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## SAFETY INFORMATION

### General Safety Information

- ▶ When performing any work, all instructions given by the manufacturer and in particular the safety instructions provided in these Installation and Commissioning Instructions are to be observed. Make sure that the local standards and regulations are observed at all times.
- ▶ The EAGLE System (including the EAGLE 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.
- ▶ Always check these Installation Instructions in order to determine which relay terminals are suitable for 230 V. Connect only suitable relay terminals to 230 V.
- ▶ 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 EAGLE 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 EAGLE controller should be secured in place using a commercially-available stopper.
- ▶ If the EAGLE 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 EAGLE Controller is a multifunctional non-safety control device intended for HVAC in home (residential, commercial, and light-industrial) environments.

#### Construction

The EAGLE Controller is an independently mounted electronic control unit with fixed wiring.

#### Mounting Method


The EAGLE Controller is suitable for mounting as follows:

- ▶ in cabinets;
- ▶ in fuse boxes conforming with standard DIN43880, and having a slot height of max. 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 >75 °C terminals >125 °C

### WEEE Directive

WEEE: Waste Electrical and Electronic Equipment Directive	
	<ul style="list-style-type: none"> <li>▪ At the end of the product life, dispose of the packaging and product in an appropriate recycling center.</li> <li>▪ Do not dispose of the device with the usual domestic refuse.</li> <li>▪ Do not burn the device.</li> </ul>

### Standards, Approvals, etc.

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 BTL, AMEV AS-A, 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 IEEE802.3.	
The device supports BACnet IP and BACnet MS/TP communications as per ANSI / ASHRAE 135-2010.	

### 3RD-PARTY SOFTWARE LICENSES

This product contains software provided by third parties. See also EAGLE Controller – Third-Party Software Licenses (Product Literature No.: EN2Z-0991GE51).

## SPECIFICATIONS OF CONTROLLER

**Table 2. EAGLE specifications**

<b>Power supply</b>	19 ... 29 VAC, 50/60 Hz or 20 ... 30 VDC
<b>Power consumption</b>	typically dc: 5 W; max. 6 W typically ac: 9 VA; max. 11 VA
<b>Current consumption</b>	typically dc: 210 mA; max. 240 mA typically ac: 370 mA; max. 410 mA
<b>Ambient temperature</b>	0 ... 40 °C (wall-mounting) 0 ... 50 °C (cabinet/door mounting)
<b>Storage temperature</b>	-20 ... +70 °C
<b>Humidity</b>	5 ... 95% r.h. non-condensing
<b>Dimensions</b>	See Fig. 18 and Fig. 20.
<b>Degree of protection</b>	IP20 (mounted on walls, with two accessory MVC-80-AC1 covers) IP30 (mounted in cabinet doors, with accessory MVC-80-AC2)
<b>Fire class</b>	V0
<b>Weight</b>	0.6 kg (excl. packaging)

# SYSTEM OVERVIEW

## Overview of Models

Table 3. Overview of models

feature	description	max. cable length	order no.								
			CLEA2014B21	CLEA2014B31	CLEA2014B22	CLEA2014B32	CLEA2026B21	CLEA2026B31	CLEA2000B21	CLEA2000B31	
UI	NTC10kΩ / NTC20kΩ / 0...10V / slow BI, 0.4 Hz	400 m	4	4	4	4	8	8	-	-	
	NTC10kΩ / NTC20kΩ / 0...10V fix pull-up / slow BI, 0.4 Hz	400 m	-	-	-	-	2	2	-	-	
BI	open = 24 V / closed 2.0 mA / totalizer 15 Hz	400 m	4	4	4	4	4	4	-	-	
AO	0..11 V (max. 1 mA)	400 m	2	2	2	2	4	4	-	-	
BO	Relay N.O. contact; 3 A, 250 VAC, 30 VDC	400 m	3	3	3	3	4	4	-	-	
	Relay N.O. contact (high in-rush) ; 10 A, 250 VAC, 30 VDC	400 m	1	1	1	1	1	1	-	-	
	Relay N.O. contact with one common; 3 A, 250 VAC, 30 VDC	400 m	-	-	-	-	3	3	-	-	
bus interfaces	RS485-1, isolated, BACnet MS/TP, Panel Bus <sup>(1)</sup> , or Modbus RTU Master or Slave communication	<sup>(2)</sup> 1200 m	1	1	1	1	1	1	1	1	
	RS485-2, non-isolated, BACnet MS/TP, Panel Bus <sup>(1)</sup> , or Modbus RTU Master or Slave communication	<sup>(2)</sup> 1200 m	1	1	1	1	1	1	1	1	
	Ethernet / RJ45 socket	e-mail communication, browser access	100 m	-	-	1	1	1	1	1	1
		BACnet IP communication	100 m	-	-	1	1	1	1	1	1
	USB 2.0 Device Interface (as Network Interface)		3 m	1	1	1	1	1	1	1	1
	USB 2.0 Host Interface (max. 500 mA)		3 m	1	1	1	1	1	1	1	1
RS232 M-Bus communication via PW3 / PW20 / PW60 converters		<sup>(3)</sup> 1000 m	1	1	1	1	1	1	1	1	
user interface	HMI with graphic LCD	--	X	-	X	-	X	-	X	-	
	Fast Access buttons	--	6	-	6	-	6	-	6	-	
	push and turn button	--	1	-	1	-	1	-	1	-	
LEDs	power LED (green)	--	1	1	1	1	1	1	1	1	
	status LED (red, controllable by firmware)	--	1	1	1	1	1	1	1	1	
	applications-specific LED L1 (yellow)	--	1	1	1	1	1	1	1	1	
	LED L2 (reserved)	--	1	1	1	1	1	1	1	1	
	bus status LEDs (for isolated RS485-1 interface)		--	2	2	2	2	2	2	2	2
Socket for CLEAHMI21	RJ45 socket for connection of CLEAHMI21 External HMI	5 m	--	X	--	X	--	X	--	X	

<sup>(1)</sup> See also section "Restriction Applying to CLEA2014B21 and CLEA2014B31" on pg. 8.  
<sup>(2)</sup> Depending upon baud rate. For max. cable lengths, see section "RS485 Standard" on pg. 9. In the case of the Panel Bus, see also section "Panel Bus Considerations" on pg. 23. In the case of the BACnet MS/TP Bus, see also section "BACnet MS/TP Bus Considerations" on pg. 28. In the case of the Modbus, see also section "Modbus Considerations" on pg. 31.  
<sup>(3)</sup> Depending upon baud rate. See also section "M-Bus Considerations" on pg. 33.

## System Architecture

An EAGLE System consists of the EAGLE Controller and various Panel Bus I/O modules. The EAGLE Controller provides interface connections, which allow connection to external systems (e.g., BACnet controllers). Via the IF-LON External Interface, the EAGLE can also communicate with LONWORKS systems, including CentraLine LONWORKS I/O Modules. Auxiliary parts (see section "Extra Parts" on page 22) enable special features.

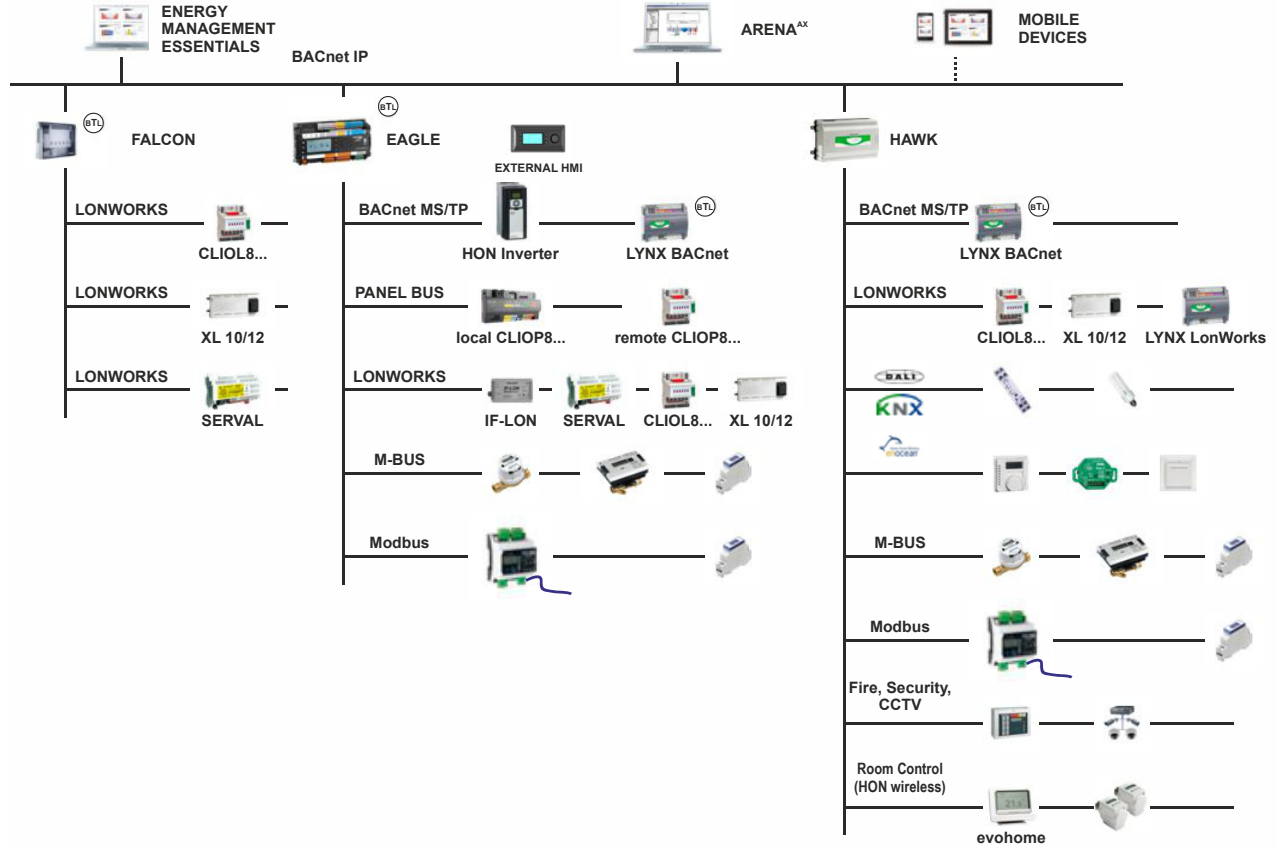


Fig. 1. CentraLine BACnet System architecture

## 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 EAGLE 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 Fig. 23), it is strongly recommended that the EAGLE controller be supplied with power from a dedicated transformer. However, if the EAGLE 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.

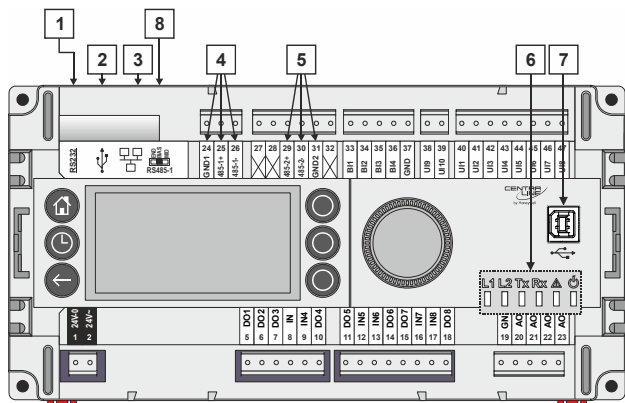


Fig. 2. Models with built-in HMI (top view)

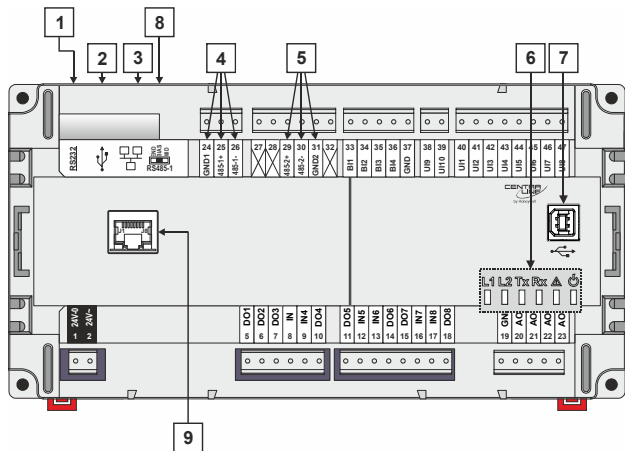


Fig. 3. Models without built-in HMI (top view)

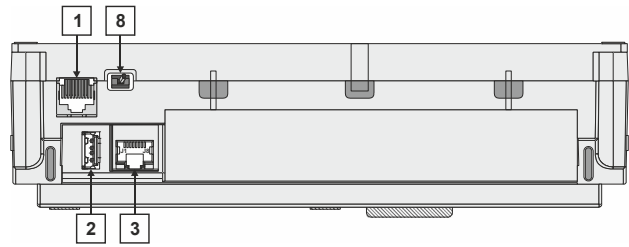


Fig. 4. All models (side view)

**Legend**

- 1 RS232 / RJ45 socket (for M-Bus connection and factory debugging)
- 2 USB 2.0 Host Interface (for connection to IF-LON)
- 3 Ethernet / RJ45 socket (for BACnet IP communication – all models except CLEA2014B21 and CLEA2014B31)
- 4 RS485-1\* (isolated; for BACnet MS/TP, Panel Bus, or Modbus RTU Master communication)
- 5 RS485-2\* (non-isolated; for BACnet MS/TP, Panel Bus, or Modbus RTU Master communication)
- 6 LEDs
- 7 USB 2.0 Device Interface (for connection to CARE / XW-Online and web browsers, CL-Touch, or other 3<sup>rd</sup>-party touch panels)
- 8 Three-position slide switch (for setting bias and termination resistance of RS485-1)
- 9 RJ45 socket for connection of CLEAHMI21 External HMI – CLEA2000B31, CLEA2014B31, CLEA2014B32, CLEA2026B31, only

\* Modbus RTU Master communication is possible on either one of the two RS485 interfaces, but not on both of them concurrently.

**NOTE:** In the case of the CLEA2014B21 and CLEA2014B31, at least one of the two RS485 interfaces must be assigned to BACnet MS/TP. The other RS485 interface can then be assigned to either Panel Bus, Modbus, or BACnet MS/TP.

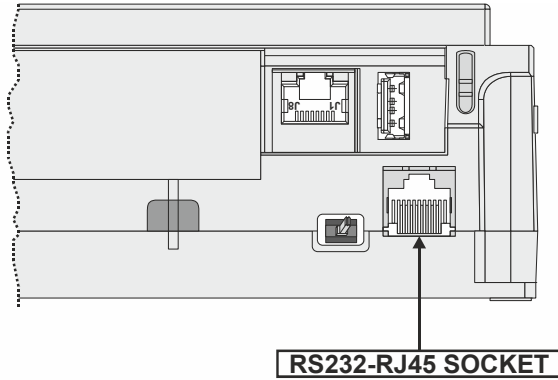
### WARNING

**Risk of electric shock or equipment damage!**

- ▶ It is prohibited to connect any of the RJ45 sockets of the EAGLE Controller to a so-called PoE-enabled device ("Power over Ethernet").

**RS232 / RJ45 Socket**

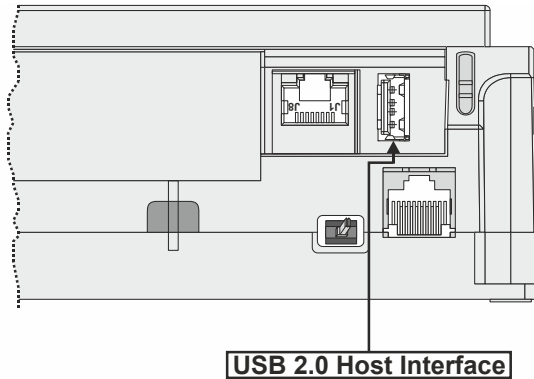
Via its RS232 / RJ45 socket, the EAGLE Controller can be connected (using an XW586 cable) to a PW M-Bus Adapter and thus to M-Bus networks. See also section "M-Bus Connection" on pg. 33.



**Fig. 5. RS232 / RJ45 socket**

**USB 2.0 Host Interface**

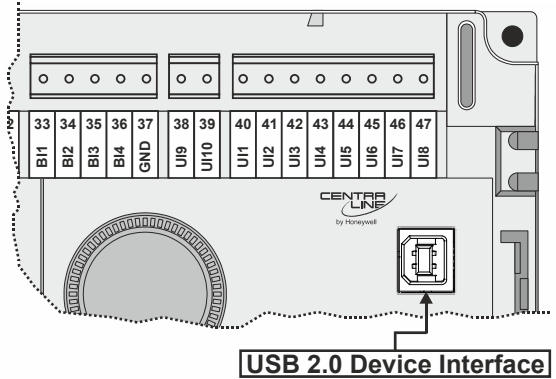
Via its USB 2.0 Host interface, the EAGLE Controller can be connected to, e.g., the IF-LON External Interface Adapter and thus to LONWORKS networks. Max. 500 mA, high speed. See also section "LonWorks Communications" on pg. 27.



**Fig. 6. USB 2.0 Host interface**

**USB 2.0 Device Interface**

All models of the EAGLE Controller are equipped with a USB 2.0 Device Interface at the front. This interface is for connection to CARE / XW-Online and web browsers, CL-Touch, or other 3<sup>rd</sup>-party touch panels.

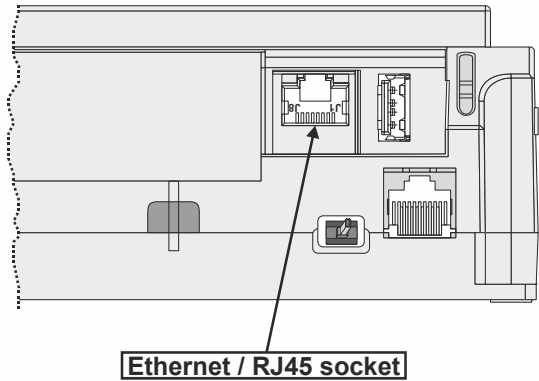


**Fig. 7. USB 2.0 Device Interface**

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 CARE.

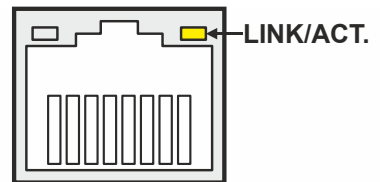
**Ethernet / RJ45 Socket**

All models of the EAGLE Controller (except CLEA2014B21 and CLEA2014B31) are equipped with an Ethernet / RJ45 socket featuring one LED.



**Fig. 8. Ethernet / RJ45 socket (CLEA2000Bxx, CLEA2014Bx2, and CLEA2026Bxx, only)**

This Ethernet / RJ45 socket is a 10/100-Mbaud Ethernet interface permitting communication (as per IEEE 802.3) on BACnet IP networks.



**Fig. 9. Ethernet / RJ45 socket**

**NOTE:** The Ethernet / RJ45 socket is usually earth-grounded. For additional information on earth grounding, see also "Appendix 1: Earth Grounding" on pg. 36.

**LEDs**

The EAGLE Controller features the following LEDs:



Fig. 10. EAGLE Controller LEDs

Table 4. EAGLE Controller LEDs

symbol	color	function, description
L1	yellow	application-specific LED indicating status information ("Cooling Mode", "Heating Mode" "Service Interval" etc.)
L2	--	Not used.
Tx	yellow	RS485-1 status LED indicating transmission of communication signals.
Rx	yellow	RS485-1 status LED indicating reception of communication signals.
	red	status LED indicating hardware problems, lack of application, sensor failure, or Panel Bus failure
	green	power LED

See also section "EAGLE Controller Troubleshooting" on page 35 for a detailed description of the behaviors of the Tx and Rx LEDs, the status LED, and the power LED and their meanings.

**RS485 Interfaces**

**General**

The EAGLE 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 BACnet MS/TP bus, Panel Bus, or Modbus RTU Master communication.
- 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 terminals 19+37 [system ground]) and can be used for BACnet MS/TP bus, Panel Bus, or Modbus RTU Master communication.

**Restriction Applying to CLEA2014B21 and CLEA2014B31**

In the case of the CLEA2014B21 and CLEA2014B31, CARE automatically assigns a minimum of one of the two RS485 interfaces to BACnet MS/TP. Although the user has the option of shifting this assignment from the automatically assigned RS485 interface to the other, the user cannot alter the fact that a minimum of one of the two RS485 interfaces will be assigned to BACnet MS/TP. Thus, in the case of the CLEA2014B21 and CLEA2014B31, the total max. no. of Panel Bus I/O modules is reduced from 128 to only 64.

**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").

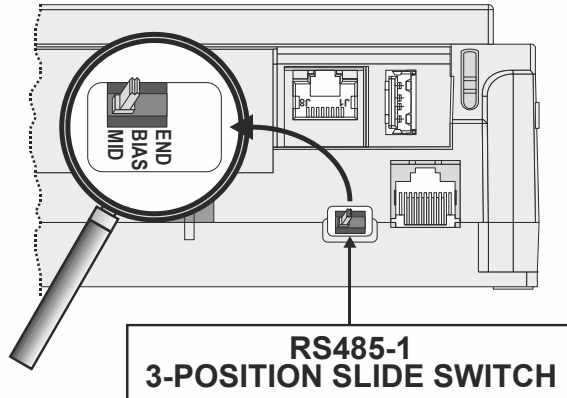


Fig. 11. RS485-1 three-position slide switch

The recommended slide switch setting depends upon the location and usage of the given EAGLE – see Fig. 12 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).

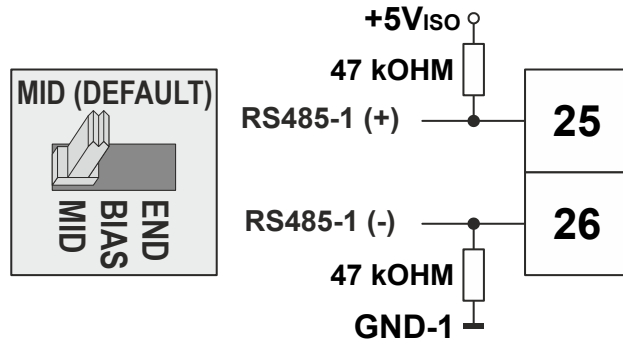


Fig. 12. RS485-1 three-position slide switch setting MID



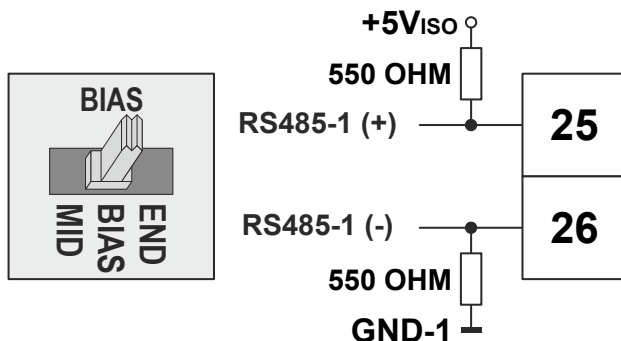


Fig. 13. RS485-1 three-position slide switch setting BIAS

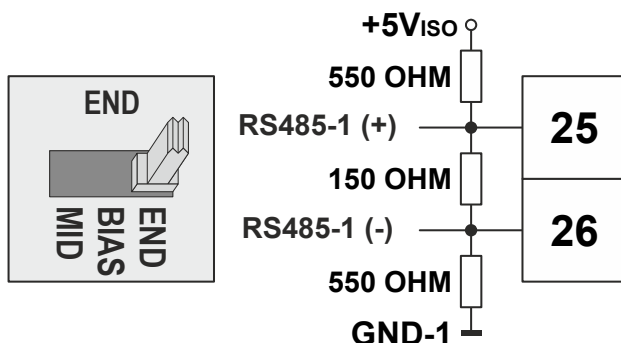


Fig. 14. RS485-1 three-position slide switch setting END

**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.

**NOTE:** 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 EAGLE, 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.

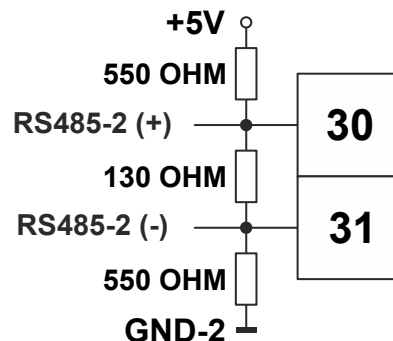


Fig. 15. RS485-2 bias and termination resistors

**NOTE:** GND-2 is internally connected with 24V-0 (terminal 1) and system GND (terminals 19+37)

**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., Centraline 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 EAGLE 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 EAGLE controllers in already-existent RS485 two-wire systems (e.g., when replacing PANTHER or LION controllers with EAGLE controllers), not using a separate signal ground wire will probably have no undesirable effects.*

The cable length affects the baud rate. The following table provides a few examples.

**Table 6. Baud rate vs. max. cable length for RS485**

Baud rate	Max. cable length (L)
9.6 - 76.8 kbps	1200 m
*115.2 kbps	1000 m

\* In the case of configuration of RS485-2 for Panel Bus, the communication rate is set to 115.2 kbps.

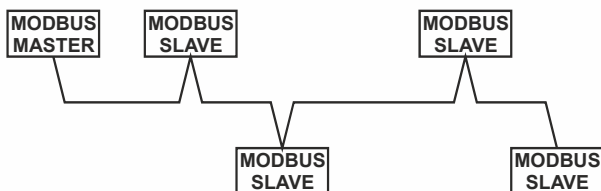
For information on wire gauge, max. permissible cable length, possible shielding and grounding requirements, and the max. number of devices which can be connected to a bus, refer to standard EIA-485.

**Modbus Connection**

The EAGLE controller can function as a Modbus Master. In general, the RS485 wiring rules must be followed.

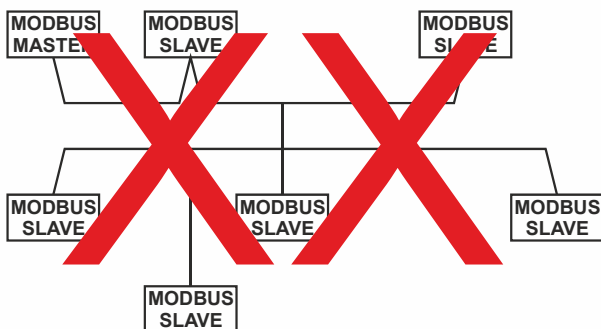
**Wiring Topology**

Only daisy-chain wiring topology is allowed.



**Fig. 16. 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.



**Fig. 17. Prohibited Modbus wiring topology (example)**

**Cables**

See also section "EIA 485 Cable Specifications" on pg. 26. Use shielded twisted pair cable J-Y-(St)-Y 2 x 2 x 0,8.

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" on pg. 31.

**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 J-Y-(St)-Y 2 x 2 x 0,8 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 EAGLE controller is a conditionally compliant "regular" Modbus device.

The EAGLE 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 kBaud (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 kBaud supported.

Max. number of devices: 32

Cable and wiring specifications: See section "Wiring and Set-Up" on pg. 14.

*Communication Mode*

Modbus Master.

*Transmission Mode*

RTU (Remote Terminal Unit)

*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.

*Function Codes*

The following function codes are supported:

**Table 7. Supported function codes**

function code (hex)	function
02	Read Discrete Inputs
01	Read Coils
05	Write Single Coil
04	Read Input Register
03	Read Holding Register
06	Write Single Register
10	Write Multiple Registers

*Exception Codes*

Upon reception of any of the following exception codes, datapoints of the EAGLE application will show "no response."

**Table 8. Supported exception codes**

exception code (hex)	function
01	illegal function
02	illegal data address
03	illegal data value
04	slave device failure
05	acknowledge
06	slave device busy

*Register Sizes*

The following Register sizes are supported:

- 16-bit Registers for Discrete inputs, Coils, Input Registers, and Holding Registers
- 32-bit Registers for Input Registers and Holding Registers.

*Data Types*

The following data types are supported:

- Discrete Inputs:
  - BOOL
- Coils:
  - BOOL
- Input Registers:
  - BOOL
  - INT16, UINT16
  - INT32, UINT32
  - FLOAT
- Holding Registers:
  - BOOL
  - INT16, UINT16
  - INT32, UINT32
  - FLOAT
  - 32-bit floating points can be transmitted as two consecutive 16-bit registers.

*Byte and Word Order Transmission*

- Most Significant Byte First (default)
- Lower Significant Byte First
- Most Significant Word first (default)
- Lower Significant Word first

*Bit Unpack*

The EAGLE allows direct reading of single bits of an Input Register or of a Holding Register into a data-point.

In typical situations in which several different status bits of a Modbus slave's Register need to be read and linked into the EAGLE application, this allows for very efficient application engineering.

*Number of Stop Bits*

One and two stop bits are supported.

*Error Checking Mode*

Parity checking: No parity, even parity, odd parity.

Frame checking: Cyclical redundancy checking (CRC).

*Life Check of Modbus Slaves*

The EAGLE checks the Modbus every 15 seconds for lost Modbus slave devices.

*Message Response Timeout*

20 msec ... 5000 msec.

*Modbus Slaves Scan Cycle*

The measurement cycle of all addressable Modbus slaves depends upon the number of connected Modbus slaves and the total number of mapped datapoints. The minimum measurement cycle is 500 msec. This cycle time is based upon the read cycle of the datapoint manager in the firmware.

*Modbus Communication Failure Indication*

As soon as the EAGLE runs an application which includes Modbus points, it will try to communicate with the Modbus devices based on the Modbus to datapoint mapping of the application.

If a Modbus slave does not respond to a message from the EAGLE controller, the message will be repeated two times. If the Modbus slave does not respond to the two message repeats either, the EAGLE will stall the messaging to this Modbus slave for 15 seconds. After these 15 seconds, the Modbus slave will be again addressed with the same two repeats, if necessary. This cycle will be repeated endlessly.

If the EAGLE does not receive any response for a duration of six (6) seconds, the System Alarm "MODB COMM ERROR" will be issued.

## MOUNTING/DISMOUNTING

### Before Installation

**IMPORTANT**

To allow the evaporation of any condensation resulting from low shipping / storage temperatures, keep the controller at room temperature for at least 24 h 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 EAGLE controller should be secured in place using a commercially-available stopper.

See also the EAGLE Mounting Instructions (MU1Z-0970GE51).

### Dimensions

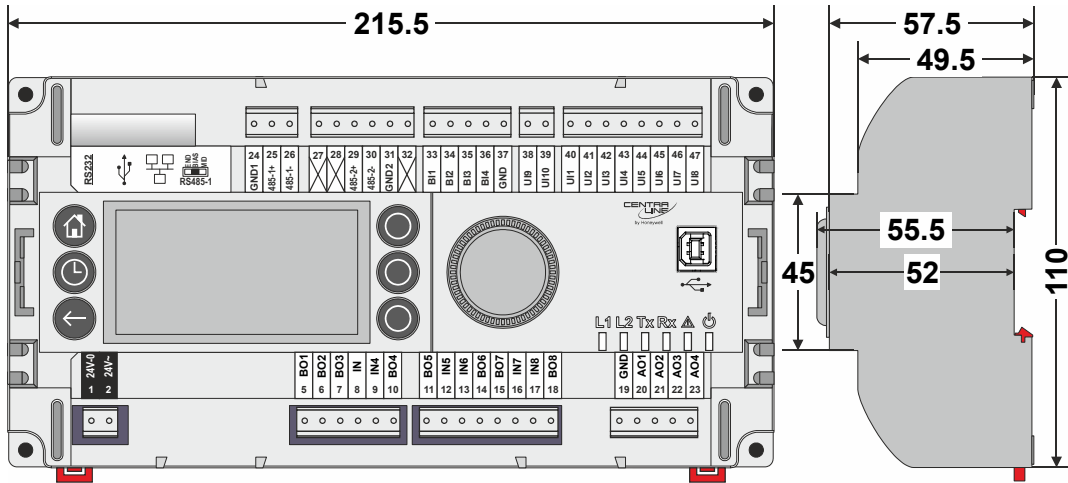


Fig. 18. EAGLE Controller with built-in HMI, dimensions (in mm)

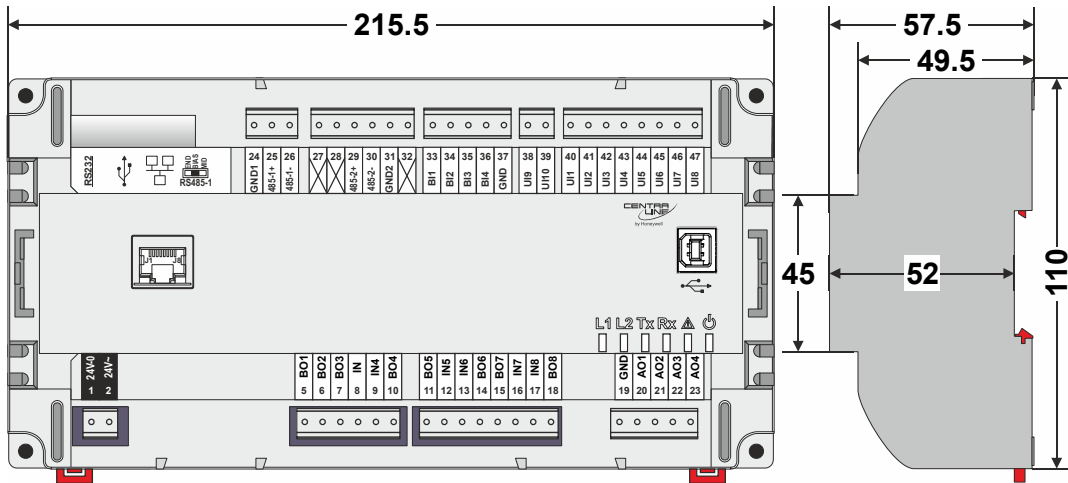


Fig. 19. EAGLE Controller with RJ45 socket for connection of CLEAHMI21 External HMI, dimensions (in mm)

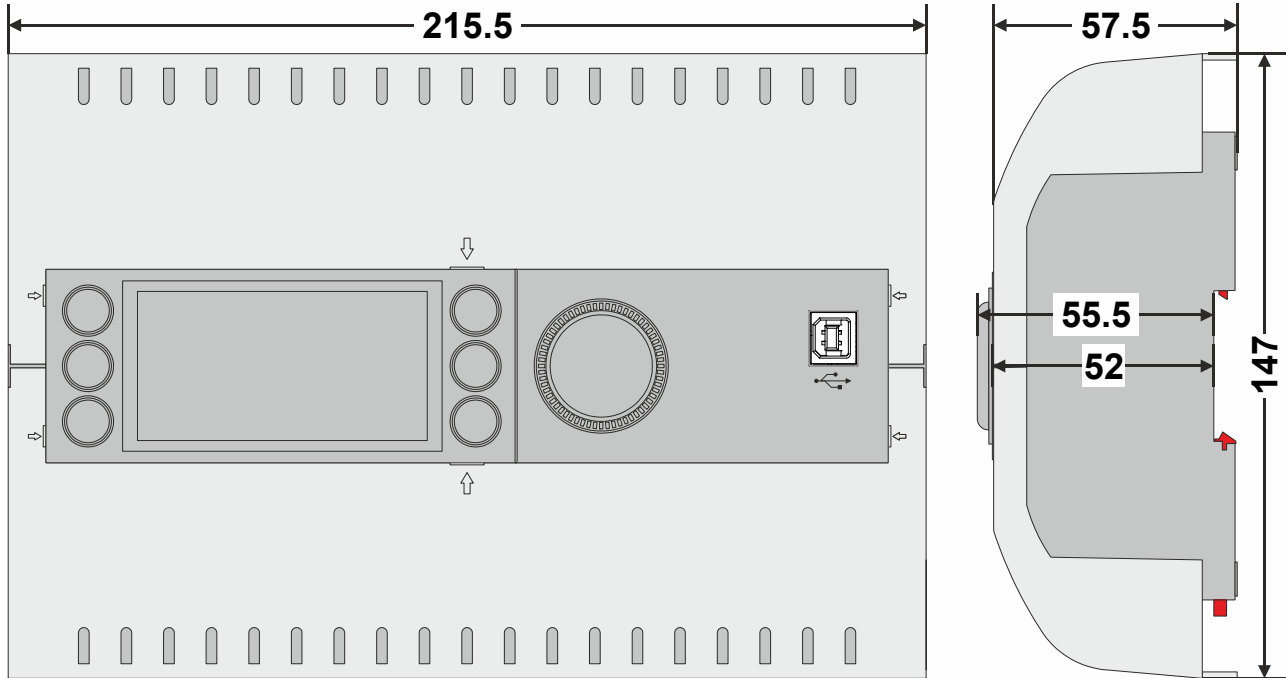


Fig. 20. EAGLE Controller with built-in HMI (with MVC-80-AC1), dimensions (in mm)

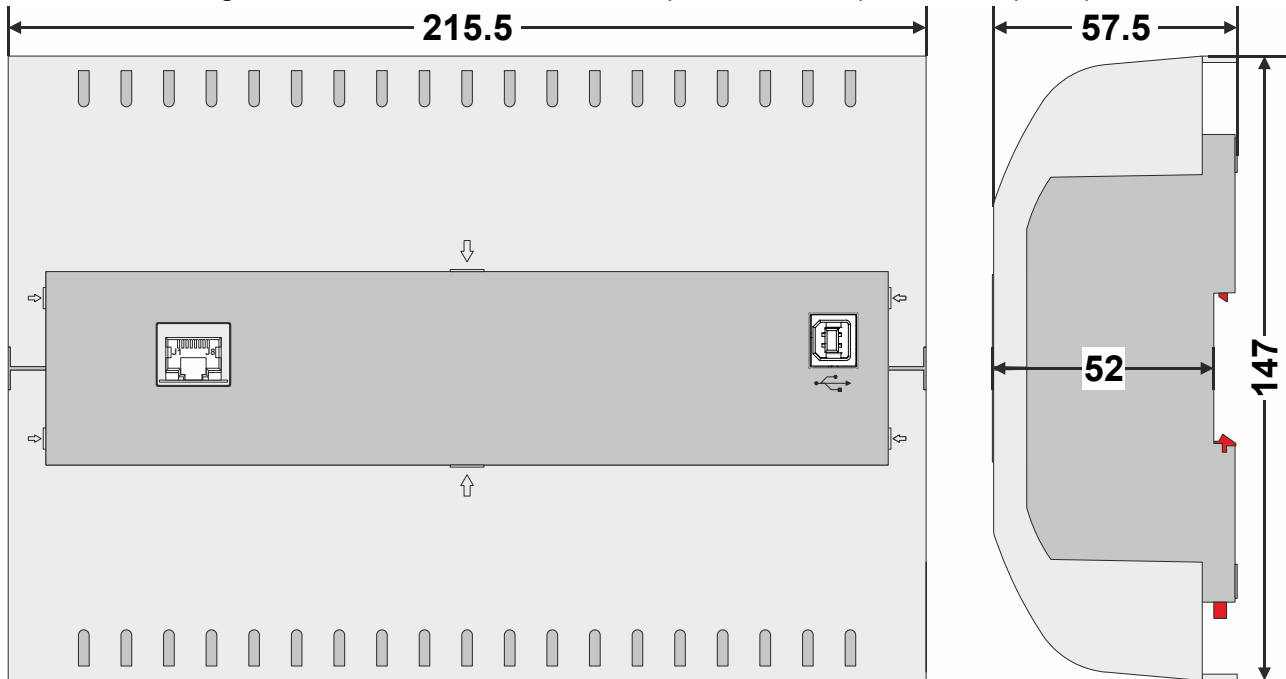


Fig. 21. EAGLE Controller with RJ45 socket for CLEAHMI21 External HMI (with MVC-80-AC1), dimensions (in mm)

**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 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 EAGLE Controller and devices wired to it.
- ▶ Do not use spare terminals as wiring support points.
- ▶ Mixing of different voltages (e.g., 24 V and 230 V) within individual relay blocks of the EAGLE is not allowed.
- ▶ 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

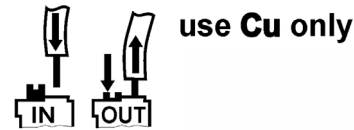
We recommend that the user equip the system with an external fuse.

#### Fusing of Active Field Devices

F2 (depends upon loads in use).

### Wiring Terminals

The EAGLE is equipped with push-in terminal plugs.



**Fig. 22. Inserting/removing wires from push-in terminals**

**NOTE:** With solid conductors, ferrules are prohibited.

**NOTE:** Use only one conductor per push-in terminal.

**NOTE:** If, nevertheless, two stranded wires are to be connected to a single push-in terminal, twin wire end ferrules must be used.

**Table 9. EAGLE push-in terminal wiring specifications**

plug gauge	0.2 ... 1.50 mm <sup>2</sup>
solid conductor H05(07) V-K	0.2 ... 1.50 mm <sup>2</sup>
stranded conductor H05(07) V-K	0.2 ... 1.50 mm <sup>2</sup>
stranded conductor with wire end ferrules (w/o plastic collar)	0.2 ... 1.50 mm <sup>2</sup>
stripping length	10.0 +1.0 mm

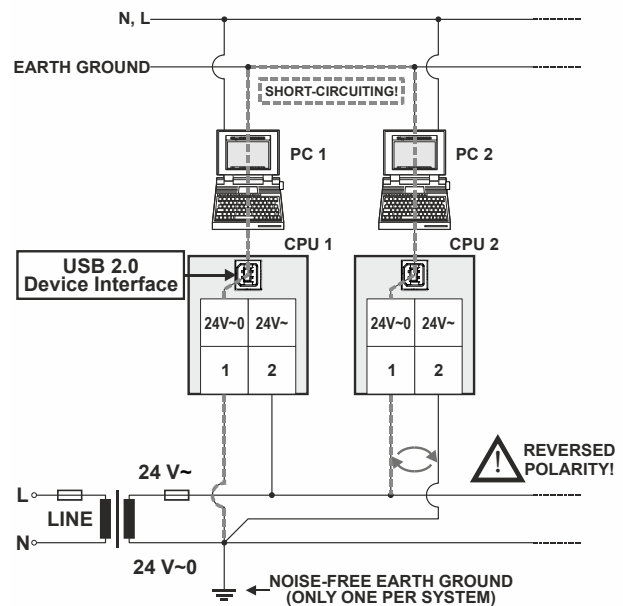
### Power Supply

#### Powering EAGLE

Power is supplied via a removable terminal plug (attached to terminals 1 and 2). See also Fig. 25.

The power supply of the EAGLE Controller must conform to Safety Class II. To reduce overall current consumption, the EAGLE can be powered by a switch power supply (rather than by a transformer). See also Table 2 on pg. 3.

Due to the risk of short-circuiting (see Fig. 23), it is strongly recommended that the EAGLE controller be supplied with power from a dedicated transformer. However, if the EAGLE 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



**Fig. 23. Incorrect polarity → SHORT-CIRCUITING!**

## Terminal Assignment

Table 10. Terminal assignment

terminal no.	signal	Description	CLEA2014Bxx	CLEA2026Bxx	CLEA2000Bxx
1	24V-0	supply voltage (GND), internally connected with term. 31 and system GND (term. 19+37)	X	X	X
2	24V~	supply voltage (24V)	X	X	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	IN4	Relay contact for BO4	X	X	-
10	BO4	Binary output 4. N.O. relay contact switching input power connected to terminal 9	X	X	-
11	BO5	Binary output 5. N.O. relay contact switching input power connected to terminal 12	X	X	-
12	IN5	Relay contact for BO5	X	X	-
13	IN6	Relay contact for BO6	X	X	-
14	BO6	Binary output 6. N.O. relay contact switching input power connected to terminal 13	X	X	-
15	BO7	Binary output 7. N.O. relay contact switching input power connected to terminal 16	X	X	-
16	IN7	Relay contact for BO7	X	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	X	-
20	AO1	Analog output 1	X	X	-
21	AO2	Analog output 2	X	X	-
22	AO3	Analog output 3	-	X	-
23	AO4	Analog output 4	-	X	-
24	GND-1	ref. GND of RS485-1 (isolated)	X	X	X
25	485-1+	"+" signal for RS485-1 (isolated)	X	X	X
26	485-1-	"-" signal for RS485-1 (isolated)	X	X	X
27,28	-	not used	-	-	-
29	485-2+	"+" signal for RS485-2 (non-isolated)	X	X	X
30	485-2-	"-" signal for RS485-2 (non-isolated)	X	X	X
31	GND-2	ref. GND of RS485-2, int. connected with 24V-0 (term. 1) and system GND (term. 19+37)	X	X	X
32	-	not used	-	-	-
33	BI1	Binary input 1 (static dry contact) / pulse counter (fast totalizer)	X	X	-
34	BI2	Binary input 2 (static dry contact) / pulse counter (fast totalizer)	X	X	-
35	BI3	Binary input 3 (static dry contact) / pulse counter (fast totalizer)	X	X	-
36	BI4	Binary input 4 (static dry contact) / pulse counter (fast totalizer)	X	X	-
37	GND	Ground terminal (see NOTE below)	X	X	-
38	UI9	Universal input 9 (for NTC10kΩ / NTC20kΩ / 0..10V / slow BI)	-	X	-
39	UI10	Universal input 10 (for NTC10kΩ / NTC20kΩ / 0..10V / slow BI)	-	X	-
40	UI1	Universal input 1 (for NTC10kΩ / NTC20kΩ / 0..10V / slow BI)	X	X	-
41	UI2	Universal input 2 (for NTC10kΩ / NTC20kΩ / 0..10V / slow BI)	X	X	-
42	UI3	Universal input 3 (for NTC10kΩ / NTC20kΩ / 0..10V / slow BI)	X	X	-
43	UI4	Universal input 4 (for NTC10kΩ / NTC20kΩ / 0..10V / slow BI)	X	X	-
44	UI5	Universal input 5 (for NTC10kΩ / NTC20kΩ / 0..10V / slow BI)	-	X	-
45	UI6	Universal input 6 (for NTC10kΩ / NTC20kΩ / 0..10V / slow BI)	-	X	-
46	UI7	Universal input 7 (for NTC10kΩ / NTC20kΩ / 0..10V / slow BI)	-	X	-
47	UI8	Universal input 8 (for NTC10kΩ / NTC20kΩ / 0..10V / 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.

### Transformer Data

In Europe, if the EAGLE is powered by transformers, then such transformers must be safety isolating transformers conforming to IEC61558-2-6.

In the U.S. and Canada, if the EAGLE is powered by transformers, then such transformers must be NEC Class-2 transformers.

Table 11. 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, and 100 VA from separate transformer
-003	120 Vac	24 Vac, 100 VA, and 24 Vdc, 600 mA
-004	240/220 Vac	24 Vac, 50 VA
-005	240/220 Vac	2 x 24 Vac, 40 VA, and 100 VA from separate transformer
-006	240/220 Vac	24 Vac, 100 VA, and 24 Vdc, 600 mA

Table 12. 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

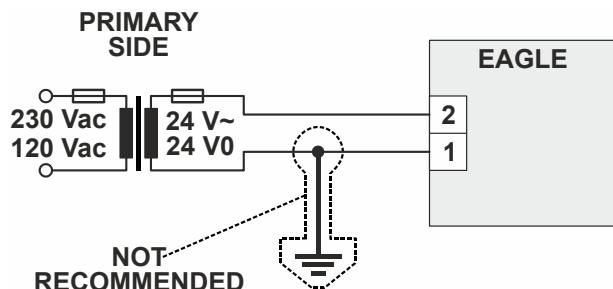


Fig. 24. Connection of EAGLE Controller

### RIN-APU24

The RIN-APU24 Uninterruptable Power Supply can be directly wired to an EAGLE Controller.

See RIN-APU24 Uninterruptable Power Supply – Mounting Instructions (EN0B-0382GE51) for a detailed wiring diagram.

### Powering Panel Bus I/O Modules and Field Devices

The EAGLE, Panel Bus I/O modules, and field devices can be powered by either separate transformers (see Fig. 25, Fig. 26, and Fig. 27) or by the same transformer (see Fig. 28 on pg. 17).

**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 26.

### Powering Field Devices and EAGLE via Separate Transformers

- 24 V actuator connected to separate transformer
- Field device located max. 400 m from EAGLE

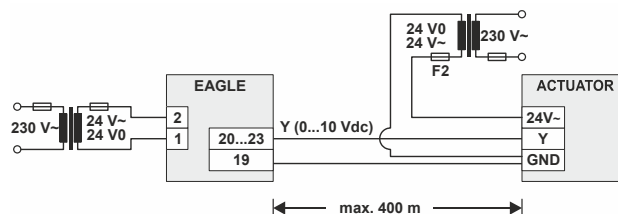


Fig. 25. Power supply of EAGLE and field devices by separate transformer

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

- 24 V actuator connected to, e.g., an analog output module
- Field device located 100 ... 400 m from the Panel Bus I/O module

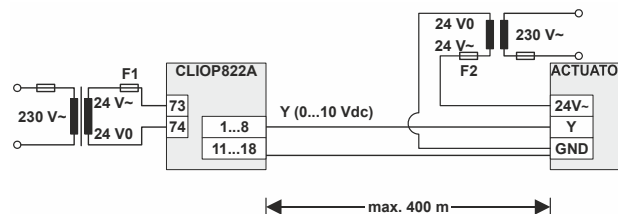


Fig. 26. Power supply via a separate transformer

### Powering Field Devices via Panel Bus I/O Module

- 24 V actuator connected to, e.g., an analog output module
- Field device located max. 100 m from the Panel Bus I/O module

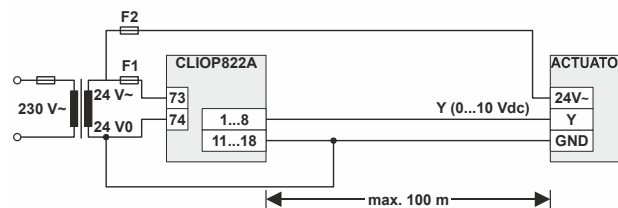


Fig. 27. Power supply via Panel Bus I/O Module

### Lightning Protection

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



### CLEA2026Bxx Connection Examples

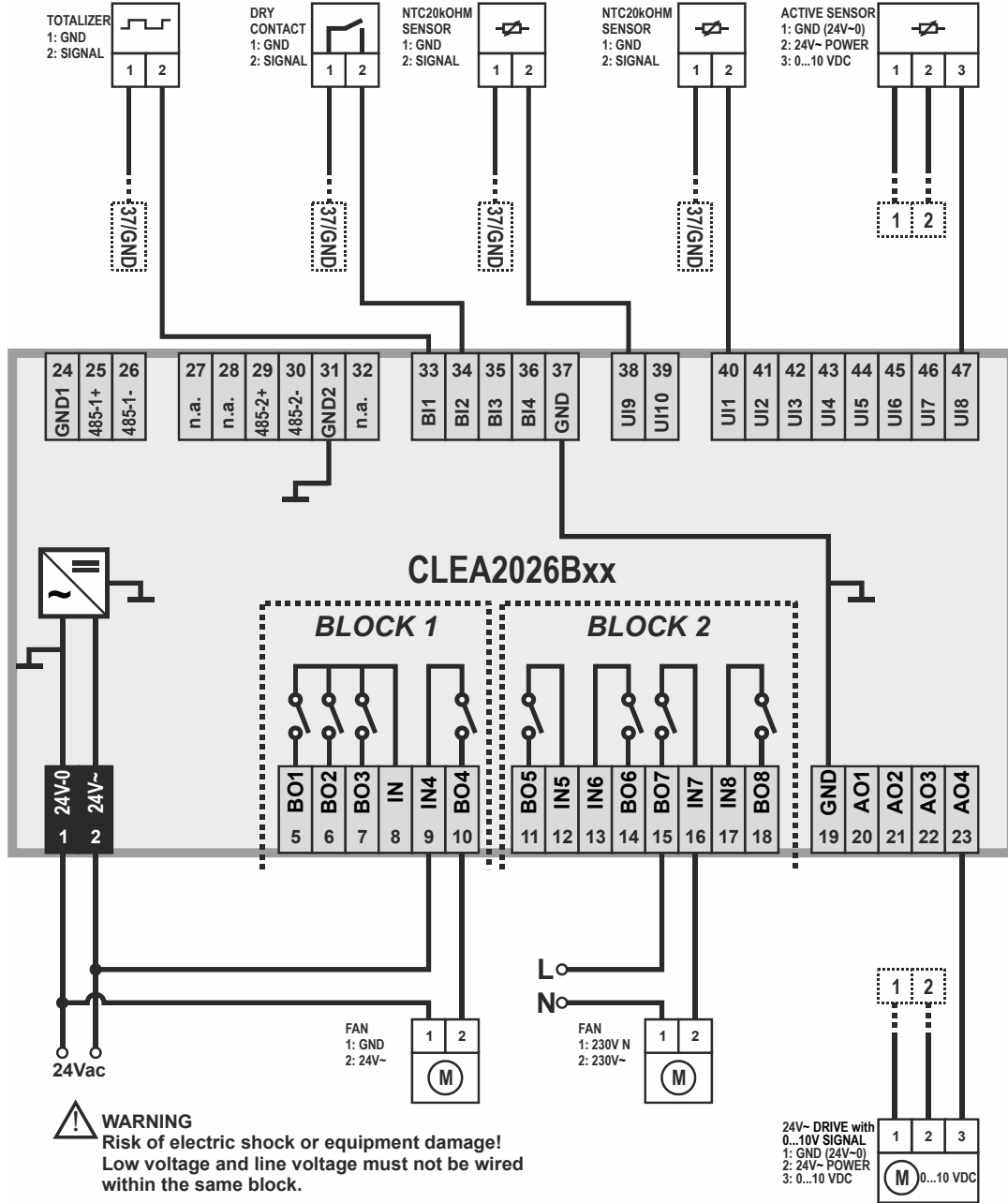
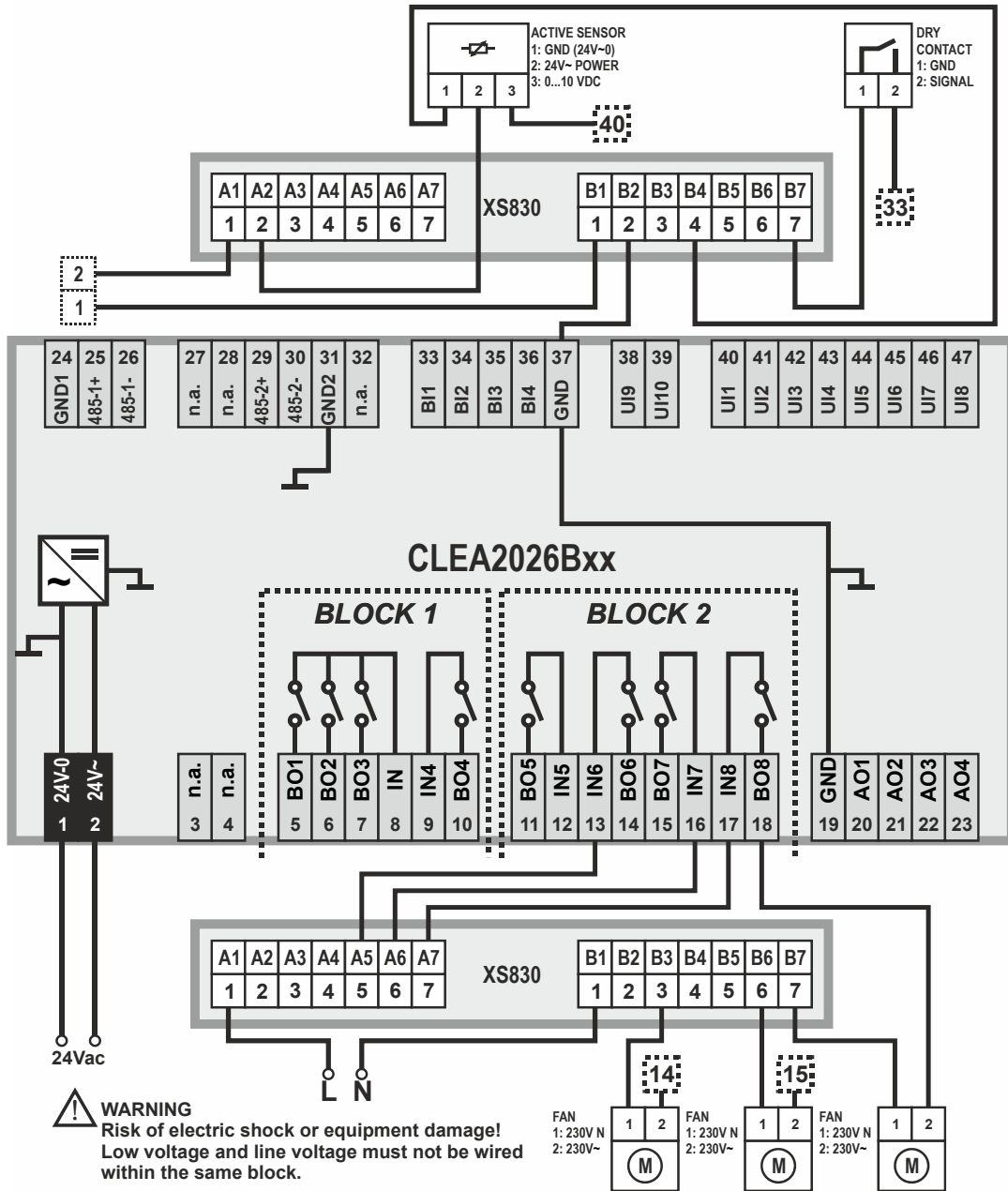


Fig. 28. CLEA2026Bxx connection example

For fusing specifications see section "Fusing Specifications" on page 14.

**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.



**Fig. 29. CLEA2026Bxx 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 EAGLE 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 EAGLE

The CLEA2000Bxx is not equipped with inputs or outputs. The following sub-sections thus apply only to the CLEA2026Bxx and CLEA2014Bxx.

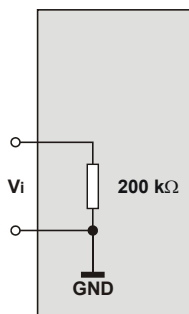
### Universal Inputs

The CLEA2026Bxx is equipped with ten (CLEA2014Bxx: four) universal inputs (UIs) configurable (in CARE).

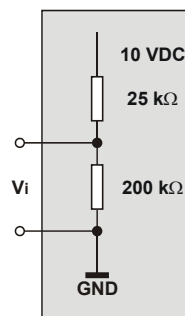
For information on the accuracy of the sensor inputs, their differential measurement error, the characteristics (i.e., resistances and resultant voltages in dependence upon temperature) of the various different sensor types which can be connected to them, and on the thresholds at which sensor failures are recognized, see section "Appendix 2" on page 39.

**Table 13. Specifications of UIs**

criteria	value
voltage input	<ul style="list-style-type: none"> <li>UI1-UI10: 0 ... 10 VDC with pull-up resistor (default)</li> <li>UI1-UI8: 0...10 VDC w/o pull-up resistor</li> <li>UI1-UI8: 2...10 VDC w/o pull-up resistor</li> </ul>
current input	<ul style="list-style-type: none"> <li>UI1-UI10: 0 ... 10 VDC w/o pull-up resistor, external 499Ω resistor required to measure 0...20 mA</li> <li>UI1-UI8: 2...10 VDC w/o pull-up resistor, external 499Ω resistor required to measure 4...20 mA</li> </ul>
supported sensor types	<ul style="list-style-type: none"> <li>NTC10kΩ (-30...+100 °C)</li> <li>NTC20kΩ (-50...+150 °C)</li> <li>Slow binary input (static, dry-contact), 0.4 Hz</li> </ul>
resolution	12-bit resolution
accuracy	±75 mV (0 ... 10 V)
protection	against short-circuiting, 24 VAC



**Fig. 30 Internal wiring of UI1-UI8 configured for voltage input (without pull-up resistor)**



**Fig. 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 EAGLE 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 CARE) 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 CARE, the universal inputs of the EAGLE 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 14. UIs of EAGLE configured as slow BIs**

frequency	max. 0.4 Hz
pulse ON	min. 1.25 s
pulse OFF	min. 1.25 s
bounce	max. 50 ms

### Analog Outputs

The CLEA2026Bxx is equipped with four (CLEA2014Bxx: two) analog outputs (AOs).

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

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

**Table 15. Specifications of AOs**

criteria	value
output type	<ul style="list-style-type: none"> <li>0...10 V (default)</li> <li>2...10 V</li> </ul>
max. output range	0 ... 11 VDC (1 mA)
min. resolution	8 bit
min. accuracy	± 150 mV
max. wire length	400 m
wire cross section	See Table 9 on pg. 14.
protection	against short-circuiting, 24 VAC

**Binary Inputs / Pulse Counters**

Both the CLEA2026Bxx and the CLEA2014Bxx are equipped with four binary inputs (static dry-contact inputs) / pulse counters (fast totalizers).

**Table 16. Specifications of BIs**

criteria	value
input type	<ul style="list-style-type: none"> <li>binary input (static dry-contact)</li> <li>pulse counter (fast totalizer)</li> </ul>
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 EAGLE 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 CARE) 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

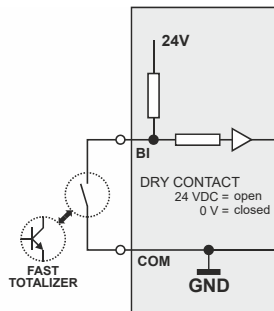
**Pulse Counter Specifications**

Using CARE, the binary inputs of the EAGLE 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 17. BIs of EAGLE configured as fast totalizers**

frequency	max. 15 Hz
pulse ON	min. 25 ms
pulse OFF	min. 25 ms
bounce	max. 5 ms



**Fig. 32. Internal wiring of BI**

**Binary Outputs**

The EAGLE features eight (CLEA2026Bxx) or four (CLEA2014Bxx) 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 CARE.

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 CARE) 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 18. Relay specifications of the EAGLE**

	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.

**NOTE:** Binary output 4 supports the switching of high inrush currents (e.g., motors, incandescent lights, etc.). The max. allowed switch current is 80 A for a duration of max. 20 ms.

## ENGINEERING, COMMISSIONING

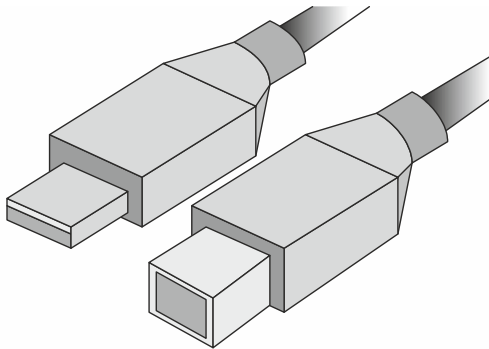
Please refer also to CARE - User Guide (Product Literature No.: EN2B-0182GE51) for detailed information.

### Required Preparations

In order to access (with a laptop or PC) the EAGLE Controller via Ethernet/IP for the first time, 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 CARE. An "A-Male to B-Male" USB cable is required.



**Fig. 33. A-male to B-male USB cable**

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

#### Option 2: Standard Ethernet Interface

The standard IP address can be set in CARE. For this purpose, connect first with the USB interface. In any case, your PC's IP address must match the EAGLE Controller's default IP address subnet. We recommend using DHCP or "Obtain an automatic IP address".

### Behavior of Outputs during Download

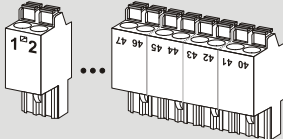
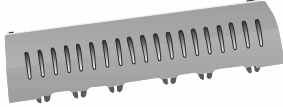
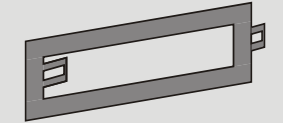
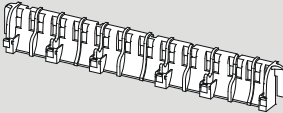

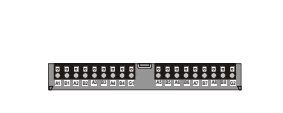
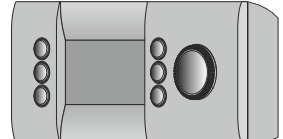
**Table 19. Behavior of outputs during firmware download / application download**

analog, binary, and floating outputs	output behavior during firmware / Linux download	output behavior during application download
onboard outputs of EAGLE, itself	Outputs go to 0 / OFF.	Outputs remain in the previous position / state
outputs of Panel I/O modules (CLIO82x)	As soon as "receive heartbeat" (the value of which CANNOT be altered using CARE) expires, outputs go to safety position.	Outputs remain in the previous position / state
outputs of LONWORKS I/O modules (CLIO82x)	As soon as "receive heartbeat" (the value of which can be altered using CARE) expires, outputs go to safety position.	Outputs remain in the previous position / state.

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

## EXTRA PARTS

Table 20. Extra parts

	order number	description
	<p><b>TPU-11-01</b></p>	<p>Removable terminal plugs, push-in type; complete set of 3 plugs (for terminals 1, 2, 24-32); for the CLEA2000Bxx.</p>
	<p><b>TPU-45-01</b></p>	<p>Removable terminal plugs, push-in type; complete set of 9 plugs (for terminals 1 - 47); for the CLEA2014Bxx and CLEA2026Bxx.</p>
	<p><b>MVC-80-AC1</b></p>	<p>Terminal cover (color: RAL9011); package of 10; for EAGLE Controllers.</p>
	<p><b>MVC-80-AC2</b></p>	<p>Front door mounting accessory (color: RAL9011); package of 10; for EAGLE Controllers.</p>
	<p><b>MVC-40-AC3</b></p>	<p>Strain relief; package of ten; for EAGLE Controllers.</p>
	<p><b>XS830</b></p>	<p>Set of ten terminals. Each Auxiliary Terminal Package consists of two groups of nine internally connected push-in terminals, for distributing signals / power. For the Mixed Panel Bus I/O Module and the EAGLE Controller, only. Please refer to CentralLine I/O Modules - Installation &amp; Commissioning Instructions (EN1Z-0973GE51) for more information.</p>
	<p><b>XS831</b></p>	<p>Set of ten terminals. Each Auxiliary Terminal 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. For the Mixed Panel Bus I/O Module and the EAGLE Controller, only. Please refer to CentralLine I/O Modules - Installation &amp; Commissioning Instructions (EN1Z-0973GE51) for more information.</p>
	<p><b>CLEAHMI21</b></p>	<p>External HMI with LCD display which derives needed electrical energy from the EAGLE controller. Suitable for connection to the RJ45 socket on the front of the CLEA2000B31, CLEA2014B31, CLEA2014B32, and CLEA2026B31.</p>

## PANEL BUS CONNECTION

The EAGLE 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) and system GND (terminals 19+37)

### Overview of Panel Bus I/O Modules

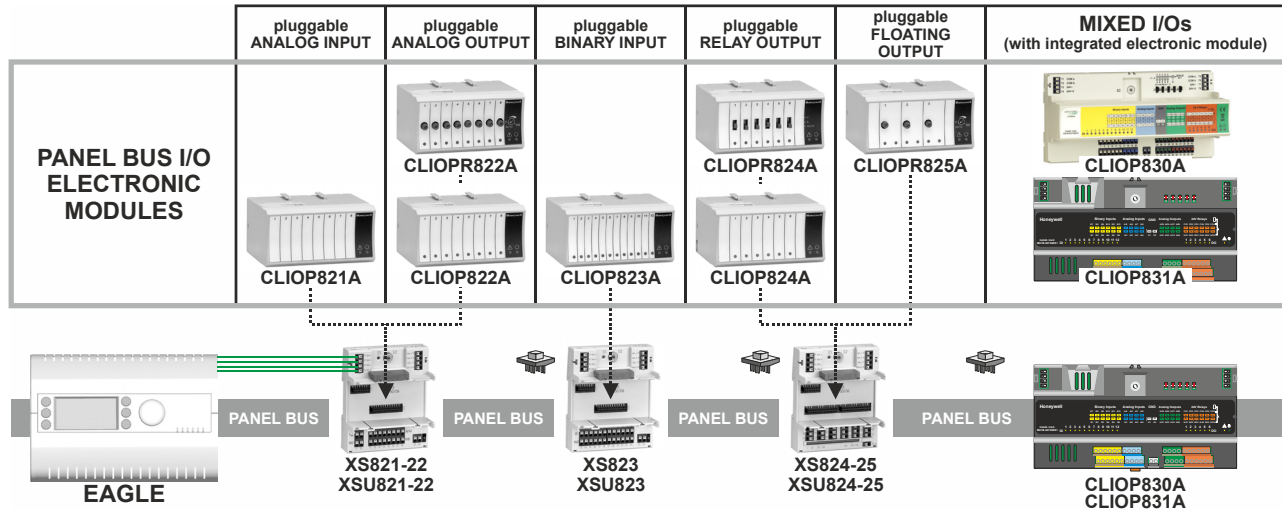


Fig. 34. Overview of Panel Bus I/O Modules

### Panel Bus Considerations

- **RS485-1 (isolated)**
  - Max. Panel Bus length:
    - 40 meters. Any type of cabling and topology (including star and loop topology) possible. No additional end termination permitted.
    - 1200 meters (9.6 – 76.8 kbps) or 1000 meters (115.2 kbps) (see also section "RS485 Standard" on pg 9). Mandatory twisted-pair or telephone cable and daisy chain topology. The EAGLE 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 Fig. 11 on pg. 8) must be set to "END."
- **RS485-2 (non-isolated)**
  - Max. Panel Bus length:
    - 40 meters. Any type of cabling and topology (including star and loop topology) possible. No additional end termination permitted.
    - 1200 meters (9.6 – 76.8 kbps) or 1000 meters (115.2 kbps) (see also section "RS485 Standard" on pg 9). Mandatory twisted-pair or telephone cable and daisy chain topology. The EAGLE 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 EAGLE**
  - Max. no. of Panel Bus I/O modules of a given model: 32
  - Total max. no. of Panel Bus I/O modules: 128 (see NOTE below)
- **Max. no. of hardware I/O points + NVs per EAGLE: 600**
  - Max. no. of mapped NVs allowed per EAGLE is thus 600 minus the no. of hardware I/O points.

**NOTE:** In the case of the CLEA2014B21 and CLEA2014B31, the total max. no. of Panel Bus I/O modules is reduced from 128 to only 64. See also section "Restriction Applying to CLEA2014B21 and CLEA2014B31" on pg. 8.

Refer to CentraLine I/O Modules - Installation & Commissioning Instructions (EN1Z-0973GE51) for more information about connection, current requirements, power supply, overvoltage protection, cable specifications, fusing, effects of manual overrides, etc. of Panel Bus I/O modules and field devices connected to them.

### Connecting RS485-1 to Panel Buses

**NOTE:** When connecting RS485-1 of the EAGLE with Panel Bus I/O modules, it is recommended that the slide switch be set to "END."

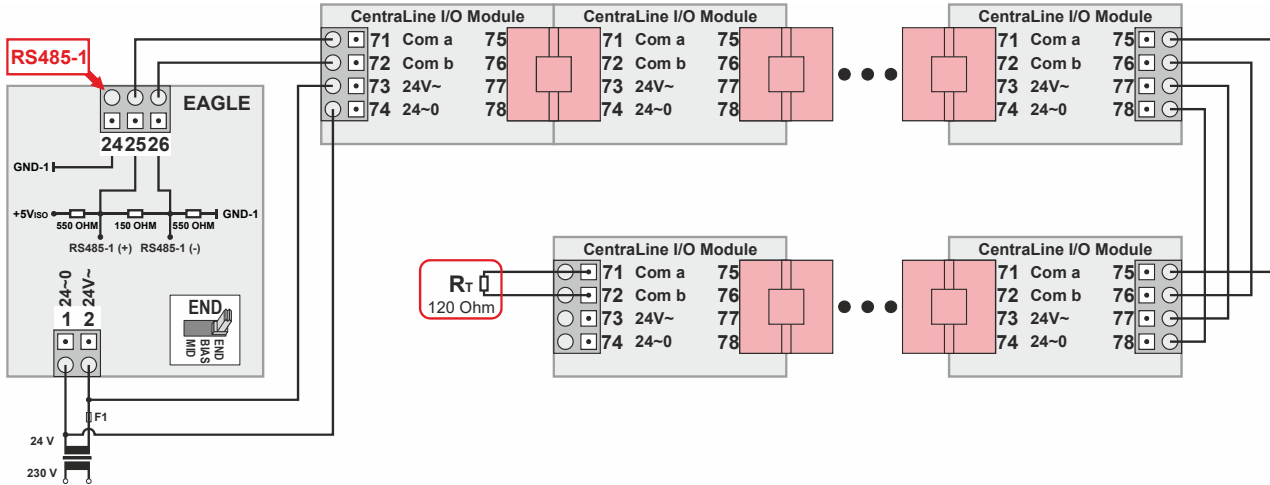


Fig. 35. Connecting RS485-1 of the EAGLE with Panel Bus I/O Modules (single transformer)

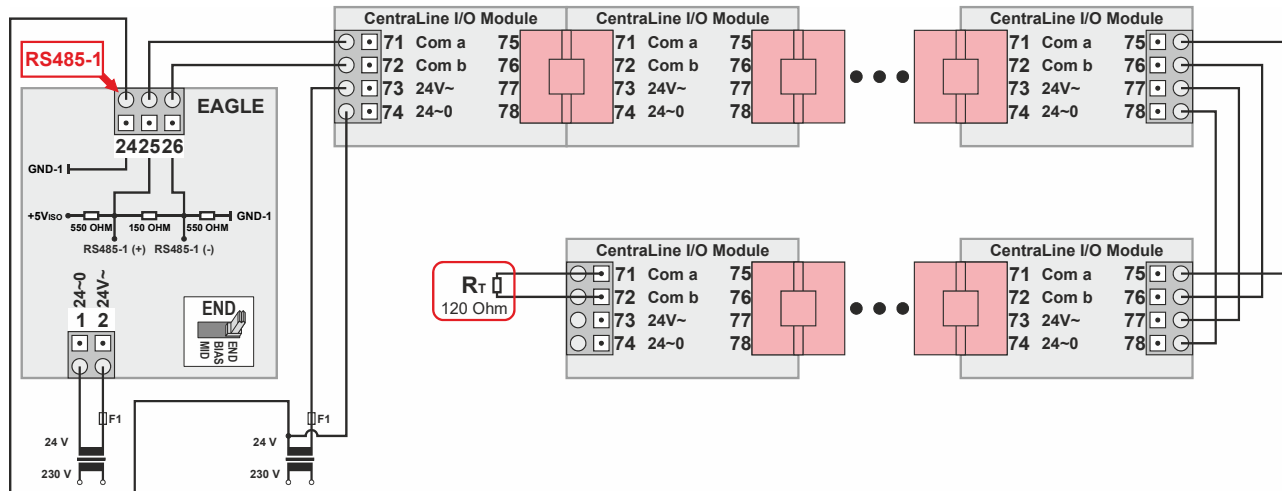


Fig. 36. Connecting RS485-1 of the EAGLE with Panel Bus I/O Modules (two transformers)



### Connecting RS485-2 to Panel Buses

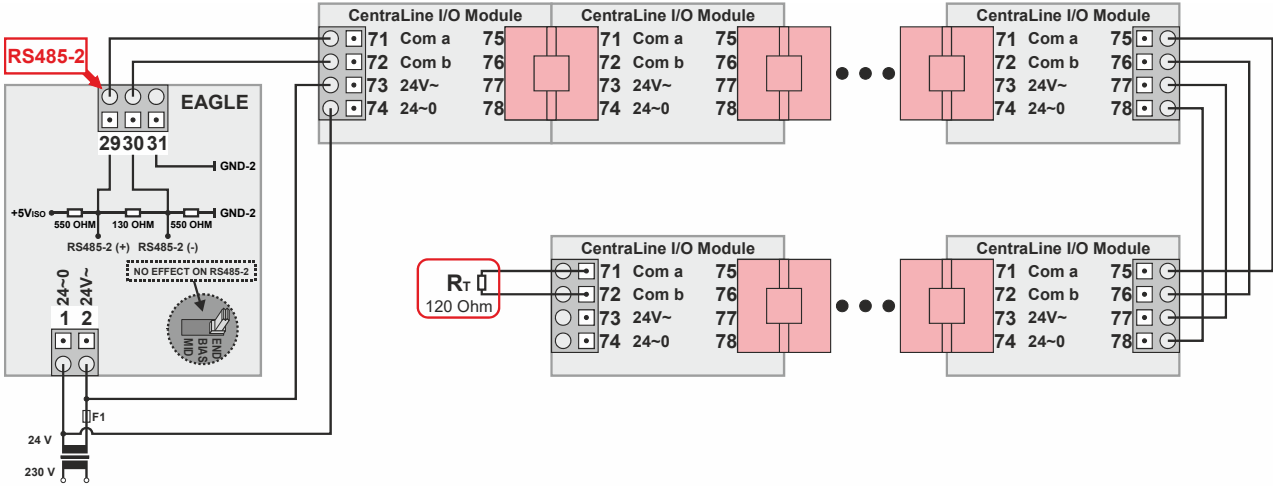


Fig. 37. Connecting RS485-2 of the EAGLE with Panel Bus I/O Modules (single transformer)

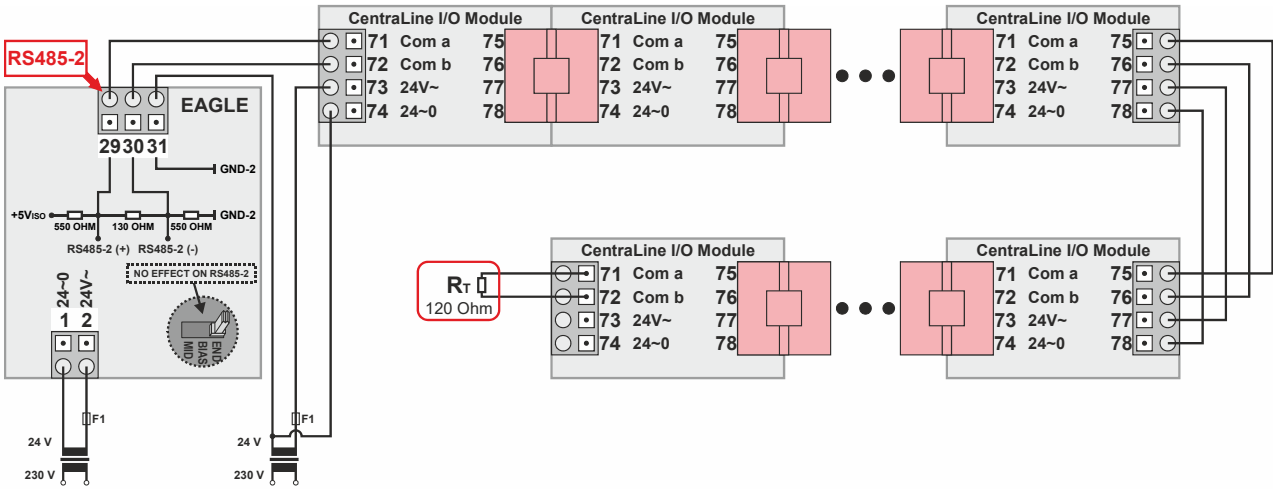
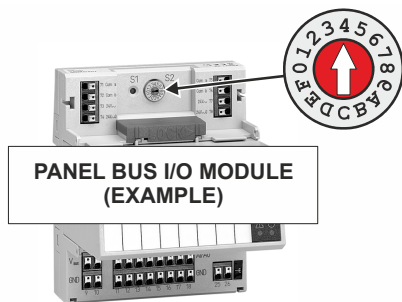


Fig. 38. Connecting RS485-2 of the EAGLE with Panel Bus I/O Modules (two transformers)

## 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 engineering tool.



**Fig. 39. Location of HEX switch on Panel Bus I/O Module**

**NOTE:** A HEX switch setting of "0" corresponds to an address in the engineering tool of "1," a setting of "1" corresponds to an address of "2," and so on.

A max. of 16 Panel Bus I/O Modules of each type (AI, DO, etc.) per RS485 interface (i.e., per Panel Bus) 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.) per RS485 interface (i.e., per Panel Bus) may be assigned the same address.

## 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 21. Power supply cable specifications**

<b>max. length</b>	3 m (from transformer to final module)
<b>cross section</b>	min. 0.75 mm <sup>2</sup> (AWG 18)

## EIA 485 Cable Specifications

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

**Table 22. EIA 485 cable specifications**

<b>max. length</b>	1200 meters (9.6 – 76.8 kbps) or 1000 meters (115.2 kbps).
<b>cable type</b>	twisted pair, shielded (foil or braided shields are acceptable)
<b>charac. impedance</b>	100...130 Ω
<b>distributed capacitance between conductors</b>	Less than 100 pF per meter (30 pF per foot)
<b>distributed capacitance between conductors and shield</b>	Less than 200 pF per meter (60 pF per foot)

The following cables fulfill this requirement:

- AWG 18;
- shielded, twisted pair cable J-Y-(St)-Y 2 x 2 x 0,8;
- CAT 5,6,7 cable (use only one single pair for one bus);
- Belden 9842 or 9842NH.

## 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 23.

**Table 23. Power / communication cable specifications**

type of signal	cross-sectional area	
	≤ 100 m (Fig. 27) single transformer	≤ 400 m (Fig. 26) sep. transformers
24 VAC power	1.5 mm <sup>2</sup> (16 AWG)	not allowed for > 100 m (300 ft)
0...10 V signals	0.081 – 2.08 mm <sup>2</sup> (28 – 14 AWG)	

For wiring field devices, see section "Powering Panel Bus I/O Modules and Field Devices" on page 16.

## Routing Cables to Field Devices

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

**Table 24. Minimum distances to power mains cables**

cable	min. distance
shielded	10 mm (0.4 in.)
unshielded	100 mm (4 in.)

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 EAGLE Controller.

## LONWORKS COMMUNICATIONS

### General Information

The EAGLE can be connected to LONWORKS networks. This requires the use of an IF-LON2 (see section "IF-LON2" below), which is then plugged into to the EAGLE's USB 2.0 Host Interface (see also section "USB 2.0 Host Interface" on pg. 7).

This permits individual EAGLE 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 Mechanisms Interface Description, EN0B-0270GE51).



Fig. 40. IF-LON2

See also IF-LON2 – Mounting Instructions (MU1B-0545GE51).

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**

### Connecting to the 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.*

#### IMPORTANT

*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 50/5000 LONWORKS Mechanisms, EN0B-0270GE51, for details, including maximum lengths.

Use wire with a minimum size of 20 AWG (0.5 mm<sup>2</sup>) and a maximum size of 14 AWG (2.5 mm<sup>2</sup>).

#### IF-LON2

Optionally, communication with physical I/O modules, with room and zone controllers, and with CentraLine PANTHER, TIGER, and LION controllers can utilize LonTalk.

The IF-LON2 is equipped with a free-topology transceiver (FTT/LPT) for communication (at a data transmission rate of 78 Kbaud) 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 50/5000 LONWORKS Mechanisms (EN0B-0270GE51) for details.

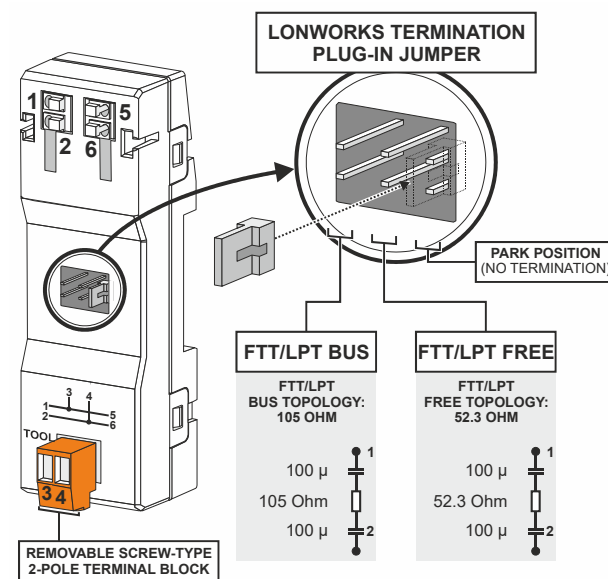


Fig. 41. LonWorks connection and termination module

## BACNET MS/TP BUS CONNECTION

The EAGLE 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) and system GND (terminals 19+37)

### BACnet MS/TP Bus Considerations

- **RS485-1 (isolated)**
  - Max. BACnet MS/TP bus length: 1200 meters (9.6 – 76.8 kbps) or 1000 meters (115.2 kbps) (see also section "RS485 Standard" on pg 9).
  - Use only shielded, twisted-pair cable and daisy-chain topology.
  - Must conform to EIA-RS485 cabling guidelines.
- **RS485-2 (non-isolated)**
  - Max. BACnet MS/TP bus length: 1200 meters (9.6 – 76.8 kbps) or 1000 meters (115.2 kbps) (see also section "RS485 Standard" on pg 9).
  - 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.
- **Max. no. of BACnet MS/TP devices**
  - The max. number of BACnet MS/TP devices per RS485 interface depends on the given traffic. The current limit is 200 messages per minute. The max. number of room controllers is 20, assuming a typical traffic of 10 messages per minute. In the case of non-room applications, the max. number of MS/TP devices can be up to 32 (including the EAGLE, itself) – provided the traffic does not exceed 200 messages per minute. Following the same logic, the max. number of BACnet MS/TP devices per EAGLE is 40 room controllers or 62 non-room MS/TP devices – provided the traffic does not exceed 200 messages per minute per RS485 interface.

### Connecting RS485-1 to BACnet MS/TP Buses

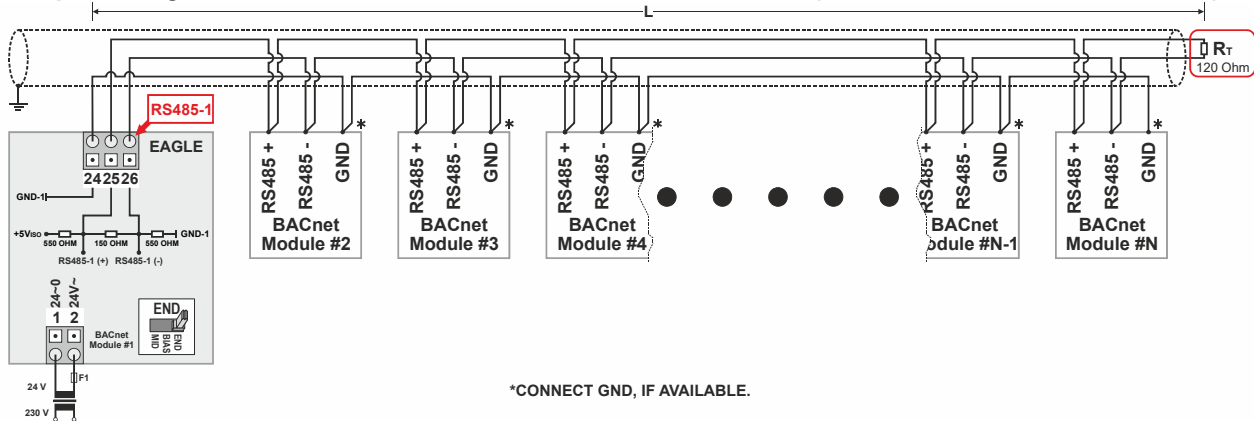
With regards to Fig. 42 through Fig. 44, please note the following:

**NOTE:** Always power each EAGLE and the connected BACnet MS/TP modules via separate transformers.

**NOTE:** For "L," see section "RS485 Standard" on pg. 9.

**NOTE:** If any of the devices are electrically isolated, it is recommended that those devices be connected to signal ground. See section "RS485 Standard" on pg. 9.

### Example 1: Single EAGLE Controller and Connected BACnet Modules (with inserted termination resistor)



**Fig. 42. Connection of RS485-1 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 EAGLE Controllers and Connected BACnet Modules

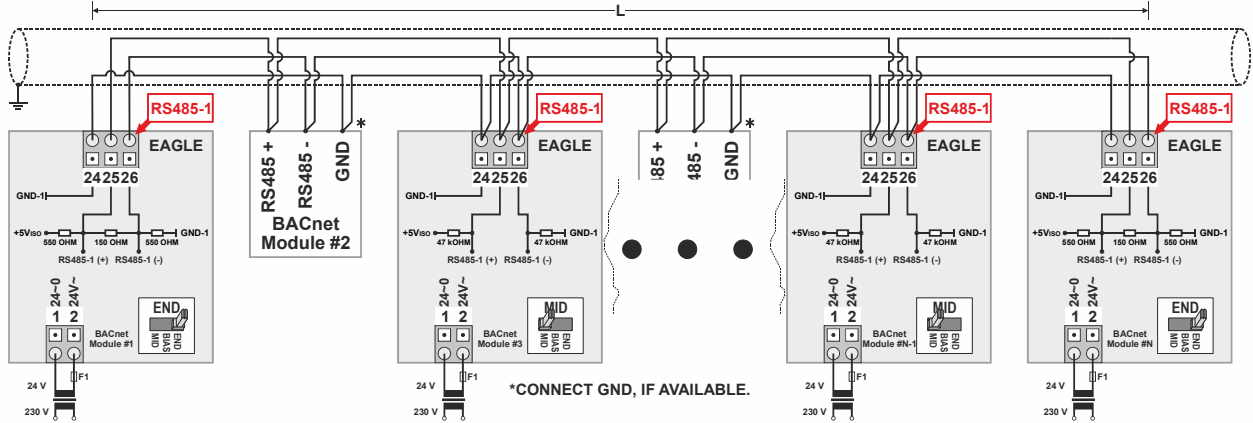


Fig. 43. Connection of RS485-1 to a BACnet MS/TP Bus

Example 3: Multiple EAGLE Controllers and Connected BACnet Modules (with inserted termination resistor)

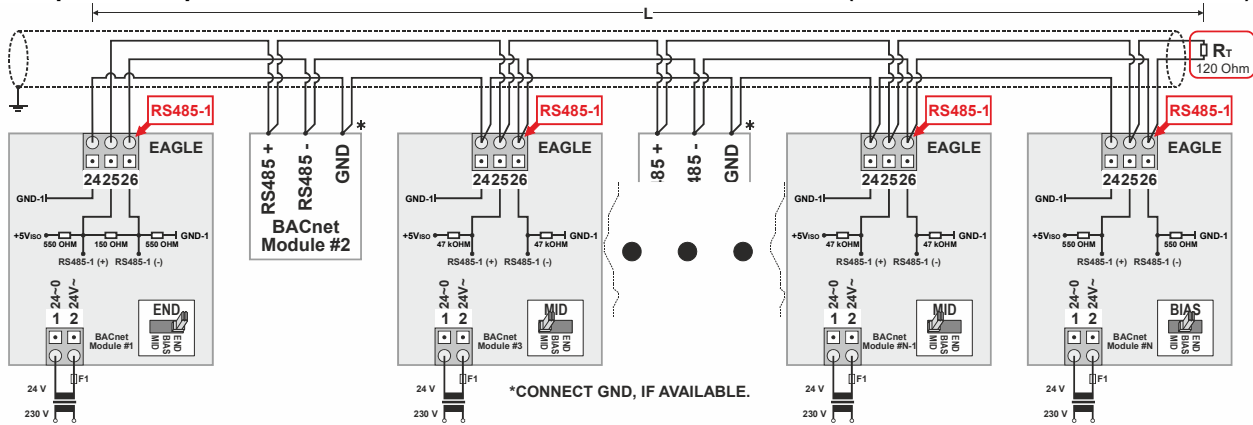


Fig. 44. Connection of RS485-1 to a BACnet MS/TP Bus

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

### Connecting RS485-2 to BACnet MS/TP Buses

With regards to Fig. 45 and Fig. 46, please note the following:

- NOTE:** Always power each EAGLE and the connected BACnet MS/TP modules via separate transformers.
- NOTE:** For "L," see section "RS485 Standard" on pg. 9.
- NOTE:** If any of the devices are electrically isolated, it is recommended that those devices be connected to signal ground. See section "RS485 Standard" on pg. 9.
- NOTE:** Between devices equipped with non-isolated RS485 bus interfaces, potential differences of max.  $\pm 7$  V are allowed. Further, this bus should not extend beyond a single building.

#### Example 1: Single EAGLE Controller and Connected BACnet Modules (with inserted termination resistor)

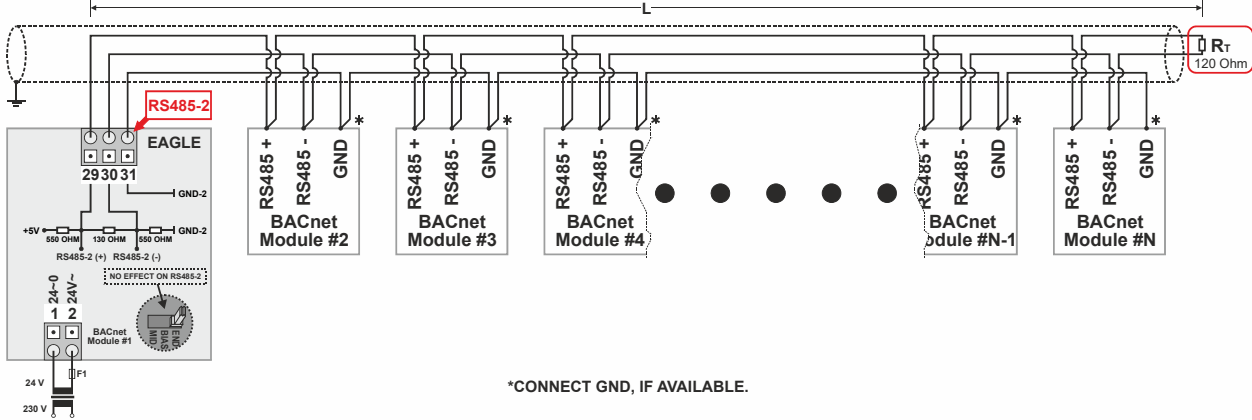


Fig. 45. Connection of RS485-2 to a BACnet MS/TP Bus

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

#### Example 2: Multiple EAGLE Controllers and Connected BACnet Modules

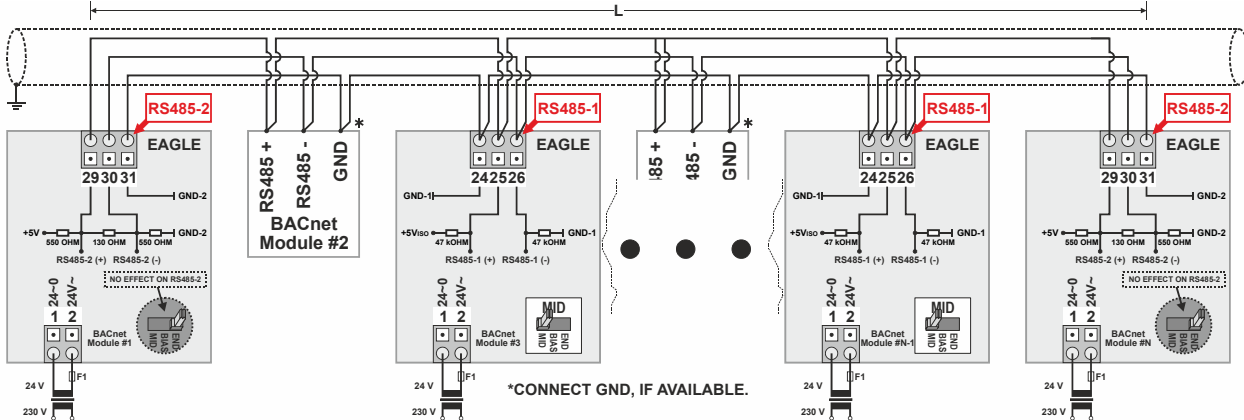


Fig. 46. Connection of RS485-2 to a BACnet MS/TP Bus

## MODBUS CONNECTION

The EAGLE controller supports Modbus RTU Master functionality.

Modbus slaves can be connected to either of the two onboard RS485 interfaces (but not to both simultaneously): 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) and system GND (terminals 19+37)

### Modbus Considerations

- **RS485-1 (isolated)**
  - Max. Modbus length: 1200 meters (9.6 – 76.8 kbps) or 1000 meters (115.2 kbps) (see also section "RS485 Standard" on pg 9).
  - Use only shielded, twisted-pair cable and daisy-chain topology.
  - Must conform to EIA-RS485 cabling guidelines.
- **RS485-2 (non-isolated)**
  - Max. Modbus length: 1200 meters (9.6 – 76.8 kbps) or 1000 meters (115.2 kbps) (see also section "RS485 Standard" on pg 9).
  - 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.
- **Max. no of Modbus devices per EAGLE: 32 (including the EAGLE, itself, which is counted twice)**

### Connecting RS485-1 to the Modbus

With regards to Fig. 47, please note the following:

**NOTE:** Always power each EAGLE and the connected Modbus slaves via separate transformers.

**NOTE:** For "L," see section "RS485 Standard" on pg. 9.

**NOTE:** If any of the devices are electrically isolated, it is recommended that those devices be connected to signal ground. See section "RS485 Standard" on pg. 9.

### Example: EAGLE Modbus Master Controller and Connected Modbus RTU Slaves (with inserted termination resistor)

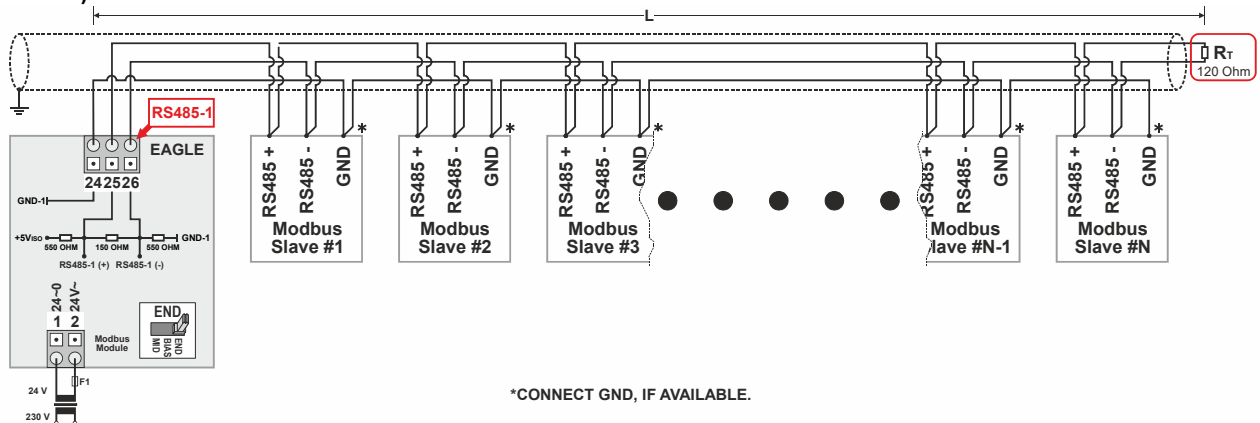


Fig. 47. Connection of EAGLE Modbus Master Controller to Modbus RTU slaves via RS485-1

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

### Connecting RS485-2 to the Modbus

With regards to Fig. 48, please note the following:

- NOTE:** Always power each EAGLE and the connected Modbus slaves via separate transformers.
- NOTE:** For "L," see section "RS485 Standard" on pg. 9.
- NOTE:** If any of the devices are electrically isolated, it is recommended that those devices be connected to signal ground. See section "RS485 Standard" on pg. 9.
- NOTE:** Between devices equipped with non-isolated RS485 bus interfaces, potential differences of max.  $\pm 7$  V are allowed. Further, this bus should not extend beyond a single building.

### Example: EAGLE Modbus Master Controller and Connected Modbus RTU Slaves (with inserted termination resistor)

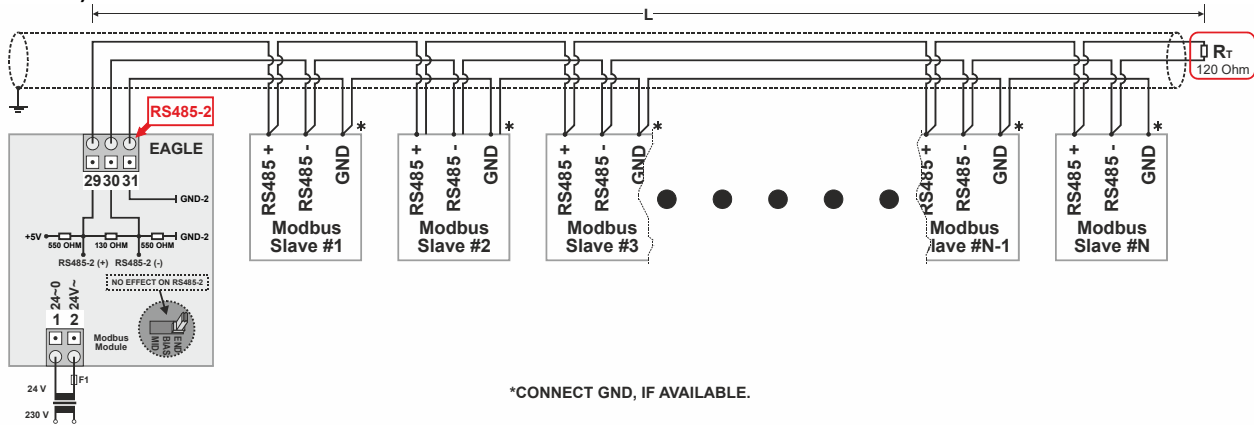


Fig. 48. Connection of EAGLE Modbus Master Controller to Modbus RTU slaves via RS485-2

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



## M-BUS CONNECTION

The EAGLE 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.

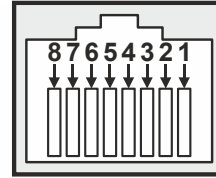


Fig. 50. EAGLE RS232 / RJ45 socket

## M-Bus Considerations

Max. no. of M-Bus devices per EAGLE: 60.

### Bus Length

- Max. M-Bus length: 350 meters from PW3 / PW20 / PW60, at baud rates of 9.6 kbaud or slower with shielded, twisted pair cable: J-Y-(St)-Y 2 x 2 x 0,8.
- The M-Bus can be extended to 1,000 meters, depending upon the baud 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.

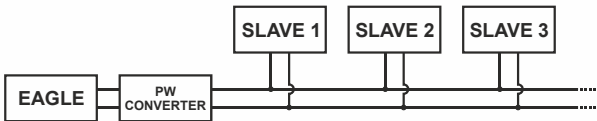


Fig. 49. Allowed M-Bus wiring topology

### Cabling EAGLE to PW3/PW20/PW60

- Use the XW586 cable between the RS232 / RJ45 socket of the EAGLE and the PW adapters.
- The XW586 cable has a length of 1.8 m, and the pin-out listed in Table 26.
- In case a third-party cable is used instead of the XW586 cable, the third-party cable must have a max. length of 15 meters and a max. cable capacitance of 2,500 pF.

Table 25. EAGLE RS232 / RJ45 socket specifications

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

Table 26. 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

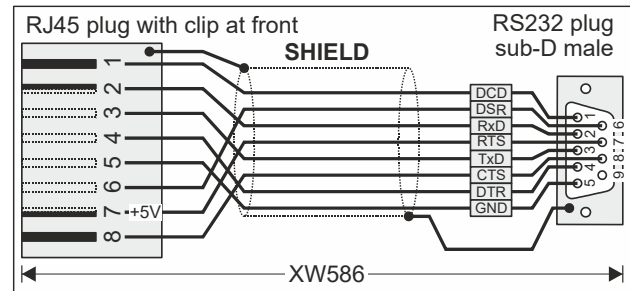


Fig. 51. XW586 power / communication cable details

### Cabling PW3/PW20/PW60 to M-Bus

- Use shielded, twisted pair cable J-Y-(St)-Y 2 x 2 x 0,8.
- 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 EAGLE 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 3<sup>rd</sup>-party touch panel to the USB 2.0 Device Interface on the front of the EAGLE 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.

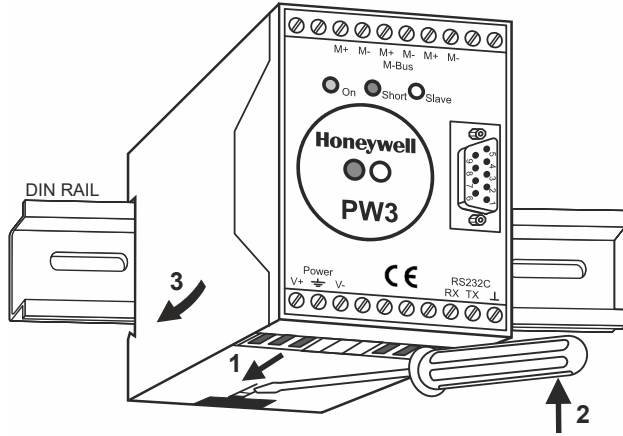


Fig. 52. Mounting of PW (PW3 shown here)

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.

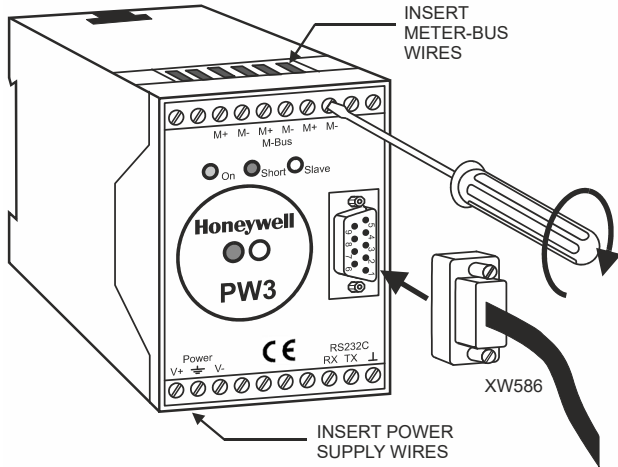


Fig. 53. PW M-Bus adapter connections

3. Connect the PW M-Bus Adapter to the RS232 / RJ45 socket of the EAGLE using the XW586 cable.

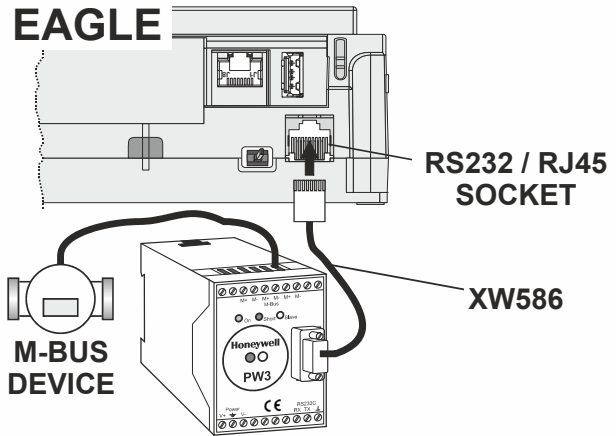


Fig. 54. Connecting the EAGLE to the PW M-Bus adapter

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 Fig. 23), it is strongly recommended that the EAGLE controller be supplied with power from a dedicated transformer. However, if the EAGLE 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.

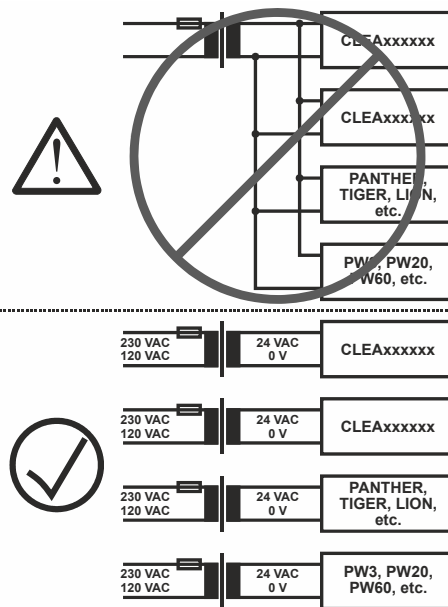


Fig. 55. Connecting power to the PW M-Bus adapter

## TROUBLESHOOTING

### EAGLE Controller Troubleshooting

The following LEDs of the EAGLE Controller can be used for troubleshooting purposes:

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

#### Power LED (green) of EAGLE

Table 27. EAGLE Controller power LED

case	power LED	meaning	remedy
1	ON	Normal operation	No action necessary.
2	OFF	Power supply not OK.	<ul style="list-style-type: none"> <li>▶ Check power supply voltage.</li> <li>▶ Check wiring.</li> <li>▶ If problem persists, replace hardware.</li> </ul>

#### Status LED (red) of EAGLE

Table 28. EAGLE Controller status LED

case	status LED	meaning	remedy
1	LED remains OFF after power-up	Normal operation.	No action necessary.
2	LED remains ON continuously after power-up	<ul style="list-style-type: none"> <li>– No or invalid firmware, or</li> <li>– No or corrupt application, or</li> <li>– License invalid or feature missing, or</li> <li>– I/O module not found or configuration mismatch, or</li> <li>– Communication error, or</li> <li>– Sensor failure on internal inputs, or</li> <li>– Hardware error detected, or</li> <li>– USB memory stick error.</li> </ul>	<ul style="list-style-type: none"> <li>▶ Try powering down and then powering up the EAGLE Controller.</li> <li>▶ If problem persists, check and – if necessary – reload the application.</li> <li>▶ If problem still persists, replace hardware.</li> </ul>

#### Tx and Rx LEDs

Table 29. EAGLE 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.
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 EAGLE 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 EAGLE Controller is attempting to establish communication on RS485-1, but there is no answer.	▶ The communication rate (Kbaud) 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 CentraLine I/O Modules - Installation & Commissioning Instructions (EN1Z-0973GE51) for more information about Panel Bus I/O module troubleshooting.

## APPENDIX 1: EARTH GROUNDING

### EAGLE Systems and SELV

In order to avoid distribution of noise or earth ground potential differences over networks or other connections, the EAGLE 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.

### EAGLE Systems and Standard EN60204-1

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

#### General Information about EN60204-1

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 EAGLE 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 mm<sup>2</sup> (16 AWG).
- ▶ For connection details, refer to the following examples.

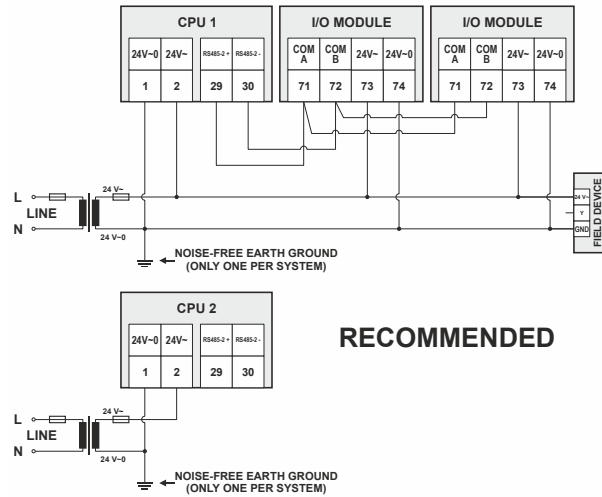
### Example 1

The following explains how to connect and earth multiple CPUs (e.g., multiple EAGLEs, PANTHERs, TIGERs, LIONS, etc. or any combination thereof) earth-grounded as per EN60204-1.

**NOTE:** Use a noise-free earth ground inside the cabinet.

**NOTE:** 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 Fig. 57.



**Fig. 56. 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).

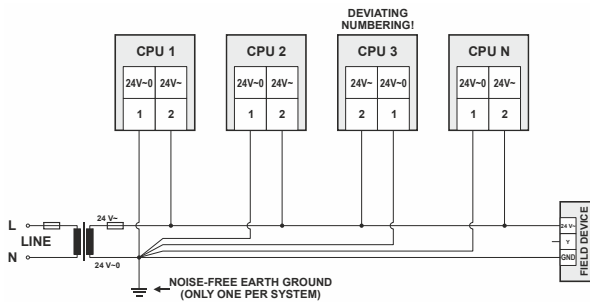
Depending upon the individual CPU, the numbering of the corresponding two terminals may possibly deviate from the norm (which is usually "terminal 1 = 24V-0" and "terminal 2 = 24V~"). In the following example, CPU 3 has a deviating numbering and must be connected accordingly.

**NOTE:** When using a single transformer for several CPUs, each CPU ground must be wired separately to the star-point.

**NOTE:** If the field device transformer is physically far away from the CPUs, earth grounding must still be performed for the controller.

**NOTE:** Use one star-point to split power for multiple CPUs and field devices.

► Connect earth ground to the proper terminal of the CPU.



**Fig. 57. Connecting and earthing multiple CPUs**

## APPENDIX 2

### Sensor Input Accuracy

The internal sensor inputs of the EAGLE Controller support both NTC10kΩ and NTC20kΩ sensors (see also section "Universal Inputs" on page 19). The following table lists the typical minimum accuracies of the hardware and software for temperature sensors.

**Table 30. Accuracies of internal NTC20kΩ sensor inputs of the EAGLE**

range	measurement error (excl. sensor characteristics)	
	NTC10kΩ sensors <sup>(1)</sup>	NTC20kΩ sensors
-50 ... -20 °C (-58 ... -4 °F)	≤ 5.0 K	≤ 5.0 K
-20 ... 0 °C (-4 ... +32 °F)	≤ 1.0 K	≤ 1.0 K
0 ... 30 °C (32 ... 86 °F)	≤ 0.5 K	≤ 0.3 K
30 ... 70 °C (86 ... 158 °F)	≤ 0.5 K	≤ 0.5 K
70 ... 100 °C (158 ... 212 °F)	≤ 1.0 K	≤ 1.0 K
100 ... 130 °C (212 ... 266 °F)	--	≤ 3.0 K
130 ... 150 °C (266 ... 302 °F)	--	≤ 5.5 K
150 ... 400 °C (302 ... 752 °F)	--	--

<sup>(1)</sup> NTC10kΩ specified for -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 CARE. Table 31 lists the measurement ranges and the corresponding thresholds for the recognition of sensor failure for the various different sensor types:

**Table 31. 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	-30 ... +100 °C	SC: < 20 Ω; SB: < -70 °C
NTC20kΩ	-50 ... +150 °C	SC: < 20 Ω; SB: < -70 °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 -51 °C will be communicated as "-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; misreadings due to a meter connected to measure resistance or voltage at the input.

**NTC 20 kΩ (same voltages for inputs of Panel Bus I/O Modules and onboard inputs of EAGLE)**

Temp. [°C]	Resistance [kΩ]	Terminal voltage [V]
-50.0	1659	8.78
-49.0	1541	8.77
-48.0	1432	8.76
-47.0	1331	8.75
-46.0	1239	8.74
-45.0	1153	8.72
-44.0	1073	8.71
-43.0	1000	8.70
-42.0	932	8.69
-41.0	869	8.67
-40.0	811	8.66
-39.0	757	8.64
-38.0	706	8.62
-37.0	660	8.60
-36.0	617	8.58
-35.0	577	8.56
-34.0	539	8.54
-33.0	505	8.52
-32.0	473	8.49
-31.0	443	8.47
-30.0	415	8.44
-29.0	389	8.41
-28.0	364	8.38
-27.0	342	8.35
-26.0	321	8.32
-25.0	301	8.28
-24.0	283	8.25
-23.0	266	8.21
-22.0	250	8.17
-21.0	235	8.13
-20.0	221	8.08
-19.0	208	8.04
-18.0	196	7.99
-17.0	184	7.94
-16.0	174	7.89
-15.0	164	7.83
-14.0	154	7.78
-13.0	146	7.72
-12.0	137	7.66
-11.0	130	7.60
-10.0	122	7.53
-9.0	116	7.46
-8.0	109	7.39
-7.0	103	7.32
-6.0	97.6	7.25
-5.0	92.3	7.17
-4.0	87.3	7.09
-3.0	82.6	7.01
-2.0	78.2	6.93
-1.0	74.1	6.85
0.0	70.2	6.76
1.0	66.5	6.67
2.0	63.0	6.58
3.0	59.8	6.49
4.0	56.7	6.40
5.0	53.8	6.30

Temp. [°C]	Resistance [kΩ]	Terminal voltage [V]
6.0	51.1	6.20
7.0	48.5	6.10
8.0	46.0	6.00
9.0	43.7	5.90
10.0	41.6	5.80
11.0	39.5	5.70
12.0	37.6	5.59
13.0	35.7	5.49
14.0	34.0	5.38
15.0	32.3	5.28
16.0	30.8	5.17
17.0	29.3	5.07
18.0	27.9	4.96
19.0	26.6	4.85
20.0	25.3	4.75
21.0	24.2	4.64
22.0	23.0	4.53
23.0	22.0	4.43
24.0	21.0	4.32
25.0	20.0	4.22
26.0	19.1	4.12
27.0	18.2	4.01
28.0	17.4	3.91
29.0	16.6	3.81
30.0	15.9	3.71
31.0	15.2	3.62
32.0	14.5	3.52
33.0	13.9	3.43
34.0	13.3	3.33
35.0	12.7	3.24
36.0	12.1	3.15
37.0	11.6	3.06
38.0	11.1	2.97
39.0	10.7	2.89
40.0	10.2	2.81
41.0	9.78	2.72
42.0	9.37	2.64
43.0	8.98	2.57
44.0	8.61	2.49
45.0	8.26	2.42
46.0	7.92	2.34
47.0	7.60	2.27
48.0	7.29	2.20
49.0	7.00	2.14
50.0	6.72	2.07
51.0	6.45	2.01
52.0	6.19	1.94
53.0	5.95	1.88
54.0	5.72	1.82
55.0	5.49	1.77
56.0	5.28	1.71
57.0	5.08	1.66
58.0	4.88	1.61
59.0	4.69	1.56
60.0	4.52	1.51
61.0	4.35	1.46

Temp. [°C]	Resistance [kΩ]	Terminal voltage [V]
62.0	4.18	1.41
63.0	4.03	1.37
64.0	3.88	1.32
65.0	3.73	1.28
66.0	3.59	1.24
67.0	3.46	1.20
68.0	3.34	1.16
69.0	3.21	1.13
70.0	3.10	1.09
71.0	2.99	1.06
72.0	2.88	1.02
73.0	2.78	0.991
74.0	2.68	0.960
75.0	2.58	0.929
76.0	2.49	0.900
77.0	2.41	0.872
78.0	2.32	0.844
79.0	2.24	0.818
80.0	2.17	0.792
81.0	2.09	0.767
82.0	2.02	0.744
83.0	1.95	0.720
84.0	1.89	0.698
85.0	1.82	0.676
86.0	1.76	0.655
87.0	1.70	0.635
88.0	1.65	0.616
89.0	1.59	0.597
90.0	1.54	0.578
91.0	1.49	0.561
92.0	1.44	0.544
93.0	1.40	0.527
94.0	1.35	0.511
95.0	1.31	0.496
96.0	1.27	0.481
97.0	1.23	0.466
98.0	1.19	0.452
99.0	1.15	0.439
100.0	1.11	0.425
101.0	1.08	0.413
102.0	1.05	0.401
103.0	1.01	0.389
104.0	0.98	0.378
105.0	0.95	0.367
106.0	0.92	0.356
107.0	0.90	0.346
108.0	0.87	0.336
109.0	0.84	0.326
110.0	0.82	0.317
111.0	0.79	0.308
112.0	0.77	0.299
113.0	0.75	0.290
114.0	0.73	0.282
115.0	0.70	0.274
116.0	0.68	0.266
117.0	0.66	0.259

Temp. [°C]	Resistance [kΩ]	Terminal voltage [V]
118.0	0.64	0.252
119.0	0.63	0.245
120.0	0.61	0.238
121.0	0.59	0.231
122.0	0.57	0.225
123.0	0.56	0.219
124.0	0.54	0.213
125.0	0.53	0.207
126.0	0.51	0.201
127.0	0.50	0.196
128.0	0.49	0.191
129.0	0.47	0.186
130.0	0.46	0.181
131.0	0.45	0.176
132.0	0.43	0.171
133.0	0.42	0.167
134.0	0.41	0.162
135.0	0.40	0.158
136.0	0.39	0.154
137.0	0.38	0.150
138.0	0.37	0.146
139.0	0.36	0.142
140.0	0.35	0.139
141.0	0.34	0.135
142.0	0.33	0.132
143.0	0.32	0.128
144.0	0.32	0.125
145.0	0.31	0.122
146.0	0.30	0.119
147.0	0.29	0.116
148.0	0.29	0.113
149.0	0.28	0.110
150.0	0.27	0.107



**NTC10kΩ (same voltages for inputs of Panel Bus I/O Modules and onboard inputs of EAGLE)**

Temp. [°C]	Resistance [kΩ]	Terminal voltage [V]
-30	177	7.904
-29	166.35	7.848
-28	156.413	7.790
-27	147.136	7.730
-26	138.47	7.666
-25	130.372	7.601
-24	122.8	7.534
-23	115.718	7.464
-22	109.089	7.392
-21	102.883	7.318
-20	97.073	7.241
-19	91.597	7.161
-18	86.471	7.080
-17	81.667	6.996
-16	77.161	6.910
-15	72.932	6.821
-14	68.962	6.731
-13	65.231	6.639
-12	61.723	6.545
-11	58.424	6.448
-10	55.321	6.351
-9	52.399	6.251
-8	49.648	6.150
-7	47.058	6.047
-6	44.617	5.943
-5	42.317	5.838
-4	40.15	5.732
-3	38.106	5.624
-2	36.18	5.516
-1	34.363	5.408
0	32.65	5.299
1	31.027	5.189
2	29.494	5.079
3	28.047	4.969

Temp. [°C]	Resistance [kΩ]	Terminal voltage [V]
4	26.68	4.859
5	25.388	4.750
6	24.166	4.641
7	23.01	4.532
8	21.916	4.423
9	20.88	4.316
10	19.898	4.209
11	18.968	4.103
12	18.087	3.998
13	17.252	3.894
14	16.46	3.792
15	15.708	3.690
16	14.995	3.591
17	14.319	3.492
18	13.678	3.396
19	13.068	3.300
20	12.49	3.207
21	11.94	3.115
22	11.418	3.025
23	10.921	2.937
24	10.449	2.850
25	10	2.767
26	9.572	2.684
27	9.165	2.603
28	8.777	2.524
29	8.408	2.447
30	8.057	2.372
31	7.722	2.299
32	7.402	2.228
33	7.098	2.159
34	6.808	2.091
35	6.531	2.025
36	6.267	1.962
37	6.015	1.900

Temp. [°C]	Resistance [kΩ]	Terminal voltage [V]
38	5.775	1.840
39	5.546	1.781
40	5.327	1.724
41	5.117	1.669
42	4.917	1.616
43	4.726	1.564
44	4.543	1.514
45	4.369	1.465
46	4.202	1.418
47	4.042	1.373
48	3.889	1.329
49	3.743	1.286
50	3.603	1.244
51	3.469	1.204
52	3.34	1.166
53	3.217	1.128
54	3.099	1.092
55	2.986	1.057
56	2.878	1.023
57	2.774	0.990
58	2.675	0.959
59	2.579	0.928
60	2.488	0.898
61	2.4	0.870
62	2.316	0.842
63	2.235	0.815
64	2.158	0.790
65	2.083	0.765
66	2.011	0.740
67	1.943	0.718
68	1.877	0.695
69	1.813	0.673
70	1.752	0.652
71	1.694	0.632

Temp. [°C]	Resistance [kΩ]	Terminal voltage [V]
72	1.637	0.612
73	1.583	0.593
74	1.531	0.575
75	1.481	0.557
76	1.433	0.541
77	1.387	0.524
78	1.342	0.508
79	1.299	0.493
80	1.258	0.478
81	1.218	0.464
82	1.179	0.450
83	1.142	0.436
84	1.107	0.423
85	1.072	0.411
86	1.039	0.399
87	1.007	0.387
88	0.976	0.375
89	0.947	0.365
90	0.918	0.354
91	0.89	0.344
92	0.863	0.334
93	0.838	0.324
94	0.813	0.315
95	0.789	0.306
96	0.765	0.297
97	0.743	0.289
98	0.721	0.280
99	0.7	0.276
100	0.68	0.265

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