devices are electrically isolated, and no earth grounding exists.

IMPORTANT

In the case of new CIPer Model 50 controller installations, we strongly recommend using a separate signal ground wire. Doing otherwise may possibly lead to unpredictable behavior if other electrically non-isolated devices are connected and the potential difference is too high. In the case of the installation of CIPer Model 50 controllers in already-existent RS485 two-wire systems (e.g., when replacing Spyder and Stryker controllers with CIPer Model 50 controllers), not using a separate signal ground wire will probably have no undesirable effects.

The cable length affects the communication rate. Table 6 provides a few examples.

Table 6. Bit rate vs. max. cable length for RS485

Bit rate	Max. cable length (L)
9.6 - 76.8 kbps	3600 ft (1200 m)
*115.2 kbps	2400 ft (800 m)
* In the case of configuration of RS485-2 for Panel Bus, the communication rate is set to 115.2 kbps.	

For information on wire gauge, max. permissible cable length, possible shielding and grounding requirements, and the max. number of devices which can be connected to a bus, refer to standard EIA-485.

Modbus Connection

The CIPer Model 50 controller can function as a Modbus Master or Slave. In general, the RS485 wiring rules must be followed.

Wiring Topology

Only daisy-chain wiring topology is allowed.

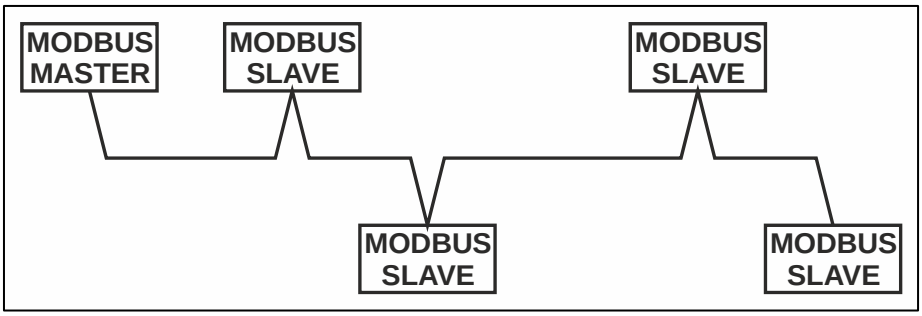


Figure 19: Allowed Modbus wiring topology

Other wiring topologies (e.g., star wiring, or mixed star wiring and daisy chain wiring) are prohibited; this is to avoid communication problems of the physical layer.

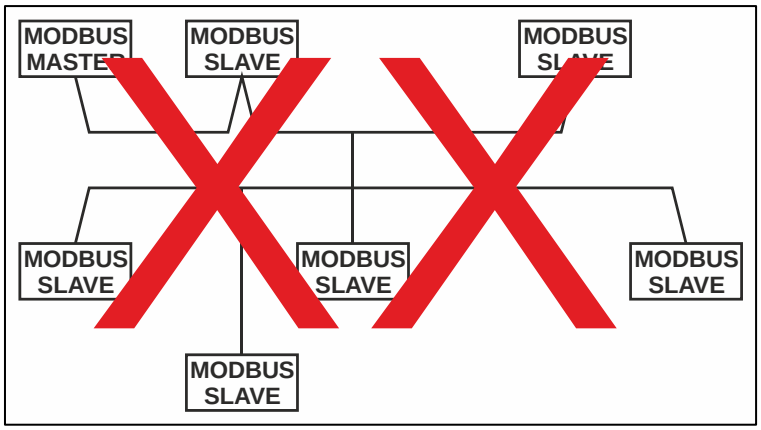


Figure 20: Prohibited Modbus wiring topology (example)

Cables

See also section "EIA 485 Cable Specifications".

Use shielded twisted pair cable 3322 or 3251.

You must use three wires:

- One wire for D1 = Modbus +
- One wire for D0 = Modbus –
- One wire for the signal common

When using one pair for D1 and D0 and one wire of another pair for the signal common, CAT5 cable may also be used.

For connection details, see section "Modbus Connection" .

Shielding

Shielding is especially recommended when the Modbus cable is installed in areas with expected or actual electromagnetic noise. Avoiding such areas is to be preferred.

Use shielded twisted pair cable shielded twisted pair cable 3322 or 3251 and connect the Modbus to a noise-free earth ground – only once per Modbus connection.

RS485 Repeaters

RS485 repeaters are possible but have not been tested by Honeywell. Hence it is within responsibility of the installing / commissioning person to ensure proper function.

NOTE

Each Modbus segment will require its own line polarization and line termination.

Modbus Master Specifications

Modbus Compliance

As per the Modbus standard, the CIPer Model 50 controller is a conditionally compliant "regular" Modbus device.

The CIPer Model 50 controller differs from an unconditionally compliant "regular" Modbus device in that it does not support communication rates of 1.2, 2.4, and 4.8 kbps (because these communication rates are not market-relevant).

Physical Layer

2-wire serial line RS485 (EIA-485) (with additional common)

Communication rates:	9.6, 19.2, 38.4, 57.6, 76.8, and 115.2 kbps supported.
Max. number of devices:	32

Cable and wiring specifications: See section "Wiring and Set-Up"

Communication Mode

Typically: Modbus Master.

Transmission Mode

RTU (Remote Terminal Unit) and (via Ethernet) TCP/IP.

Address Range

Modbus slaves can have an address between 1 and 247.

Discrete Inputs, Coils, Input Registers and Holding Registers can have an address between 1 and 65534.

Further Information

For further information, refer to the Modbus Driver documentation (docModbus.pdf).

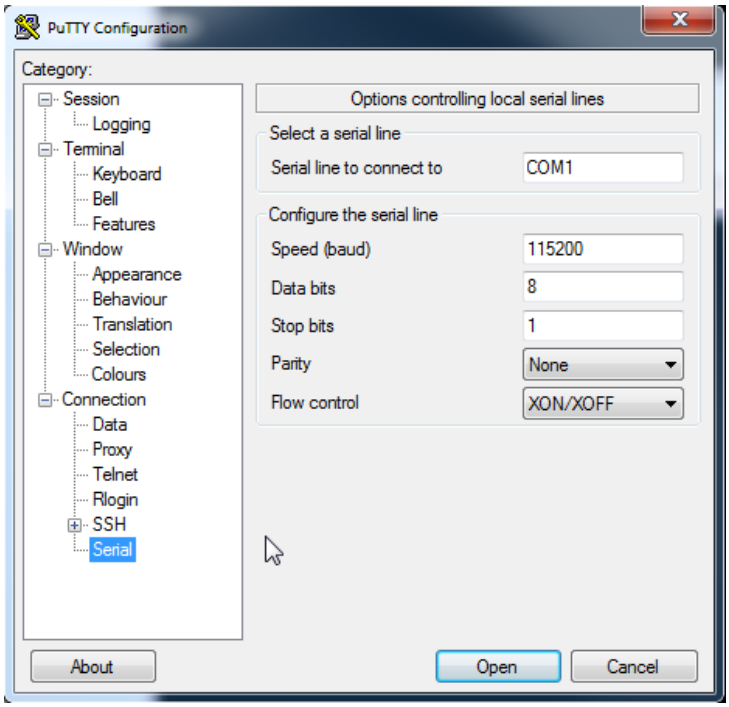
Set Up and Configuration

You can access the CIPer Model 50 controller via the RS232 interface using a terminal program (serial port) such as "PuTTY." This can be helpful in the following cases:

- When the CIPer Model 50 controller cannot be accessed via network. Solution: The network can be configured to the required settings (see step 6 below).
- When the CIPer Model 50 controller application or status is unknown Solution: The controller can be reset to the factory defaults (see step 7 below).

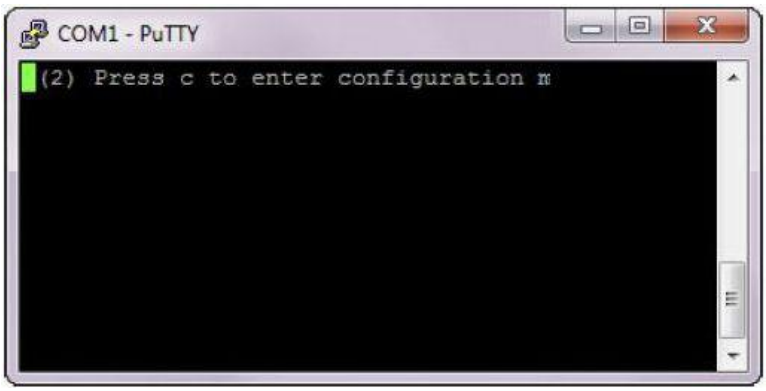
Before proceeding (see section "Procedure" below), you must first connect the RS232 interface of the CIPer Model 50 controller and the PC on which PuTTY is running using the following two cables connected end-to-end: TECHTOO USB 3.0 and YIOVVOM DB9

The interface parameters for serial communication are as shown in the following screenshot:

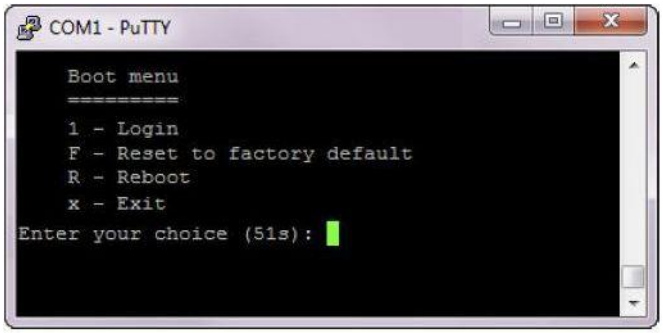


Procedure

1. Start PuTTY. As soon as the following line displays, press **C**.

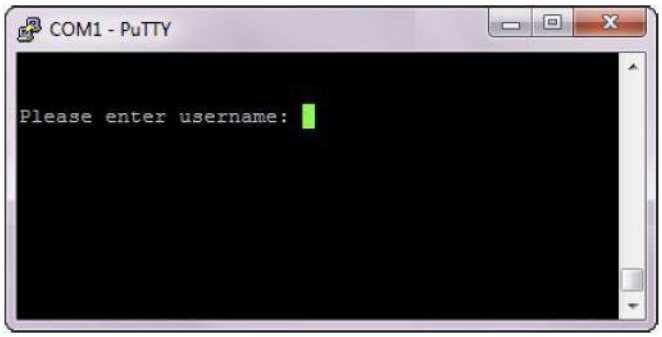


RESULT: The Boot menu displays.



- To login and change the IP address and/ or configure further network settings, press 1.

  RESULT: You will be asked to enter your username.

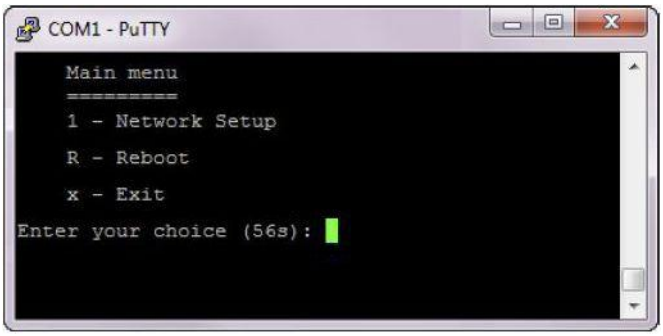


- Enter the username and press Enter.

  RESULT: You will be asked to enter your password.

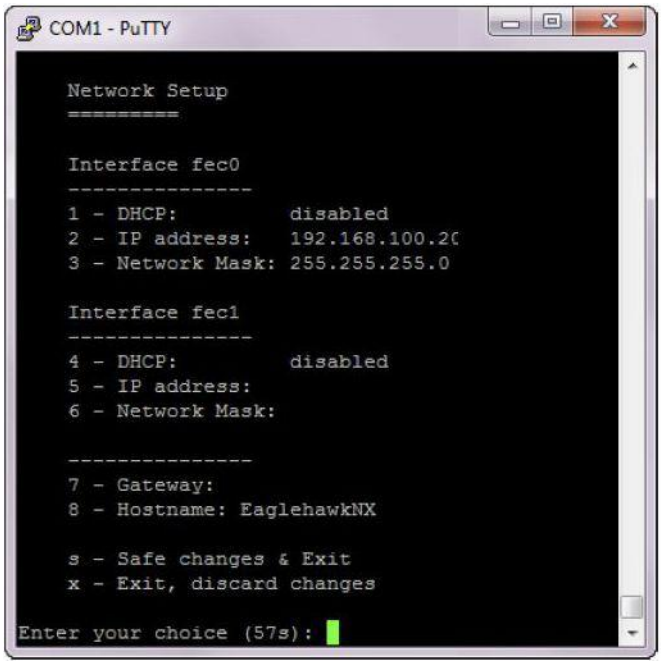
- Enter the password and press Enter.

  RESULT: The Main menu displays.



- Press 1 in the Main menu.

  RESULT: The Network Setup displays.

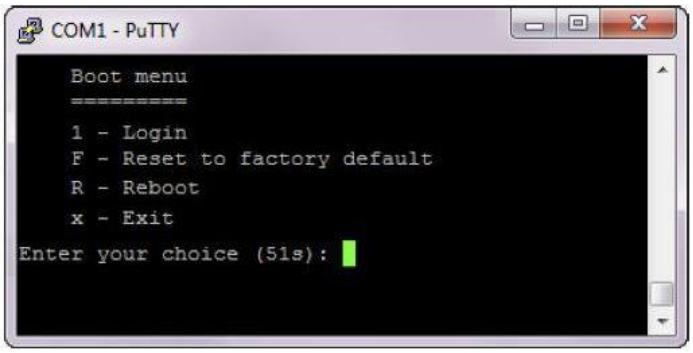


- Configure the network as desired by applying the available options displayed.
- To reset the controller to factory defaults, press F in the Boot menu.

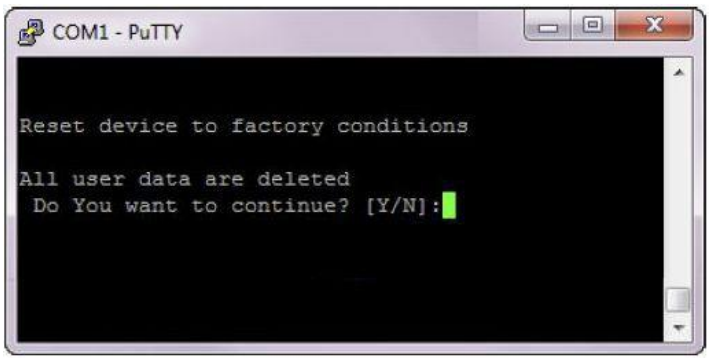
ATTENTION: Resetting the controller to its factory defaults will result in the following:

- The station will be deleted.
- The platform credentials will be deleted.
- The IP settings will be reset to the factory defaults (see section "Default IP Addresses of Ethernet Interfaces 1 and 2").

RECOMMENDATION: Before leaving (closing) the terminal program, go to "Network Setup" and enter the desired IP settings.



- Reset the controller by entering **Y**.



Configuring Ports to Enable Webserver Functions

The CIPer Model 50 controller provides webserver functionality, e.g., for using the WEBs N4 Supervisor. In order to use webserver functions, the http and https standard port settings must be changed as follows:

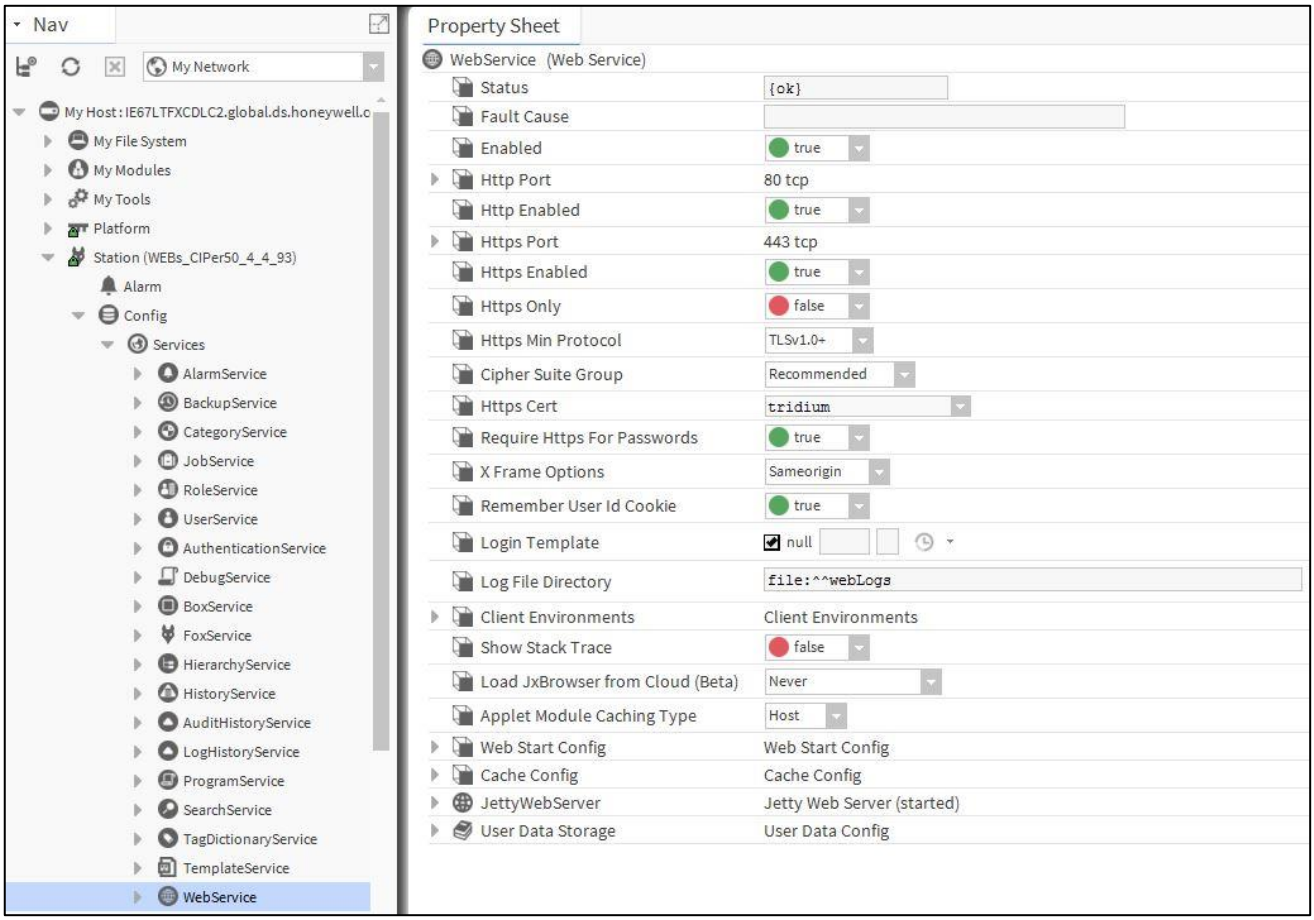
- http standard port 80 to 8080
- https standard port 443 to 8443

After the changes are done, the controller is reachable via both pairs of ports, i.e., via the old standard ports and via the newly set ports.

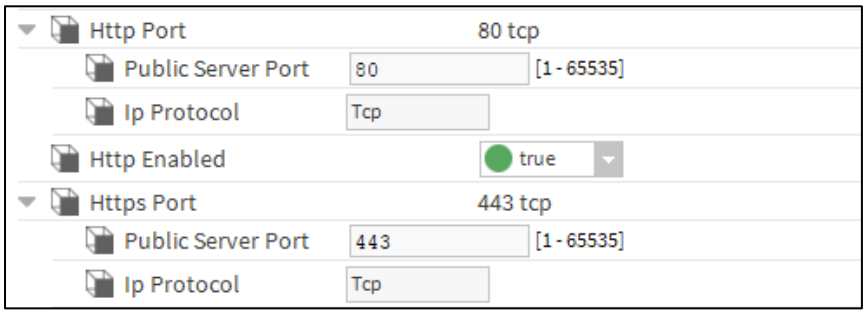
Procedure

1. In the WEBs N4 Nav tree, expand the Services folder, and then double-click *WebService*.

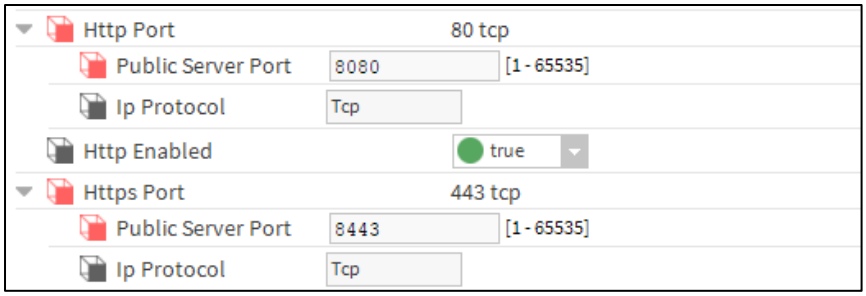
RESULT: The Property Sheet displays to the right.



- Expand the Http Port and Https Port options.

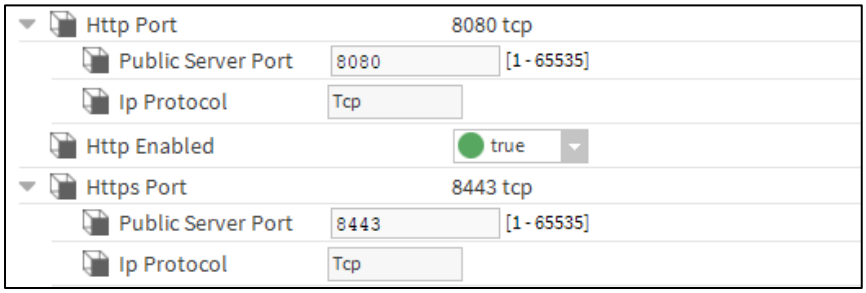


- Change Http Port to 8080 and the Https Port to 8443.



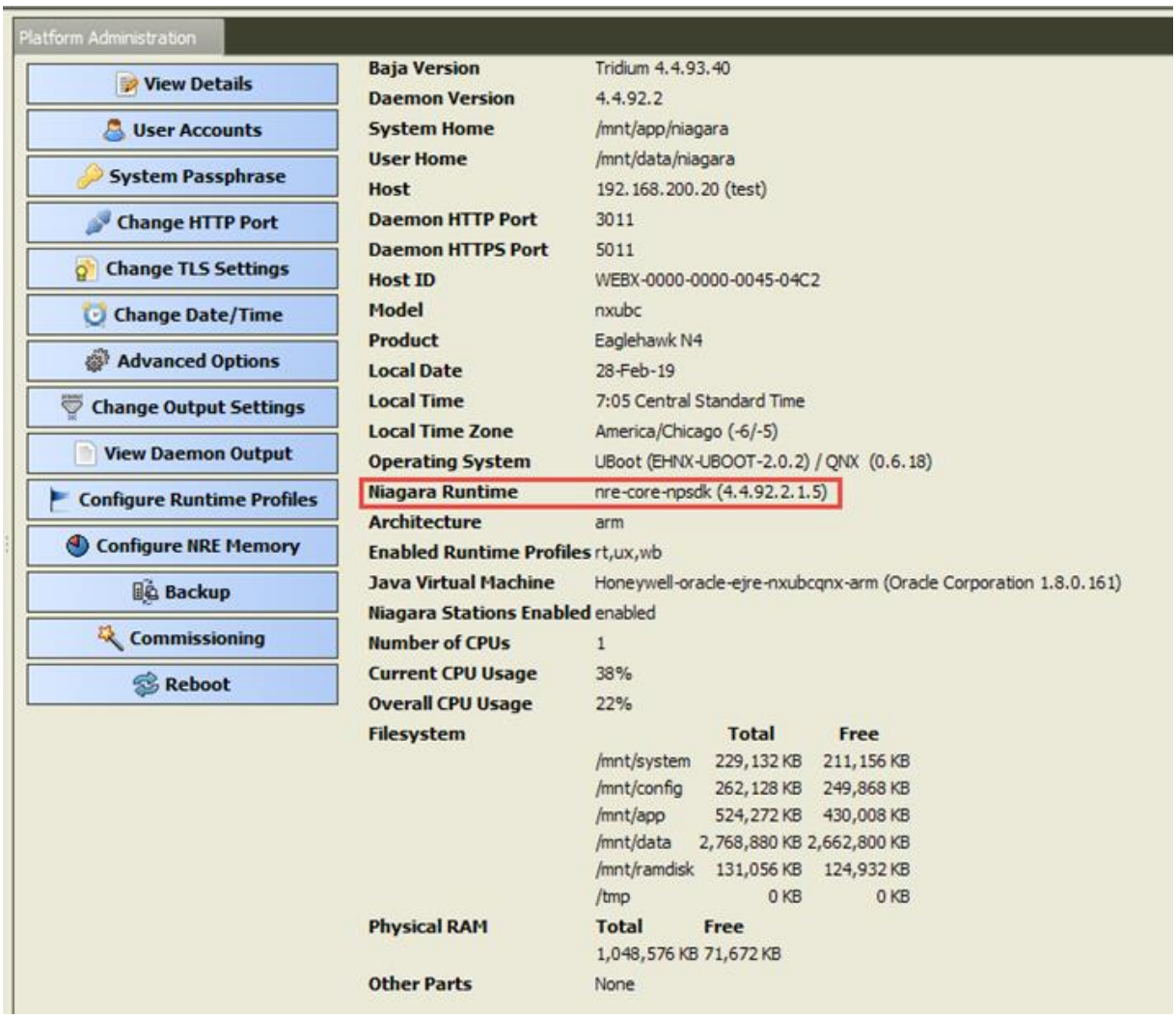
- Click the Save button at the bottom.

RESULT: The changed port settings are saved.



Firmware Update

Check the firmware version installed in your CIPer Model 50 as follows: Open WEBs N4, go to the Platform/Platform Administration, and check the version of the Niagara Runtime installed in the CIPer Model 50.



Firmware updates may be available on the Honeywell Buildings Forum and the firmware upgrade procedure will be available with the firmware updates. If there are any queries on Firmware updates, please reach out to your WEBs technical support.

Mounting and Dismounting

IMPORTANT

To allow the evaporation of any condensation resulting from low shipping / storage temperatures, keep the controller at room temperature for at least 24hrs before applying power.

US requirement, only: This device must be installed in a UL-listed enclosure offering adequate space to maintain the segregation of line voltage field wiring and Class 2 field wiring.

In the case of vertical mounting on DIN rails, the CIPer Model 50 controller should be secured in place using a commercially available stopper. See also the *CIPer Model 50 Mounting Instructions-31-00234*.

Dimensions

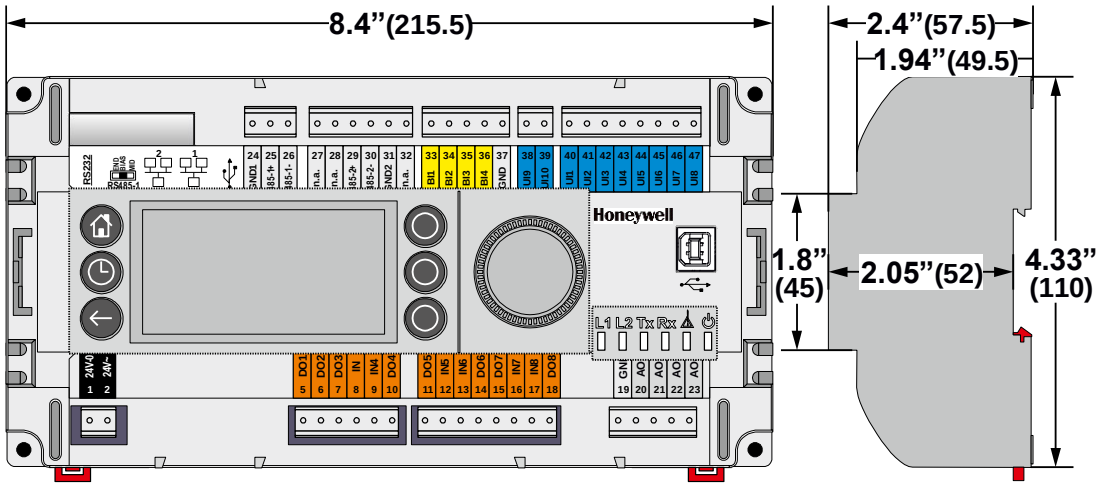


Figure 21: CIPer Model 50 controller (w/o HMI but with RJ45 socket for connection of portable HMI, and with full complement of onboard I/Os), dimensions in inches (mm)

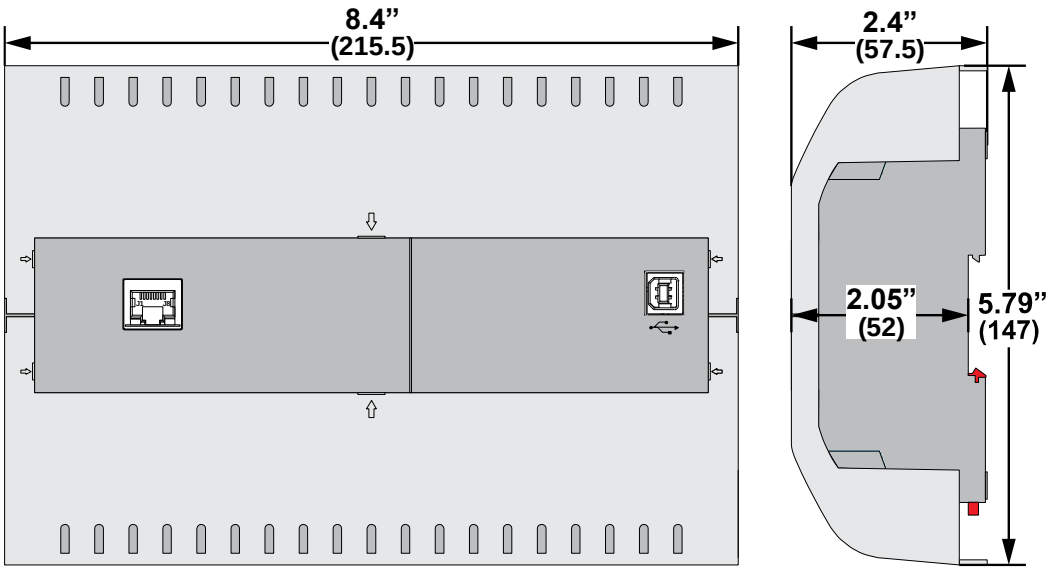


Figure 22: CIPer Model 50 controller with covers, dimensions in inches (mm)

NOTE

Use of the covers (MVC-80-AC1) obstructs access to the Ethernet and USB 2.0 Host Interfaces and RS232 socket

Wiring and Set-Up

General Safety Considerations

- All wiring must comply with applicable electrical codes and ordinances, including VDE, National Electric Code (NEC) or equivalent, and any local regulations must be observed. Refer to job or manufacturer's drawings for details. Local wiring guidelines (e.g. IEC 364-6-61 or VDE 0100) may take precedence over recommendations provided here.
- Electrical work should be carried out by a qualified electrician.
- Electrical connections must be made at terminal blocks.
- For Europe, only: To comply with CE requirements, devices with a voltage in the range of 50 ... 1000 VAC or 75 ... 1500 VDC which are not provided with a supply cord and plug or with other means for disconnection from the supply having a contact separation of at least 0.1" (3 mm) in all poles must have the means for disconnection incorporated in the fixed wiring.

⚠ WARNING

Risk of electric shock or equipment damage!

- Observe precautions for handling electrostatic sensitive devices.
- Do not touch any live parts in the cabinet.
- Do not open the controller housing.
- Disconnect the power supply before making connections to or removing connections from terminals of the CIPer Model 50 controller and devices wired to it.
- Do not use spare terminals as wiring support points.
- To prevent risk of injury due to electrical shock and/or damage to the device due to short-circuiting, low-voltage and high-voltage lines must be kept separate from one another.
- All terminals are protected (up to 24 VAC) against short-circuiting and incorrect wiring (unless the 3-position slide switch is set to "END," in which case the terminals of the RS485-1 bus [24, 25, and 26] have no such protection). Higher voltages may damage the device.
- Do not reconnect the power supply until you have completed the installation.

Fusing Specifications

System Fusing

We recommend that the system be equipped with an external fuse.

Fusing of Active Field Devices

F2 (depends upon given load)

Lightning Protection

Please contact your local Honeywell representative for information on lightning protection.

Wiring Terminals

The CIPer Model 50 is equipped with push-in terminal plugs.

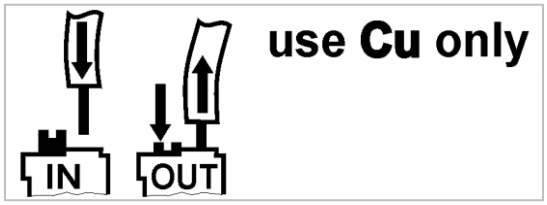


Figure 23: Inserting/removing wires from push-in terminals

NOTE

- With solid conductors, ferrules are prohibited.
- Use only one conductor per push-in terminal.
- If, nevertheless, two stranded wires are to be connected to a single push-in terminal, twin wire end ferrules must be used.

Table 7. CIPer Model 50 push-in terminal wiring specifications

Plug gauge	0.0003... 0.002" (0.2 ... 1.50 mm)
Solid conductor H05(07) V-K	0.0003... 0.002" (0.2 ... 1.50 mm)
Stranded conductor H05(07) V-K	0.0003... 0.002" (0.2 ... 1.50 mm)
Stranded conductor with wire end ferrules (w/o plastic collar)	0.0003... 0.002" (0.2 ... 1.50 mm)
Stripping length	0.4" + 0.04" (10.0 +1.0 mm)

Terminal Assignment

Table 8. Terminal assignment

Terminal no.	Signal	Description	WEB-EHSERIESNX26XX
1	24V-0	Supply voltage (GND), int. connected with term. 31 and system GND (term. 19+37)	X
2	24V~	supply voltage (24V)	X
3,4	-	Not used	-
5	BO1	Binary output 1. N.O. relay contact switching input power connected to terminal 8	X
6	BO2	Binary output 2. N.O. relay contact switching input power connected to terminal 8	X
7	BO3	Binary output 3. N.O. relay contact switching input power connected to terminal 8	X
8	IN1,2,3	Common relay contact for BO1, BO2, and BO3	X
9	INX	Relay contact for BO4	X
10	BO4	Binary output 4. N.O. relay contact switching input power connected to terminal 9	X
11	BO5	Binary output 5. N.O. relay contact switching input power connected to terminal 12	X
12	IN5	Relay contact for BO5	X
13	IN6	Relay contact for BO6	X
14	BO6	Binary output 6. N.O. relay contact switching input power connected to terminal 13	X

15	BO7	Binary output 7. N.O. relay contact switching input power connected to terminal 16	X
16	IN7	Relay contact for BO7	X
17	IN8	Relay contact for BO8	X
18	BO8	Binary output 8. N.O. relay contact switching input power connected to terminal 17	X
19	GND	Ground terminal (see NOTE below)	X
20	AO1	Analog output 1	X
21	AO2	Analog output 2	X
22	AO3	Analog output 3	X
23	AO4	Analog output 4	X
24	GND-1	ref. GND of RS485-1 (isolated)	X
25	485-1+	"+" signal for RS485-1 (isolated)	X
26	485-1-	"-" signal for RS485-1 (isolated)	X
27,28		not used	-
29	485-2+	"+" signal for RS485-2 (non-isolated)	X
30	485-2-	"-" signal for RS485-2 (non-isolated)	X
31	GND-2	ref. GND of RS485-2, int. conn. with 24V-0 (term. 1) and system GND (term. 19+37)	X
32	-	not used	-
33	BI1	Binary input 1 (static dry contact) / pulse counter (fast totalizer)	X
34	BI2	Binary input 2 (static dry contact) / pulse counter (fast totalizer)	X
35	BI3	Binary input 3 (static dry contact) / pulse counter (fast totalizer)	X
36	BI4	Binary input 4 (static dry contact) / pulse counter (fast totalizer)	X
37	GND	Ground terminal (see NOTE below)	X
38	UI9	Universal input 9 (for NTC10kΩ / NTC20kΩ / 0...10 V / slow BI)	X
39	UI10	Universal input 10 (for NTC10kΩ / NTC20kΩ / 0...10 V / slow BI)	X
40	UI1	Universal input 1 (for NTC10kΩ / NTC20kΩ / 0...10 V / slow BI)	X
41	UI2	Universal input 2 (for NTC10kΩ / NTC20kΩ / 0...10 V / slow BI)	X
42	UI3	Universal input 3 (for NTC10kΩ / NTC20kΩ / 0...10 V / slow BI)	X
43	UI4	Universal input 4 (for NTC10kΩ / NTC20kΩ / 0...10 V / slow BI)	X
44	UI5	Universal input 5 (for NTC10kΩ / NTC20kΩ / 0...10 V / slow BI)	X
45	UI6	Universal input 6 (for NTC10kΩ / NTC20kΩ / 0...10 V / slow BI)	X
46	UI7	Universal input 7 (for NTC10kΩ / NTC20kΩ / 0...10 V / slow BI)	X
47	UI8	Universal input 8 (for NTC10kΩ / NTC20kΩ / 0...10 V / slow BI)	X

NOTE

All AOs, UIs, and BIs share the same ground potential. It is thus possible to connect just one combined GND signal for all AOs, UIs, and BIs. Auxiliary terminals may be used if needed.

Power Supply

Powering CIPer Model 50

Power is supplied via a removable terminal plug (attached to terminals 1 and 2).

The power supply of the CIPer Model 50 controller must conform to Safety Class II. To reduce overall current consumption, the CIPer Model 50 can be powered by a switch power supply (rather than by a transformer). See also Table 2.

NOTE

Due to the risk of short-circuiting (see Figure 24), it is strongly recommended that the CIPer Model 50 controller be supplied with power from a dedicated transformer. However, if the CIPer Model 50 controller is to be supplied by the same transformer powering other controllers or devices (e.g., the PW M-Bus Adapter), care must be taken to ensure that correct polarity is observed.

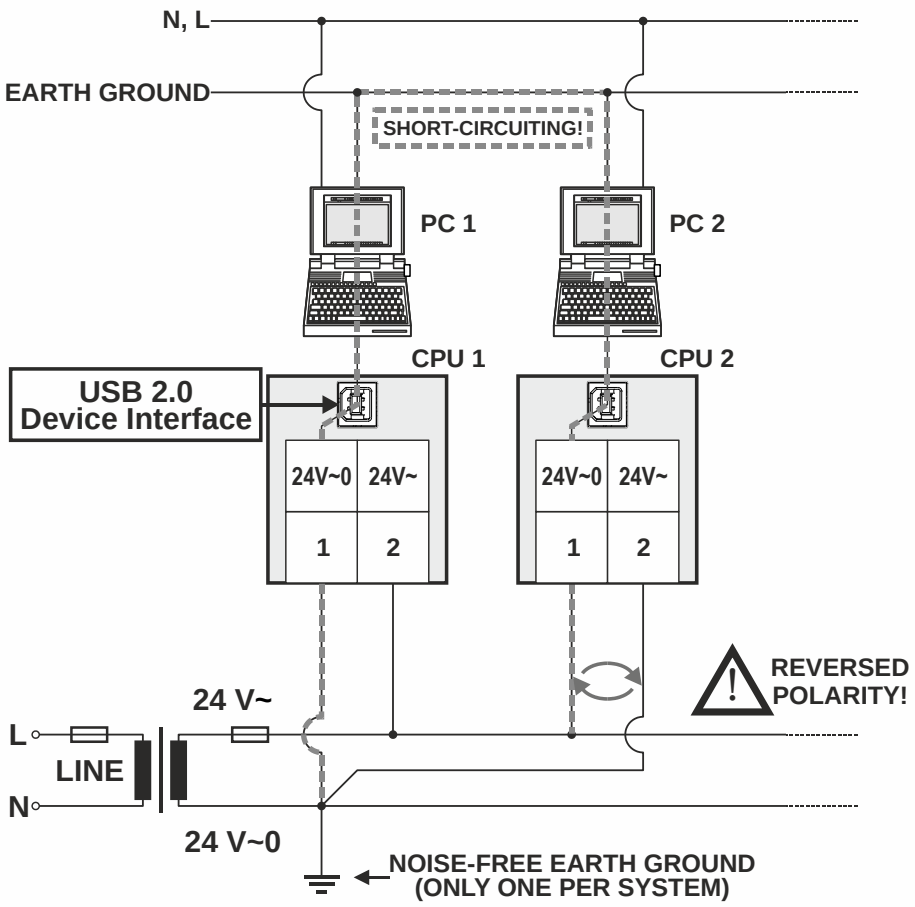


Figure 24: Incorrect polarity → SHORT-CIRCUITING!

Transformer Data

In the U.S. and Canada, if the CIPer Model 50 is powered by transformers, then such transformers must be NEC Class-2 transformers. In Europe, if the CIPer Model 50 is powered by transformers, then such transformers must be safety isolating transformers conforming to IEC61558-2-6.

Table 9. 1450 series transformers data

Part # 1450 7287	Primary side	Secondary side
-001	120 VAC	24 VAC, 50 VA
-002	120 VAC	2 x 24 VAC, 40 VA, 100 VA from separate transformer
-003	120 VAC	24 VAC, 100 VA, 24 VDC, 600 mA
-004	240/220 VAC	24 VAC, 50 VA
-005	240/220 VAC	2 x 24 VAC, 40 VA, 100 VA from separate transformer
-006	240/220 VAC	24 VAC, 100 VA, 24 VDC, 600 mA

Table 10. Overview of CRT Series AC/DC current

Transformer	Primary side	Max. AC current	Max. DC current
CRT 2	230 VAC	2 A	500 mA
CRT 6	230 VAC	6 A	1300 mA
CRT 12	230 VAC	12 A	2500 mA

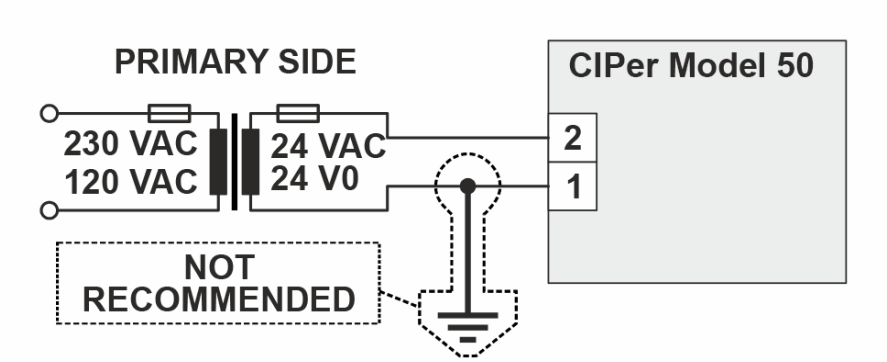


Figure 25: Connection of CIPer Model 50 controller

NOTE

An Uninterruptable Power Supply can be directly wired to a CIPer Model 50 controller.

Powering Panel Bus I/O Modules and Field Devices

The CIPer Model 50, Panel Bus I/O modules, and field devices can be powered by either separate transformers (see Figure 26 and Figure 27) or by the same transformer.

NOTE

Use a min. distance of 10 cm between power cables and 0...10 V / sensor cables in order to prevent signal disturbances on the 0...10 V / sensor cables. See also section "Addressing Panel Bus I/O Modules" on page 301.

Powering Field Devices and Panel Bus I/O Module via Separate Transformers

- 24V actuator connected to an analog output module
- Field device located 100 ... 400 m from the analog output module

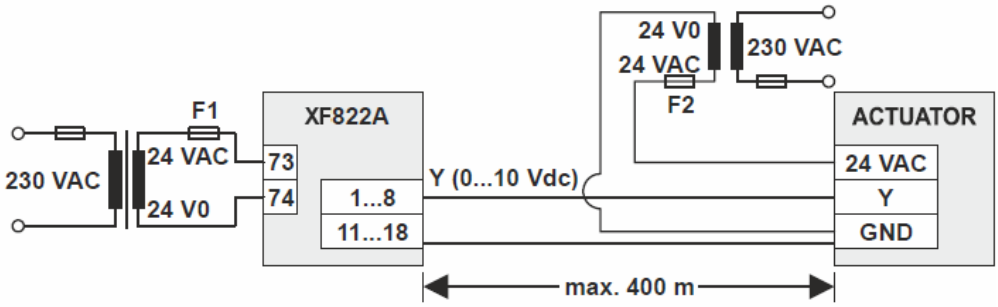


Figure 26: Power supply via a separate transformer

Powering Field Devices via Panel Bus I/O Module

- 24V actuator connected to an analog output module
- Field device located max. 100 m from the analog output module

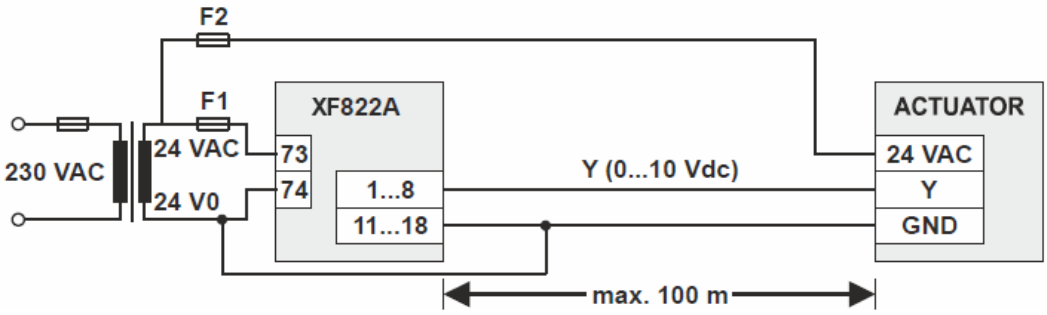


Figure 27: Power supply via Panel Bus I/O Module

WEB-EHSERIESNX26X Connection Examples

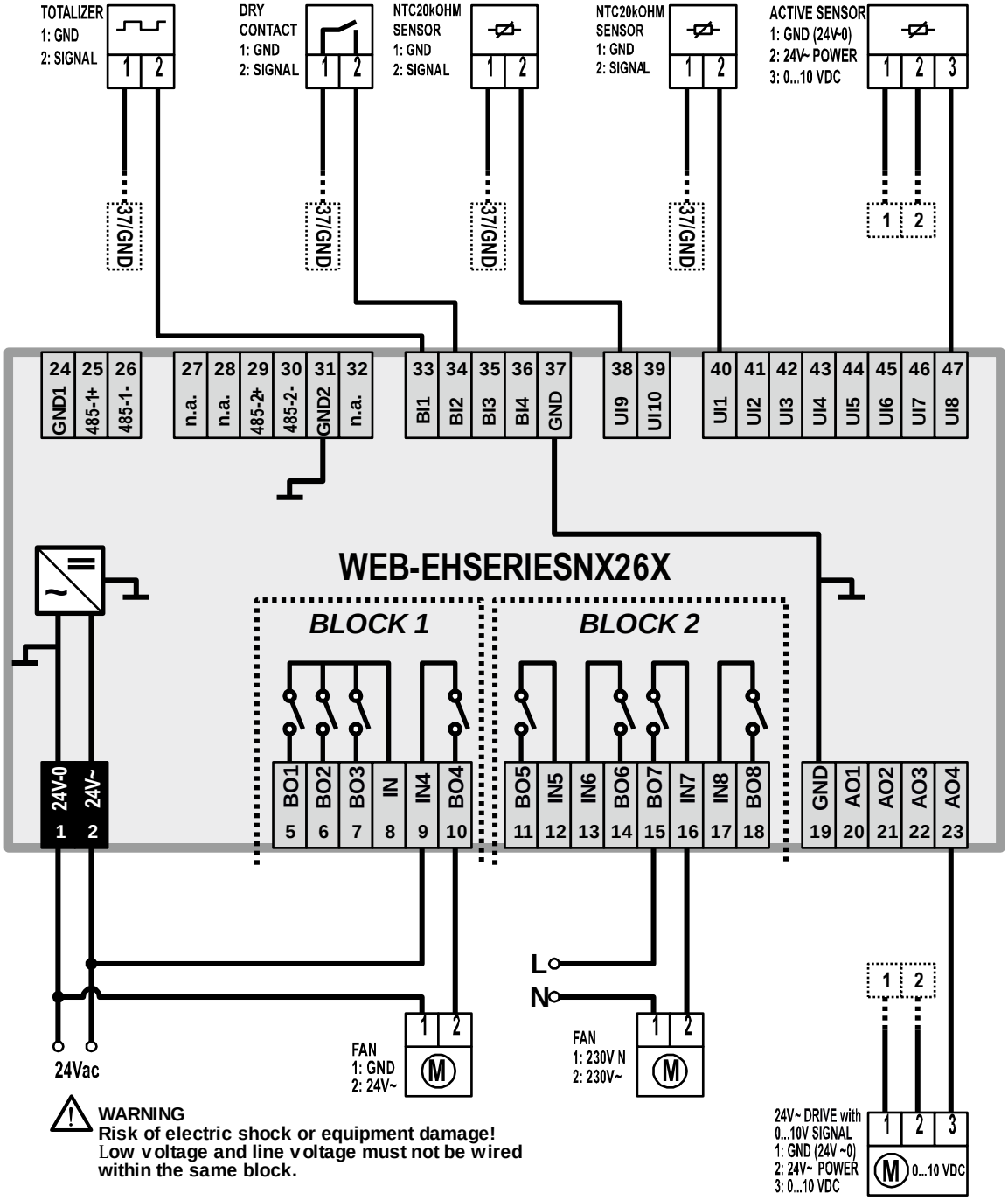


Figure 28: WEB-EHSERIESNX26X connection example

For fusing specifications see section "*Fusing Specifications*".

NOTE

Use a min. distance of 10 cm between power cables and 0...10 V / sensor cables in order to prevent signal disturbances on the 0...10 V / sensor cables.

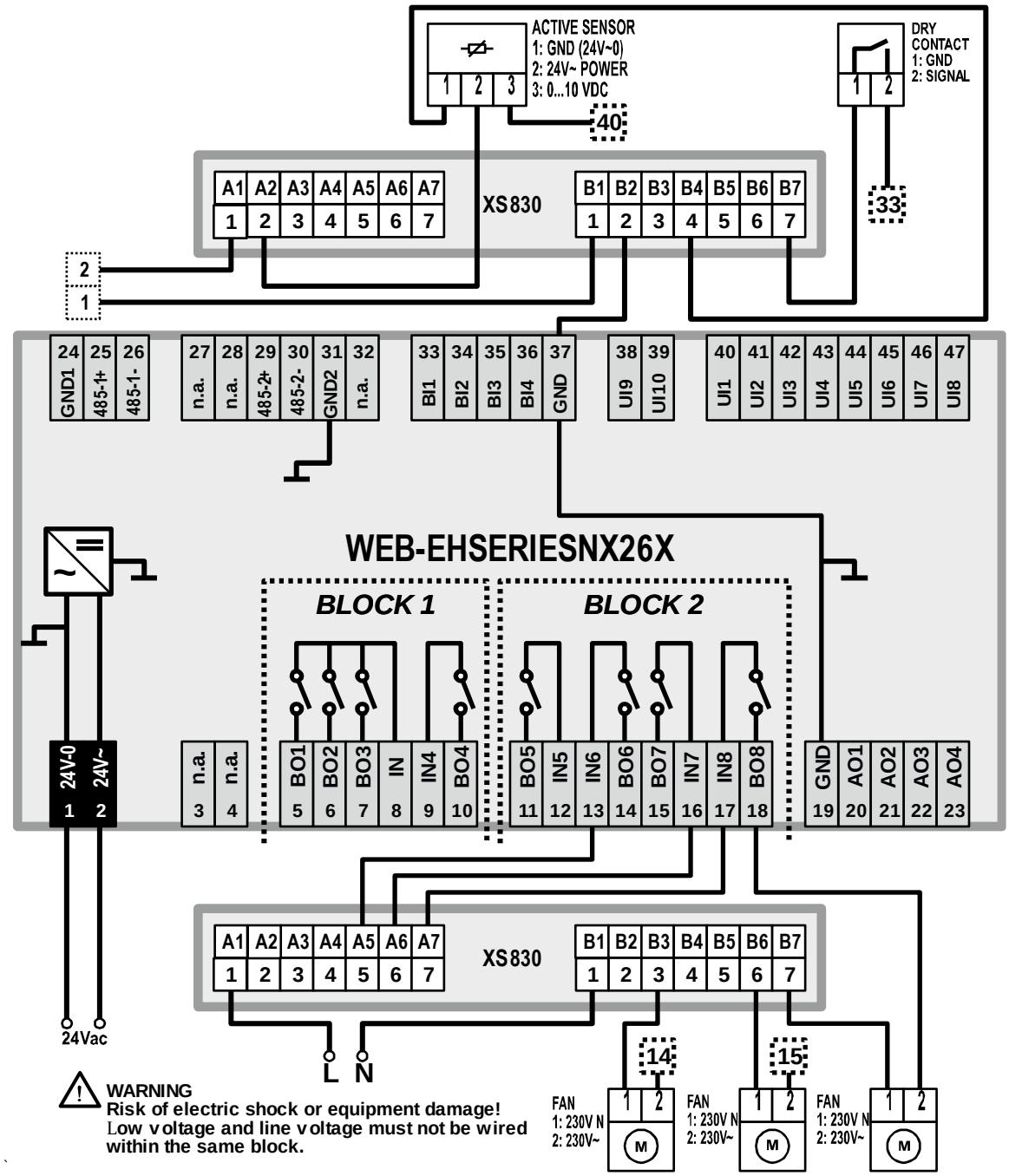


Figure 29: WEB-EHSERIESNX26X connection example (with two XS830 Auxiliary Terminal Packages)

The XS830 and XS831 Auxiliary Terminal Packages are optional accessories which can be mounted onto the top and/or bottom of the CIPer Model 50 controller in order to equip them with additional terminals for the connection of, e.g., shields, sensors, GND, N, 230 V, or 24 V (but not earth).

NOTE

Use a min. distance of 10 cm between power cables and 0...10 V / sensor cables in order to prevent signal disturbances on the 0...10 V / sensor cables.

Internal I/Os of the CIPer Model 50

Universal Inputs

The WEB-EHSERIESNX26XX is equipped with ten universal inputs (UIs) configurable (in WEBs N4). For information on the accuracy of the sensor inputs, their differential measurement error, the characteristics

(i.e., resistances and resultant voltages in dependence upon temperature) of the various different sensor types which can be connected to them, and on the thresholds at which sensor failures are recognized.

Table 11. Specifications of UIs

Criteria	Value
Voltage input	UI1-UI10: 0 … 10VDC with pull-up resistor (default) UI1-UI8: 0…10VDC w/o pull-up resistor UI1-UI8: 2…10VDC w/o pull-up resistor
Current input	UI1-UI10: 0 … 10VDC w/o pull-up resistor, external 499Ω resistor required to measure 0…20mA UI1-UI8: 2…10VDC w/o pull-up resistor, external 499Ω resistor required to measure 4…20 mA
Supported sensor types	NTC10kΩ (Type II) -22…+212 °F (-30..100°C) NTC20kΩ (Type II) -58…+302 °F (-50..150°C) Slow binary input (static, dry contact), 0.4 Hz
Resolution	12-bit resolution
Accuracy	±75 mV (0 … 10V)
Protection	Against short-circuiting, 24VAC

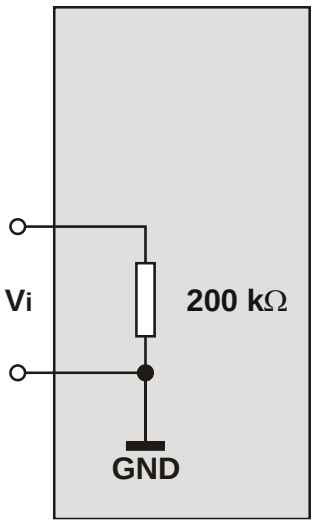


Figure 30: Internal wiring of UI1-UI8 configured for voltage input (without pull-up resistor)

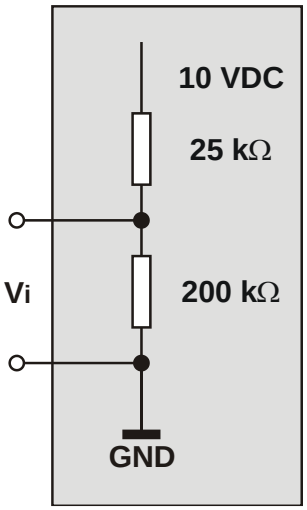


Figure 31: Internal wiring of UI1-UI10 configured for input from NTC10kΩ / NTC20kΩ / voltage input (with pull-up resistor)

Slow Binary Input Specifications

When configured as slow binary inputs, the universal inputs of the CIPer Model 50 have the following specifications:

Open contact	≥ 100 kΩ
Closed contact	≤ 100 Ω

The polarity (normal = N.O. contact or reverse = N.C. contact) configuration defines if a logical 1 or a logical 0 is detected for a closed contact. This is done by selecting (in WEBs N4) one of the following options:

Normal (default)	Closed external contact → state=1
	Open external contact → state=0
Reverse	Closed external contact → state=0
	Open external contact → state=1

Pulse Counter Specifications

Using WEBs N4, the universal inputs of the CIPer Model 50 can be configured as pulse counters (totalizers).

If the duty cycle is 50% / 50%, the pulse counter supports up to 0.4 Hz. Counting is done on the rising edge.

Table 12. UIs of CIPer Model 50 configured as slow BIs

Frequency	max. 0.4Hz
Pulse ON	min. 1.25s
Pulse OFF	min. 1.25s
Bounce	max. 50ms

Analog Outputs

The WEB-EHSERIESNX26XX is equipped with four analog outputs (AOs).

In the event of an application stop (e.g., during application download), the analog outputs assume the safety positions configured in WEBs N4.

The analog outputs can be configured in WEBs N4 as binary outputs (with an output of 0 V or 10 V, as the case may be).

Table 13. Specifications of AOs

Criteria	Value
Output type	0...10 V (default) 2...10 V
Max. output range	0 ... 11 VDC (1 mA)
Min. resolution	8 bit
Min. accuracy	± 150 mV
Max. wire length	1200 ft
Wire cross section	See Table 7
Protection	against short-circuiting, 24VAC

Binary Inputs / Pulse Counters

The WEB-EHSERIESNX26XX is equipped with four binary inputs (static dry-contact inputs) / pulse counters (fast totalizers).

Table 14. Specifications of BIs

Criteria	Value
Input type	Binary input (static dry-contact) pulse counter (fast totalizer)
Current rating (closed input)	2 mA
Open contact voltage	24 VDC
Protection	Against short-circuiting, 24 VAC

Binary Input Specifications

The binary inputs of the CIPer Model 50 are static dry-contact inputs. This reduces the wiring effort, as it is then not necessary to distribute an auxiliary voltage signal.

Open contact	≥ 3000 Ω (24 VDC on BI terminal)
Closed contact	≤ 500 Ω (short-circuit current: 2.0 mA)

The polarity (normal = N.O. contact or reverse = N.C. contact) configuration defines if a logical 1 or a logical 0 is detected for a closed contact. This is done by selecting (in WEBs N4) one of the following options:

normal (default)	closed external contact →	state=1
	open external contact →	state=0
reverse	closed external contact →	state=0
	open external contact →	state=1

Pulse Counter Specifications

Using WEBs N4, the binary inputs of the CIPer Model 50 can be configured as pulse counters (fast totalizers) for operation in conjunction with devices equipped with an open collector output.

If the duty cycle is 50% / 50%, the pulse counter supports up to 15 Hz. Counting is done on the rising edge.

Table 15. BIs of CIPer Model 50 configured as fast totalizers

Frequency	max. 15Hz
Pulse ON	min. 25ms
Pulse OFF	min. 25ms
Bounce	max. 5ms

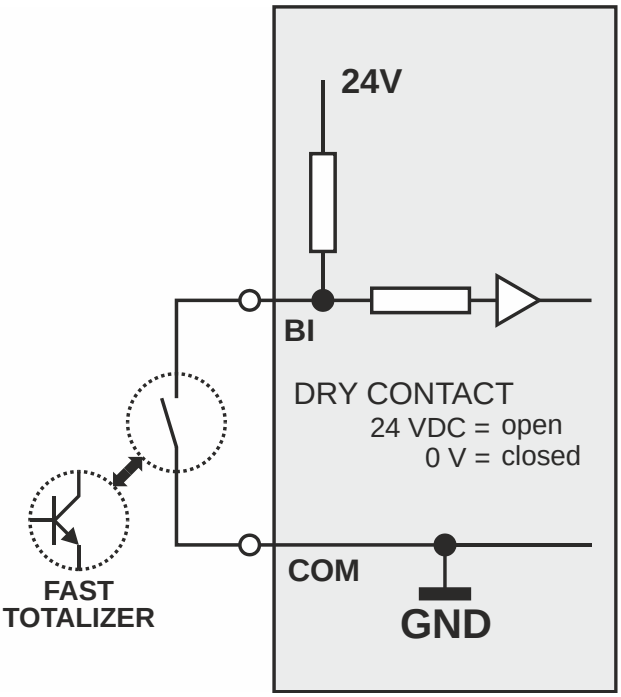


Figure 32: Internal wiring of BI

Binary Outputs

The CIPer Model 50 features eight binary outputs arranged in two blocks (BO1…4 and BO5…8, respectively).

WARNING

Risk of electric shock or equipment damage

Low voltage and line voltage must not be wired within the same block.

In the event of an application stop (e.g., during application download), the binary outputs assume the safety positions configured in WEBs N4.

The polarity (normal = N.O. contact or reverse = N.C. contact) configuration defines if a relay is open or closed, depending upon whether there is a logical 1 or a logical 0. This is done by selecting (in WEBs N4) one of the following options:

normal (default)	state=1 →relay contact is closed
	state=0 →relay contact is opened
reverse	state=0 →relay contact is closed
	state=1 →relay contact is opened

Table 16. Relay specifications of the CIPer Model 50

	Block 1		Block 2
	BO1…3	BO4	BO5…8
Contact volt. AC	5…253 V	5…253 V	5…253 V
Contact volt. DC	5…30 V	20…30 V	5…30 V
Max. contact current AC (resistive)	3 A	10 A	3 A
Max. contact current AC (induct.)	0.3 A*	10 A	0.3 A*
Max. contact current AC (induct.)	2 A**	10 A	2 A**
Max. contact current DC	3 A	7 A	3 A
Min. load	100 mA /5 VDC	40 mA /24 VDC	100 mA /5 VDC
* Typically, 250,000 cycles; ** typically 50,000 cycles			

NOTE

- The total max. sum load for all binary outputs (BO1…8) equals 14 A.
- Binary output 4 supports the switching of high in-rush currents (e.g., motors, incandescent lights, etc.). The max. allowed switch current is 80 A for a duration of max. 20ms.

Engineering and Commissioning

Required Preparations

In order to access (with a laptop or PC) the CIPer Model 50 controller via Ethernet/IP for the first time, the default passwords are used. For IP connections, you may employ any one of the following two options:

Option 1: USB 2.0 Device (recommended)

This USB 2.0 Device interface is the recommended interface for downloading applications and firmware via WEBs N4. An "A-Male to B-Male" USB cable is required.

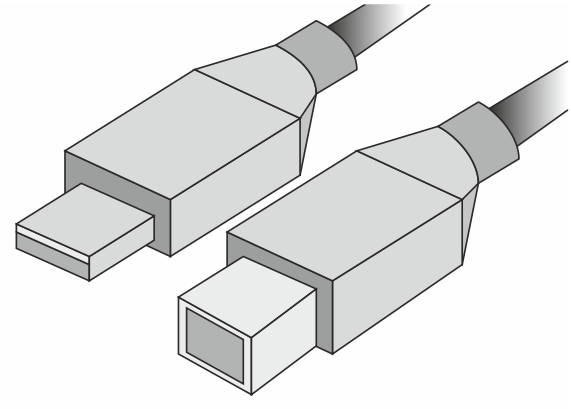


Figure 33: A-male to B-male USB cable

For access via USB, the CIPer Model 50 controller has a permanent default IP address 192.168.255.241. Your PC's IP address must match the CIPer Model 50 controller's default IP address subnet: We recommend using DHCP or "Obtain an automatic IP address".

Option 2: Standard Ethernet Interface

The default IP address of Ethernet interface 1: 192.168.200.20
The default IP address of Ethernet interface 2: 192.168.201.20
In any case, your PC's IP address must match the CIPer Model 50 controller's default IP address subnet (255.255.255.0).

Behavior of Outputs during Download

Table 17. Behavior of outputs during firmware download / application download

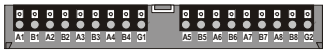
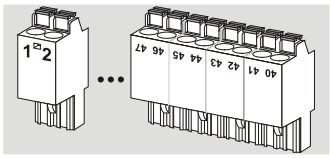
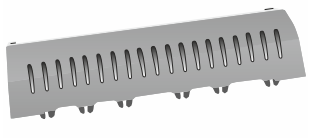
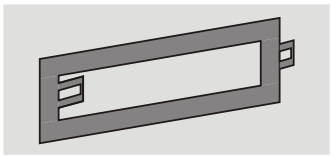
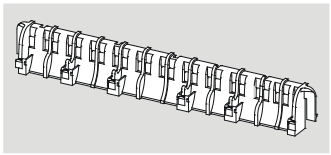
Analog, binary, and floating outputs	Output behavior during firmware download	Output behavior during application download
Outputs of Panel I/O modules	As soon as "receive heartbeat" (the value of which CANNOT be altered using WEBs N4) expires, outputs go to safety position.	As soon as "receive heartbeat" (the value of which CANNOT be altered using WEBs N4) expires, outputs go to safety position.
Outputs of LONWORKS I/O modules	As soon as "receive heartbeat" (the value of which can be altered using WEBs N4) expires, outputs go to safety position.	As soon as "receive heartbeat" (the value of which can be altered using WEBs N4) expires, outputs go to safety position.
Onboard I/Os	After the configured time-out, go to safety position.	After the configured time-out, go to safety position.

NOTE

These behaviors were determined using a test application with a cycle time of 10 seconds. A value update was triggered every 10 seconds.

Additional Parts

Table 18. Additional parts

	Order no.	Description
	**XS830**	Set of ten terminals. Each package consists of two groups of nine internally connected push-in terminals, for distributing signals / power.
	**XS831**	Set of ten terminals. Each package consists of two groups of four pairs of push-in terminals (each with a 499 Ω resistor), for converting 0...20 mA signals into 0...10 VDC signals, and one push-in ground terminal per group.
	**TPU-11-01**	Removable terminal plugs, push-in type; complete set of 3 plugs (for terminals 1, 2, 24-32); for the WEB-EHSERIESNX26.
	TPU-45-01	Removable terminal plugs, push-in type; complete set of 9 plugs (for terminals 1 - 47); for the WEB-EHSERIESNX26.
	**MVC-80-AC1**	Terminal cover (color: RAL9011); package of ten.
	**MVC-80-AC2**	Front door mounting accessory (color: RAL9011); package of 10.
	**MVC-40-AC3**	Strain relief; package of ten.

Software Licenses and Upgrades

Table 19. Software Licenses and Upgrades

Model	License content / upgrade license
WEB-EHSERIESNX26ND	100 Global Points (Panel-bus, on-board I/O) +10 Analytics Points + WEBS N4 Software Maintenance Agreement
WEB-EHSERIESNX26D	
EHSERIESH255UP	255 Additional Panel-bus Expansion I/O Points
PIN-Dev-UP-1	+50 open points upgrade, +1 Device
PIN-Dev-UP-2	+100 open points, +2 Devices
PIN-Dev-UP-10	+500 open points, +10 Devices
PIN-Dev-UP-25	+1250 open points, +25 Devices
PIN-Dev-UP-50	+2500 open points, +50 Devices

NOTE

For more details on the licenses, please refer to the Release Bulletin.

Panel Bus Connection

The CIPer Model 50 controller features two RS485 interfaces to which Panel Bus modules can be connected: RS485-1 (consisting of push-in terminals 24 [GND-1], 25, and 26) and/or RS485-2 (consisting of push-in terminals 29, 30, and 31 [GND-2]).

NOTE

GND-2 is internally connected with 24V-0 (terminal 1)

Overview of Panel Bus I/O Modules

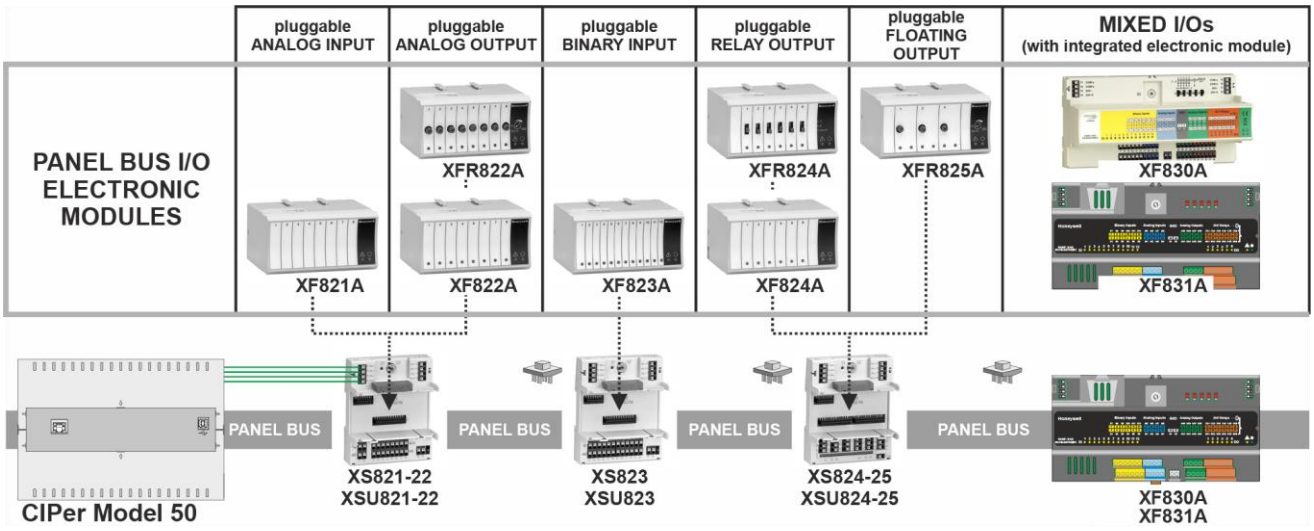


Figure 34: Overview of Panel Bus I/O Modules

Panel Bus Considerations

- **RS485-1 (isolated)**
  - Max. Panel Bus length:
    - 1200 feet. Any type of cabling and topology (including star and loop topology) possible. No additional end termination permitted.
    - 3600 feet (9.6 – 78.8 kbps) or 2400 feet (115.2 kbps) (see also section "RS485 Standard"). Mandatory twisted-pair or telephone cable and daisy chain topology. The CIPer Model 50 must be positioned at one end of the Panel Bus, and an end termination (120 Ω) at the other end. Further, the three-position slide switch (see Figure 14) must be set to "END."
- **RS485-2 (non-isolated)**
  - Max. Panel Bus length:
    - 1200 feet. Any type of cabling and topology (including star and loop topology) possible. No additional end termination permitted.
    - 3600 feet (9.6 – 78.8 kbps) or 2400 feet (115.2 kbps) (see also section "RS485 Standard"). Mandatory twisted-pair or telephone cable and daisy chain topology. The CIPer Model 50 controller must be positioned at one end of the Panel Bus, and an end termination (120 Ω) at the other end.
  - Must not extend beyond a single building or building floor
- **Max. no. of Panel Bus I/O modules per RS485 interface**
  - Max. no. of Panel Bus I/O modules of a given model: 16
  - Total max. no. of Panel Bus I/O modules: 64
- **Max. no. of Panel Bus I/O modules per CIPer Model 50**
  - Max. no. of Panel Bus I/O modules of a given model: 32

  - Total max. no. of Panel Bus I/O modules: 128
- **Max. no. of hardware I/O points per CIPer Model 50: 1000** (given a polling rate of 2 seconds)

Connecting CIPer Model 50 via its RS485-1 Interface to a Panel Bus

NOTE

When connecting an CIPer Model 50 via its RS485-1 to a Panel Bus I/, it is recommended that the slide switch be set to "END."

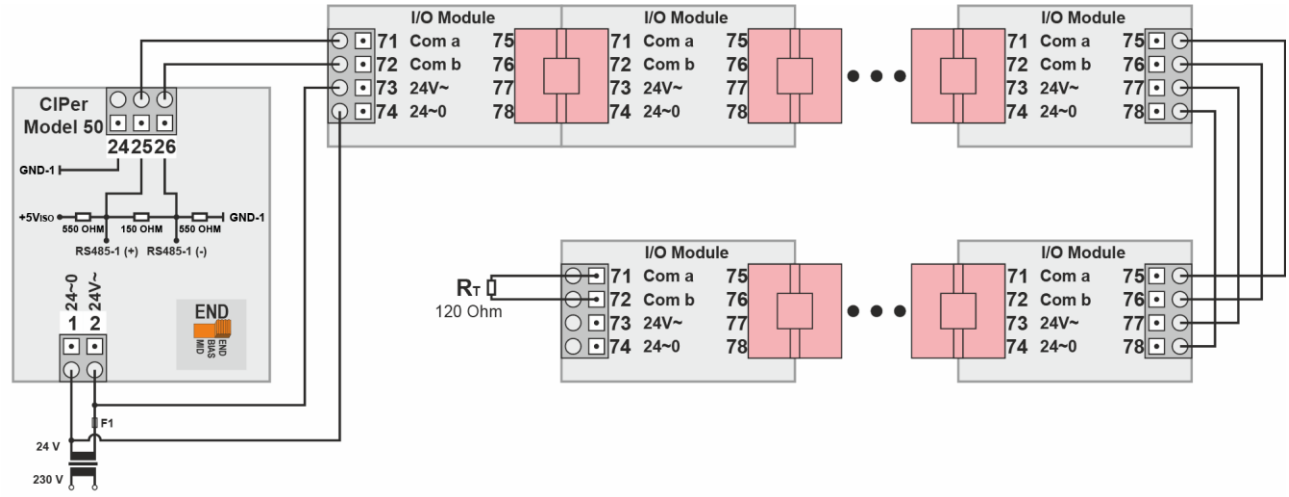


Figure 35: Connecting an CIPer Model 50 controller via its RS485-1 interface to a Panel Bus (single transformer)

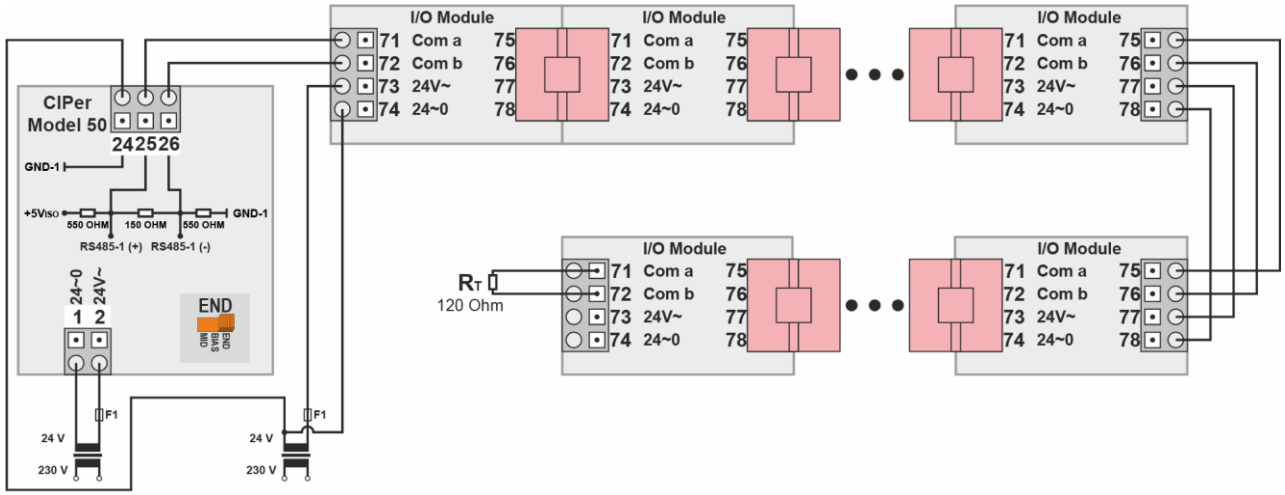


Figure 36: Connecting an CIPer Model 50 controller via its RS485-1 interface to a Panel Bus (two transformers)

Connecting CIPer Model 50 via its RS485-2 Interface to a Panel Bus

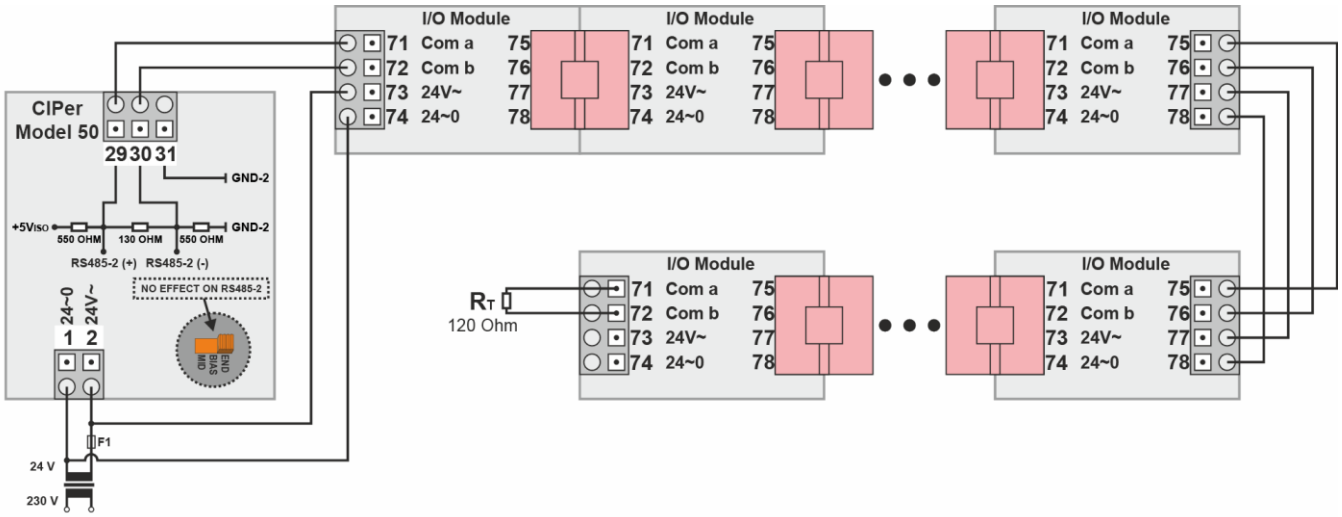


Figure 37: Connecting an CIPer Model 50 controller via its RS485-2 interface to a Panel Bus (single transformer)

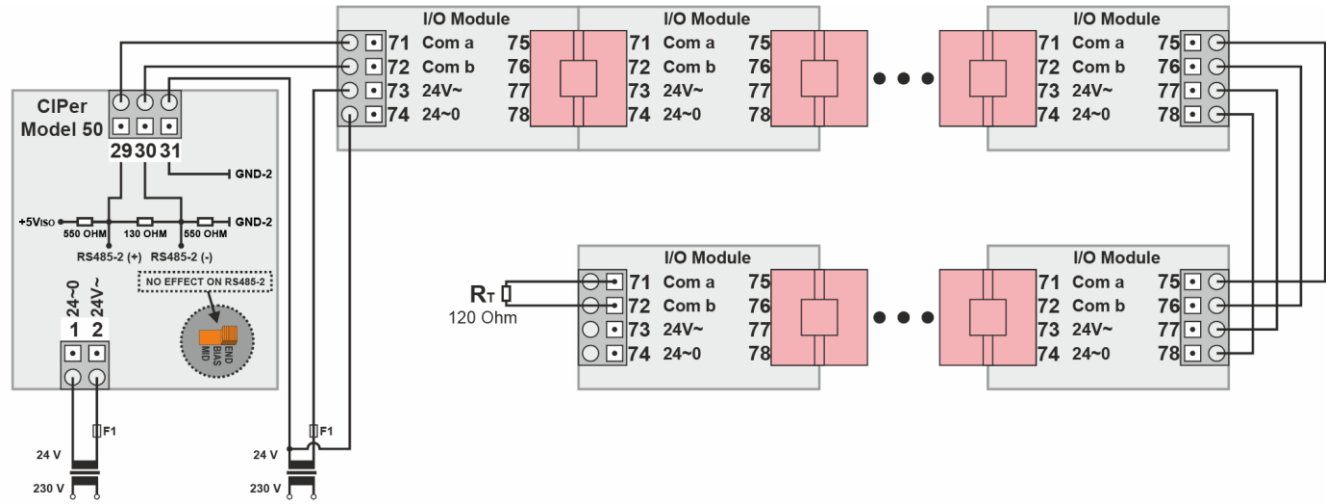


Figure 38: Connecting an CIPer Model 50 controller via its RS485-2 interface to a Panel Bus

Addressing Panel Bus I/O Modules

Each Panel Bus I/O Module must be addressed manually using its HEX switch (S2). The HEX switch setting is defined using the WEBs N4 engineering tool.

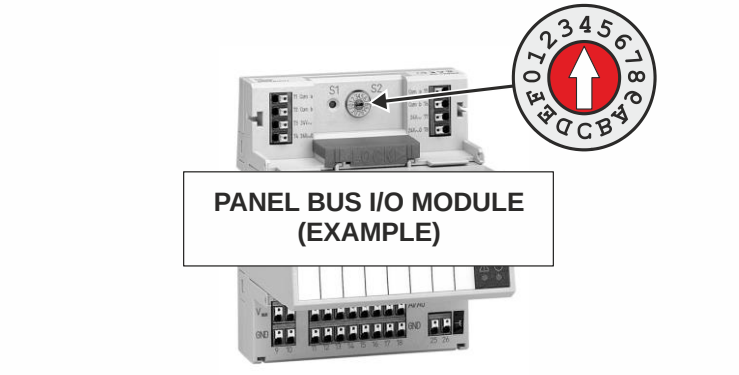


Figure 39: Location of HEX switch on Panel Bus I/O Module

NOTE

A HEX switch setting of "0" corresponds to an address in WEBs N4 of "1," a setting of "1" corresponds to an address of "2," and so on.

During commissioning, a max. of 16 Panel Bus I/O Modules of each type (AI, DO, etc.) can be assigned addresses. In doing so, no two modules of the same type (e.g., no two Analog Input Modules, no two Digital Output modules, etc.) may be assigned the same address. See also Figure 40.

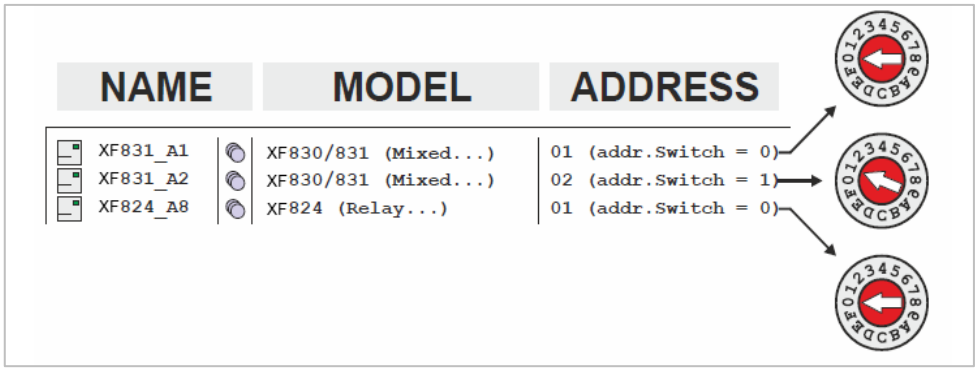


Figure 40: HEX switch setting and corresponding address

Failing to observe this requirement will cause a "Fail [date] timeout" error message to appear in the "Health" column, and the device status "down" to appear in the "Status" column. This same error message will likewise appear if an address is assigned to a module with which the controller cannot, for any reason (e.g., due to defective wiring, or because the module has not been physically installed, etc.), communicate.

Automatic Updating of Panel Bus I/O Module Firmware

The firmware of the Panel Bus I/O modules is part of the CIPer Model 50 firmware. The CIPer Model 50 controller will thus automatically update the firmware of the Panel Bus I/O modules as soon as it detects an older version in them.

Cable Specifications

Panel Bus I/O Modules

When checking the length of the power supply cable, the connection cables to all Panel Bus I/O Modules must be taken into account

Table 20. Power supply cable specifications

Max. length	9 ft (2.7 m) (from transformer to final module)
Cross section	min. 0.75 mm^2 (AWG 18)

EIA 485 Cable Specifications

The following cable specification is valid for all EIA 485 buses (e.g., Panel Bus, Modbus, and BACnet MS/TP).

Table 21. EIA 485 cable specifications

Max. length	3600 feet (9.6 – 78.8 kbps) or 2400 feet (115.2 kbps).
Cable type	twisted pair, shielded (foil or braided shields are acceptable)
Characteristic impedance	100...130 Ω
Distributed capacitance between conductors	Less than 100 pF per meter (30 pF per foot)
Distributed capacitance between conductors and shield	Less than 200 pF per meter (60 pF per foot)

The following cables fulfill this requirement:

- AWG 18;
- shielded, twisted pair cable 3322 or 3251;
- CAT 5,6,7 cable (use only one single pair for one bus);
- Belden 9842 or 9842NH.

Tuning Panel Bus Communication

The default polling interval for all Panel Bus points is set to "normal = 10s". Data from the field is thus updated every 10s.

Write commands are sent without time delay.

It is recommended that you update the polling interval of those points requiring more-frequent updating (see Figure 41)

IMPORTANT

- For CIPer Model 50, the fastest poll rate is 200 milliseconds.
- Do NOT set a faster poll rate, as this may overload the CPU in larger systems

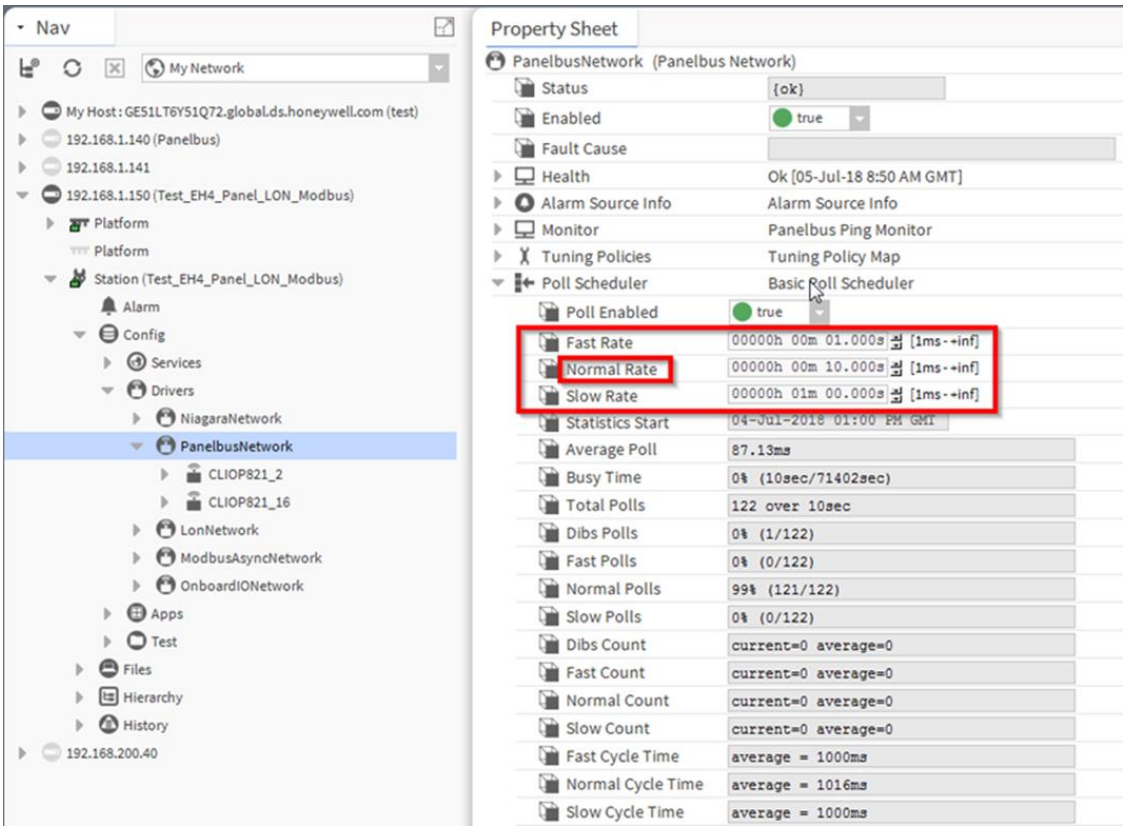


Figure 41: Editing the standard polling interval in "Poll Scheduler" of Property Sheet of PanelbusNetwork

You can assign different poll intervals to individual points in the Panel Bus Point Discovery Dialog (see Figure 42).

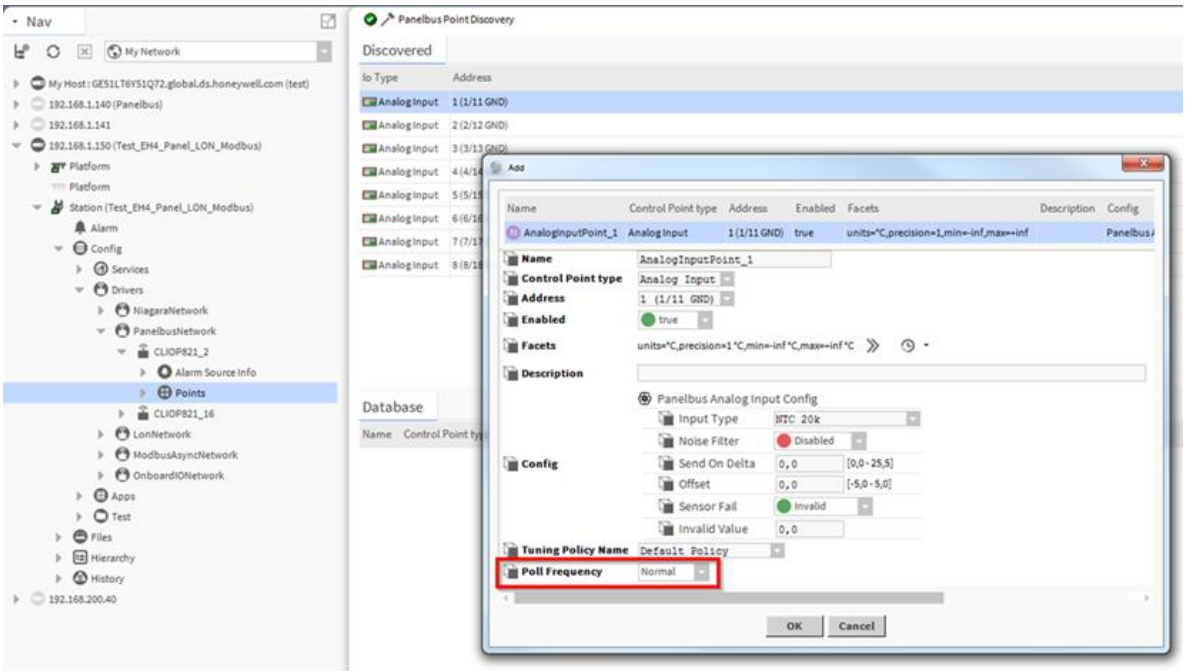


Figure 42: Assigning different poll intervals to individual points in the Panel Bus Point Discovery Dialog

Field Devices

Depending on the distance from the controller, field devices can be supplied with power by the same transformer used for the Panel Bus I/O Modules, or by a separate transformer, using cables as specified in Table 22.

Table 22. Power / communication cable specifications

Type of signal	Cross-sectional area	
	≤ 328 ft (100 m) (Figure 27) Power supply via Panel Bus I/O Module	≤ 1312 ft (400 m) (Figure 26) Power supply via a separate transformer
24 VAC power	16 AWG (1.5 mm^2)	not allowed for >328 ft (100 m)
0...10 V signals	28 – 14 AWG (0.081 – 2.08 mm^2)	

For wiring field devices, see section "*Powering Panel Bus I/O Models and Field Devices*".

Routing Cables to Field Devices

Route low-voltage signal and output cables to field devices separately from mains cables.

Table 23. Minimum distances to power mains cables

Cable	Minimum Distance
shielded	0.4" (10 mm)
unshielded	4" (100 mm)

All low-voltage signal and output cables should be regarded as communication circuits in accordance with VDE 0100 and VDE 0800 (or NEC or other equivalent).

- If the general guidelines for cable routing are observed, it is not necessary to shield field device signal and power supply cables.
- If for whatever reason, the routing guidelines cannot be observed, the field device signal and power supply cables must be shielded.
  - Shielding of cables leading to field devices must be grounded only at one end.
  - Do not connect the shield to the CIPer Model 50 controller.

LonWorks Communications

General Information

The CIPer Model 50 can be connected to LONWORKS networks. This requires the use of an IF-LON (see section "IF-LON" below), which is then plugged into to the CIPer Model 50 controller's USB 2.0 Host Interface (see also section "USB 2.0 Host Interface").

This permits individual CIPer Model 50 controllers to be connected / disconnected from the LONWORKS network without disturbing the operation of other devices.

The LONWORKS network is insensitive to polarity, eliminating the possibility of installation errors due to miswiring.

Different network configurations (daisy-chain, loop, and star configurations, or any combination thereof) are possible (see also Excel 50/500 LONWORKS Wiring Guidelines, 74-2865).

Connecting to a LONWORKS Network

IMPORTANT

- Do not bundle wires carrying field device signals or LONWORKS communications together with high-voltage power supply or relay cables. Specifically, maintain a min. separation of 3 inches (76 mm) between such cables. Local wiring codes may take precedence over this recommendation.
- Try to avoid installing in areas of high electromagnetic noise (EMI).

Cable Types

The unit must be wired to the LONWORKS network using either

- Level IV 22 AWG (Belden part number 9D220150)

  or

- Plenum-rated level IV 22 AWG (Belden part number 9H2201504) non-shielded, twisted-pair, solid-conductor wire.

When possible, use Honeywell AK3781, AK3782, AK3791, or AK3792 cable (US part numbers). See Excel 50/500 LONWORKS Wiring Guidelines 74-2865 for details, including maximum lengths.

Use wire with a minimum size of 20 AWG (0.5 mm^2) and a maximum size of 14 AWG (2.5 mm^2).

IF-LON2

Optionally, communication with physical I/O modules, with room and zone controllers, and with WEBS Spyder controllers can utilize LonTalk.

The IF-LON is equipped with a free-topology transceiver (FTT10A) for communication (at a data transmission rate of 78 kbps) on LONWORKS® networks (using the LonTalk protocol).

The LONWORKS network is insensitive to polarity, eliminating the possibility of installation errors due to miswiring. Different network configurations (daisy-chain, loop, and star configurations, or any combination thereof) are possible. See Excel 50/500 LONWORKS Wiring Guidelines, 74-2865 for details.

Figure 43: IF-LON2

Depending upon the chosen network configuration, one or two terminations may be required.

The following LONWORKS termination module is available:

- LONWORKS connection / termination module (mountable on DIN rails and in fuse boxes), order no. **XAL-Term2**

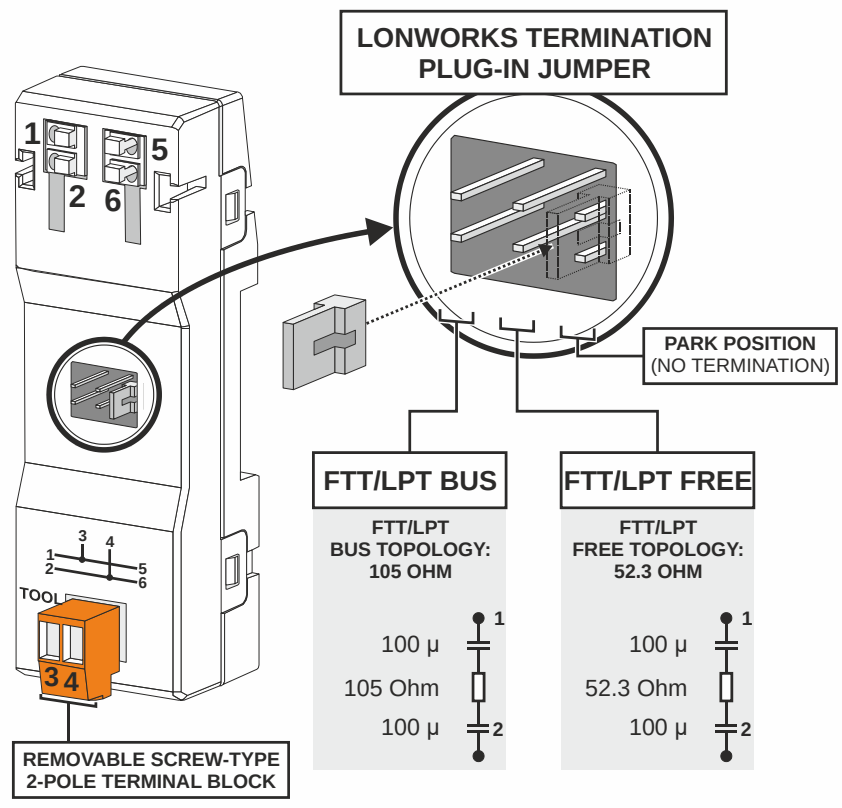


Figure 44: LONWORKS connection and termination module

BACnet MS/TP Bus Connection

The CIPer Model 50 controller features two RS485 interfaces to which BACnet MS/TP devices can be connected: RS485-1 (consisting of push-in terminals 24 [GND-1], 25, and 26) and/or RS485-2 (consisting of push-in terminals 29, 30, and 31 [GND-2]).

NOTE

GND-2 is internally connected with 24V-0 (terminal 1)

BACnet MS/TP Bus Considerations

- **RS485-1 (isolated)**
  - Max. BACnet MS/TP bus length: 3600 feet (9.6 – 78.8 kbps) or 2400 feet (115.2 kbps) (see also section "RS485 Standard").
  - Use only shielded, twisted-pair cable and daisy-chain topology.
  - Must conform to EIA-RS485 cabling guidelines (see section "EIA 485 Cable Specifications").
- **RS485-2 (non-isolated)**
  - Max. BACnet MS/TP bus length: 3600 feet (9.6 – 78.8 kbps) or 2400 feet (115.2 kbps) (see also section "RS485 Standard").
  - Use only shielded, twisted-pair cable and daisy-chain topology.
  - Ground noise should not exceed the EIA-485 common mode voltage limit.
  - Must conform to EIA-RS485 cabling guidelines.
  - Should not extend beyond a single building.

Connecting CIPer Model 50 via RS485-1 Interface to a BACnet MS/TP Bus

NOTE

For Figure 45a and Figure 47, please note the following:

- Always power each CIPer Model 50 controller and the connected BACnet MS/TP modules via separate transformers.
- For "L," see section "RS485 Standard".
- If any of the devices are electrically isolated, it is recommended that those devices be connected to signal ground. See section "RS485 Standard".

Example 1: Single CIPer Model 50 Controller and Connected BACnet Modules (with inserted termination resistor)

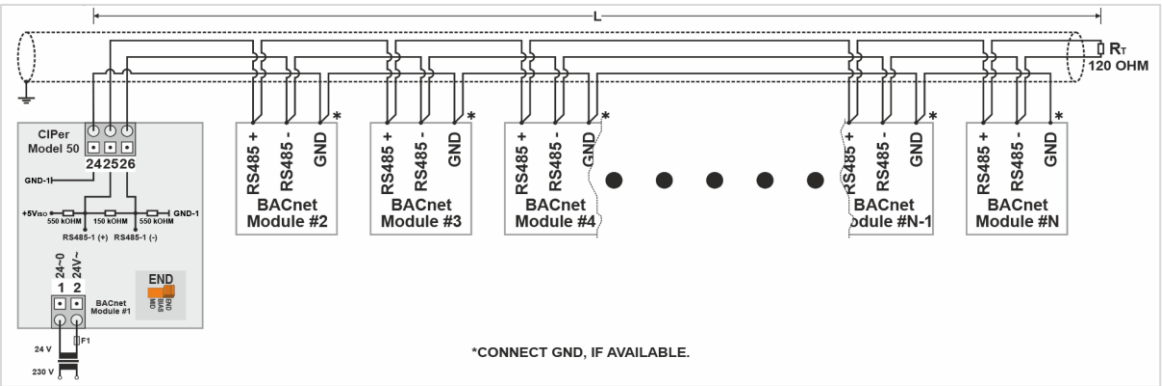


Figure 45; Connection of a single CIPer Model 50 controller via its RS485-1 interface to a BACnet MS/TP Bus

The termination resistor must be inserted directly into the terminals of the last BACnet MS/TP module.

Example 2: Multiple CIPer Model 50 Controllers and Connected BACnet Modules

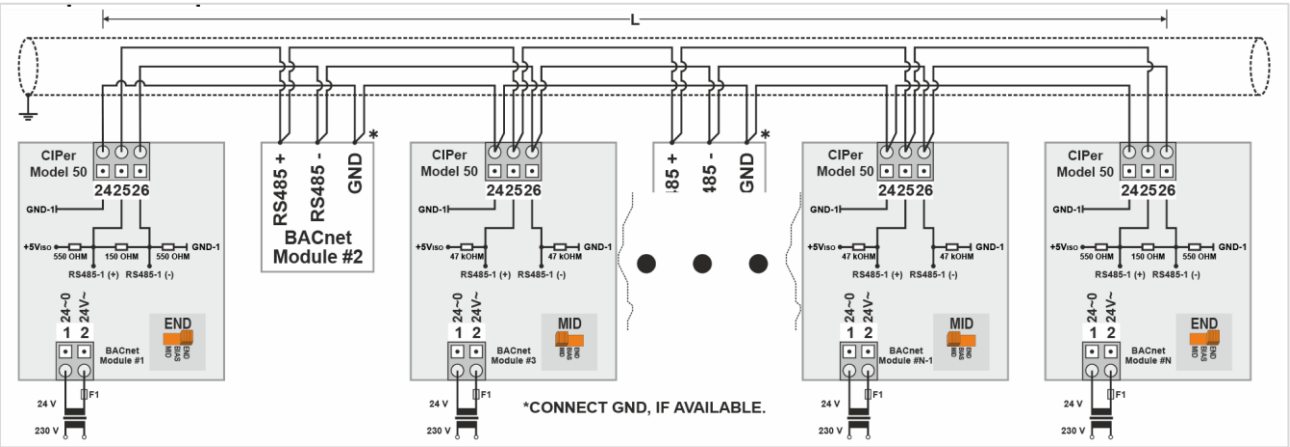


Figure 46: Connection of multiple CIPer Model 50 controllers via their RS485-1 interfaces to a BACnet MS/TP Bus

Example 3: Multiple CIPer Model 50 Controllers and Connected BACnet Modules (with inserted termination resistor)

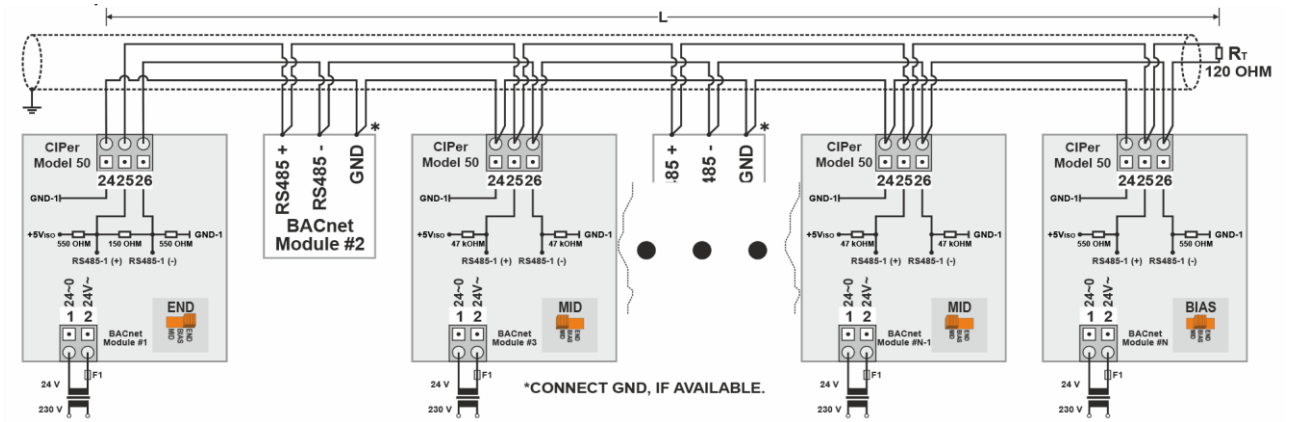


Figure 47: Connection of multiple CIPer Model 50 controllers via their RS485-1 interfaces to a BACnet MS/TP Bus

The termination resistor must be inserted directly into the terminals of the last BACnet MS/TP module (in this example, that is the rightmost CIPer Model 50, the 3-position slide switch of which has been set to "BIAS.")

Connecting CIPer Model 50 via RS485-2 Interface to a BACnet MS/TP Bus

NOTE

With regards to Figure 50 and Figure 51, please note the following:

- Always power each CIPer Model 50 controller and the connected BACnet MS/TP modules via separate transformers.
- For "L," see section "RS485 Standard".
- If any of the devices are electrically isolated, it is recommended that those devices be connected to signal ground. See section "RS485 Standard".
- Between devices equipped with non-isolated RS485 bus interfaces, potential differences of max. ±7 V are allowed. Further, this bus should not extend beyond a single building.

Example 1: Single CIPer Model 50 Controller and Connected BACnet Modules (with inserted termination resistor)

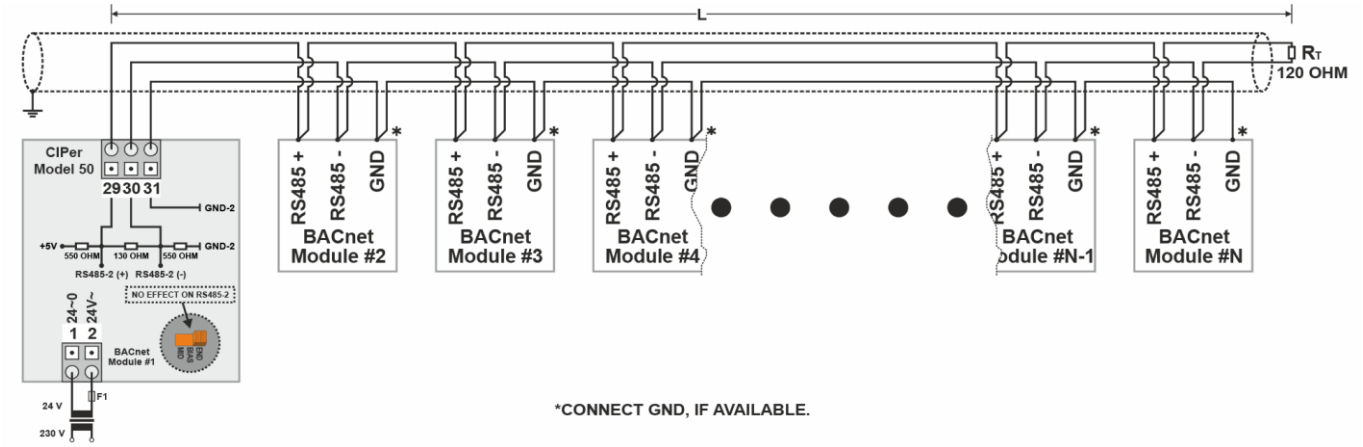


Figure 48: Connection of a single CIPer Model 50 controller via its RS485-2 interface to a BACnet MS/TP Bus

The termination resistor must be inserted directly into the terminals of the last BACnet MS/TP module.

Example 2: Multiple CIPer Model 50 Controllers and Connected BACnet Modules

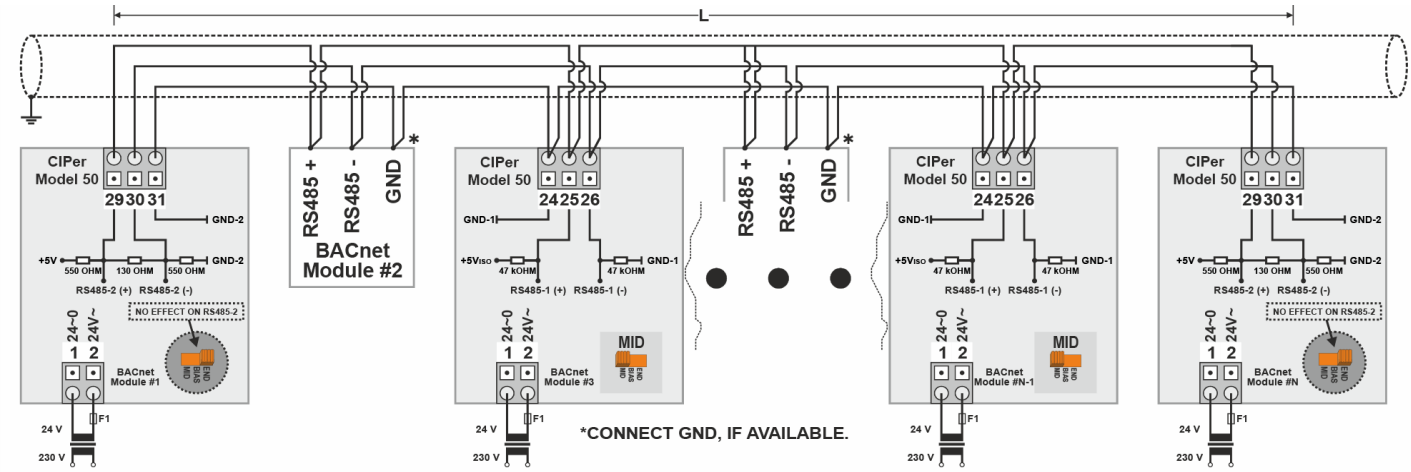


Figure 49: Connection of multiple CIPer Model 50 controllers via their RS485-2 interfaces to a BACnet MS/TP Bus

Modbus Connection

The CIPer Model 50 controller supports both Modbus RTU master and Modbus RTU slave functionality.

Modbus slaves can be connected to either or both of the two onboard RS485 interfaces: RS485-1 (consisting of push-in terminals 24 [GND-1], 25, and 26) or RS485-2 (consisting of push-in terminals 29, 30, 31 [GND-2]).

NOTE

GND-2 is internally connected with 24V-0 (terminal 1)

Modbus Considerations

- **RS485-1 (isolated)**
  - Max. Modbus length: 3600 feet (9.6 – 78.8 kbps) or 2400 feet (115.2 kbps) (see also section "RS485 Standard").
  - Use only shielded, twisted-pair cable and daisy-chain topology.
  - Must conform to EIA-RS485 cabling guidelines (see section "EIA 485 Cable Specifications").
- **RS485-2 (non-isolated)**
  - Max. Modbus length: 3600 feet (9.6 – 78.8 kbps) or 2400 feet (115.2 kbps) (see also section "RS485 Standard").
  - Use only shielded, twisted-pair cable and daisy-chain topology.
  - Ground noise should not exceed the EIA-485 common mode voltage limit.
  - Must conform to EIA-RS485 cabling guidelines (see section "EIA 485 Cable Specifications").
  - Should not extend beyond a single building.
- **Max. no of Modbus devices per CIPer Model 50 RS485 interface: 32 (including the CIPer Model 50, itself, which is counted twice)**

Connecting CIPer Model 50 via RS485-1 Interface to a Modbus

With regards to

Figure 50**:** Connection of an CIPer Model 50 Modbus master controller via its RS485-1 interface to a Modbus with slaves

, please note the following:

NOTE

- Always power each CIPer Model 50 controller and the connected BACnet MS/TP modules via separate transformers.
- For "L," see section "RS485 Standard".
- If any of the devices are electrically isolated, it is recommended that those devices be connected to signal ground. See section "RS485 Standard"

Example: CIPer Model 50 Modbus Master Controller and Connected Modbus Slaves (with inserted termination resistor)

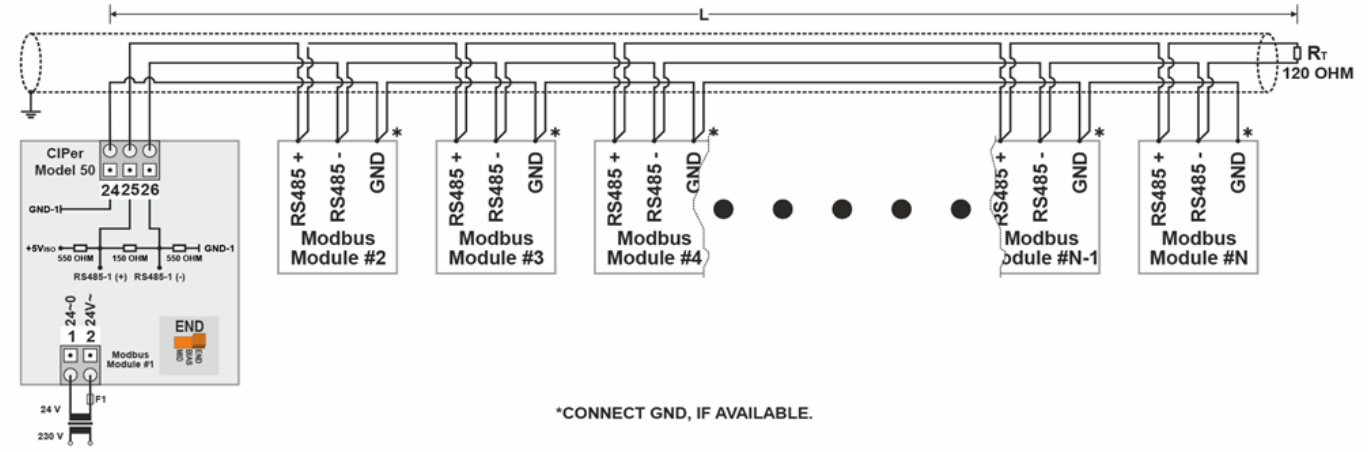


Figure 50: Connection of an CIPer Model 50 Modbus master controller via its RS485-1 interface to a Modbus with slaves

The termination resistor must be inserted directly into the terminals of the last Modbus slave.

NOTE

In this example, any or all of the Modbus RTU slaves depicted here can be CIPer Model 50 Modbus RTU slaves. In such cases, an CIPer Model 50 Modbus RTU slave positioned at the end of the Modbus (as "Modbus Module #N") must have its 3-position slide switches set to "End" (see Figure 17) (the insertion of the aforementioned termination resistor is then unnecessary) and any CIPer Model 50 Modbus RTU slaves positioned elsewhere on the Modbus must have their 3-position slide switch set to "Mid" (see Figure 15).

Connecting CIPer Model 50 via RS485-2 Interface to a Modbus

With regards to

Figure 51**:** Connection of an CIPer Model 50 Modbus master controller via its RS485-2 interface to a Modbus with slaves

, please note the following:

NOTE

- Always power each CIPer Model 50 controller and the connected Modbus slaves via separate transformers.
- For "L," see section "RS485 Standard".
- If any of the devices are electrically isolated, it is recommended that those devices be connected to signal ground. See section "RS485 Standard".
- Between devices equipped with non-isolated RS485 bus interfaces, potential differences of max. ±7 V are allowed. Further, this bus should not extend beyond a single building.

Example: CIPer Model 50 Modbus Master Controller and Connected Modbus Slaves (with inserted termination resistor)

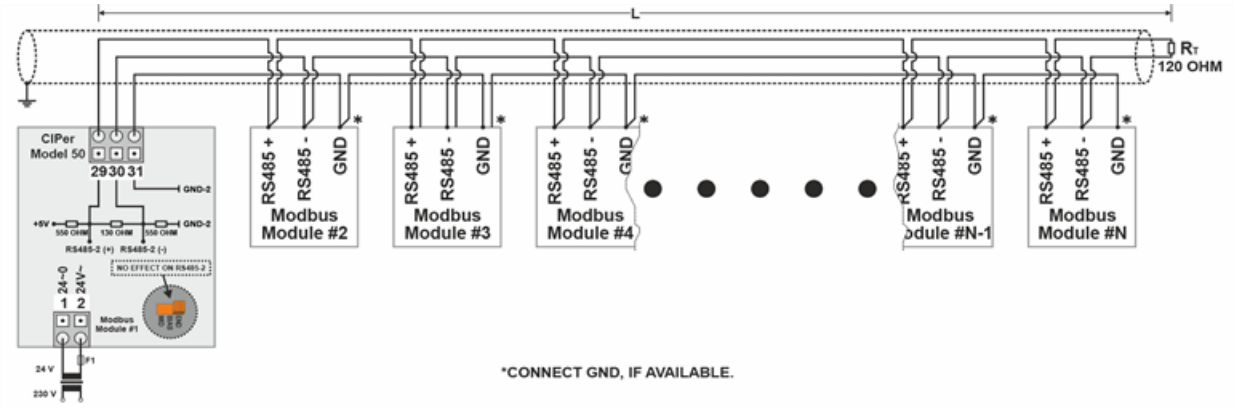


Figure 51: Connection of an CIPer Model 50 Modbus master controller via its RS485-2 interface to a Modbus with slaves

The termination resistor must be inserted directly into the terminals of the last Modbus slave.

NOTE

In this example, a maximum of one of the Modbus RTU slaves can be an CIPer Model 50 Modbus RTU slave – which must then be positioned at the end of the Modbus (as "Modbus Module #N"); the insertion of the aforementioned termination resistor is then unnecessary.

M-Bus Connection

The CIPer Model 50 controller supports M-Bus Master functionality via its onboard RS232 / RJ45 socket.

It uses standard PW3/PW20/PW60 converters to connect to the M-Bus devices.

M-Bus Considerations

Max. no. of M-Bus devices per CIPer Model 50 is 60.

Bus Length

- Max. M-Bus length: 1050 feet from PW3 / PW20 / PW60, at communication rates of 9.6 kbps or slower with shielded, twisted pair cable: 3322 or 3251.
- The M-Bus can be extended to 3000 feet, depending upon the communication rate, and provided that the following electrical limitations are observed:
  - Bus voltage must at no point fall below 12 VDC
  - Maximum cable capacitance of 180 nF

For bus length extension, M-Bus repeaters can be used, but have not been tested by Honeywell. Hence, it is the responsibility of the installing / commissioning personnel to ensure proper functioning.

Wiring Topology

M-Bus meters are connected to the bus cable in parallel.

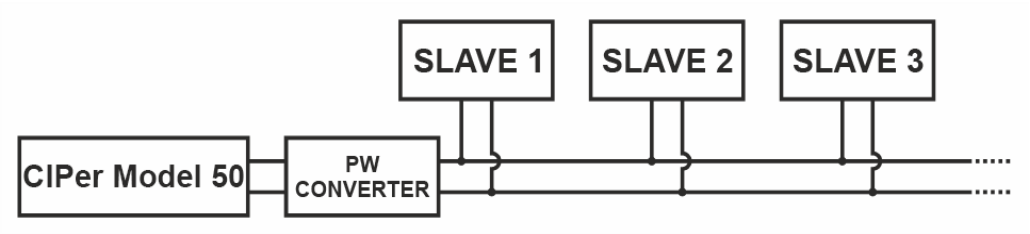


Figure 52: Allowed M-Bus wiring topology

Cabling CIPer Model 50 to PW3/PW20/PW60

- Use the TECHTOO USB 3.0 and YIOVVOM DB9 Breakout Connector cable setup between the RS232 / RJ45 socket of the CIPer Model 50 and the PW adapters.
- The TECHTOO USB 3.0 cable has a length of 10 ft, and the pin-out listed in Table 25.
- In case a third-party cable is used instead of the TECHTOO USB 3.0 cable, the third-party cable must have a max. length of 45 ft and a max. cable capacitance of 2,500 pF.

Table 24. CIPer Model 50 RS232 / RJ45 socket specifications

RJ45 plug, pin no.	RS232 function
1	
2	RxD
3	TxD
4	
5	GND
6	
7	
8	

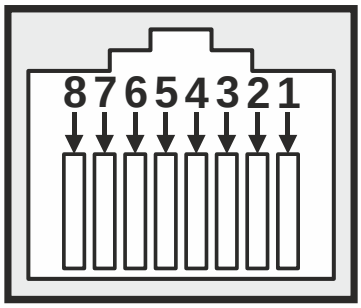


Figure 53: CIPer Model 50 RS232 / RJ45 socket

Table 25. RS232-to-PW cable specifications

RJ45 plug, pin no.	RS232 function	9-Pin sub-D connector pin no.
1	DCD	1
2	RxD	2
3	TxD	3
4	DTR	4
5	GND	5
6	DSR	6
7	RTS	7
8	CTS	8
--	Not used	9

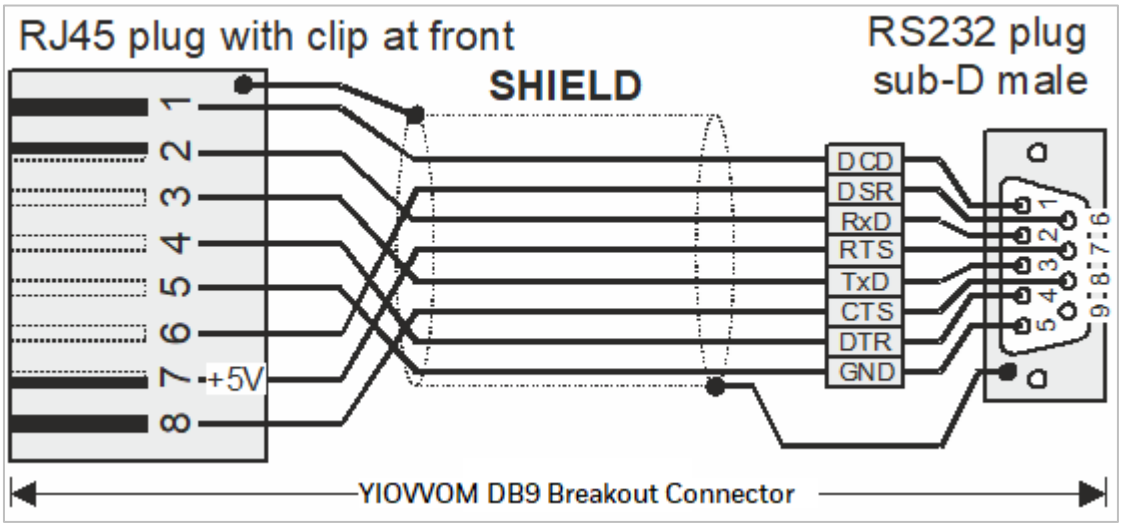


Figure 54: YIOVVOM DB9 Breakout Connector power / communication cable details

Cabling PW3/PW20/PW60 to M-Bus

- Use shielded, twisted pair cable 322 or 3251.
- Shielding is especially recommended when the M-Bus cable is installed in areas with expected or actual electromagnetic noise. Avoiding such areas is to be preferred.
- Connect the shield to a noise-free earth ground – only once per M-Bus connection.
- Power the CIPer Model 50 controller and the PW M-Bus Adapter with separate transformers – see WARNING below.

NOTE

If, alternatively, only a single transformer is available, when connecting a laptop, PC, web browser, CL-Touch, or 3rd-party touch panel to the USB 2.0 Device Interface on the front of the CIPer Model 50 controller, use an optical isolator for the USB connection or substitute an M-Bus Mikro-Master USB (Relay GmbH, D-33106 Paderborn) for the PW M-Bus Adapter.

M-Bus Connection Procedure

1. Install the PW M-Bus Adapter on DIN rail. Insert a screwdriver into the slot in the DIN rail clamp on the underside of the PW and pry downward to loosen clamp until the unit snaps onto the rail.

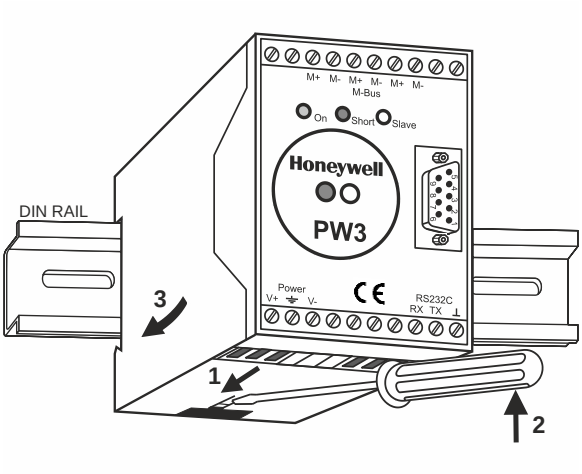


Figure 55: Mounting of PW (PW3 shown here)

2. Connect the M-Bus devices to the PW M-Bus Adapter. All M+ and M- terminals are connected in parallel in the PW M-Bus Adapter.

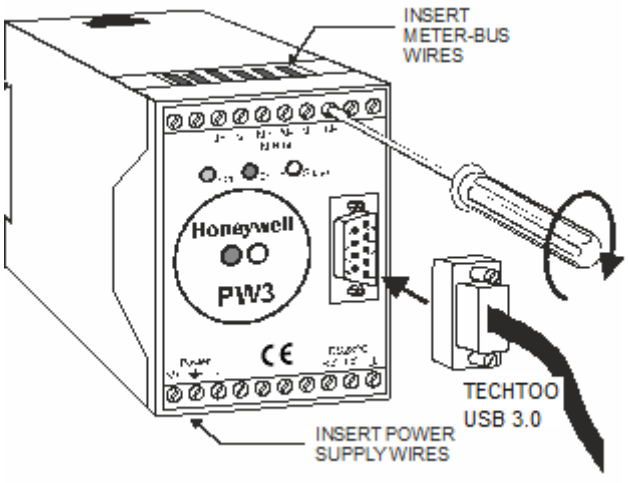
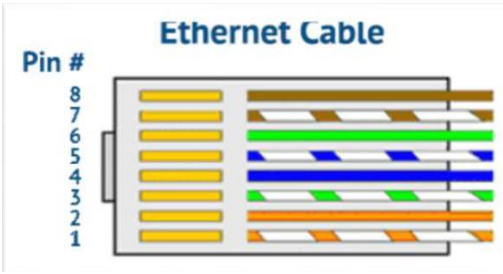


Figure 56: PW M-Bus adapter connections

3. Connect the PW M-Bus Adapter to the RS232 / RJ45 socket of the CIPer Model 50 using the TECHTOO USB 3.0 and YIOVVOM DB9 Breakout Connector cable.

   Both a USB RS-232 DB-9 male adapter (since most PCs and laptops no longer have a conventional DB-9 male jack) as well as a nifty little DB-9 female Jack with (small) screw terminals to connect wires (your cut Ethernet cable) to the pins.

To can make up your own RJ-45 to conventional to RS-232 DB-9 female connecting cable using a standard Ethernet cable with the one end cut off. The standard color codes are:



- Pin **2** / RxD (receive data) = **Orange**
- Pin **3** / TxD (transmit data) = **White/Green stripe**
- Pin **5** / GND = **White/Blue Stripe**

For proper serial communication:

Tx on your host (laptop) must go to Rx on the CIPer50

Tx on the CIPer50 must connect to Rx on your host so your Wire PIN 2 <> PIN 3 and PIN 3 <> PIN 2.

At the RS-232 DB-9 female connection:

- **Orange** > DB-9 pin **3**
- **White/Green** > DB-9 Pin **2**
- **White/Blue** > DB-9 Pin **5**

NOTE

TECHTOO USB 3.0 to Serial Adapter USB RS232 Cable USB Serial Cable Converter DB9 USB (10ft) with FTDI Chipset Gold Plated for Win10/8.1/8/7/Vista/XP/2000/Android/Linux/Mac OS X10.6 & Above.

YIOVVOM DB9 Breakout Connector to Wiring Terminal RS232 D-SUB Male Serial Adapters Port Breakout Board Solder-Free Module with case (Female Serial Adapter).

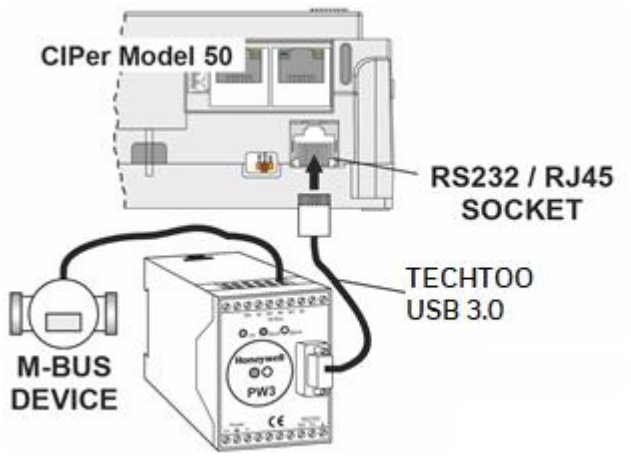


Figure 57: Connecting the CIPer Model 50 to the PW M-Bus adapter

4. Connect 24 V power to the M-Bus Adapter.

⚠ WARNING

Risk of electric shock or equipment damage!

Due to the risk of short-circuiting (see Figure 24), it is strongly recommended that the CIPer Model 50 controller be supplied with power from a dedicated transformer. However, if the CIPer Model 50 controller is to be supplied by the same transformer powering other controllers or devices (e.g., the PW M-Bus Adapter), care must be taken to ensure that correct polarity is observed.

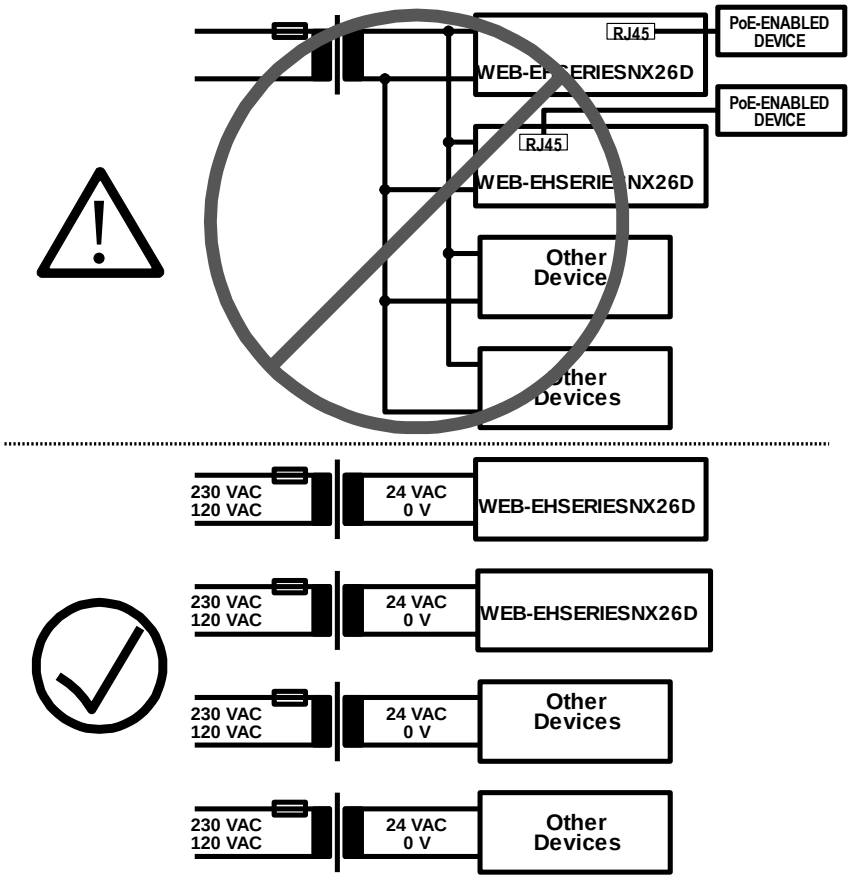


Figure 58: Connecting power to the PW M-Bus adapter

Controller Performance

The controller performance has been tested in two test scenarios.

NOTE

These are example scenarios. It is therefore, of course, possible for you to use any other mix of Panel Bus points and BACnet MS/TP points as long as the maximum number of hardware I/O points (see section "Panel Bus Considerations" on pg. 46) is observed..

Table 26. Performance test 1 (simple statement for the COV updates, no HVAC application)

	No. of modules	No. of hardware I/O points	Points in PX pages	Freq. of value changes	Histories enabled	CPU usage	Test result
Panel Bus (via RS485-1)	46[A]	491	491[B]	2 sec (poll rate)	--	30% (occasionally: 50%)	OK for non-critical applications [C]
BACnet MS/TP (via RS485-2)	13	559	559[D]	2 sec (COV)	500		

[A] 9x 821A, 9x 822A, 9x 823A, 9x 824, 5x 825, 5x 830A

[B] Four (4) PX pages: AI, AO, BI, and BO points each in a dedicated PX page per point type

[C] About 0.5% of the BACnet MS/TP point updates are occasionally delayed.

[D] One (1) PX page with all points

Table 27. Performance test 2

	COV frequency	Max. no. of COV updates per min. across RS485-1 and RS485-2 together	CPU usage	Test result
BACnet MS/TP at 38,500 bps	4 sec	4,000	25...35% (occasionally: 60%)	OK

Troubleshooting

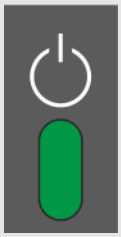
CIPer Model 50 Controller Troubleshooting

The following LEDs of the CIPer Model 50 controller can be used for troubleshooting purposes:

- Power LED (green)
- Status LED (red)
- L1 and L2 LEDs (yellow)
- Tx (sending data on RS485-1) and Rx (receiving data on RS485-1) LEDs

Power LED (green) of CIPer Model 50

Table 28. CIPer Model 50 controller power LED

Case	Power LED	Meaning	Remedy
			
1	ON	Normal operation.	No action necessary.
2	OFF	Power supply not OK.	• Check power supply voltage. • Check wiring. • If problem persists, replace hardware.

Status LED (red) of CIPer Model 50

Table 29. CIPer Model 50 controller status LED

Case	Status LED	Meaning	Remedy
			
1	OFF after power-up	Normal operation.	No action necessary.
2	ON continuously after power-up	Indicates an active alarm; is controlled by WEBs-Alarm System; is configurable.	• Try powering down and then powering up the CIPer Model 50 controller. • If problem persists, replace hardware.

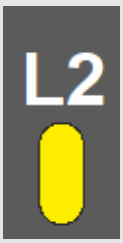
L1 LED

Table 30. CIPer Model 50 controller bus L1 LED

Case	Bus LED	Meaning	Remedy
			
1	ON continuously after power-up	Normal operation; Daemon starting.	No action necessary.
2	Flashes constantly	Station starting; if L2 is also flashing, then the station has started.	No action necessary.
3	OFF	Severe software problems.	Contact TAC.

L2 LED

Table 31. CIPer Model 50 controller bus L2 LED

Case	Bus LED	Meaning	Remedy
			
1	ON continuously after power-up	Platform has started / is reachable.	No action necessary.
2	OFF	Station is not running.	• Start station (enable auto start). • Contact TAC.
3	Flashing	Station has started.	No action necessary.

Tx and Rx LEDs

Table 32. CIPer Model 50 controller bus LEDs Tx and Rx

Case	Bus LEDs 	Meaning	Remedy
1	Both Tx and Rx are flashing	Normal operation; RS485-1 is functioning properly.	No action necessary. In case of communication problems, check settings (communication rate, parity, etc.).
2	Both Tx and Rx are OFF	No communication on RS485-1.	Switch ON communication on RS485-1. L1 should then flash. Further handling like case 4 (below).
3	Rx is flashing and Tx is OFF	Communication on RS485-1 has been switched OFF, but the CIPer Model 50 is receiving data from other controllers.	Switch ON communication on RS485-1. If this proves unsuccessful, the hardware may be defective.
4	Tx is flashing and Rx is OFF	The CIPer Model 50 controller is attempting to establish communication on RS485-1, but there is no answer.	The communication rate (kbps) on RS485-1 has not been correctly set; other controllers on the bus may have been incorrectly assigned the same device number; wiring problem or hardware defect.

Panel Bus I/O Module Troubleshooting

Please refer to HONEYWELL EXCEL 5000 OPEN SYSTEM - Installation & Commissioning Instructions (EN1B-0375GE51) for more information about Panel Bus I/O module troubleshooting.

APPENDIX 1: Earth Grounding

CIPer Model 50 Systems and SELV

In order to avoid distribution of noise or earth ground potential differences over networks or other connections, the CIPer Model 50 controller is designed to be in compliance with SELV (Safety Extra-Low Voltage).

Furthermore, SELV offers the greatest possible safety against electrical impact.

To support SELV, all Honeywell external (CRT series) or internal transformers comply with standard EN60742.

Earth grounding is therefore not recommended.

CIPer Model 50 Systems and Standard EN60204-1

However, if compliance with EN60204-1 is required, note the following:

General Information

EN60204-1 defines electrical safety for a complete application / machine including controllers, sensors, actuators and any connected/controlled electrical device.

EN60204-1 requires controllers to be powered by PELV (Protective Extra-Low Voltage) and earth grounding of the secondary side of the used transformers or earth grounding of the system ground.

Earth grounding is prescribed to prevent unexpected start-up of connected rotating/moving machines due to an insulation fault and double earth grounding somewhere in the plant.

In order to fulfill PELV (if earth grounding is prohibited), the use of an earth leakage monitor is also possible.

When is EN60204-1 applicable to CIPer Model 50 Systems?

- Safety against electrical impact
  - EN60204-1 is not mandatory; this is because electrical safety is provided by the use of SELV and transformers according to standard EN60742.
- Safety against unexpected start-up of rotating/moving machines
  - If the application/plant does not contain machines that can be harmful to the operator due to an unexpected start-up, the standard EN60204-1 is not applicable.

If such machines are encountered, then EN60204-1 must be followed. Grounding is required.

Earth Grounding of EN60204-1 Applicable Systems

NOTE

We strongly recommend that each CPU be supplied with electricity from its own dedicated transformer.

- If system protective earth grounding is planned, use a cable as short as possible for grounding: min. 1.5 mm² (16 AWG).
- For connection details, refer to the following examples.

Example 1:

The following explains how to connect and earth multiple CPUs (e.g., multiple CIPer Model 50 controllers, Spyder, Stryker etc. or any combination thereof) earth-grounded as per EN60204-1.

NOTE

- Use a noise-free earth ground inside the cabinet.
- If a field device that prohibits earth grounding is connected to the system ground, an isolation monitoring device must be used instead of earth grounding.

Connect earth ground to the respective terminal of the CPU, see Figure 60

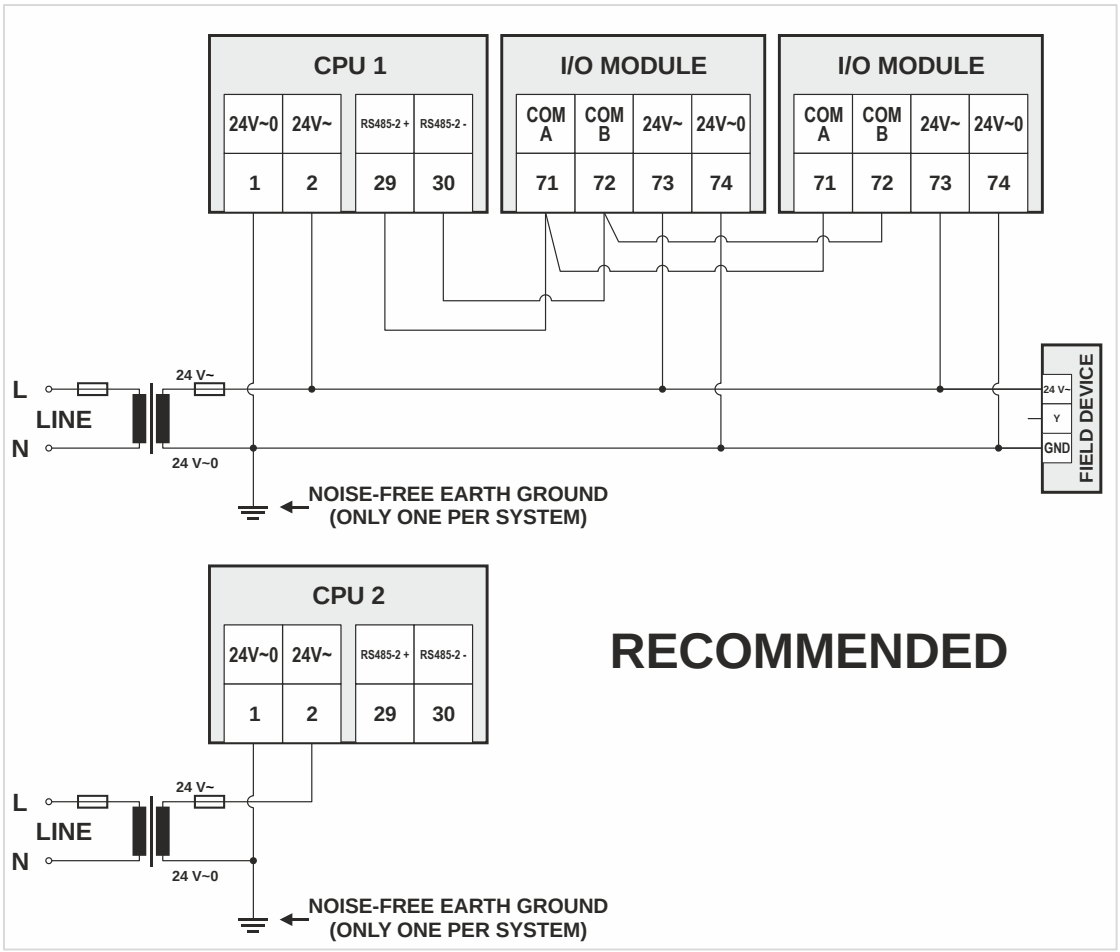


Figure 59: Connecting and earthing multiple CPUs (RECOMMENDED USE OF SEPARATE TRANSFORMERS)

Example 2:

When connecting multiple CPUs to a single transformer, it is imperative that the polarity of the power supply terminals of the CPUs and the polarity of the transformer always correspond (namely: 24V-0 of the transformer must always be connected to 24V-0 of the CPU, and 24V~ of the transformer must always be connected with 24V~ of the CPU).

Depending upon the individual CPU, the numbering of the corresponding two terminals may possibly deviate from the norm (which is usually "terminal 1 = 24V-0" and "terminal 2 = 24V~"). In the following example, CPU 3 has a deviating numbering and must be connected accordingly.

NOTE

- When using a single transformer for several CPUs, each CPU ground must be wired separately to the star-point.
- If the field device transformer is physically far away from the CPUs, earth grounding must still be performed for the controller.
- Use one star-point to split power for multiple CPUs and field devices.

Connect earth ground to the proper terminal of the CPU.

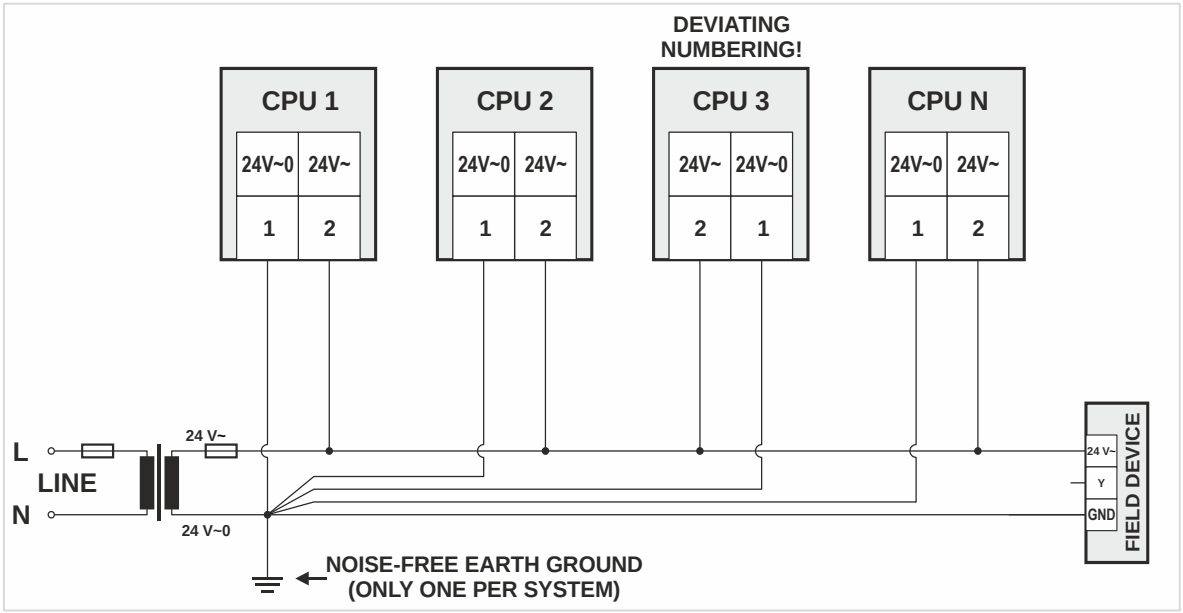


Figure 60: Connecting and earthing multiple CPUs

APPENDIX 2

Sensor Input Accuracy

The internal sensor inputs of the CIPer Model 50 controller support both NTC10kΩ (Type II) and NTC20kΩ (Type II) sensors (see also section "Universal Inputs"). The following table lists the typical minimum accuracies of the hardware and software for temperature sensors.

Table 33. Accuracies of internal NTC20kΩ sensor inputs of the CIPer Model 50

Range	**Measurement error (excl. sensor characteristics)**	
	NTC10kΩ (Type II) sensors	NTC20kΩ (Type II) sensors
-58 ... -4 °F (-50 ... -20 °C)	≤ 5.0 K	≤ 5.0 K
-4 ... +32 °F (-20 ... 0 °C)	≤ 1.0 K	≤ 1.0 K
32 ... 86 °F (0 ... 30 °C)	≤ 0.5 K	≤ 0.3 K
86 ... 158 °F (30 ... 70 °C)	≤ 0.5 K	≤ 0.5 K
158 ... 212 °F (70 ... 100 °C)	≤ 1.0 K	≤ 1.0 K
212 ... 266 °F (100 ... 130 °C)	--	≤ 3.0 K
266 ... 302 °F (130 ... 150 °C)	--	≤ 5.5 K
302 ... 752 °F (150 ... 400 °C)	--	--
NTC10kΩ specified for -22... 212 °F (-30 ... +100 °C), only.		

NOTE

This is the accuracy of the internal sensor input (hardware + software [linearization]), only. This table does not include the characteristics of the sensors, themselves (see section "Sensor Characteristics" below). If a different sensor or sensor accuracy is required, one may instead use the inputs of, e.g., a connected Panel I/O module.

Recognition of Sensor Failure of Sensor Inputs

The thresholds at which sensor failures – i.e., sensor breaks (SB) and short-circuits (SC) – are recognized depends upon the given sensor type. In the event of a recognized sensor failure, the sensor inputs assume the safety values configured in WEBs-N4. Table 34 lists the measurement ranges and the corresponding thresholds for the recognition of sensor failure for the various different sensor types:

Table 34. Thresholds for short-circuit (SC) and sensor-break (SB) recognition

I/O configuration	**Measurement range**	**Recognition thresholds**
2...10 V	2...10 V / 4...20 mA (without pull-up)	SC: < 1.5 V / 3 mA; SB: no recognition
NTC10kΩ (Type II)	-22 ... 212 °F (-30.....+100°C)	SC: < 20 Ω; SB: < -94°F (-70 °C)
NTC20kΩ (Type II)	-58 ... 302 °F (-50.....+150°C)	SC: < 20 Ω; SB: < -94°F (-70 °C)
NI1000 TK6180 DIN	-58 ... 302 °F (-50.....+150°C)	--
NI1000 TK5000 DIN	-22 ... 302 °F (-30.....+130°C)	--
PT1000-1	-58 ... 302 °F (-50.....+150°C)	

PT1000-2	32 ... 752°F (0...400°C)	
BALCO500	22 ... 248 °F (-30.....+120°C)	

NOTE

In the case of temperatures lying *outside* the aforementioned ranges, the lowest/highest value within the range, instead, will be communicated. Thus, a temperature of -59.8°F (-51 °C) will be communicated as " -58°F (-50 °C)."

Sensor Characteristics

The characteristics (resistance in relation to temperature) of the sensors and the resultant voltage are listed on the following pages. The stated values do not include failures due to: sensor failures; wiring resistance or wiring failures; misreading due to a meter connected to measure resistance or voltage at the input.

NTC 20 kΩ (Type II) Temperature Characteristics

NTC 20 kΩ (same voltages for inputs of Panel Bus I/O Modules and Onboard inputs of CIPer Model 50).

NTC 20 kΩ (Type II) Temperature			
Temp. [°F]	Temp. [°C]	Resistance	Terminal voltage [V]
-58	-50	1659	8.78
-56.2	-49	1541	8.77
-54.4	-48	1432	8.76
-52.6	-47	1331	8.75
-50.8	-46	1239	8.74
-49	-45	1153	8.72
-47.2	-44	1073	8.71
-45.4	-43	1000	8.7
-43.6	-42	932	8.69
-41.8	-41	869	8.67
-40	-40	811	8.66
-38.2	-39	757	8.64
-36.4	-38	706	8.62
-34.6	-37	660	8.6
-32.8	-36	617	8.58
-31	-35	577	8.56
-29.2	-34	539	8.54
-27.4	-33	505	8.52
-25.6	-32	473	8.49
-23.8	-31	443	8.47
-22	-30	415	8.44
-20.2	-29	389	8.41
-18.4	-28	364	8.38
-16.6	-27	342	8.35
-14.8	-26	321	8.32
-13	-25	301	8.28
-11.2	-24	283	8.25
-9.4	-23	266	8.21
-7.6	-22	250	8.17

NTC 20 kΩ (Type II) Temperature			
Temp. [°F]	Temp. [°C]	Resistance	Terminal voltage [V]
122	50	6.72	2.07
123.8	51	6.45	2.01
125.6	52	6.19	1.94
127.4	53	5.95	1.88
129.2	54	5.72	1.82
131	55	5.49	1.77
132.8	56	5.28	1.71
134.6	57	5.08	1.66
136.4	58	4.88	1.61
138.2	59	4.69	1.56
140	60	4.52	1.51
141.8	61	4.35	1.46
143.6	62	4.18	1.41
145.4	63	4.03	1.37
147.2	64	3.88	1.32
149	65	3.73	1.28
150.8	66	3.59	1.24
152.6	67	3.46	1.2
154.4	68	3.34	1.16
156.2	69	3.21	1.13
158	70	3.1	1.09
159.8	71	2.99	1.06
161.6	72	2.88	1.02
163.4	73	2.78	0.991
165.2	74	2.68	0.96
167	75	2.58	0.929
168.8	76	2.49	0.9
170.6	77	2.41	0.872
172.4	78	2.32	0.844

NTC 20 kΩ (Type II) Temperature			
Temp. [°F]	**Temp. [°C]**	**Resistance**	**Terminal voltage [V]**
-5.8	-21	235	8.13
-4	-20	221	8.08
-2.2	-19	208	8.04
-0.4	-18	196	7.99
1.4	-17	184	7.94
3.2	-16	174	7.89
5	-15	164	7.83
6.8	-14	154	7.78
8.6	-13	146	7.72
10.4	-12	137	7.66
12.2	-11	130	7.6
14	-10	122	7.53
15.8	-9	116	7.46
17.6	-8	109	7.39
19.4	-7	103	7.32
21.2	-6	97.6	7.25
23	-5	92.3	7.17
24.8	-4	87.3	7.09
26.6	-3	82.6	7.01
28.4	-2	78.2	6.93
30.2	-1	74.1	6.85
32	0	70.2	6.76
33.8	1	66.5	6.67
35.6	2	63	6.58
37.4	3	59.8	6.49
39.2	4	56.7	6.4
41	5	53.8	6.3
42.8	6	51.1	6.2
44.6	7	48.5	6.1
46.4	8	46	6
48.2	9	43.7	5.9
50	10	41.6	5.8
51.8	11	39.5	5.7
53.6	12	37.6	5.59
55.4	13	35.7	5.49
57.2	14	34	5.38
59	15	32.3	5.28
60.8	16	30.8	5.17
62.6	17	29.3	5.07
64.4	18	27.9	4.96
66.2	19	26.6	4.85
68	20	25.3	4.75
69.8	21	24.2	4.64
71.6	22	23	4.53
73.4	23	22	4.43
75.2	24	21	4.32

NTC 20 kΩ (Type II) Temperature			
Temp. [°F]	**Temp. [°C]**	**Resistance**	**Terminal voltage [V]**
174.2	79	2.24	0.818
176	80	2.17	0.792
177.8	81	2.09	0.767
179.6	82	2.02	0.744
181.4	83	1.95	0.72
183.2	84	1.89	0.698
185	85	1.82	0.676
186.8	86	1.76	0.655
188.6	87	1.7	0.635
190.4	88	1.65	0.616
192.2	89	1.59	0.597
194	90	1.54	0.578
195.8	91	1.49	0.561
197.6	92	1.44	0.544
199.4	93	1.4	0.527
201.2	94	1.35	0.511
203	95	1.31	0.496
204.8	96	1.27	0.481
206.6	97	1.23	0.466
208.4	98	1.19	0.452
210.2	99	1.15	0.439
212	100	1.11	0.425
213.8	101	1.08	0.413
215.6	102	1.05	0.401
217.4	103	1.01	0.389
219.2	104	0.98	0.378
221	105	0.95	0.367
222.8	106	0.92	0.356
224.6	107	0.9	0.346
226.4	108	0.87	0.336
228.2	109	0.84	0.326
230	110	0.82	0.317
231.8	111	0.79	0.308
233.6	112	0.77	0.299
235.4	113	0.75	0.29
237.2	114	0.73	0.282
239	115	0.7	0.274
240.8	116	0.68	0.266
242.6	117	0.66	0.259
244.4	118	0.64	0.252
246.2	119	0.63	0.245
248	120	0.61	0.238
249.8	121	0.59	0.231
251.6	122	0.57	0.225
253.4	123	0.56	0.219
255.2	124	0.54	0.213

NTC 20 kΩ (Type II) Temperature			
Temp. [°F]	**Temp. [°C]**	**Resistance**	**Terminal voltage [V]**
77	25	20	4.22
78.8	26	19.1	4.12
80.6	27	18.2	4.01
82.4	28	17.4	3.91
84.2	29	16.6	3.81
86	30	15.9	3.71
87.8	31	15.2	3.62
89.6	32	14.5	3.52
91.4	33	13.9	3.43
93.2	34	13.3	3.33
95	35	12.7	3.24
96.8	36	12.1	3.15
98.6	37	11.6	3.06
100.4	38	11.1	2.97
102.2	39	10.7	2.89
104	40	10.2	2.81
105.8	41	9.78	2.72
107.6	42	9.37	2.64
109.4	43	8.98	2.57
111.2	44	8.61	2.49
113	45	8.26	2.42
114.8	46	7.92	2.34
116.6	47	7.6	2.27
118.4	48	7.29	2.2
120.2	49	7	2.14

NTC 20 kΩ (Type II) Temperature			
Temp. [°F]	**Temp. [°C]**	**Resistance**	**Terminal voltage [V]**
257	125	0.53	0.207
258.8	126	0.51	0.201
260.6	127	0.5	0.196
262.4	128	0.49	0.191
264.2	129	0.47	0.186
266	130	0.46	0.181
267.8	131	0.45	0.176
269.6	132	0.43	0.171
271.4	133	0.42	0.167
273.2	134	0.41	0.162
275	135	0.4	0.158
276.8	136	0.39	0.154
278.6	137	0.38	0.15
280.4	138	0.37	0.146
282.2	139	0.36	0.142
284	140	0.35	0.139
285.8	141	0.34	0.135
287.6	142	0.33	0.132
289.4	143	0.32	0.128
291.2	144	0.32	0.125
293	145	0.31	0.122
294.8	146	0.3	0.119
296.6	147	0.29	0.116
298.4	148	0.29	0.113
300.2	149	0.28	0.11
302	150	0.27	0.107

NTC 10 kΩ (Type II) Temperature Characteristics

NTC10kΩ (same voltages for inputs of Panel Bus I/O Modules and onboard inputs of CIPer Model 50).

NTC 10 kΩ (Type II) Temperature			
Temp. [°F]	**Temp. [°C]**	**Resistance**	**Terminal voltage [V]**
-22	-30	177	7.904
-20.2	-29	166.35	7.848
-18.4	-28	156.413	7.79
-16.6	-27	147.136	7.73
-14.8	-26	138.47	7.666
-13	-25	130.372	7.601
-11.2	-24	122.8	7.534
-9.4	-23	115.718	7.464
-7.6	-22	109.089	7.392
-5.8	-21	102.883	7.318
-4	-20	97.073	7.241
-2.2	-19	91.597	7.161
-0.4	-18	86.471	7.08
1.4	-17	81.667	6.996
3.2	-16	77.161	6.91
5	-15	72.932	6.821
6.8	-14	68.962	6.731
8.6	-13	65.231	6.639
10.4	-12	61.723	6.545
12.2	-11	58.424	6.448
14	-10	55.321	6.351
15.8	-9	52.399	6.251
17.6	-8	49.648	6.15
19.4	-7	47.058	6.047
21.2	-6	44.617	5.943
23	-5	42.317	5.838
24.8	-4	40.15	5.732
26.6	-3	38.106	5.624
28.4	-2	36.18	5.516
30.2	-1	34.363	5.408
32	0	32.65	5.299
33.8	1	31.027	5.189
35.6	2	29.494	5.079
37.4	3	28.047	4.969
39.2	4	26.68	4.859
41	5	25.388	4.75
42.8	6	24.166	4.641
44.6	7	23.01	4.532
46.4	8	21.916	4.423
48.2	9	20.88	4.316

NTC 10 kΩ (Type II) Temperature			
Temp. [°F]	**Temp. [°C]**	**Resistance**	**Terminal voltage [V]**
93.2	34	6.808	2.091
95	35	6.531	2.025
96.8	36	6.267	1.962
98.6	37	6.015	1.9
100.4	38	5.775	1.84
102.2	39	5.546	1.781
104	40	5.327	1.724
105.8	41	5.117	1.669
107.6	42	4.917	1.616
109.4	43	4.726	1.564
111.2	44	4.543	1.514
113	45	4.369	1.465
114.8	46	4.202	1.418
116.6	47	4.042	1.373
118.4	48	3.889	1.329
120.2	49	3.743	1.286
122	50	3.603	1.244
123.8	51	3.469	1.204
125.6	52	3.34	1.166
127.4	53	3.217	1.128
129.2	54	3.099	1.092
131	55	2.986	1.057
132.8	56	2.878	1.023
134.6	57	2.774	0.99
136.4	58	2.675	0.959
138.2	59	2.579	0.928
140	60	2.488	0.898
141.8	61	2.4	0.87
143.6	62	2.316	0.842
145.4	63	2.235	0.815
147.2	64	2.158	0.79
149	65	2.083	0.765
150.8	66	2.011	0.74
152.6	67	1.943	0.718
154.4	68	1.877	0.695
156.2	69	1.813	0.673
158	70	1.752	0.652
159.8	71	1.694	0.632
161.6	72	1.637	0.612
163.4	73	1.583	0.593

NTC 10 kΩ (Type II) Temperature			
Temp. [°F]	**Temp. [°C]**	**Resistance**	**Terminal voltage [V]**
50	10	19.898	4.209
51.8	11	18.968	4.103
53.6	12	18.087	3.998
55.4	13	17.252	3.894
57.2	14	16.46	3.792
59	15	15.708	3.69
60.8	16	14.995	3.591
62.6	17	14.319	3.492
64.4	18	13.678	3.396
66.2	19	13.068	3.3
68	20	12.49	3.207
69.8	21	11.94	3.115
71.6	22	11.418	3.025
73.4	23	10.921	2.937
75.2	24	10.449	2.85
77	25	10	2.767
78.8	26	9.572	2.684
80.6	27	9.165	2.603
82.4	28	8.777	2.524
84.2	29	8.408	2.447
86	30	8.057	2.372
87.8	31	7.722	2.299
89.6	32	7.402	2.228
91.4	33	7.098	2.159

NTC 10 kΩ (Type II) Temperature			
Temp. [°F]	**Temp. [°C]**	**Resistance**	**Terminal voltage [V]**
165.2	74	1.531	0.575
167	75	1.481	0.557
168.8	76	1.433	0.541
170.6	77	1.387	0.524
172.4	78	1.342	0.508
174.2	79	1.299	0.493
176	80	1.258	0.478
177.8	81	1.218	0.464
179.6	82	1.179	0.45
181.4	83	1.142	0.436
183.2	84	1.107	0.423
185	85	1.072	0.411
186.8	86	1.039	0.399
188.6	87	1.007	0.387
190.4	88	0.976	0.375
192.2	89	0.947	0.365
194	90	0.918	0.354
195.8	91	0.89	0.344
197.6	92	0.863	0.334
199.4	93	0.838	0.324
201.2	94	0.813	0.315
203	95	0.789	0.306
204.8	96	0.765	0.297
206.6	97	0.743	0.289
208.4	98	0.721	0.28
210.2	99	0.7	0.276
212	100	0.68	0.265

NI1000 TK6180 DIN B Temperature Characteristics

Nominal Resistance: R_0 = 1000 Ω, Sensitivity: TC = 6180 ppm/K (same voltages inputs for Panel Bus I/O Modules).

NI1000 TK6180 DIN B Temperature											
°F	**°C**	**0**	**-1**	**-2**	**-3**	**-4**	**-5**	**-6**	**-7**	**-8**	**-9**
-58	-50	742.55									
-40	-40	791.31	786.37	781.45	776.54	771.64	766.76	761.89	757.03	752.19	747.36
-22	-30	841.46	836.38	831.32	826.27	821.23	816.21	811.21	806.21	801.23	796.26
-4	-20	892.96	887.75	882.56	877.37	872.2	867.04	861.9	856.77	851.65	846.55
14	-10	945.82	940.47	935.14	929.82	924.51	919.22	913.94	908.68	903.43	898.19
32	0	1000	994.52	989.06	983.6	978.17	972.74	967.33	961.93	956.55	951.17
°F	**°C**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
32	0	1000	1005.5	1011	1016.5	1022.05	1027.59	1033.15	1038.72	1044.31	1049.9
50	10	1055.5	1061.1	1066.8	1072.4	1078.09	1083.77	1089.46	1095.17	1100.89	1106.62
68	20	1112.4	1118.1	1123.9	1129.7	1135.48	1141.29	1147.12	1152.96	1158.81	1164.68
86	30	1170.6	1176.5	1182.4	1188.3	1194.21	1200.16	1206.13	1212.1	1218.09	1224.09
104	40	1230.1	1236.1	1242.2	1248.3	1254.32	1260.41	1266.51	1272.62	1278.75	1284.89
122	50	1291.1	1297.2	1303.4	1309.6	1315.82	1322.05	1328.29	1334.55	1340.82	1347.1
140	60	1353.4	1359.7	1366.1	1372.4	1378.75	1385.12	1391.51	1397.91	1404.33	1410.76
158	70	1417.2	1423.7	1430.1	1436.6	1443.14	1449.67	1456.2	1462.75	1469.32	1475.91
176	80	1482.5	1489.1	1495.8	1502.4	1509.05	1515.73	1522.42	1529.13	1535.85	1542.59
194	90	1549.3	1556.1	1562.9	1569.7	1576.53	1583.36	1590.21	1597.08	1603.97	1610.87
212	100	1617.8	1624.7	1631.7	1638.6	1645.62	1652.62	1659.64	1666.68	1673.73	1680.8
230	110	1687.9	1695	1702.1	1709.3	1716.41	1723.58	1730.77	1737.98	1745.21	1752.45
248	120	1759.7	1767	1774.3	1781.6	1788.95	1796.3	1803.68	1811.07	1818.48	1825.9
266	130	1833.4	1840.8	1848.3	1855.8	1863.33	1870.87	1878.43	1886.01	1893.61	1901.23
284	140	1908.9	1916.5	1924.2	1931.9	1939.62	1947.35	1955.11	1962.89	1970.69	1978.51

NI1000 TK5000 DIN B Temperature Characteristics

Nominal Resistance: R0 = 1000 Ω, Sensitivity: TC = 5000 ppm/K (same voltages inputs for Panel Bus I/O Modules).

NI1000 TK5000 DIN B Temperature											
°F	**°C**	**0**	**-1**	**-2**	**-3**	**-4**	**-5**	**-6**	**-7**	**-8**	**-9**
-58	-50	790.88									
-40	-40	830.84	826.8	822.78	818.76	771.64	810.75	806.76	802.78	798.8	794.84
-22	-30	871.69	867.57	863.45	859.34	821.23	851.15	847.07	843	838.94	834.88
-4	-20	913.48	909.26	905.05	900.85	872.2	892.47	888.3	884.13	879.98	875.83
14	-10	956.24	951.92	947.61	943.31	924.51	934.74	930.47	926.21	921.96	917.72
32	0	1000	995.58	991.17	986.77	978.17	977.99	973.62	969.26	964.91	960.57
°F	**°C**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
32	0	1000	1004.43	1008.87	1013.33	1022.05	1022.26	1026.75	1031.24	1035.75	1040.27
50	10	1044.79	1049.33	1053.88	1058.44	1078.09	1067.59	1072.18	1076.78	1081.39	1086.02
68	20	1090.65	1095.3	1099.96	1104.62	1135.48	1113.99	1118.7	1123.41	1128.13	1132.87
86	30	1137.62	1142.37	1147.14	1151.92	1194.21	1161.52	1166.34	1171.16	1176	1180.85
104	40	1185.71	1190.59	1195.47	1200.37	1254.32	1210.2	1215.13	1220.07	1225.03	1230
122	50	1234.98	1239.97	1244.97	1249.99	1315.82	1260.06	1265.11	1270.18	1275.25	1280.34
140	60	1285.45	1290.56	1295.69	1300.83	1378.75	1311.14	1316.32	1321.51	1326.71	1331.92
158	70	1337.15	1342.39	1347.64	1352.91	1443.14	1363.47	1368.78	1374.09	1379.42	1384.77
176	80	1390.12	1395.49	1400.87	1406.26	1509.05	1417.09	1422.53	1427.97	1433.43	1438.91
194	90	1444.39	1449.9	1455.41	1460.94	1576.53	1472.03	1477.6	1483.18	1488.77	1494.38
212	100	1500	1505.64	1511.29	1516.95	1645.62	1528.32	1534.03	1539.75	1545.48	1551.22
230	110	1556.98	1562.76	1568.55	1574.35	1716.41	1586	1591.84	1597.7	1603.58	1609.47
248	120	1615.37	1621.28	1627.22	1633.16	1788.95	1645.1	1651.08	1657.09	1663.11	1669.14
266	130	1675.19	1681.25	1687.33	1693.42	1863.33	1705.65	1711.78	1717.93	1724.1	1730.28
284	140	1736.48	1742.69	1748.91	1755.15	1939.62	1767.68	1773.97	1780.27	1786.59	1792.92

BALCO 500 Temperature Characteristics

Same voltages for inputs of Panel Bus I/O Modules and Onboard inputs.

BALCO 500 Temperature		
Temp[°F]	**Temp [°C]**	**Resistance (Ω)**
-40.0	-40.0	379.35
-38.2	-39.0	381.10
-36.4	-38.0	382.85
-34.6	-37.0	384.61
-32.8	-36.0	386.37
-31.0	-35.0	388.14
-29.2	-34.0	389.91
-27.4	-33.0	391.69
-25.6	-32.0	393.47
-23.8	-31.0	395.26
-22.0	-30.0	397.05
-20.2	-29.0	398.85
-18.4	-28.0	400.65
-16.6	-27.0	402.46
-14.8	-26.0	404.27
-13.0	-25.0	406.09
-11.2	-24.0	407.91
-9.4	-23.0	409.74
-7.6	-22.0	411.57
-5.8	-21.0	413.41
-4.0	-20.0	415.25
-2.2	-19.0	417.10
-0.4	-18.0	418.95
1.4	-17.0	420.81
3.2	-16.0	422.68
5.0	-15.0	424.54
6.8	-14.0	426.42
8.6	-13.0	428.30
10.4	-12.0	430.18
12.2	-11.0	432.07
14.0	-10.0	433.96
15.8	-9.0	435.96
17.6	-8.0	437.77
19.4	-7.0	439.68
21.2	-6.0	441.59
23.0	-5.0	443.51
24.8	-4.0	445.43
26.6	-3.0	447.36
28.4	-2.0	449.30
30.2	-1.0	451.24
32.0	0.0	453.18
33.8	1	455.13
35.6	2	457.09
37.4	3	459.05

BALCO 500 Temperature		
Temp[°F]	**Temp[°C]**	**Resistance (Ω)**
91.4	33	520.21
93.2	34	522.33
95.0	35	524.45
96.8	36	526.58
98.6	37	528.71
100.4	38	530.85
102.2	39	532.99
104.0	40	535.14
177.8	81	627.58
179.6	82	629.95
181.4	83	632.31
183.2	84	634.68
185.0	85	637.06
186.8	86	639.44
188.6	87	641.83
190.4	88	644.22
192.2	89	646.62
194.0	90	649.02
195.8	91	651.43
197.6	92	653.84
199.4	93	656.26
201.2	94	658.68
203.0	95	661.11
204.8	96	663.54
206.6	97	665.98
208.4	98	668.42
210.2	99	670.87
212.0	100	673.32
213.8	101	675.78
215.6	102	678.24
217.4	103	680.71
219.2	104	683.18
221.0	105	685.66
222.8	106	688.14
224.6	107	690.63
226.4	108	693.12
228.2	109	695.62
230.0	110	698.13
231.8	111	700.64
233.6	112	703.25
235.4	113	705.67
237.2	114	708.19
239.0	115	710.72
240.8	116	713.25

BALCO 500 Temperature		
Temp[°F]	**Temp [°C]**	**Resistance (Ω)**
39.2	4	461.01
41.0	5	462.98
42.8	6	464.96
44.6	7	466.94
46.4	8	468.92
48.2	9	470.91
50.0	10	472.91
51.8	11	474.91
53.6	12	476.92
55.4	13	478.93
57.2	14	480.94
59.0	15	482.96
60.8	16	484.99
62.6	17	487.02
64.4	18	489.06
66.2	19	491.1
68.0	20	493.15
69.8	21	495.2
71.6	22	497.25
73.4	23	499.32
75.2	24	501.38
77.0	25	503.45
78.8	26	505.53
80.6	27	507.61
82.4	28	509.7
84.2	29	511.79
86.0	30	513.89
87.8	31	515.99
89.6	32	518.1

BALCO 500 Temperature		
Temp[°F]	**Temp[°C]**	**Resistance (Ω)**
242.6	117	715.79
244.4	118	718.34
246.2	119	720.89
248.0	120	723.44
249.8	121	726
251.6	122	728.57
253.4	123	731.14
255.2	124	733.71
257.0	125	736.28
258.8	126	738.88
260.6	127	741.47
262.4	128	744.06
264.2	129	746.66
266.0	130	749.27
267.8	131	751.88
269.6	132	754.49
271.4	133	757.11
273.2	134	759.74
275.0	135	762.37
276.8	136	765
278.6	137	767.64
280.4	138	770.29
282.2	139	772.94
284.0	140	775.68
285.8	141	778.26
287.6	142	780.92
289.4	143	783.6
291.2	144	786.28
293.0	145	788.96
294.8	146	791.64
296.6	147	794.32
298.4	148	797
300.2	149	799.68
302.0	150	802.36

PT1000 Temperature Characteristic (PT1000-1, PT1000-2)

Same voltages for inputs of Panel Bus I/O Modules and Onboard inputs.

PT1000 Temperature		
Temp [°F]	**Temp [°C]**	**Resistance (Ω)**
-40	-40	842.7
-38.2	-39	846.7
-36.4	-38	850.7
-34.6	-37	854.6
-32.8	-36	858.6
-31	-35	862.5
-29.2	-34	866.5
-27.4	-33	870.4
-25.6	-32	874.3
-23.8	-31	878.3
-22	-30	882.2
-20.2	-29	886.2
-18.4	-28	890.1
-16.6	-27	894.1
-14.8	-26	898
-13	-25	901.9
-11.2	-24	905.6
-9.4	-23	909.8
-7.6	-22	913.7
-5.8	-21	917.7
-4	-20	921.6
-2.2	-19	925.5
-0.4	-18	929.9
1.4	-17	933.4
3.2	-16	937.3
5	-15	941.3
6.8	-14	945.2
8.6	-13	949.1
10.4	-12	953
12.2	-11	956.9
14	-10	960.9
15.8	-9	964.8
17.6	-8	968.7
19.4	-7	972.6
21.2	-6	976.5
23	-5	980.4
24.8	-4	984.4
26.6	-3	988.3
28.4	-2	992.2
30.2	-1	996.1
32	0	1000
33.8	1	1003.9
35.6	2	1007.8
37.4	3	1011.7
39.2	4	1015.6
41	5	1019.5
42.8	6	1023.4
44.6	7	1027.3
46.4	8	1031.2
48.2	9	1035.1

PT1000 Temperature		
Temp [°F]	**Temp [°C]**	**Resistance (Ω)**
138.2	59	1228.6
140	60	1232.4
141.8	61	1236.3
143.6	62	1240.1
145.4	63	1243.9
147.2	64	1247.8
149	65	1251.6
150.8	66	1255.4
152.6	67	1259.3
154.4	68	1263.1
156.2	69	1266.9
158	70	1270.8
159.8	71	1274.6
161.6	72	1278.4
163.4	73	1282.2
165.2	74	1286
167	75	1289.9
168.8	76	1293.7
170.6	77	1297.5
172.4	78	1301.3
174.2	79	1305.2
176	80	1309
177.8	81	1312.8
179.6	82	1316.6
181.4	83	1320.4
183.2	84	1324.2
185	85	1328
186.8	86	1331.8
188.6	87	1335.7
190.4	88	1339.5
192.2	89	1343.3
194	90	1347.1
195.8	91	1350.9
197.6	92	1354.7
199.4	93	1358.4
201.2	94	1362.3
203	95	1366.1
204.8	96	1369.9
206.6	97	1373.7
208.4	98	1377.5
210.2	99	1381.3
212	100	1385
213.8	101	1388.9
215.6	102	1392.6
217.4	103	1396.4
219.2	104	1400.2
221	105	1404
222.8	106	1407.8
224.6	107	1411.6
226.4	108	1415.4

PT1000 Temperature		
Temp [°F]	**Temp [°C]**	**Resistance (Ω)**
50	10	1039
51.8	11	1042.9
53.6	12	1046.8
55.4	13	1050.7
57.2	14	1054.5
59	15	1058.5
60.8	16	1062.4
62.6	17	1066.3
64.4	18	1070.2
66.2	19	1074.1
68	20	1077.9
69.8	21	1081.8
71.6	22	1085.7
73.4	23	1089.6
75.2	24	1093.5
77	25	1097.4
78.8	26	1101.2
80.6	27	1105.1
82.4	28	1109
84.2	29	1112.9
86	30	1116.7
87.8	31	1120.6
89.6	32	1124.5
91.4	33	1128.4
93.2	34	1132.2
95	35	1136.1
96.8	36	1140
98.6	37	1143.8
100.4	38	1147.7
102.2	39	1151.6
104	40	1155.4
105.8	41	1159.3
107.6	42	1163.1
109.4	43	1167
111.2	44	1170.9
113	45	1174.7
114.8	46	1178.6
116.6	47	1182.4
118.4	48	1186.3
120.2	49	1190.1
122	50	1194
123.8	51	1197.8
125.6	52	1201.7
127.4	53	1205.5
129.2	54	1209.4
131	55	1213.2
132.8	56	1217.1
134.6	57	1220.9
136.4	58	1224.7

PT1000 Temperature		
Temp [°F]	**Temp [°C]**	**Resistance (Ω)**
228.2	109	1419.1
230	110	1422.9
231.8	111	1426.7
233.6	112	1430.5
235.4	113	1434.3
237.2	114	1438
239	115	1441.8
240.8	116	1445.6
242.6	117	1449.4
244.4	118	1453.1
246.2	119	1456.9
248	120	1460.6
249.8	121	1464.5
251.6	122	1468.2
253.4	123	1472
255.2	124	1475.8
257	125	1479.5
258.8	126	1483.3
260.6	127	1487
262.4	128	1490.8
264.2	129	1494.6
266	130	1498.3
267.8	131	1502.1
269.6	132	1505.6
271.4	133	1509.6
273.2	134	1513.3
275	135	1517.1
276.8	136	1520.9
278.6	137	1524.6
280.4	138	1528.4
282.2	139	1532.1
284	140	1535.8
285.8	141	1539.6
287.6	142	1543.3
289.4	143	1547.1
291.2	144	1550.8
293	145	1554.6
294.8	146	1558.3
296.6	147	1562
298.4	148	1565.8
300.2	149	1569.5
302	150	1573.1

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