CentraLine I/O Modules

Installation & Commissioning Instructions

by Honeywell

CentraLine
I/O MODULES

INSTALLATION AND COMMISSIONING INSTRUCTIONS

CONTENTS

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EN1Z-0973GE51 R0119

Safety Information

General Safety Information

- ► When performing any work (installation, mounting, start-up), all instructions given by the manufacturer and in particular the safety instructions provided in these Installation and Commissioning Instructions are to be observed.
- ► The controller system (including the controller itself, the CentraLine I/O modules and auxiliary terminal packages) may be installed and mounted only by authorized and trained personnel.
- ► Rules regarding electrostatic discharge should be followed.
- ► If the controller system is modified in any way, except by the manufacturer, all warranties concerning operation and safety are invalidated.
- ► Make sure that the local standards and regulations are observed at all times. Examples of such regulations are VDE 0800 and VDE 0100 or EN 60204-1 for earth grounding.
- ► Use only accessory equipment which comes from or has been approved by CentraLine.
- ► It is recommended that devices are to 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 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.
- ► Investigated according to United States Standard UL916 (USL-listed).
- ► Investigated according to Canadian National Standard(s) C22.2 (CNL-listed).

Safety Information as per EN60730-1

Purpose

The controller system is an incorporated electronic control system for cabinet mounting.

It is used for the purpose of building HVAC control and is suitable for use only in non-safety controls for installation on or in appliances.

Table 1. System data as per EN60730-1

Pollution degree	Pollution Degree 2, suitable for home (residential, commercial, and light-industrial) environments.
Overvoltage category	Category II for mains-powered (16A) controls Category I for 24 V powered controls
Rated impulse voltage	2500 VAC
Automatic action	Type 1.C (micro-interruption for the relay outputs)
Software class	Class A
Ball-pressure test temperature	75 °C for all housing and plastic parts 125 °C in the case of devices applied with voltage-carrying parts and connectors
Electromagnetic interference	Tested at 230 VAC, with the modules in normal condition.
System transformer	Europe: safety isolating transformers according to IEC61558-2-6 U.S.A. and Canada: NEC Class-2 transformers
DC power supply	Europe: EN 60950-1 U.S.A. and Canada: NEC Class-2 / LPS compliant transformers

System Overview

System Architecture

A controller system consists of a controller and various CentraLine I/O modules.

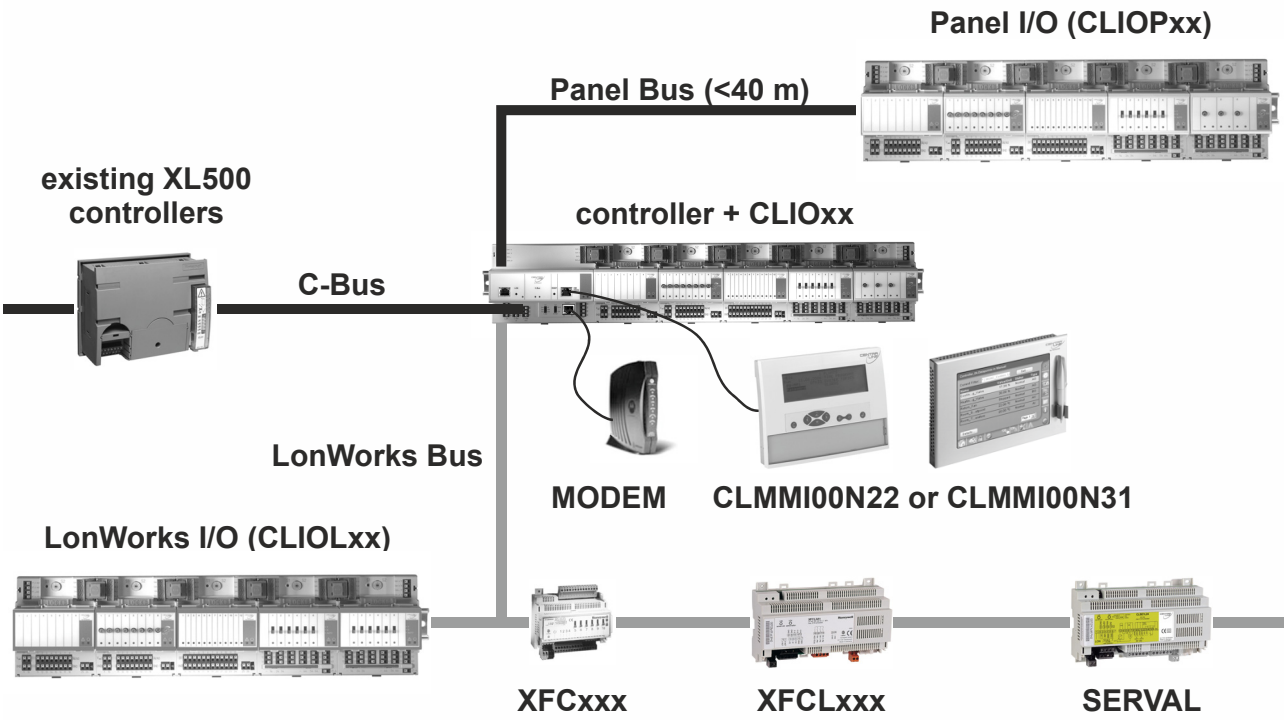


Fig. 1. Typical controller system architecture

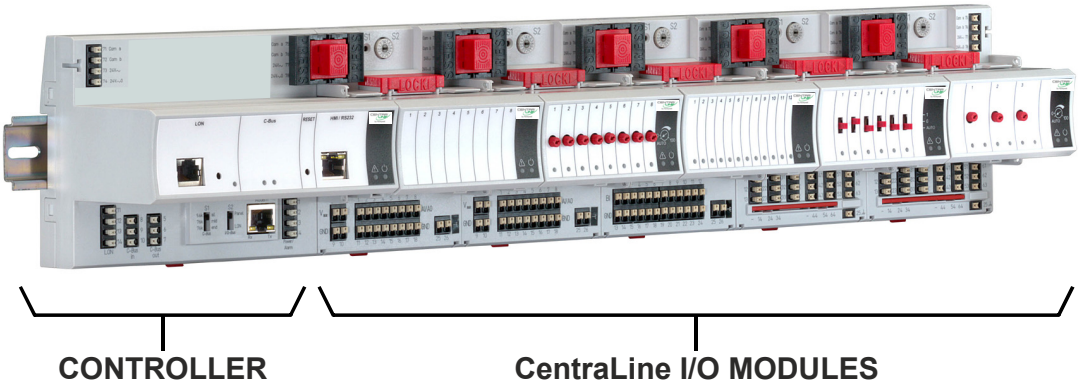


Fig. 2. Controller and CentraLine I/O modules

CentraLine I/O Modules and Sockets

Pluggable Panel Bus and LonWorks I/O Modules

There are two variants of pluggable I/O modules (consisting of a terminal socket and a removable electronic module):

- Panel Bus I/O modules with communication via Panel Bus (light gray housings)
- LONWORKS Bus I/O modules (dark gray housings) with communication via LONWORKS (FTT10-A, link power compatible) for easy integration and use with 3rd-party controllers.

The firmware of pluggable I/O modules is automatically updated by the controller, and the controller automatically configures them as needed by the application.

Mixed Panel Bus I/O Modules

Besides the *pluggable* I/O modules, there are also *mixed* Panel Bus I/O modules. Specifically: the CLIOP830A and CLIOP831A are mixed Panel Bus I/O modules featuring an integrated terminal socket and a variety of inputs and outputs.

- The CLIOP830A has a light-gray housing.
- The CLIOP831A has a black housing.

Their firmware is automatically updated and configured by the controller, and the controller automatically configures the mixed Panel Bus I/O modules as needed by the application.

Terminal Sockets

Pluggable I/O modules are mounted on the appropriate terminal sockets (see Table 4). Pluggable Panel Bus I/O modules and pluggable LONWORKS Bus I/O modules use the same terminal sockets. The terminal sockets are available with push-in terminals (XS821-22, XS823, and XS824-25) or with screw-type terminals (XSU821-22, XSU823, and XSU824-25). The mixed Panel Bus I/O modules (i.e. the CLIOP830A with push-in terminals, and the CLIOP831A with screw-type terminals) feature an integrated terminal socket.

Color Coding

To distinguish modules and components, the following color coding is used:

Table 2. Color coding of CentraLine I/O Modules

Color	Part
Red	All user-accessible adjustable mechanical parts (i.e., bridge connectors and locking mechanism) and operating controls (manual overrides, etc.)
Light-gray	Panel Bus I/O modules (exc. CLIOP831A)
Black	CLIOP831A mixed Panel Bus I/O module
Dark-gray	LONWORKS Bus I/O modules

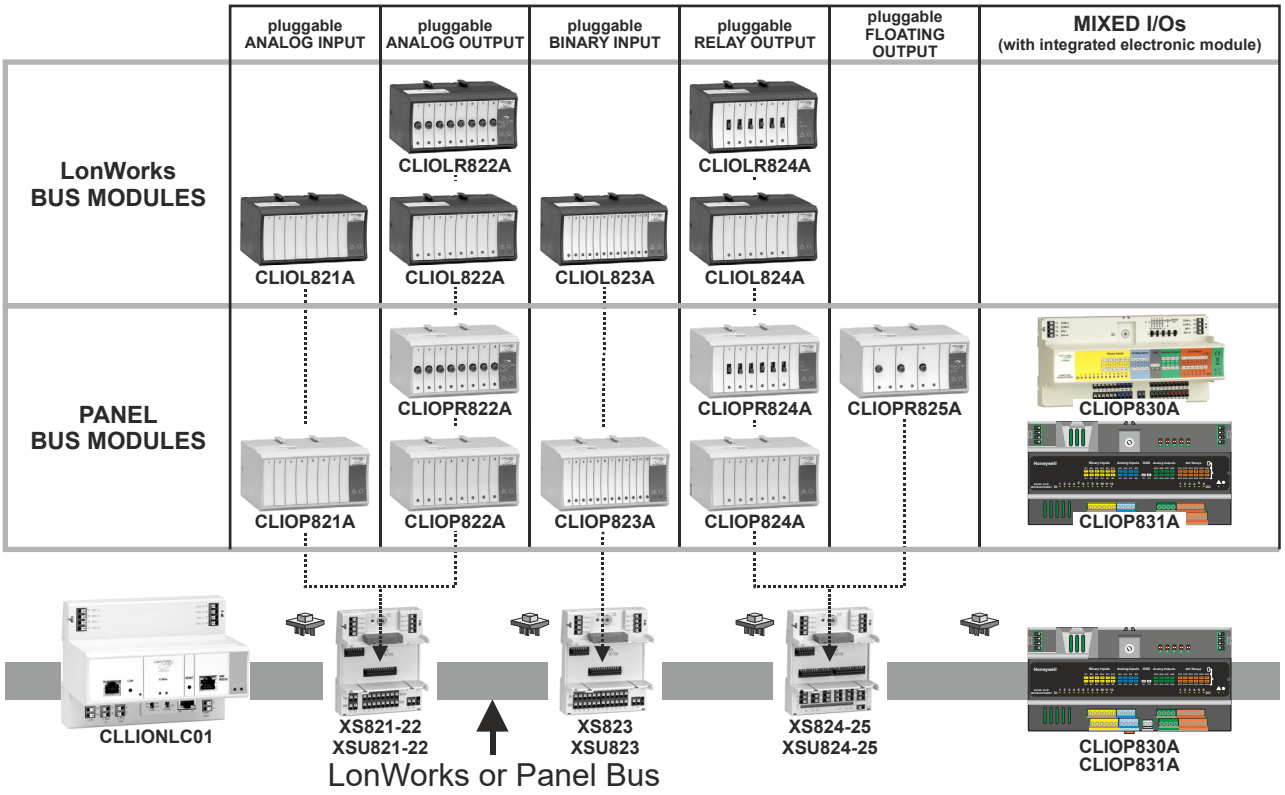


Fig. 3. Overview of CentraLine I/O modules and terminal sockets

CentraLine I/O Module Overview

Table 3. Overview of CentraLine I/O modules

Panel Bus module	LONWORKS Bus module	Description	Inputs	Outputs	Manual controls	LEDs [1]
CLIOP821A	CLIOL821A	Analog input module	8	–	–	–
CLIOP822A	CLIOL822A	Analog output module	–	8	–	8 status LEDs
CLIOPR822A	CLIOLR822A	Analog output module	–	8	8 Manual overrides	8 status LEDs
CLIOP823A	CLIOL823A	Binary input module	12	–	–	12 status LEDs
CLIOP824A	CLIOL824A	Relay output module	–	6 [2]	–	6 status LEDs
CLIOPR824A	CLIOLR824A	Relay output module	–	6 [2]	6 Manual overrides	6 status LEDs
CLIOPR825A	–	Floating output module	–	3	3 Manual overrides	3 pairs of status LEDs
CLIOP830A	--	Mixed I/O module	20	14	--	18 status LEDs
CLIOP831A	--	Mixed I/O module	20	14	--	18 status LEDs

[1] In addition to the power LED and service LED
[2] Changeover outputs

Corresponding Terminal Sockets

Table 4. Pluggable I/O modules and corresponding terminal sockets

I/O module CLIOP/CLIOL…	Socket	Scope of delivery
…821A	XS821-22 with push-in terminals XSU821-22 with screw-type terminals	1 terminal socket, 1 bridge connector 1 swivel label holder
…822A		
…823A	XS823 with push-in terminals XSU823 with screw-type terminals	1 terminal socket, 1 bridge connector 1 swivel label holder
…824A	XS824-25 with push-in terminals XSU824-25 with screw-type terminals	1 terminal socket, 1 bridge connector 1 swivel label holder 1 cross connector
…825A		

Manual Overrides as per EN ISO 16484-2:2004

The manual override switches and potentiometers of the output modules (…R822A, …R824A, and CLIOPR825A) support direct operation as per EN ISO 16484-2:2004, section 5.4.3 "Local Priority Override/Indicating Units."

Specifically, the positions of the manual override switches and potentiometers directly control the outputs – independently of the connected controller or HMI. When a manual override switch or potentiometer is not in its default position ("auto"), the corresponding output LED will blink continuously, and the output module will send a feedback signal with the status "manual override" and the given override position to the connected controller (which will then also store this information in its alarm memory).

NOTE: When updating the firmware of output modules, their outputs are turned OFF – regardless of the position of their manual override switches and/or potentiometers.

NOTE: In the following, e.g., …822A is used to summarize all analog output modules (Panel Bus/LONWORKS Bus, with/without manual overrides).

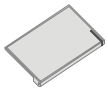
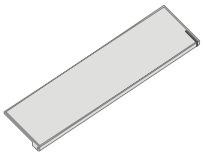
Auxiliary Parts

Table 5. Auxiliary parts

Module	Type	Figure	Corresponding I/O modules CLIOP/CLIOL…	Information
Auxiliary terminal package	XS814		All pluggable CentraLine I/O modules	Two groups of 7 terminals connected to each other for redistributing voltage (see also Fig. 64)
	XS830		Mixed Panel Bus I/O modules, only	Two groups of nine internally-connected push-in terminals, for distributing signals/power (see also Fig. 66).
	XS831			Two groups of four pairs of push-in terminals (each with a 499Ω resistor to GND), for converting 0…20 mA signals into 0…10 VDC signals, and one push-in ground terminal per group. (see also Fig. 68)

Spare Parts

Table 6. Spare parts

Module	Type	Figure	Corresponding I/O modules CLIOP/CLIOL…	Information
Cross connectors (red)	XS815		…824A …825A	Connects 6 relay commons
Bridge connector	XS816		All CentraLine I/O modules	Connects CLLIONLC01 and I/O modules (exc. CLIOP831A)
Swivel label holder	XAL10		All pluggable CentraLine I/O modules	Can be plugged into socket, for attaching label generated by the engineering tool
Swivel label holder	XAL11		Mixed Panel Bus I/O modules, only	Can be plugged into module, for attaching label generated by the engineering tool. NOTE: Phased out.

Interfaces and Bus Connections

The CentraLine I/O Modules can be connected to the following devices and systems:

Panel Bus

- For communication with up to 16 Panel Bus I/O modules
- Polarity-insensitive

LONWORKS Bus

- For communication with other LONWORKS Bus devices within the building
- FTT10, link power compatible
- Polarity-insensitive

Technical Data

System Data

Table 7. System data

Operating voltage	24 VAC, ± 20 %, 21 … 30 VDC
Current requirement	See Table 11.
Push-in terminals	1.5 mm^2
Screw-type terminals	1.5 mm^2
Overvoltage protection	The inputs and outputs of all CentraLine analog and binary I/O modules are protected against short circuit, 24 VAC +20%, and 40 VDC. In the case of the relay outputs of other CentraLine I/O modules (i.e., relay output modules, floating output modules, and mixed I/O modules), appropriate fusing must be provided to ensure that permissible load currents are not exceeded.
Calculated lifetime of weakest component under typical operating conditions	MTBF ≥ 13.7 years

System Constraints

Table 8. System constraints

Max. no. of I/O modules (any combination) connected to controller	depends upon controller type
Max. no. of I/O modules per row	10
Max. current (F1)	4 A
Max. current (F2)	12 A
Max. current (F3)	12 A
Max. row length	3 m
Max. distance between rows	40 m
Min. cross-section of GND (terminal 9) (protected by F2)	1.5 mm^2

Standards

Table 9. Standards

Protection class	IP20
Product standard (EMC)	EN 60730-1 EN 60730-2-9
Testing electrical components	IEC68
Certification	CE
System transformer	The system transformer(s) must be safety isolating transformers according to IEC 61558-2-6. In the U.S.A. and Canada, NEC Class 2 transformers must be used.
Low-Voltage Device Safety Assessment	EN 60730-1 EN 60730-2-9

Operational Environment

Table 10. Operational environment

Ambient operating temperature	0 … 50 °C (32 … 122 °F)
Ambient operating humidity	5 … 93 % rel. humidity (non-condensing)
Ambient storage temperature	–20 … 70 °C (–4 … +158 °F)
Ambient storage humidity	5 … 95 % rel. humidity (non-condensing)
Vibration under operation	0.024” double amplitude (2 … 30 Hz), 0.6 g (30 … 300 Hz)
Dust, vibration	According to EN60730-1
RFI, EMI	Home environment

Planning

Overview

In this step, the following has to be defined, if applicable:

- Power supply
- Fusing
- Earth grounding
- Lightning protection
- Panel Bus wiring
- Design of a LONWORKS network
- Useful accessories
- Cable selection

Transformer Selection

NOTE: In Europe, the system transformer(s) must be safety isolating transformers according to IEC61558-2-6.
In the U.S.A. and Canada, NEC Class-2 transformers must be used.

Current / Power Supply Requirement

When selecting the appropriate transformer, take into account the number of individual modules, accessories, and field devices in determining the total current requirement.

Table 11. Current requirement of CentraLine I/O Modules depending on power supply

Devices powered	Current requirement	
	24 VAC	24 VDC
…821A	130 mA	80mA
…822A	160 mA	90 mA
…823A	180 mA	130 mA
…824A	140 mA	90 mA
…825A	140 mA	90 mA
CLIOP830A	200 mA	95 mA
CLIOP831A	200 mA	95 mA

Connectable Power Supplies

CentraLine CRT Series (Europe)

Table 12. CentraLine CRT series transformers data

Transformer	Primary side	Secondary side
CRT 2	220/230 VAC	24 VAC, 50 VA, 2 A
CRT 6	220/230 VAC	24 VAC, 150 VA, 6 A
CRT 12	220/230 VAC	24 VAC, 300 VA, 12 A

CentraLine 1450 Series (North America)

- 50/60 Hz
- Insulated accessory outputs
- Built-in fuses
- Line transient /surge protection
- AC convenience outlet
- NEC Class-2

Table 13. CentraLine 1450 series transformers data

Part no. 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 sep. 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 sep. transformer
-006	240/220 VAC	24 VAC, 100 VA, and 24 VDC, 600 mA

Standard Transformers (Europe, North America)

Standard commercially available transformers used to supply power to CentraLine Systems must fulfill the following:

Table 14. Requirements for standard transformers

Output voltage	Impedance	AC current
24.5 VAC to 25.5 VAC	≤ 1.15 Ω	max. 2 A
24.5 VAC to 25.5 VAC	≤ 0.40 Ω	max. 6 A
24.5 VAC to 25.5 VAC	≤ 0.17 Ω	max. 12 A

Standard 24 VDC power supply

Output voltage > 19 VDC, < 30 VDC

Current according to Table 11.

RIN-APU24 Uninterruptable Power Supply

The RIN-APU24 Uninterruptable Power Supply can be wired to power CentraLine Systems. See also RIN-APU24 Uninterruptable Power Supply – Mounting Instructions (MU1B-0258GE51) for detailed wiring diagrams.

Power Supply of Field Devices

Depending upon the power consumption of the field devices, it is possible to use either a single transformer to power both the CentraLine I/O Modules and attached field devices, or it may be necessary to employ an additional transformer. See

also section "Field Device Cables" on page 10 and connection examples on page 20.

Fusing Specifications

Please see section "System Constraints" on pg. 7 and observe the following when selecting fusing (F1 / F2 / F3 / F4) for the CentraLine I/O Modules and active field devices:

- Use separate fusing for different loads (e.g., for the controller and CentraLine I/O Modules on one hand versus for active field devices on the other).
- Fuse ratings must always be calculated according to the loads connected. Refer to Table 11 and the load tables appearing in the documentation of your CentraLine devices.
- Use slow-acting fuses; this is because the controller, the CentraLine I/O Modules, and active field devices have a high in-rush current due to their built-in capacitors (current typically limited by one internal 2 Ω resistor per device).
- Fuses should be calculated to protect the transformer against overloading and the wiring against short-circuiting. The controller and the CentraLine I/O Modules are protected by an internal fuse (not user-replaceable) against internal component defects.

For connection examples, see section "Description of the CentraLine I/O Modules" on page 22 and following.

System Protective Earth Grounding

CentraLine controller systems comply with SELV (Safety Extra-Low Voltage). Earth grounding is therefore not recommended. However, if compliance with EN60204-1 is required, see Appendix 1.

Lightning Protection

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

Panel Bus Topologies

- A single LION controller can control up to 16 Panel Bus I/O modules.
- Each of the EAGLEHAWK controller's two RS485 interfaces (max. one bus per interface) is limited to max. 16 Panel Bus I/O modules of a given type, and each interface is limited to a max. of 64 Panel Bus I/O modules. This yields a total max. of 128 Panel Bus I/O modules per controller.
- Each of the EAGLE controller's two RS485 interfaces (max. one bus per interface) is limited to max. 16 Panel Bus I/O modules of a given type, and each interface is limited to a max. of 64 Panel Bus I/O modules. This yields a total max. of 128 Panel Bus I/O modules per controller. In the case of the CLEA2014B21 and CLEA2014B31, the total max. no. is reduced to 64.
- Panel Bus I/O modules must be addressed using the HEX switch (see section "Addressing Panel Bus I/O Modules" on pg. 20).
- Max. distance between controller and Panel Bus I/O module: 40 m (any type of cabling and topology, incl. star and loop topology, possible; no additional end termination permitted); 1200 meters (mandatory twisted-pair or telephone cable and daisy chain topology; controller must be positioned at one end of the Panel Bus, and an end termination of 120 Ω positioned at the other end)
- No bus termination
- Polarity-insensitive

LONWORKS Bus Topologies

The LONWORKS Bus is a 78-kilobit serial link that uses transformer isolation so that the bus wiring does not have a polarity. I.e. it is not important which of the two LONWORKS Bus terminals are connected to each wire of the twisted pair.

The LONWORKS Bus does not need to be shielded.

The LONWORKS Bus can be wired in daisy chain, star, loop or any combination thereof as long as the max. wire length requirements are met.

Configuration

The recommended configuration is a daisy chain with two bus terminations. This layout allows for max. LONWORKS Bus lengths, and its simple structure presents the least number of possible problems, particularly when adding on to an existing bus. See also “LONWORKS Mechanisms”, Product Literature no.: EN0B-0270GE51.

LONWORKS Bus Termination Modules

Table 15. LONWORKS Bus termination module

Type	Description
XAL-Term2	LONWORKS connection and termination module, which can be mounted on DIN rails and in fuse boxes

Cable Specifications

Power Supply Cables

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

Table 16. Power supply cables specification

Max. length	3 m (per side of the controller), see Fig. 19 on page 17
Cross section	min. 0.75 mm^2 (AWG 18)

Panel Bus Cables

Table 17. Panel Bus cables specification

Max. length	40 m (any type of cabling and topology, incl. star and loop topology, possible; no additional end termination permitted); 1200 m (mandatory twisted-pair or telephone cable and daisy chain topology; controller must be positioned at one end of the Panel Bus, and an end termination of 120 Ω positioned at the other end)
Cable type	twisted pair, e.g., J-Y-Y 2 x 2 x 0.8

LONWORKS Bus Cables

Table 18. Doubly-terminated bus specifications

Cable type	Max. bus length
Belden 85102 (plenum)	2700 m (8900 ft)
Belden 8471 (non-plenum)	2700 m (8900 ft)
Level IV, 22 AWG	1400 m (4600 ft)
JY (St) Y 2 x 2 x 0.8	900 m (3000 ft)
TIA568A Cat. 5 24AWG, twisted pair	900 m (3000 ft)

NOTE: The above-listed cable types are as recommended by Echelon in their FTT-10A User Guide.

NOTE: CentraLine recommends the use of level IV, 22 AWG, solid core, non-shielded cable.

NOTE: Belden part numbers are 9H2201504 (plenum) and 9D220150 (non-plenum).

FTT Specification

The FTT specification includes two components that must be met for proper system operation:

- The distance from each transceiver to all other transceivers and to the termination must not exceed the max. node-to-node distance.
- If multiple paths exist, the max. total wire length is the total amount of wire used.

Table 19. Free topology (singly-terminated) specifications

Cable type	Max. node-to-node distance	Max. total wire length
Belden 85102	500 m (1650 ft)	500 m (1650 ft)
Belden 8471	400 m (1300 ft)	500 m (1650 ft)
Level IV, 22AWG	400 m (1300 ft)	500 m (1650 ft)
JY (St) Y 2 x 2 x 0.8	320 m (1050 ft)	500 m (1650 ft)
TIA568A Cat. 5 24AWG, twisted pair	250 m (825 ft)	450 m (1500 ft)

NOTICE

Unpredictable reflections on the bus due to step change in line impedance characteristics!

► Do not use different wire types or gauges on the same LONWORKS network segment.

NOTE: In the event that the limit on the total wire length is exceeded, the FTT physical layer repeaters (FTT 10A) can be added to interconnect segments. This increases the overall length by an amount equal to the original specification for that cable type and bus type for each repeater used. For example, adding repeaters for a doubly-terminated bus using JY (St) Y 2 x 2 x 0.8 cable increases the max. length by 900 m (3000 ft) for each repeater.

Field Device Cables

Table 20. Cable sizing for connection of field devices

Type of signal	Cross-sectional area	
	≤ 100 m (300 ft) (Fig. 26 on p. 20) one transformer	**≤ 400 m (1300 ft) (Fig. 27 on p. 20) separate transformers**
24 VAC power	1.5 mm² (16 AWG)	not allowed for > 100 m (300 ft)
0…10 V signals	0.081 – 2.08 mm² (28 – 14 AWG)	

For wiring field devices see page 20.

Dimensions

Pluggable I/O Modules

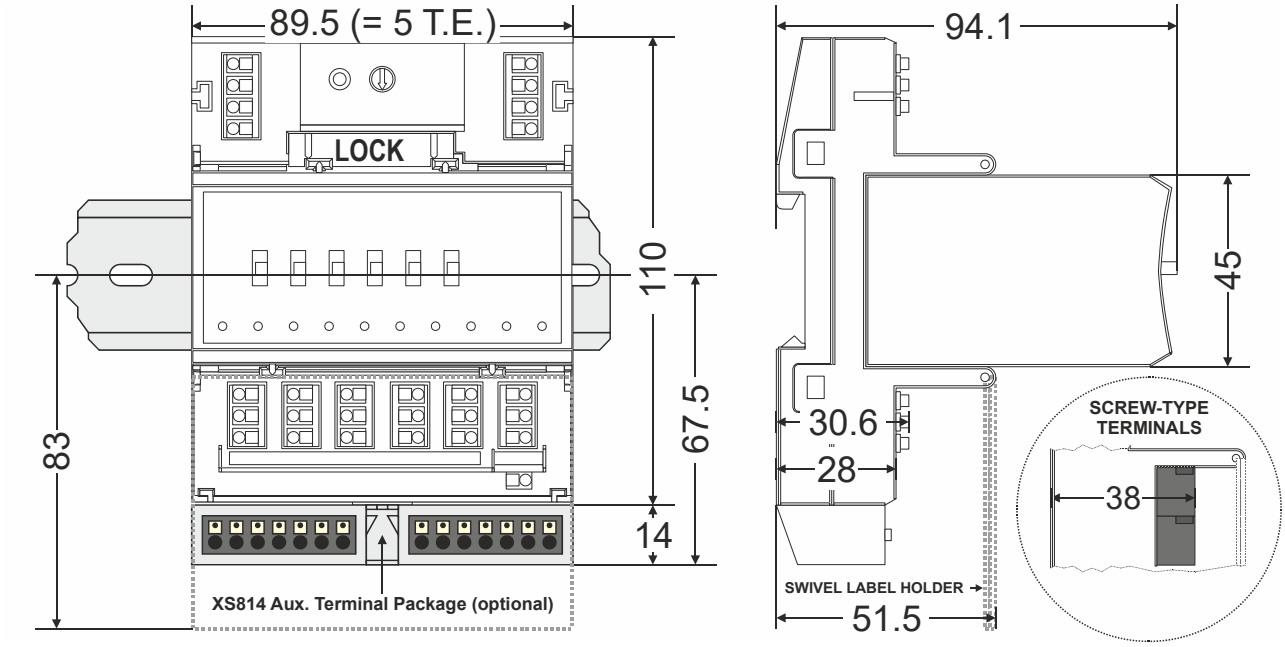


Fig. 4. Pluggable I/O modules (shown with manual overrides), including XS814 Aux. Terminal Package, dimensions (in mm)

Mixed I/O Modules

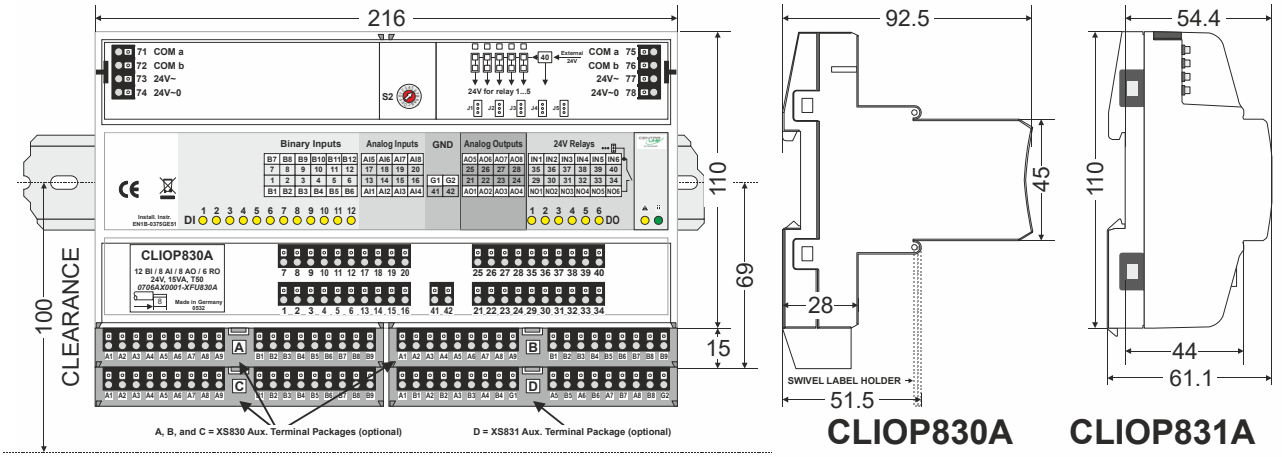


Fig. 5. Mixed I/O Modules CLIOP830A (shown with four auxiliary terminal packages) and CLIOP831A (shown without auxiliary terminal packages – which can be mounted on the bus side, only), dimensions (in mm)

Mounting/Dismounting Modules

⚠ WARNING

Risk of electric shock or equipment damage!

- ► Do not touch any live parts in the cabinet.
- ► Disconnect the power supply before you start to install the controller system.
  More than one disconnect switch may be required to de-energize the system.
- ► Do not reconnect the power supply until you have completed the installation.
- ► Unused terminals must be closed (by completely screwing in the terminal screws), thus preventing the accidental touching of “live” parts.

NOTE: The terminal socket of each pluggable I/O module can be mounted and wired before inserting and locking the corresponding electronic module.

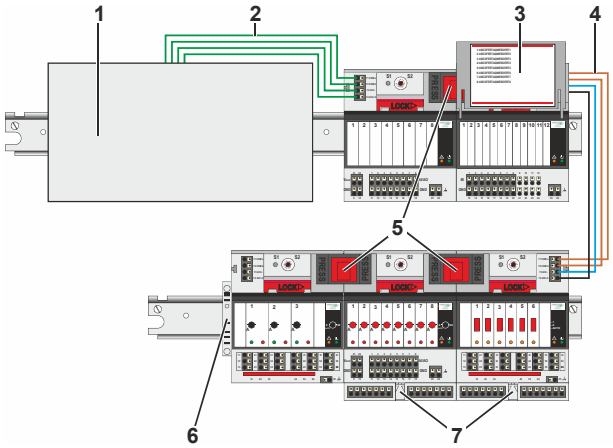


Fig. 6. CentraLine I/O Modules on DIN rails

Legend

1 Controller (e.g., LION, EAGLE, EAGLEHAWK, etc.)

2 Cable (power, LONWORKS / Panel Bus) connection from controller to CentraLine I/O Modules

3 Swivel label holder

4 Cable connection between CentraLine I/O Modules on separate DIN rails

5 Bridge connectors between CentraLine I/O Modules on same DIN rail

6 Stopper (from 3rd-party supplier)

7 Auxiliary terminal packages

Mounting/Dismounting Modules / Sockets

Mounting Sockets

NOTE: When using both Panel Bus and LONWORKS Bus I/O modules in a CentraLine controller system, group both Panel Bus I/O modules and LONWORKS Bus I/O modules, e.g., on different rails.

NOTE: The mixed Panel Bus I/O modules are mounted on the DIN rail in the same way as a terminal socket.

- ► Angle the terminal socket at the upper edge of the DIN rail until it snaps in.
- ► Swing the terminal socket down and apply gentle force until it snaps into position with an audible "click".
- ► Position controller module and terminal sockets flush with one another along the rail.
- ► If desired, mount stoppers at the ends of the rail to prevent sliding.

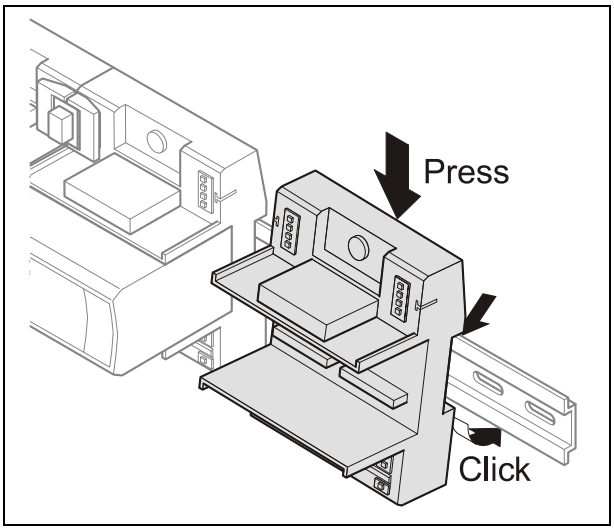


Fig. 7. Mounting terminal sockets

NOTE: Take care to not bend the Omega clamp, which serves to establish the electrical contact with the DIN rail and which located on the back of the terminal socket.

Connecting Sockets

Controller, terminal sockets, and mixed I/O modules (exc. CLIOP831A) on the same DIN rail can be connected mechanically and electrically with bridge connectors.

Controller and terminal sockets on different DIN rails must be connected using cables.

NOTICE

Risk of malfunction!

- ► Wire Panel Bus I/O modules and LONWORKS Bus I/O modules separately.
- ► When using both Panel Bus and LONWORKS Bus I/O modules in a CentraLine controller system, LONWORKS Bus I/O modules must be connected to the controller via LON terminals 11 … 14.

Position the bridge connector on terminals 71 … 74 of the right hand terminal socket or mixed I/O module or controller and on terminals 75 … 78 of the left hand terminal socket or mixed I/O module or controller. Then press the bridge connector down.

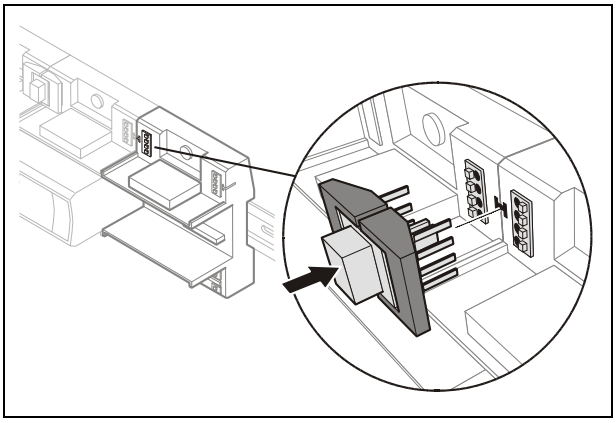


Fig. 8. Connecting terminal sockets with bridge connector

NOTE: Bridge connectors transmit both communication signals and power supply between modules. Removing bridge connectors will thus interrupt the transmission of both communication signals and power supply between the modules.

Dismounting Sockets

Disconnecting Sockets

Release all bridge connectors before removing the controller module and/or the terminal sockets and/or mixed I/O modules from the DIN rail.

- ► Press down at the same time both the gray side wings next to the red button and then pull the bridge connector out of the module.

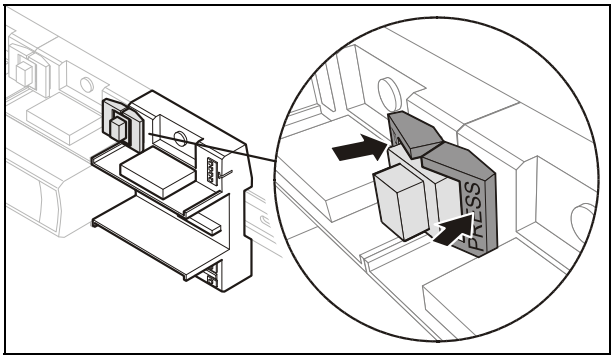


Fig. 9. Releasing bridge connectors

Dismounting Controller / Terminal Sockets / Mixed I/O Modules

- ► Insert a screwdriver into the latch on the underside of the module and lever the red latch 2–3 mm downwards. The module can then be swung away from the rail.

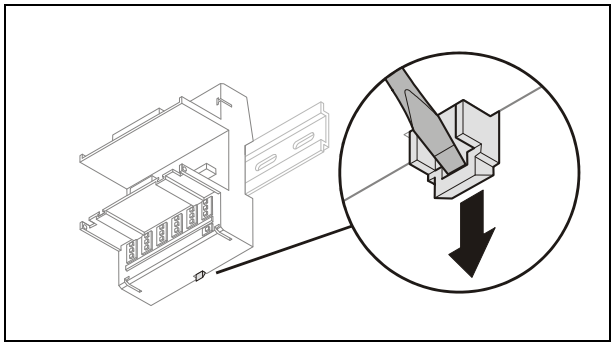


Fig. 10. Releasing latch

Mounting/Dismounting Electronic Modules

Mounting Electronic Modules

NOTE: Electronic modules can be removed from the socket or inserted into the sockets without switching off the power supply, but the resultant behavior of connected field devices must be taken into consideration.

► Make sure that terminal socket und electronic I/O module match; see Table 4 on page 5.

► Make sure that the red locking mechanism is in the open, i.e., left, position.

► Gently push the electronic module onto the terminal socket until snug.

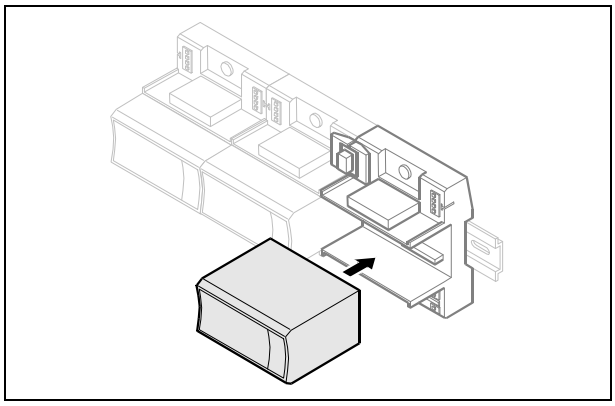


Fig. 11. Inserting the electronic module

► Lock the red locking mechanism by sliding it to the right.

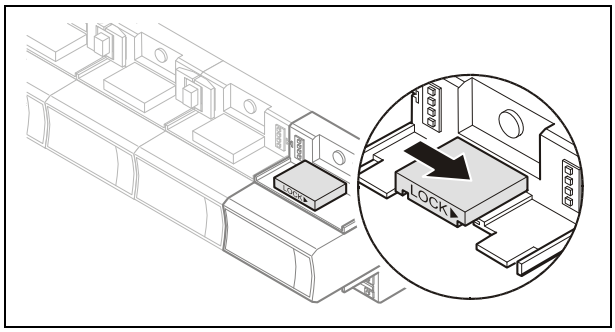


Fig. 12. Locking the electronic module

NOTE: The red locking mechanism will not close if the electronic module is not properly mounted.

Dismounting Electronic Modules

NOTE: Electronic modules can be removed from the socket or inserted into the sockets without switching off the power supply, but the resultant behavior of connected field devices must be taken into consideration.

► Open the red locking mechanism by sliding it to the left and then gently pull the electronic module out of the terminal socket.

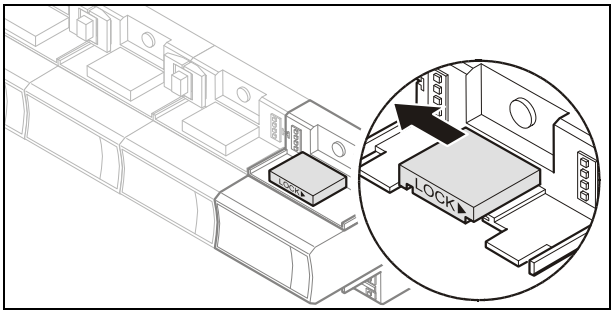


Fig. 13. Dismounting the electronic module

Mounting/Dismounting Auxiliary Terminal Packages

The XS814 Auxiliary Terminal Package can be mounted on any pluggable I/O module.

The XS830 and XS831 Auxiliary Terminal Packages are suitable for the mixed I/O modules, only, and can be mounted on the top and/or bottom of the mixed I/O modules.

For reasons of mechanical stability, a max. of two rows of Auxiliary Terminal Packages may be mounted together on the mixed I/O modules.

NOTE: While the CLIOP830A can be equipped with up to two rows of XS830 and/or XS831 auxiliary terminal blocks on the top and/or bottom, the CLIOP831A can be equipped with up to two rows of XS830 and/or XS831 auxiliary terminal blocks on the top, only.

Mounting Auxiliary Terminal Packages

► Push the auxiliary terminal package onto the grooves of the corresponding terminal socket / the mixed I/O module.

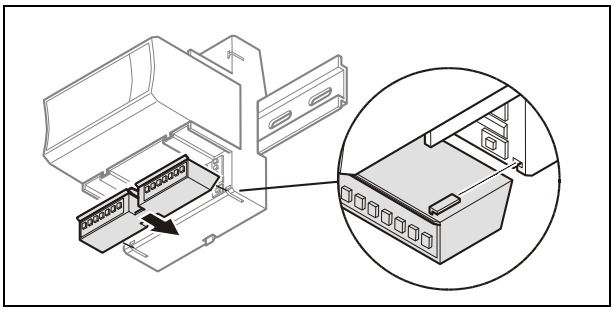


Fig. 14. Mounting the auxiliary terminal package onto the terminal socket / mixed I/O module

Dismounting Auxiliary Terminal Packages

► Push down the catch of the auxiliary terminal package and pull it out of the grooves of the terminal socket / the mixed I/O module.

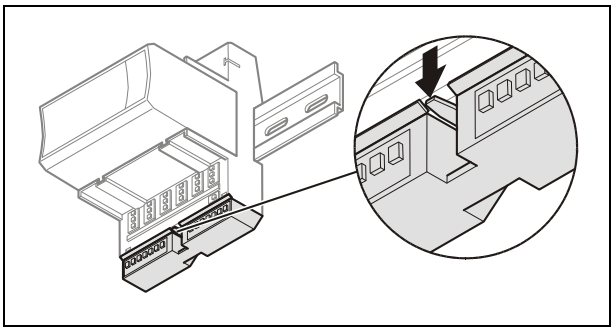


Fig. 15. Dismounting the auxiliary terminal package from the terminal socket / the mixed I/O module

Mounting/Dismounting Cross Connectors

NOTE: The XS815 cross connector (incl. in the delivery) can be mounted to the XS824-25 or XSU824-25, as required. It is not permitted to replace these cross connectors with wire.

► Insert a screwdriver on one end of the cross connector and swivel it to the right and to the left.

► Insert a screwdriver on the other end of the cross connecter and swivel it to the right and to left until the cross connector is released.

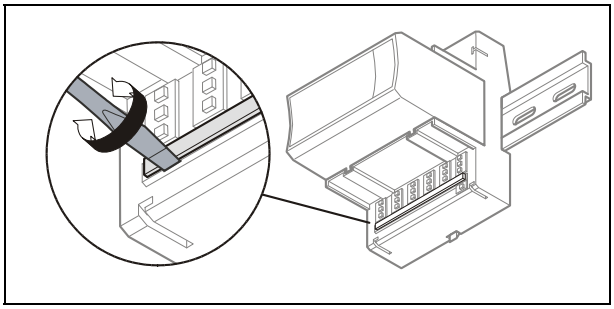


Fig. 16. Dismounting the cross connectors

Mounting/Dismounting Swivel Label Holders

NOTE: A swivel label holder is included in the delivery of each module.

Use only the (short / long) swivel label holders appropriate for the given type (pluggable or mixed, respectively) of I/O module.

Mounting Swivel Label Holders

► Snap the swivel label holder onto the hinges of the terminal socket / mixed I/O module.

► Apply self-adhesive labels to the holders.

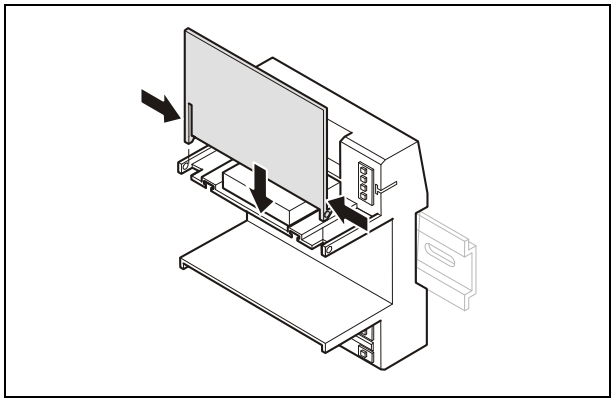


Fig. 17. Mounting the swivel label holder

Dismounting Swivel Label Holders

► Press the hinges together and remove the swivel label holder.

Wiring and Setting up the System

General Safety Considerations

- When connecting the controller or CentraLine I/O modules, both VDE, National Electric Code (NEC) or equivalent, and any local regulations concerning grounding and zero voltage must be observed.
- Electrical work should be carried out by a qualified electrician.
- The electrical connections must be made at the terminal blocks. The corresponding connection diagrams are located on the individual controller module and I/O modules.
- 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!

► Do not touch any live parts in the cabinet.

► Disconnect the power supply before making connections to or removing connections from terminals of controller or I/O modules.

► Do not use spare terminals as wiring support points.

► Do not reconnect the power supply until you have completed the installation.

► Unused terminals must be closed (by completely screwing in the terminal screws), thus preventing the accidental touching of “live” parts.

► Observe precautions for handling electrostatic sensitive devices.

Wiring Push-in Terminals

The terminal sockets of the pluggable I/O modules are available in versions (XS821-22, XS823, and XS824-25) featuring convenient push-in terminals for easy wiring. The CLIOP830A likewise features push-in terminals.

For correct wiring, cables must fulfill the following specifications according to IEC664-1 / VDE 0110 (4.97):

Table 21. Push-in terminals wiring specifications

Max. plug gauge	0.14 … 1.50 mm^2
Solid conductor H05/07) V-U	0.25 … 1.50 mm^2
Stranded conductor H05(07) V-K	0.25 … 1.50 mm^2
Stranded conductor with wire end ferrules (without plastic collar)	0.25 ... 1.50 mm^2
Stripping length	8.0 +1.0 mm

NOTE: In the case of solid conductors, the use of ferrules is prohibited.

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

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

Wiring Screw-Type Terminals

The terminal sockets of the pluggable I/O modules are also available with screw-type terminals (XSU821-22, XSU823, and XSU824-25). The CLIOP831A likewise features screw-type terminals.

For correct wiring, cables must fulfill the following specifications according to IEC664-1 / VDE 0110 (4.97):

Table 22. Screw-type terminals wiring specifications

Max. plug gauge	0.14 … 1.50 mm^2
Solid conductor H05/07) V-U	0.25 … 1.50 mm^2
Stranded conductor H05(07) V-K	0.25 … 1.50 mm^2
Stranded conductor with wire end ferrules (without plastic collar)	0.25 ... 1.50 mm^2
Stripping length	11.0 +1.0 mm

Connecting Power Supply

The CentraLine controller system can be powered by one or more external transformers.

NOTE: The max. length for the power supply cable from a transformer is 3 m. This also includes the length of the modules and the connection cables between the rails.

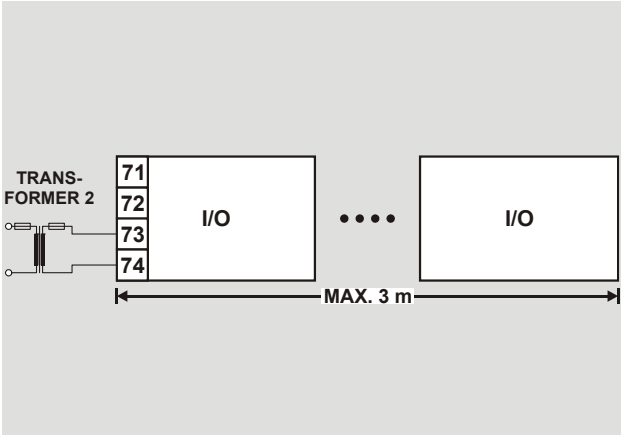


Fig. 18. Wiring the power supply from a transformer

Additional Transformer / DC Power Supply

► Connect the additional transformer / DC power supply in a second room or cabinet to terminals 73 and 74 or 77 and 78 of a CentraLine I/O module.

NOTICE

Equipment damage!

► Do not use bridge connectors to connect modules powered by different transformers / DC power supplies.

► When connecting modules powered by different transformers / DC power supplies using cables, be sure to not connect terminals 73 and 77.

Connecting Single Bus Controller Systems

This section describes how to connect a controller system which uses **Panel Bus I/O modules only** or **LONWORKS Bus I/O modules only**.

Controller and CentraLine I/O Modules on a Single Rail

► Connect the controller and CentraLine I/O modules using the bridge connectors (if supported); otherwise, use wire.

This provides power supply and communication connection. No further wiring is necessary.

Controllers not Supporting Bridge Connectors

► Connect the controller and CentraLine I/O modules which do not support bridge connectors using wire. See also Fig. 22.

Controller and I/O Modules on Several Rails in a Single Cabinet

The rails of a controller system are connected in series.

► Connect the rail ends as follows:

– **Power supply**
via power supply terminals 73, 74 or 77, 78

– **Communication**
via communication terminals 71, 72 or 75, 76

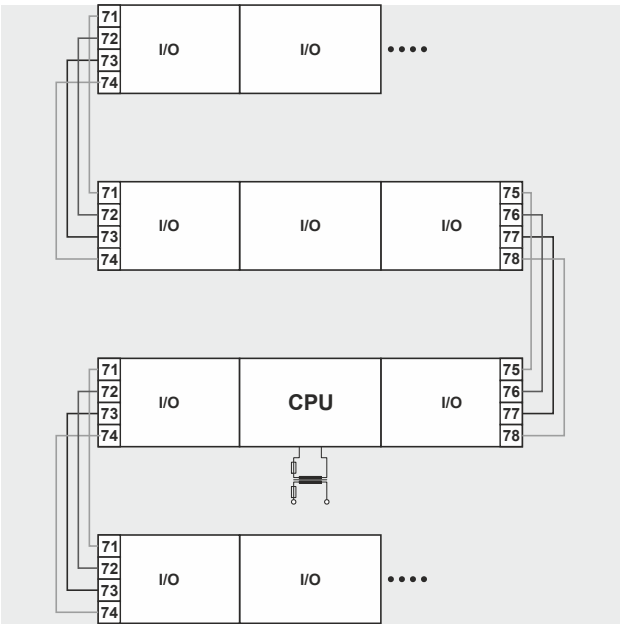


Fig. 19. Wiring the power supply and the communication lines to the CentraLine I/O modules

Max. Power Cable Length

The max. length for power supply cable per side is 3 m. This includes the connection cables between the rails, the lengths of the modules, and the cable from the transformer.

Panel Bus I/O Modules in Separate Rooms

In this scenario, communication and reference voltage (24 V0) must be connected between the rooms.

► Connect the last module of room 1 to the first module of room 2:

– **Reference voltage**
via power supply terminals 74 or 78
terminals 73 and 77 must not be connected

– **Communication**
via communication terminals 71, 72 or 75, 76

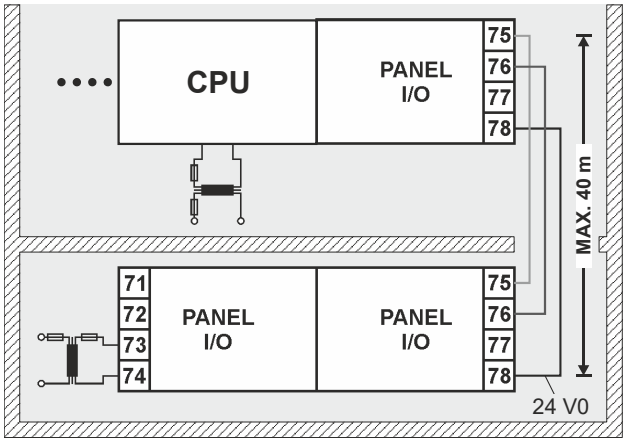


Fig. 20. Wiring the Panel Bus I/O modules in separate rooms

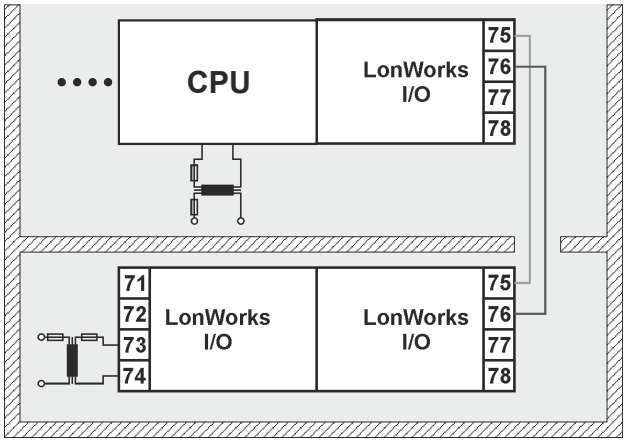


Fig. 21. Wiring the LONWORKS Bus I/O modules in separate rooms

Max. Cable Length

The max. cable length for connecting room 1 and room 2 is:

- 40 m (any type of cabling and topology, incl. star and loop topology, possible; no additional end termination permitted);
- 1200 m (mandatory twisted-pair or telephone cable and daisy chain topology; controller must be positioned at one end of the Panel Bus, and an end termination of 120 Ω positioned at the other end).

LonWorks Bus I/O Modules in Separate Rooms

In this scenario, only communication lines must be connected between the rooms.

► Connect the last module of room 1 to the first module of room 2:

  – via communication terminals 71, 72 or 75, 76

Max. Cable Length

For max. cable lengths and cable specifications of the communication lines, see Table 18 and
Table 19 on page 10.

Connecting Panel Bus and LONWORKS Bus Mixed Controller Systems

Connecting I/O Modules with Each Other

For connecting the I/O modules with each other, proceed as described for single bus controller systems on page 17.

Connecting I/O Modules to the Controller

Panel Bus I/O Modules

► Connect communication terminals 71/72 or 75/76 of Panel Bus I/O modules to the communication terminals of the given controller using either

  – Bridge connectors (for flush mounting on a single DIN rail) or

  – Cables (for separate mounting, e.g., on multiple rails, separate cabinets, etc.).

LONWORKS Bus I/O Modules

► Connect communication terminals 71/72 or 75/76 of LONWORKS Bus I/O modules to the LONWORKS terminals of the given controller using cables and terminate properly (see also section "LONWORKS Bus Termination Modules" on pg. 9).

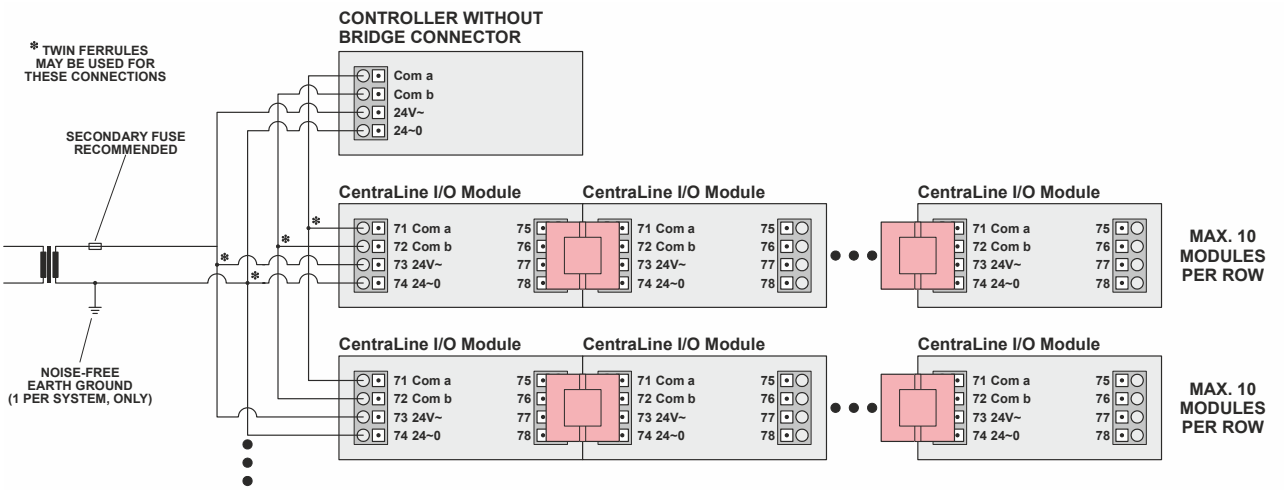


Fig. 22 Wiring controllers not supporting bridge connectors (for fusing, see section "Fusing Specifications" on page 9)

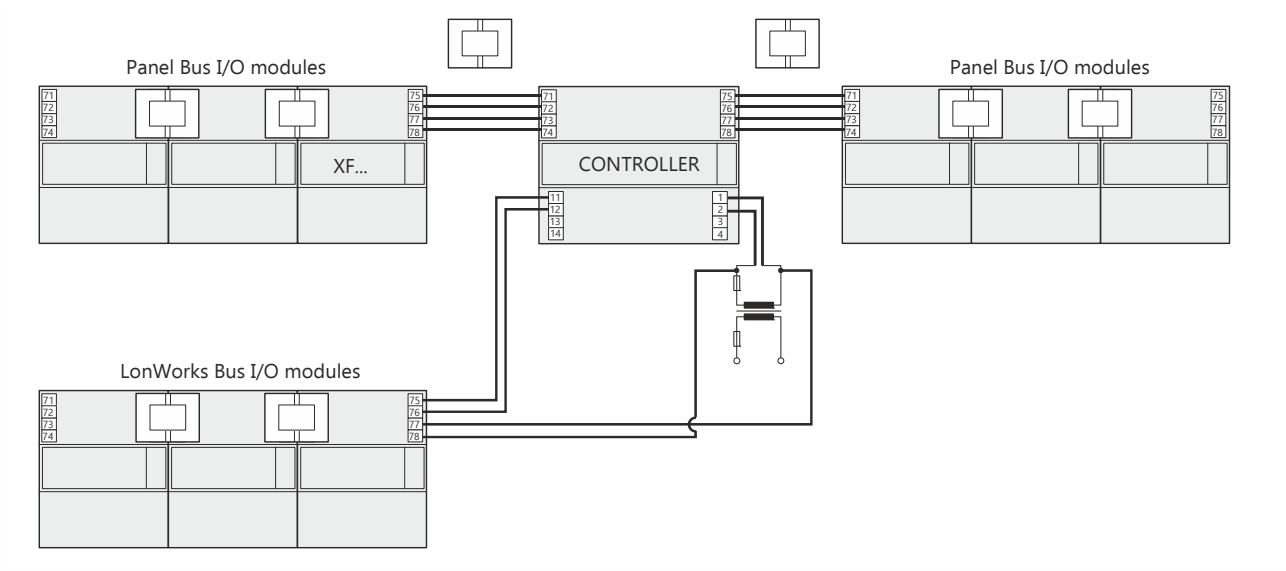


Fig. 23. Mixed bus system – correct wiring

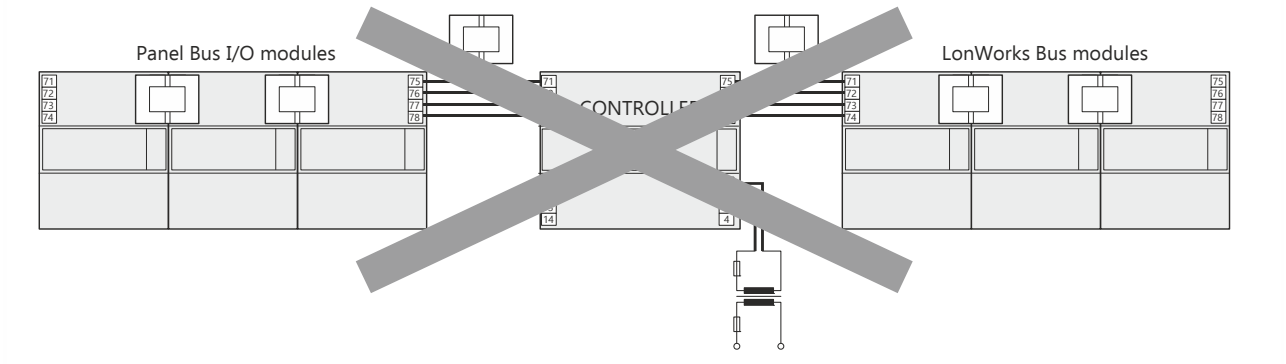


Fig. 24. Mixed bus system – incorrect wiring

Addressing Panel Bus I/O Modules

During engineering, each Panel Bus I/O module (LION) / each Panel Bus I/O module of a given type (EAGLE, EAGLEHAWK) per RS485 interface is assigned its own unique address. For the sake of clarity for maintenance personnel, it is recommended that you address the Panel Bus I/O modules in ascending order 0 through F.

Table 23. HEX switch settings and addresses

Hex switch	0	1	2	3	4	5	6	7
Address	01	02	03	04	05	06	07	08

Hex switch	8	9	A	B	C	D	E	F
Address	09	10	11	12	13	14	15	16

► Use the rotary HEX switch to set the address to the one already defined using the engineering tool.

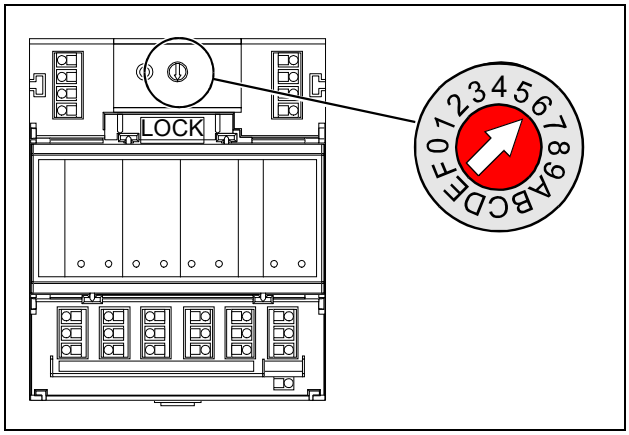


Fig. 25. HEX switch location

NOTE: If the HEX switch is changed, the Panel Bus I/O module will revert to its default configuration.

NOTE: In the case of LONWORKS Bus I/O modules, the HEX switch is without function.

Connecting Field Devices

Connecting Field Devices with Power Supply

Depending on the distance from the controller, field devices can be supplied by the controller or need a separate transformer, see Table 20 on page 10.

For fusing see section "Fusing Specifications" on page 9.

Example 1: Power Supply via Controller or Same Transformer

- 24 V actuator connected to an analog output module
- Less than 100 m away from the controller

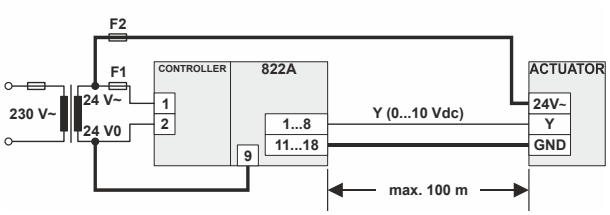


Fig. 26. Power supply of field devices via I/O module

Example 2: Power Supply via Separate Transformer

- 24 V actuator connected to an analog output module
- 100 … 400 m away from the controller

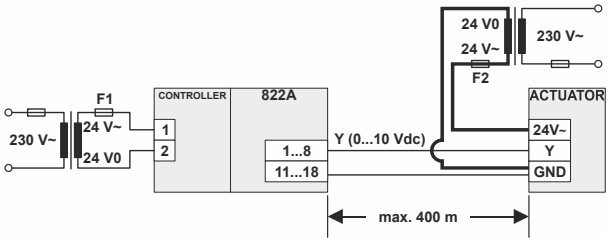


Fig. 27. Power supply of field devices via a separate transformer

Cabling Field Devices

Cable Routing

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

Table 24. Min. 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).

Cable Shielding

- 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 the cabinet end.
  - The shield must not be terminated at the controller.

Commissioning and Updating Firmware

Commissioning Panel Bus I/O Modules

During engineering, the HEX address of the Panel I/O modules is defined.

NOTE: With Panel Bus I/O modules it is essential that the HEX switch be set to the address assigned by the engineering tool.

The CentraLine controller automatically commissions all Panel Bus I/O modules.

Commissioning LONWORKS Bus I/O Modules

The commissioning of LonWorks Bus I/O modules is done using the engineering tool.

Updating Software with Panel Bus I/O Modules

The CentraLine controller automatically updates all Panel Bus I/O modules. Thus, whenever the controller's firmware is updated, the firmware of the Panel Bus I/O modules is automatically updated, too.

Updating Software with LONWORKS Bus I/O Modules

You can update the LONWORKS I/O modules using CARE or EXCELON.

Description of the CentraLine I/O Modules

Common Features

Table 25. Switches located on the Terminal Socket

Feature	Function
Service button S1 (pluggable I/O modules, only)	• LED test, see section "Troubleshooting" on page 56 • LONWORKS service button functionality for LONWORKS Bus I/O modules
Hex switch S2	• Module addressing for Panel Bus I/O modules

Table 26. LEDs located on the I/O Module

Feature	Function
Service LED (yellow)	• Service information, see section "Troubleshooting" on page 56
Power LED (green)	• Information on power supply, see section "Troubleshooting" on page 56

For the location of these elements, see figures of the relative modules.

Analog Input Modules

Types of Analog Input Modules and Terminal Socket

Table 27. CentraLine Analog Input Modules

Type	Description	Housing
CLIOP821A	Panel Bus analog input module	Light gray
CLIOL821A	LONWORKS Bus analog input module	Dark gray
XS821-822 XSU821-822	Terminal socket	Light gray

Features

- 8 analog inputs
- Sensor-break and short-circuit detection, see section "Troubleshooting" on page 56.

Fig. 28. CLIOP821A Analog Input Module with terminal socket

Legend

1 Service button S1
2 Hex switch S2
3 Service LED
4 Power LED

Functionality of service LED and power LED: see Table 57 to Table 59 on page 56 and following.

Terminals

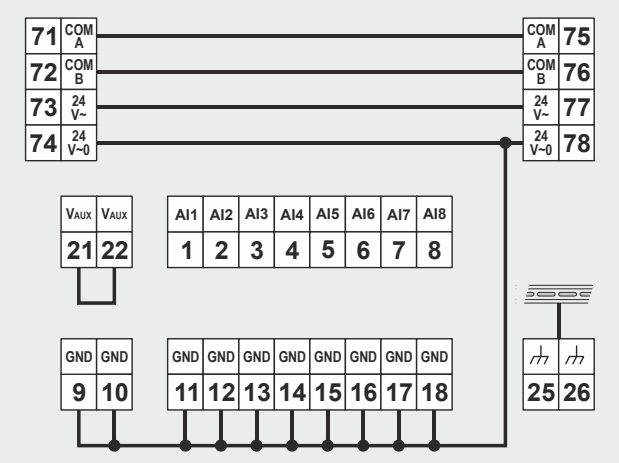


Fig. 29. Terminal assignment and internal connections

Table 28. Description of analog input module terminals

Ter-minal	SIGNAL	Comment
71, 75	COM a	2-wire communication bus (LON/Panel Bus)
72, 76	COM b	2-wire communication bus (LON/Panel Bus)
73, 77	24 V~	Power supply
74, 78	24 V~0	Power supply
1…8	AI1 … AI8	Analog inputs 1…8
9…18	GND	Ground. All grounds are connected internally to each other
21, 22	10 VDC/ 5 mA, ±2 %	Auxiliary voltage signal (used, e.g., for supplying setpoint potentiometers)
25, 26	⏚	Shield connection (functional earth), internally connected to the DIN rail

NOTE: Shield connection to be used for shielded I/O cables, only. It is not allowed to connect a LONWORKS shield, since LONWORKS requires a resistor and a capacitor.

NOTE: If additional shield terminals are needed, the XS814 Auxiliary Terminal Package can be installed.

Technical Data

Table 29. Analog input modules data

Input	• 0(2) ... 10 VDC • 0(4) ... 20 mA (via external 499 Ω/0.25 % resistor • NTC20k (-50…+150 °C; default) • PT1000-1 (-50…+150 °C) • Johnson A99 PTC (-40…+120 °C) • PT1000-2 (0…+400 °C) • PT3000 (-50…+150 °C) • BALCO500 (-30…+120 °C) • Slow binary input
Protection	Protected against 24 VAC and 40 VDC overvoltage as well as against short-circuiting
Resolution	16-bit resolution
Accuracy	±75 mV (0 ... 10 V), without sensor

Table 30. Accuracy of analog input sensors

Range	PT1000-1 Johnson A99 PTC[1]	PT1000-2	Balco500[2]	PT3000	NTC20kΩ (default)	NTC10kΩ[3]	NI1000TK5000[4]
-50...-20 °C (-58...-4 °F)	≤ 1.2 K	–	≤ 1.2 K	≤ 1.2 K	≤ 5.0 K	≤ 5.0 K	≤ 1.2 K
-20…0 °C (-4…+32 °F)	≤ 0.7 K	–	≤ 0.7 K	≤ 0.7 K	≤ 1.0 K	≤ 1.0 K	≤ 0.7 K
0...30 °C (32…86 °F)	≤ 0.5 K	≤ 0.5 K	≤ 0.5 K	≤ 0.5 K	≤ 0.3 K	≤ 0.5 K	≤ 0.5 K
30...70 °C (86...158 °F)	≤ 0.7 K	≤ 0.7 K	≤ 0.7 K	≤ 0.7 K	≤ 0.5 K	≤ 0.5 K	≤ 0.7 K
70...100 °C (158...212 °F)	≤ 1.2 K	≤ 1.2 K	≤ 1.2 K	≤ 1.2 K	≤ 1.0 K	≤ 1.0 K	≤ 1.2 K
100...130 °C (212...266 °F)	≤ 1.2 K	≤ 1.2 K	≤ 1.2 K	≤ 1.2 K	≤ 3.0 K	–	≤ 1.2 K
130...150 °C (266...302 °F)	≤ 1.2 K	≤ 1.2 K	–	≤ 1.2 K	≤ 5.5 K	–	–
150…400 °C (302…752 °F)	–	≤ 1.2 K	–	–	–	–	–

[1] Johnson A99 PTC specified for -40…+120 °C, only

[2] Balco specified for -30…+120 °C, only

[3] NTC10kΩ specified for -30…+100 °C, only

[4] NI1000TK5000 specified for -30…+130 °C, only

NOTE: The accuracy of the sensor itself is not included in this table.

Internal Impedance when Connecting Sensors

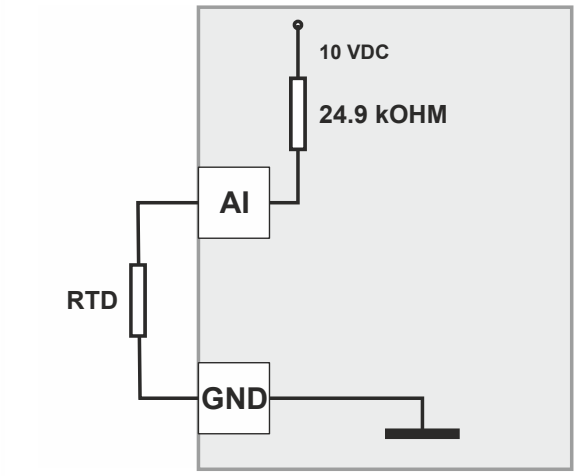


Fig. 30. Analog input low impedance (input circuit for PT1000, Johnson A99 PTC, Balco500, PT3000, NI1000TK5000, slow binary input)

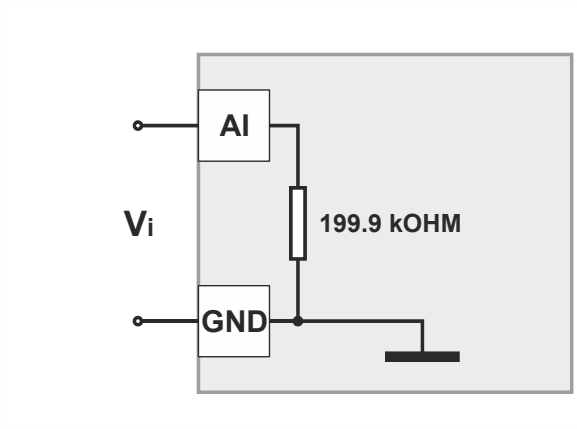


Fig. 31. Analog input high impedance (input circuit for voltage input for active sensors)

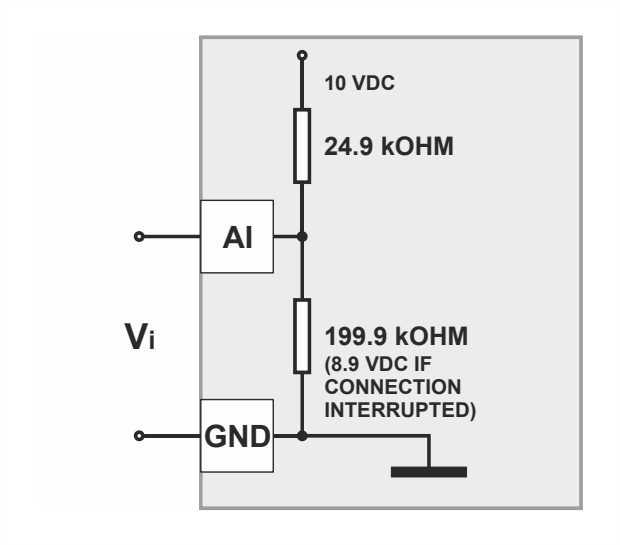


Fig. 32. Analog input impedance setpoint (input circuit for NTC10kΩ, NTC20kΩ, wall module setpoint)

Connection Examples

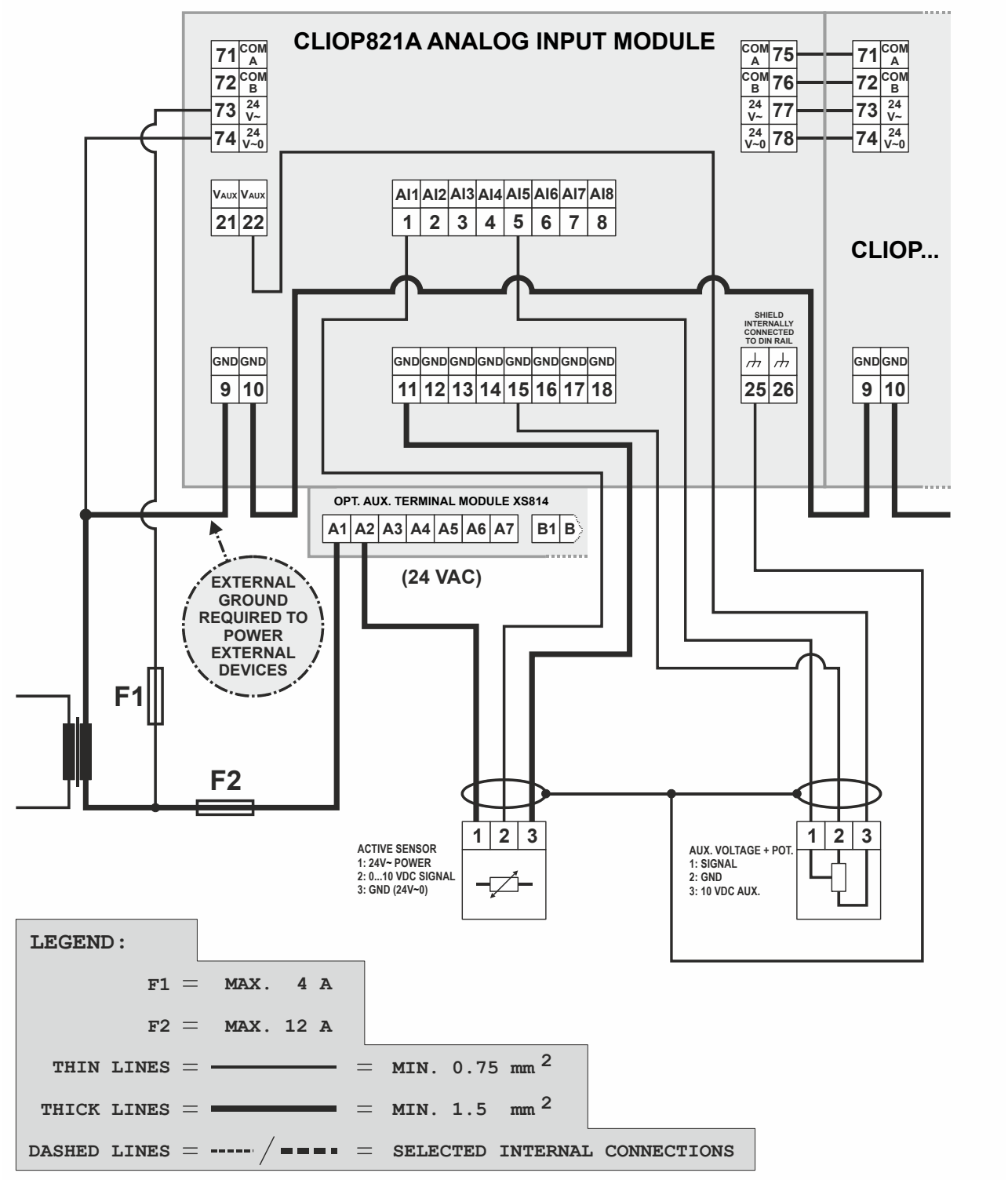


Fig. 33. Analog input module, wiring example 1 (active sensor and potentiometer)

For fusing specifications see section "Fusing Specifications" on page 8.

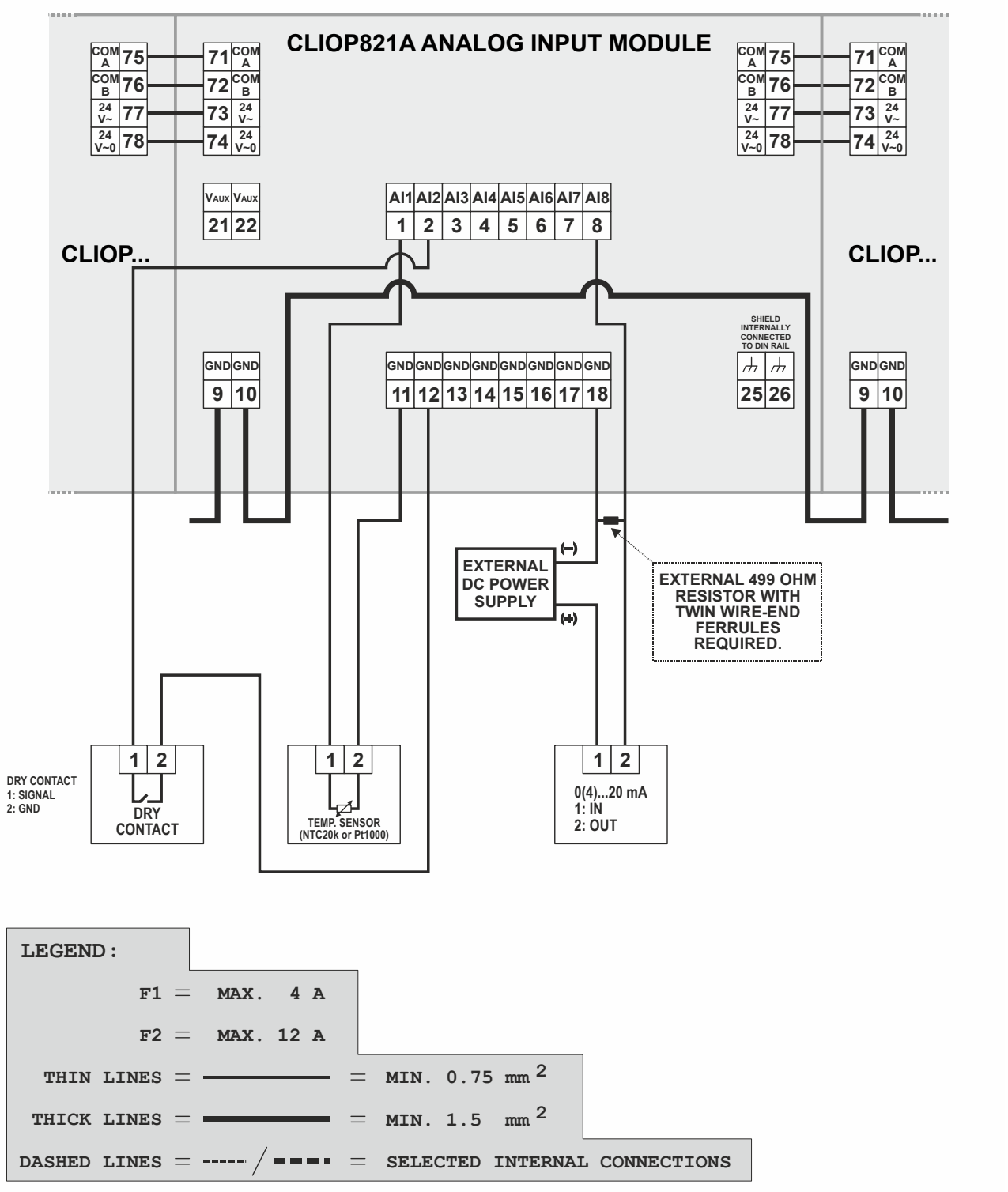


Fig. 34. Analog input module, wiring example 2 (Passive Sensor and 0 (4) … 20 mA Signal)

Analog Output Modules

Types of Analog Output Modules and Terminal Socket

Table 31. CentraLine Analog Output Modules

Type	Description	Housing
CLIOP822A	Panel Bus analog output module	Light gray
CLIOPR822A	Panel Bus analog output module with manual overrides	Light gray
CLIOL822A	LONWORKS Bus analog output module	Dark gray
CLIOLR822A	LONWORKS Bus analog output module with manual overrides	Dark gray
XS821-22 XSU821-22	Terminal socket	Light gray

Features

- 8 analog outputs; can also be configured per output as binary outputs (0 … 10 V, 2 … 10 V, ON/OFF, or floating)
- Corresponding output status LEDs (red)
- …**R**822A: 8 manual overrides, see figure below

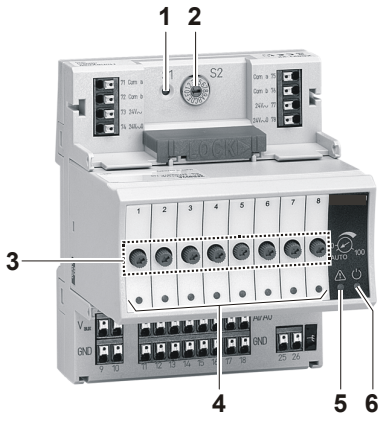


Fig. 35. CLIOP822A Analog Output Module with terminal socket

Legend

1 Service button S1
2 Hex switch S2
3 Manual overrides
4 Output LEDs
5 Service LED
6 Power LED

Functionality of service LED and power LED: see Table 57 to Table 59 on page 56 and following.

In the event of communication problems, the analog outputs will move to the safety positions you have configured using the engineering tool, see analog output point description in the CARE – User Guide, 74-5587/EN2B-0182GE51.

Terminals

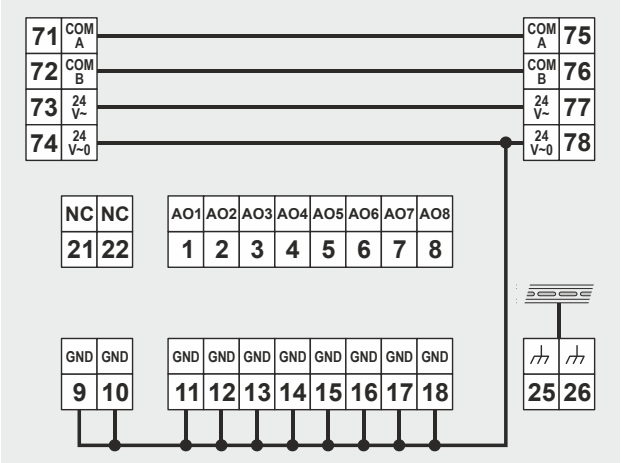


Fig. 36. Terminal assignment and internal connections

Table 32. Description of analog output module terminals

Ter-minal	Signal	COMMENT
71, 75	COM a	2-wire communication bus (LON/Panel Bus)
72, 76	COM b	2-wire communication bus (LON/Panel Bus)
73, 77	24 V~	Power supply
74, 78	24 V~0	Power supply
1…8	AO1…AO8	Analog outputs 1…8
9…18	GND	Ground. All grounds are connected internally to each other
21, 22	N.C.	Do not use!
25, 26	⏚	Shield connection (functional earth), internally connected to the DIN rail

NOTE: Shield connection to be used for shielded I/O cables only. It is not allowed to connect a LONWORKS shield, since LONWORKS requires a resistor and a capacitor.

NOTE: If additional shield terminals are needed, the XS814 Auxiliary Terminal Package can be installed.

Technical Data

Table 33. Analog output module data

Voltage rating	0(2)…11 V (default)
Current rating	max. ±1 mA
Resolution	8 bit
Accuracy	±150 mV
Zero output voltage	< 200 mV
Protection	Protected against 24 VAC and 40 VDC overvoltage as well as against short-circuiting
Feedback signal	Auto/manual mode and output value

Status LED Behavior

Table 34. Analog output status LED behavior

Automatic mode	Brightness follows the commanded output signal
Override mode	Flashes

Status LEDs with Manual Overrides

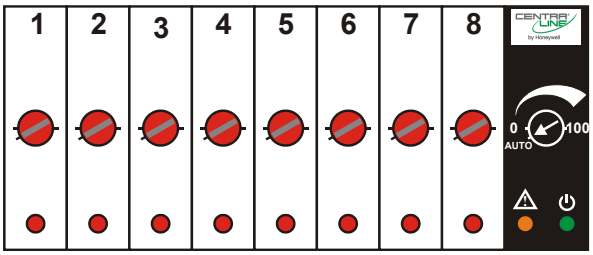


Fig. 37. Manual overrides (rotary knobs)

The CLIOPR822A/CLIOLR822A Analog Output Modules are equipped with manual overrides: one for each analog output. These rotary knobs can be manually set to either "AUTO" or "0…100%" (infinitely adjustable).

NOTICE

Damage to the electronic module!

► Do not use a tool to adjust the rotary knobs.

► Do not use excessive force. Adjust only by hand.

Manual Override in the AUTO Position

When a manual override of the CLIOPR822A/CLIOLR822A is set to AUTO, and the corresponding analog output has been configured, the following applies:

- If the LONWORKS network is functioning properly, the output voltage of the analog output will be as commanded.
- If the LONWORKS network is not functioning properly, the output voltage of the analog output will be the safety position value.
- The brightness of the status LED (red) of the analog output will be proportional to the commanded output signal.

When a manual override of the CLIOPR822A/CLIOLR822A is set to AUTO, and the corresponding analog output has ***not*** been configured, the following applies:

- Regardless as to whether the LONWORKS network is functioning properly or not, the output voltage of the analog output will be 0 V (values from the LONWORKS Bus will be ignored, and there will be no heartbeat or safety position).
- The feedback signal on the LONWORKS network nvoAoActPosnFb[ ] will have a value of 0% and a state of 0.
- The analog output status LED will be dark.

Manual Override in the Override Position (0…100%)

When a manual override of the CLIOPR822A/CLIOLR822A is set to 0…100%, and the corresponding analog output has been configured, the following applies:

- The output voltage of the analog output will be 0…10 V (direct) or 10…0 V (reverse).
- The feedback signal on the LONWORKS network nvoAoActPosnFb[ ] will have a value of 0…100% and a state of -1.
- The status LED (red) of the analog output will flash to indicate “manual override.”

When a manual override of the CLIOPR822A/CLIOLR822A is set to 0…100%, and the corresponding analog output has ***not*** been configured, the following applies:

- The output voltage of the analog output will be 0…10 V.
- The feedback signal on the LONWORKS network nvoAoActPosnFb[ ] will have a value of 0…100% and a state of -1.
- The status LED (red) of the analog output will flash to indicate “manual override.”

Analog Outputs Configured as Binary Outputs

Using the engineering tool, the analog outputs can be configured individually as binary outputs. The voltage output is then 0 V or 10 V, depending upon the signal from the controller.

Connection Example

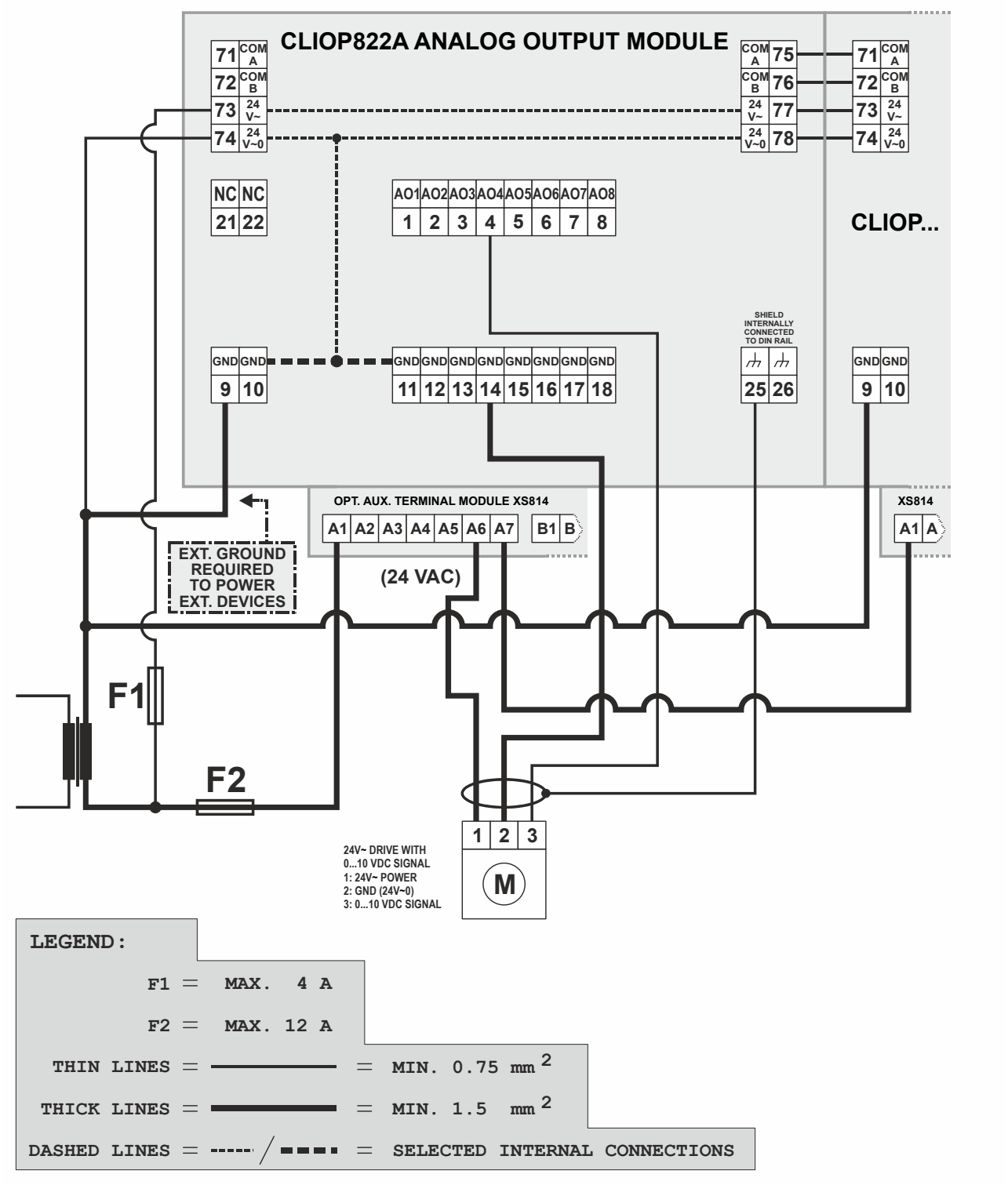


Fig. 38. Analog output connection example

For fusing specifications see section "Fusing Specifications" on page 8.

Synchronization Behavior of Analog Output Module Configured as Floating Output

In order to regularly update the real actuator position with the calculated position and thus ensure that the actuator definitely reaches its end position, a synchronization process is performed by the analog output module.

During the synchronization process, the analog output module will continue running for the configured runtime once it reaches the calculated end position.

This updating (synchronization) is performed:

- If the calculated position of the actuator < lower synchronization threshold (2 %) = synchronization towards 0 %
- If the calculated position of the actuator > upper synchronization threshold (98 %) = synchronization towards 100 %
- Following any power-up or any reset

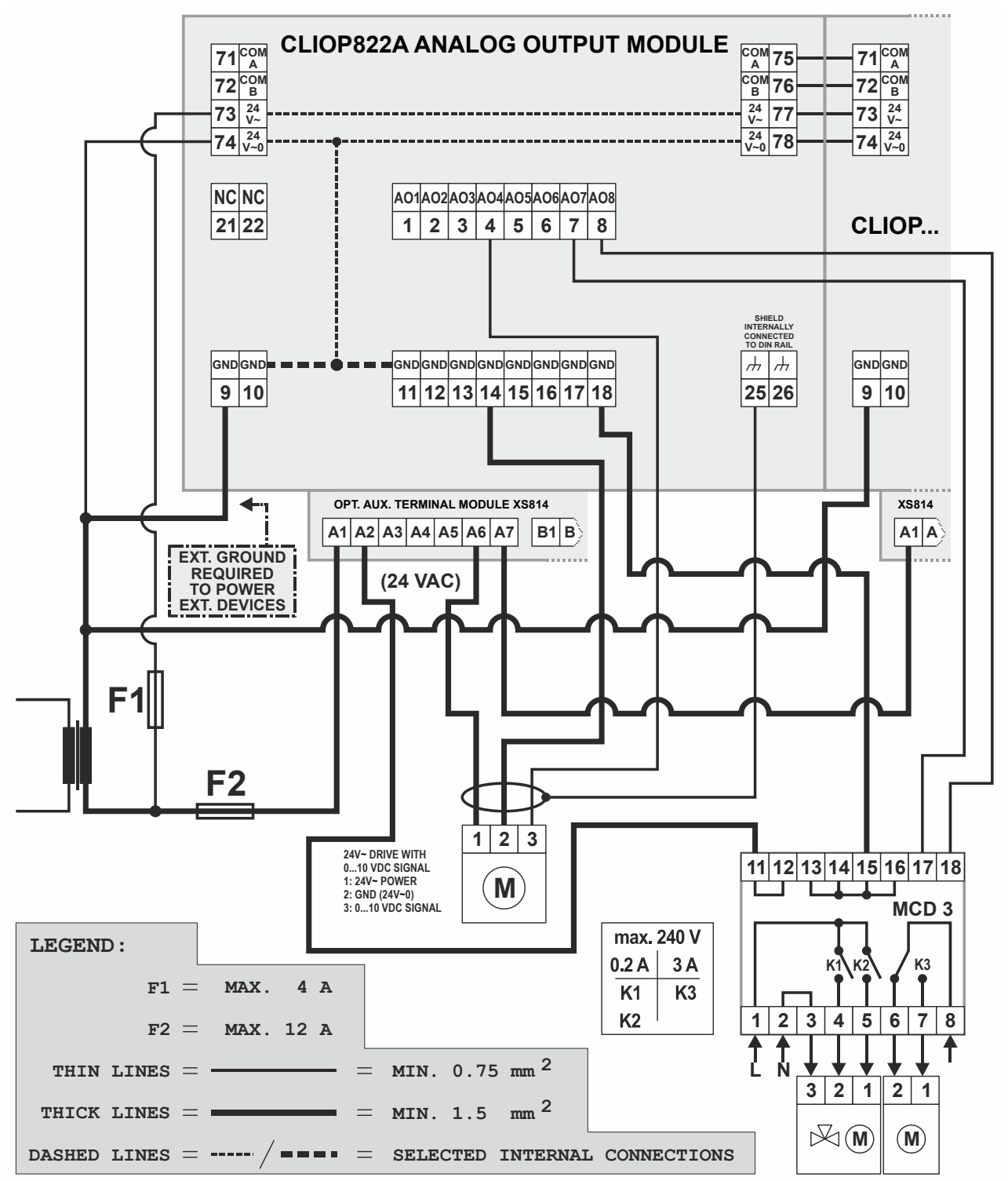


Fig. 39. Connection example with Relay Module MCD 3

- The relay module facilitates the control of peripheral devices with high load via the analog outputs.
- Input terminal 17 controls of MCD3 controls changeover contact K3.
- Relay terminal 18 of MCD3 controls the N.O. contacts (floating outputs) K1, K2.

For fusing specifications, see section "Fusing Specifications" on page 8.

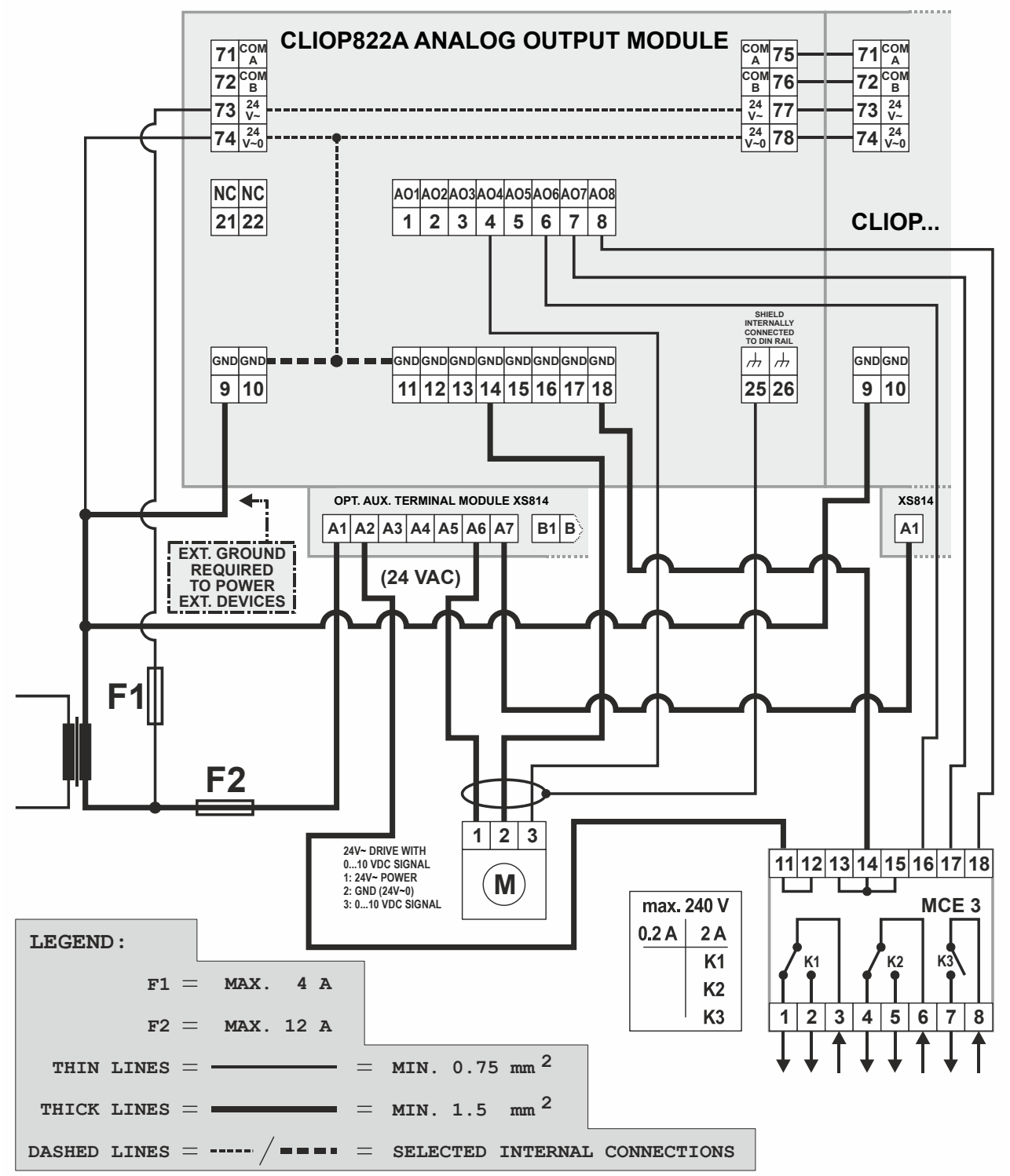


Fig. 40. Connection example with Relay Module MCE 3

The relay module facilitates the control of peripheral devices with high load via the analog outputs.

- Input terminal 16 of MCE3 controls the N.O. contact K3.
- Input terminal 17 of MCE3 controls the changeover contact K2.
- Input terminal 18 of MCE3 controls the changeover contact K1.

For fusing specifications, see section "Fusing Specifications" on page 8.

Binary Input Modules

Types of Binary Input Modules and Terminal Socket

Table 35. CentraLine Binary Input Modules

Type	Description	Housing
CLIOP823A	Panel Bus binary input module	Light gray
CLIOL823A	LONWORKS Bus binary input module	Dark gray
XS823 XSU823	Terminal socket	Light gray

Features

- 12 binary inputs
- 12 configurable status LEDs (green/red, yellow/OFF)
- Binary inputs can be used as
  - Static digital inputs as dry-contacts (default)
  - Fast totalizers (up to 20 Hz)

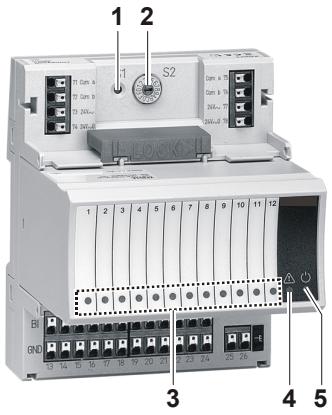


Fig. 41. CLIOP823A Binary Input Module with terminal socket

Legend

1 Service button S1
2 Hex switch S2
3 Input LEDs
4 Service LED
5 Power LED

Functionality of service LED and power LED: see Table 57 to Table 59 on page 56 and following.

Terminals

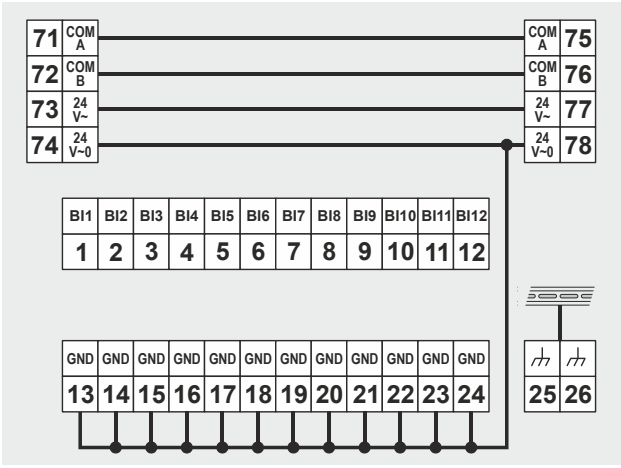


Fig. 42. Terminal assignment and internal connections

Table 36. Description of binary input module terminals

Ter-minal	Signal	COMMENT
71, 75	COM a	2-wire communication bus (LON/Panel Bus)
72, 76	COM b	2-wire communication bus (LON/Panel Bus)
73, 77	24 V~	Power supply
74, 78	24 V~0	Power supply
1…12	BI1…BI12	Binary inputs 1…12
13…24	GND	Ground. All grounds are connected internally to each other.
25, 26	⏚	Shield connection (functional earth), internally connected to the DIN rail.

NOTE: Shield connection to be used for shielded I/O cables only. It is not allowed to connect a LONWORKS shield, since LONWORKS requires a resistor and capacitor.

NOTE: If additional shield terminals are needed, the XS814 Auxiliary Terminal Package can be installed.

Technical Data

Table 37. Binary input module data

Input type	Dry-contact or open collector
Current rating (closed input)	2 mA
Open contact voltage	16…22 VDC
Protection	Protected against 24 VAC and 40 VDC overvoltage as well as against short-circuiting

Status LED Behavior

Using the engineering tool, the status LEDs can be configured individually for use as either alarm LEDs (red/green) or as status LEDs (yellow/OFF [default]).

Given a state of "logical ON," the LED will be lit (yellow or red).

Configuration as Fast Totalizer

Using the engineering tool, the binary inputs can be configured as fast totalizers for operation in conjunction with devices equipped with an open collector output.

Table 38. Binary inputs used as fast totalizers

Frequency	max. 20 Hz
Pulse ON	min. 25 ms
Pulse OFF	min. 25 ms
Bounce	max. 5 ms

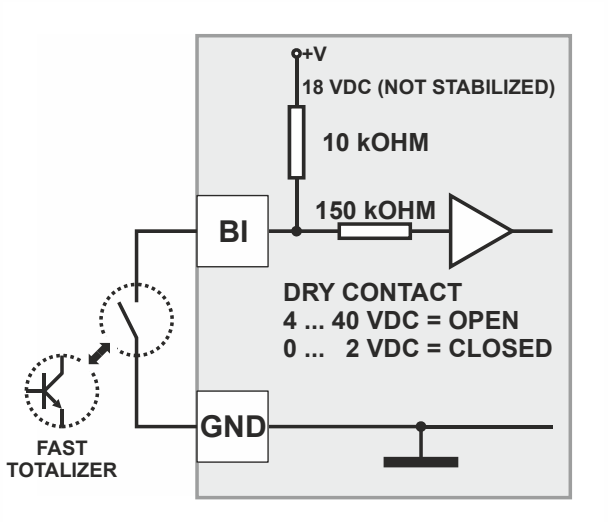


Fig. 43. Configuration of a binary input as a fast totalizer

Connection Example

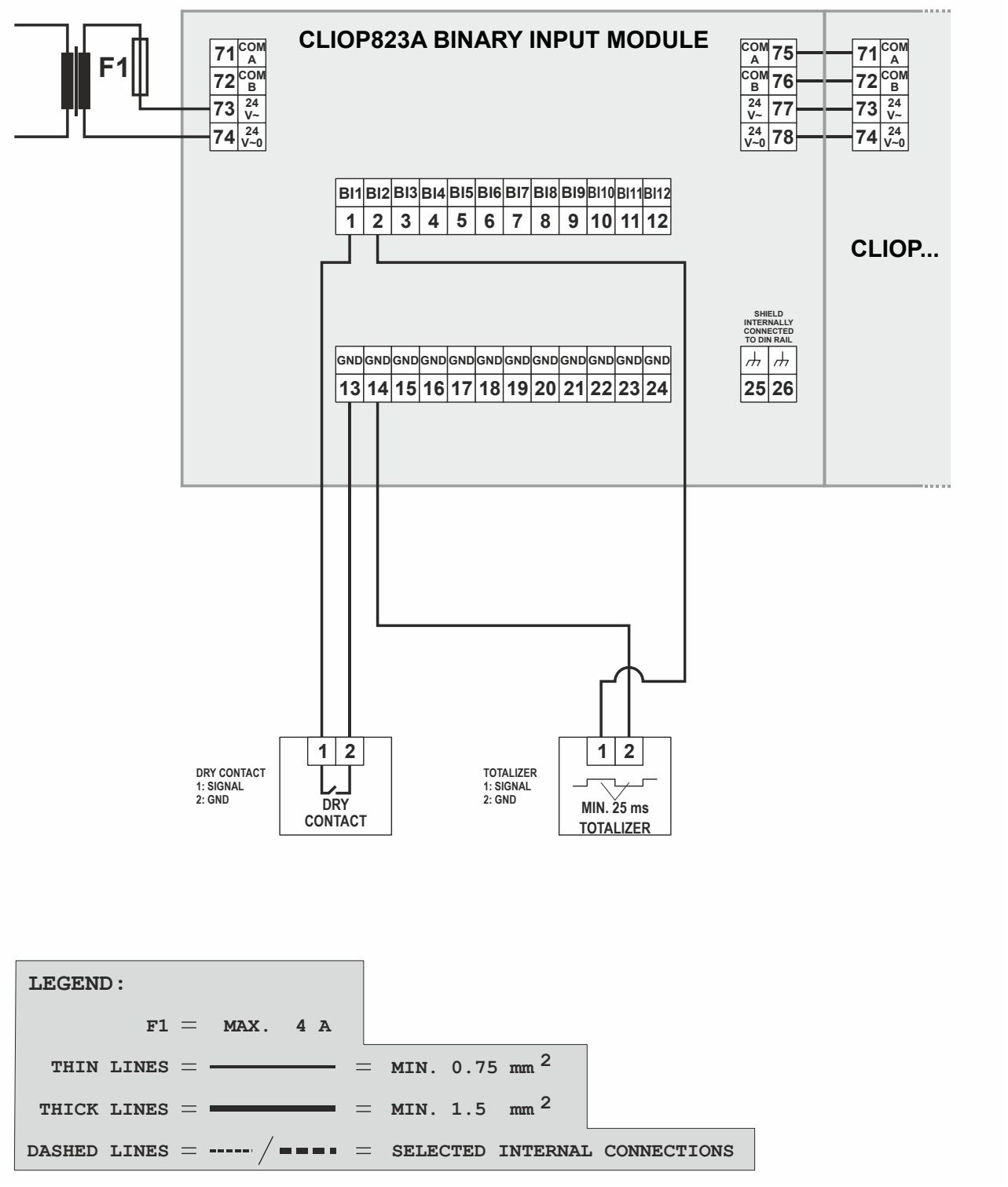


Fig. 44. CLIOP823A connection examples

For fusing specifications, see section "Fusing Specifications" on page 8.

Relay Output Modules

Types of Relay Output Modules and Terminal Socket

Table 39. CentraLine Relay Output Modules

Type	Description	Housing
CLIOP824A	Panel Bus relay output module	Light gray
CLIOPR824A	Panel Bus relay output module with manual overrides	Light gray
CLIOL824A	LONWORKS Bus relay output module	Dark gray
CLIOLR824A	LONWORKS Bus relay output module with manual overrides	Dark gray
XS824-25 XSU824-25	Terminal socket; can be fitted with cross connector (incl. in the delivery)	Light gray

Features

- 6 relays (changeover contacts), arranged in two blocks
- …**R**824A: 6 manual overrides
- Low and line voltage allowed, see WARNING.

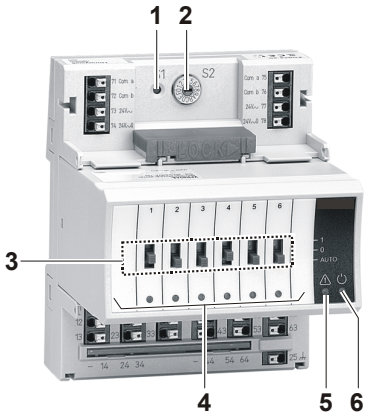


Fig. 45. CLIOP824A Relay Output Module with terminal socket

Legend

1 Service button S1
2 Hex switch S2
3 Manual overrides
4 Status LEDs
5 Service LED
6 Power LED

Functionality of service LED and power LED: see Table 57 to Table 59 on page 56 and following.

In the event of communication problems, the relay outputs will move to the safety positions you have configured using the engineering tool, see relay output point description in the CARE – User Guide, 74-5587/EN2B-0182GE51.

⚠ WARNING

Risk of electric shock or equipment damage!
Low voltage and line voltage must not be wired within the same relay block.

► Wire low voltage e.g., to relay block 1 and line voltage to relay block 2 or vice versa. In this case, a cross connector must not be used; rather, each relay must be wired separately.

NOTICE

Risk of malfunction!
Cross connectors may only be used if the same voltage is used on all relays they connect.

► Do not use a cross connector if different voltages are used on any of the six relays. In such cases, each relay must be wired separately.

Terminals

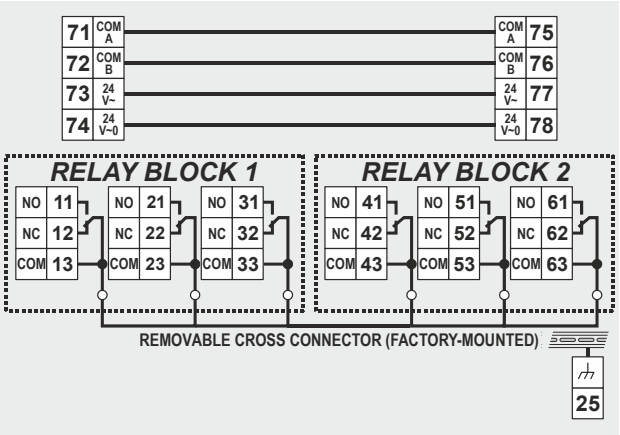


Fig. 46. Terminal assignment and internal connections

Table 40. Description of relay output module terminals

Terminal		Signal	Comment
71, 75		COM a	2-wire communication bus (LON/Panel Bus)
72, 76		COM b	2-wire communication bus (LON/Panel Bus)
73, 77		24 V~	Power supply
74, 78		24 V~0	Power supply
RELAY BLOCK 1	11	REL1 N.O.	Relay 1 N.O. contact
	12	REL1 N.C.	Relay 1 N.C. contact
	13	R1 COM	relay 1 common contact
	14	R1 COM	For connection of relay 1 common via cross connector*
	21	REL2 N.O.	Relay 2 N.O. contact
	22	REL2 N.C.	Relay 2 N.C. contact
	23	R2 COM	Relay 2 common contact
	24	R2 COM	For connection of relay 2 common via cross connector*
	31	REL3 N.O.	Relay 3 N.O. contact
	32	REL3 N.C.	Relay 3 N.C. contact
	33	R3 COM	Relay 3 common contact
	34	R3 COM	For connection of relay 3 common via cross connector*
RELAY BLOCK 2	41	REL4 N.O.	Relay 4 N.O. contact
	42	REL4 N.C.	Relay 4 N.C. contact
	43	R4 COM	Relay 4 common contact
	44	R4 COM	For connection of relay 4 common via cross connector*
	51	REL5 N.O.	Relay 5 N.O. contact
	52	REL5 N.C.	Relay 5 N.C. contact
	53	R5 COM	Relay 5 common contact
	54	R5 COM	For connection of relay 5 common via cross connector*
	61	REL6 N.O.	Relay 6 N.O. contact
	62	REL6 N.C.	Relay 6 N.C. contact
	63	R6 COM	Relay 6 common contact
	64	R6 COM	For connection of relay 6 common via cross connector*
25		⏚	Shield connection (functional earth), internally connected to the DIN rail

* Do not connect by wire!

Permissible Loads

Table 41. Permissible loads of relay output modules

	Max. load	Min. load
Per relay output module (total) (fuse F3)	**19…250 VAC** current at cos φ ≥ 0.6: 12 A **1…29 VDC** 12 A resistive, 3 A inductive	–
Per normally open contact	**19…250 VAC** current at cos φ ≥ 0.6: 4 A **1…29 VDC** 4 A resistive, 1 A inductive	50 mW
Per normally closed contact	**19…250 VAC** current at cos φ ≥ 0.95: 2 A, current at cos φ ≥ 0.6: 1 A **1…29 VDC** 4 A resistive, 1 A inductive	50 mW

NOTE: In the case of voltages above 30 VAC/DC and if inductive components are to be connected to relays switching more often than once every 2 minutes, these components must be prevented from causing harmful interference to radio or television reception (conformance with EN 55014).

NOTE: Relays must not be used for electronic ballasts, energy-efficient lamps, or any other capacitive devices. Such devices may display a high in-rush current for which the relays were not designed. To prevent damage to the relay module, use power gates or a coupling relay.

NOTE: Max. voltage for UL 864-compliant applications is 24 V.

Status LED Behavior

Table 42. Relay output status LED behavior

Mode	LED	Relay output	
		N.O.* (direct)	N.C.* (reverse)
Automatic mode, logical state “ON”	ON	ON	OFF
Automatic mode, logical state “OFF”	OFF	OFF	ON
Override mode (setting “0”)	Flashes	OFF	ON
Override mode (setting “1”)	Flashes	ON	OFF

*As configured using the engineering tool.

Status LEDs with Manual Overrides

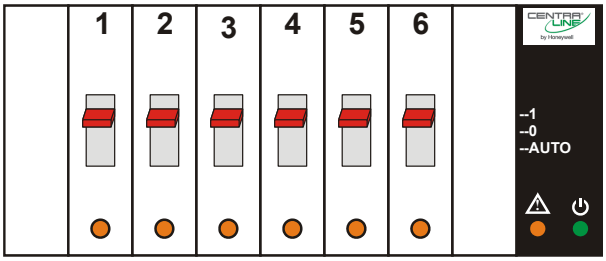


Fig. 47. Manual overrides (toggle switches)

The …**R**824A Relay Output Modules are equipped with manual overrides: one for each relay output. These sliding switches can manually be set to either "auto" or "0" or "1".

Manual Override in the AUTO Position

When a manual override of the …**R**824A Relay Output Module is set to the "AUTO" position, and the corresponding relay output has been configured, the following applies:

- If the LONWORKS network is functioning properly, the logical status of the relay output will be "AUTO."
- If the LONWORKS network is ***not*** functioning properly, the feedback signal will be switched to the safety position value.
- The feedback signal on the LONWORKS network: nvoDoActPosnFb[ ] will have a value of either 0% or 100%, and a state of -1.
- The status LED (yellow) will indicate the actual logical state of the relay output as commanded (by nviDoSwitch[ ]).

When a manual override of the …**R**824A Relay Output Module is set to the "AUTO" position, and the corresponding relay output has ***not*** been configured, the following applies:

- Regardless as to whether the LONWORKS network is functioning properly or not, values from the LONWORKS Bus will be ignored, and there will be no heartbeat or safety position.
- The feedback signal on the LONWORKS network: nvoDoActPosnFb[ ] will have a value of 0% and a state of 0.
- The status LED will be dark.

Manual Override in the ON Position

When a manual override of the …**R**824A Relay Output Module is set to the "ON" position, the following applies:

- If the relay output has been configured, its logical state will depend upon the actual output configuration.
- If the relay output is unconfigured, it will be switched ON.
- Regardless of configuration, the feedback signal on the LONWORKS network: nvoDoActPosnFb[ ] will have a value of 100…0% and a state of -1.
- Regardless of configuration, the status LED (yellow) will flash to indicate "manual override."

Manual Override in the OFF Position

When a manual override of the …**R**824A Relay Output Module is set to the "OFF" position, the following applies:

- If the relay output has been configured, its logical state will depend upon the actual output configuration.
- If the relay output is unconfigured, it will be switched OFF.
- Regardless of configuration, the feedback signal on the LONWORKS network: nvoDoActPosnFb[ ] will have a value of 0% (direct) or 100% (reverse) and a state of -1.
- Regardless of configuration, the status LED (yellow) will flash to indicate "manual override."

Connection Example

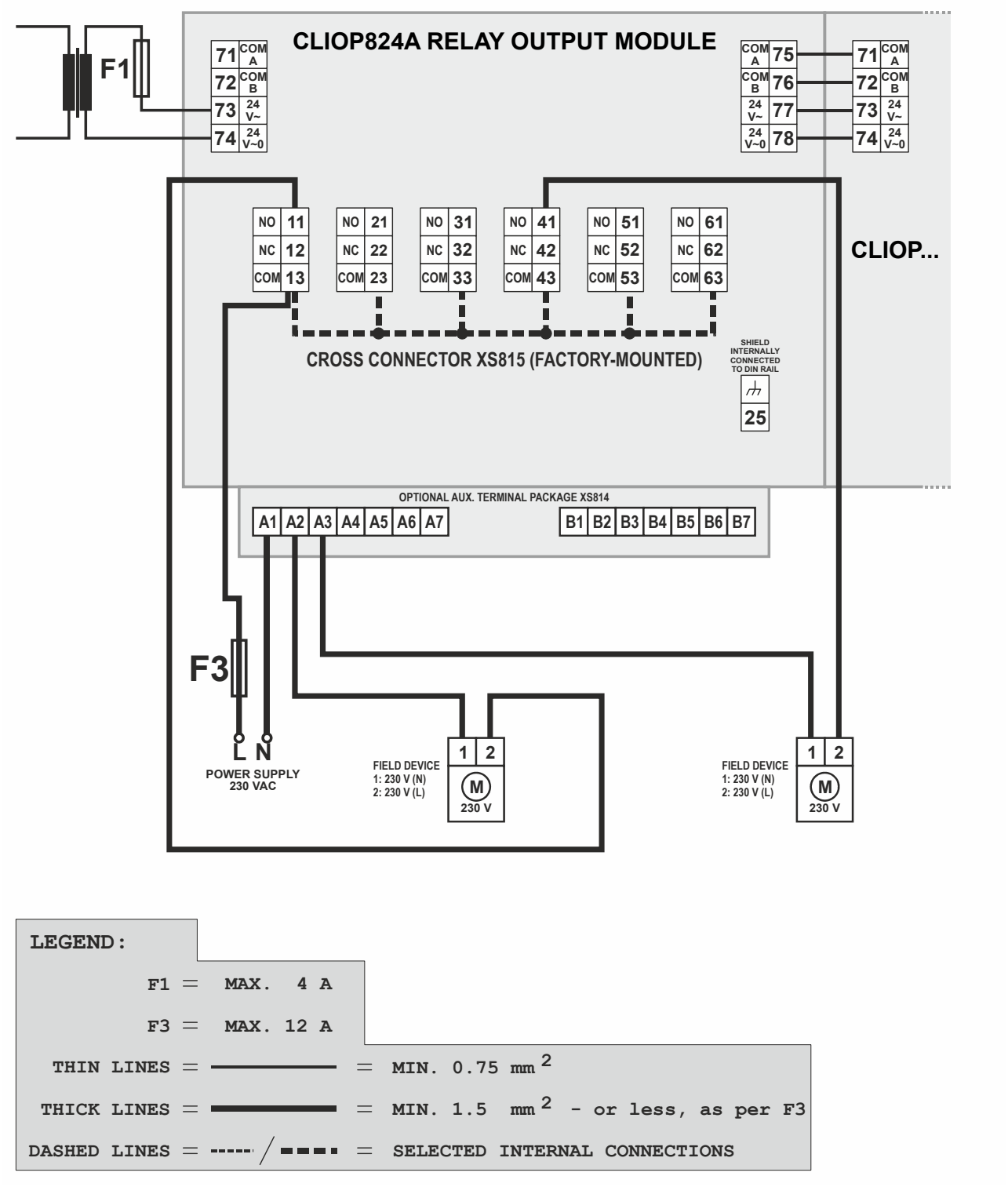


Fig. 48. CLIOP824A connection example (both relay blocks with line voltage)

For fusing specifications see section "Fusing Specifications" on page 8.

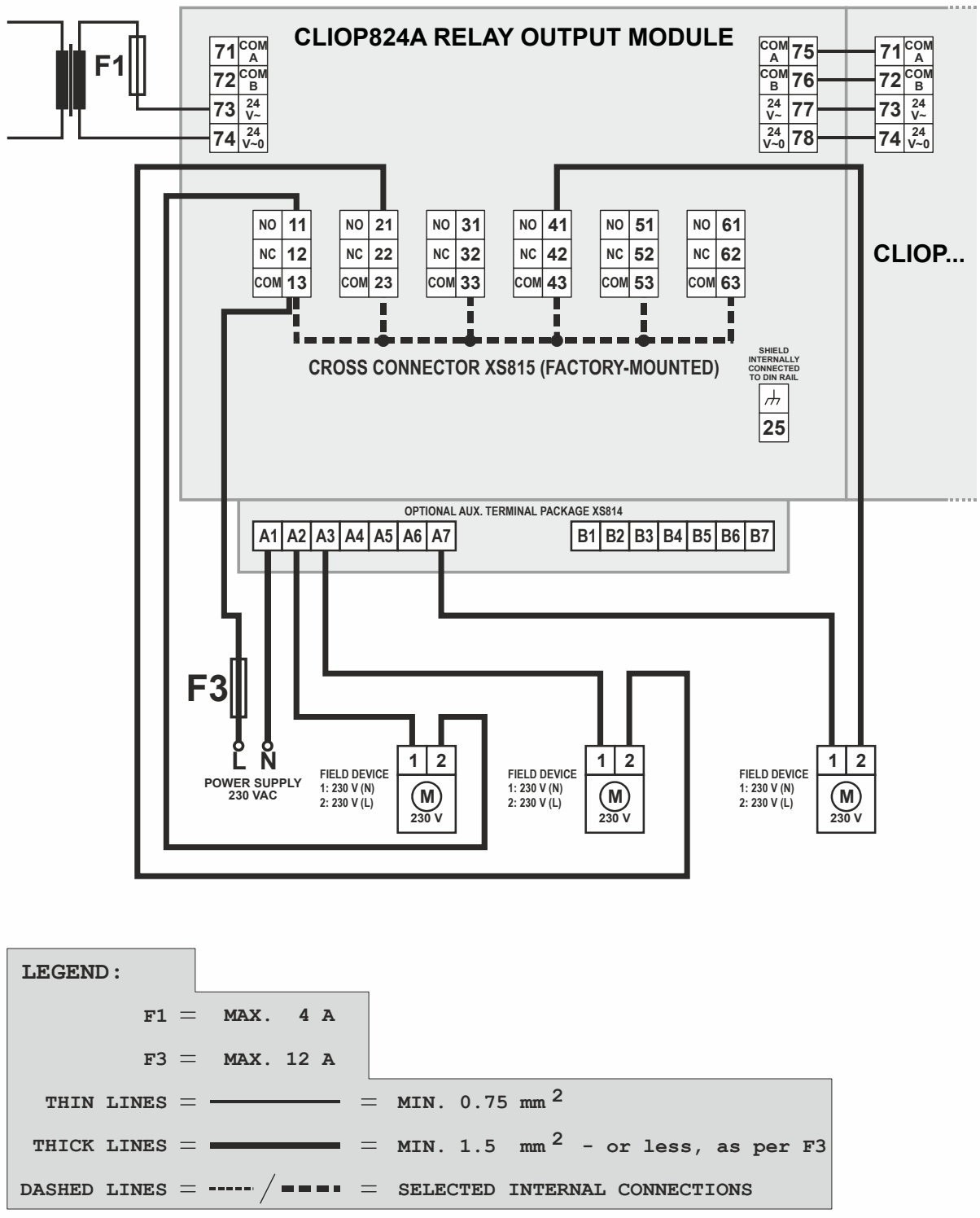


Fig. 49. CLIOP824A connection example (relay blocks with low and line voltage)

For fusing specifications see section "Fusing Specifications" on page 8.

Floating Output Module

Features

- Type: CLIOPR825A Floating Output Module
- Housing: light gray
- Floating outputs sufficient for driving up to 3 floating actuators
- Manual overrides and 3 corresponding pairs of status LEDs

In the event of communication problems, the 3 floating outputs will move to the safety positions you have configured using the engineering tool, see floating output point description in the CARE – User Guide, 74-5587/EN2B-0182GE51.

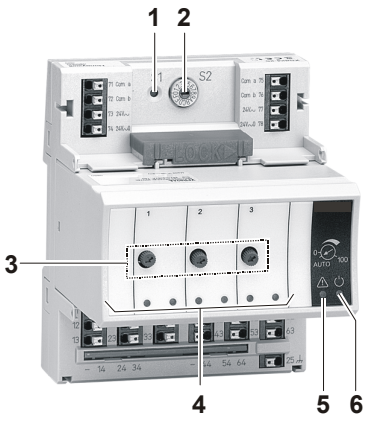


Fig. 50. CLIOPR825A Floating Output Module with terminal socket

Legend

1 Service button S1
2 Hex switch S2
3 Manual overrides
4 Status LEDs
4 Service LED
5 Power LED

Functionality of service LED and power LED: see Table 57 to Table 59 on page 56 and following.

⚠ WARNING

Risk of electric shock or equipment damage!
Low voltage and line voltage must not be wired within the same module.

Permissible loads

Table 43. Permissible loads of floating output modules

	Max. load	Min. load
Per relay output module (total) (fuse F3)	**19…250 VAC** current at cos φ ≥ 0.6: 12 A **1…29 VDC** 12 A resistive, 3 A inductive	–
Per normally open contact	**19…250 VAC** current at cos φ ≥ 0.6: 4 A) **1…29 VDC** 4 A resistive, 1 A inductive	50 mW
Per normally closed contact	**19…250 VAC** current at cos φ ≥ 0.95: 2 A, current at cos φ ≥ 0.6: 1 A **1…29 VDC** 4 A resistive, 1 A inductive	50 mW

NOTE: In the case of voltages above 30 VAC/DC and if inductive components are to be connected to relays switching more often than once every 2 minutes, these components must be prevented from causing harmful interference to radio or television reception (conformance with EN 55014).

NOTE: Max. voltage for UL 864-compliant applications is 24 V.

Terminals

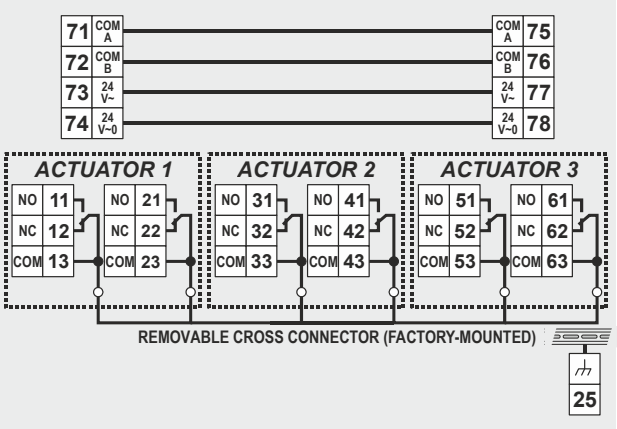


Fig. 51. Terminal assignment and internal connections

Table 44. Description of floating output module terminals

Terminal		Signal	Comment
71, 75		COM a	2-wire communication bus (LON/Panel Bus)
72, 76		COM b	2-wire communication bus (LON/Panel Bus)
73, 77		24 V~	Power supply
74, 78		24 V~0	Power supply
ACTUATOR 1	11	REL1 N.O.	Floating relay 1 N.O. contact
	12	REL1 N.C.	Floating relay 1 N.C. contact
	13	R1 COM	Floating relay 1 common contact
	14	R1 COM	For connection of floating relay 1 common via cross connector*
	21	REL2 N.O.	Floating relay 2 N.O. contact
	22	REL2 N.C.	Floating relay 2 N.C. contact
	23	R2 COM	Floating relay 2 common contact
	24	R2 COM	For connection of floating relay 2 common via cross connector*
ACTUATOR 2	31	REL3 N.O.	Floating relay 3 N.O. contact
	32	REL3 N.C.	Floating relay 3 N.C. contact
	33	R3 COM	Floating relay 3 common contact
	34	R3 COM	For connection of floating relay 3 common via cross connector*
	41	REL4 N.O.	Floating relay 4 N.O. contact
	42	REL4 N.C.	Floating relay 4 N.C. contact
	43	R4 COM	Floating relay 4 common contact
	44	R4 COM	For connection of floating relay 4 common via cross connector*
ACTUATOR 3	51	REL5 N.O.	Floating relay 5 N.O. contact
	52	REL5 N.C.	Floating relay 5 N.C. contact
	53	R5 COM	Floating relay 5 common contact
	54	R5 COM	For connection of floating relay 5 common via cross connector*
	61	REL6 N.O.	Floating relay 6 N.O. contact
	62	REL6 N.C.	Floating relay 6 N.C. contact
	63	R6 COM	Floating relay 6 common contact
	64	R6 COM	For connection of floating relay 6 common via cross connector*
25		⏚	Shield connection (functional earth), internally connected to the DIN rail

* Do not connect by wire!

Status LED Behavior

The respective pair of status LEDs will display the following:

Table 45. LED behavior (for e.g., floating output 1)

Mode	LED	Actuator 1		
		Closing	Opening	Not moving
Auto	Green LED	ON	OFF	OFF
	Red LED	OFF	ON	OFF
Override	Green LED	Flashing	OFF	Flashing
	Red LED	OFF	Flashing	Flashing

Status LEDs with Manual Overrides

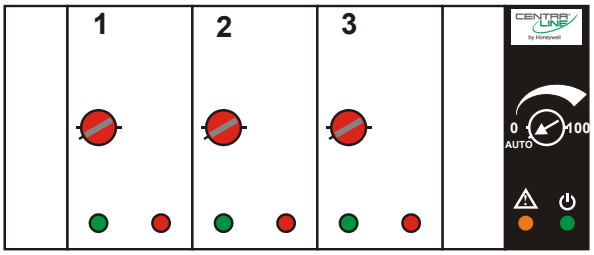


Fig. 52. Manual overrides (rotary knobs)

The floating output module is equipped with manual overrides: one for each floating output. These rotary knobs can be manually set to either "AUTO" or "0 … 100%" (infinitely adjustable).

NOTICE

Damage to the electronic module!

► Do not use a tool to adjust the rotary knobs.

► Do not use excessive force. Adjust only by hand.

Manual Override in the AUTO Position

When a manual override of the CLIOPR825A is set to AUTO, the following applies:

- The output signal of the respective floating output (R1 + R2 or R3 + R4 or R5 + R6) will be as commanded.
- The respective pair of status LEDs will be ON/OFF as commanded.

Manual Override in the Override Position (0…100%)

When a manual override of the CLIOPR825A is set to 0…100%, the respective floating output will drive to the set position. The runtime depends upon the actuator runtime configured using the engineering tool and on the actual position.

Configured Floating Relay Output

If a floating relay output has been configured, the following applies:

The corresponding manual override can be used to adjust the respective floating actuator so that it drives to any desired position between fully closed (0%) and fully open (100%). The "open" relay or "closed" relay – as the case may be – is then switched ON for the time the actuator requires to drive to the desired position, whereupon it will stop. This required time depends upon the configured motor runtime (time to open / time to close), while the direction of movement is dependent upon the configured direct/reverse setting.

Unconfigured Floating Relay Output

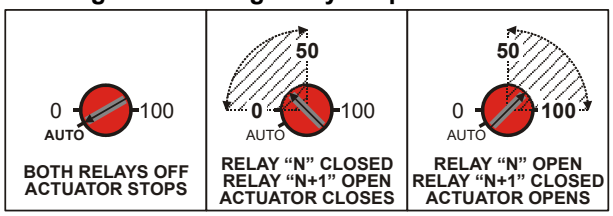


Fig. 53. Use of manual override (floating relay output unconfigured)

If a floating relay output has ***not*** been configured (see Fig. 53), the following applies:

Although the motor runtime is unknown to the CLIOPR825A, the corresponding manual override can be used during the commissioning phase to adjust the respective floating actuator so that it drives to any desired position between fully closed (0%) and fully open (100%).

The "open" relay (relay "n," i.e. “1,” “3,” or “5”) and the "closed" relay (relay "n+1," i.e. “2,” “4,” or “6”) are then switched ON and/or OFF, respectively, when the corresponding manual override is set to "0…100%." Specifically, the actuator will drive towards its closed position as long as the manual override is set to "0…50%," and it will drive towards its open position as long as it is set to "50…100%." Setting the manual override to "AUTO" stops the actuator.

Connection Example

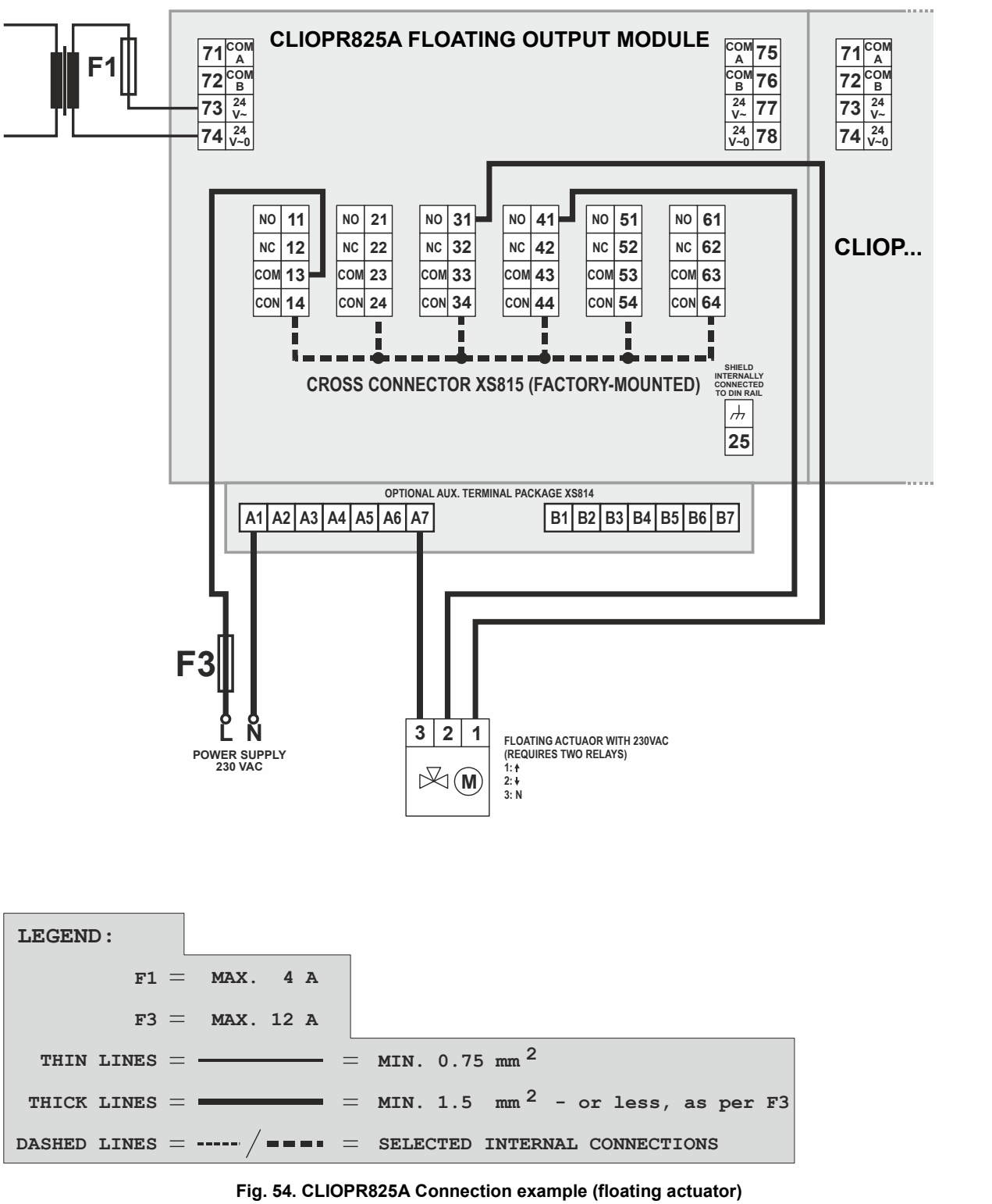


Fig. 54. CLIOPR825A Connection example (floating actuator)

For fusing specifications see section "Fusing Specifications" on page 8.

Mixed Panel Bus I/O Modules

Features

- Type: CLIOP830A and CLIOP831A Mixed Panel Bus I/O Module
- Housing: light-gray (CLIOP830A) and black (CLIOP831A)

In the event of communication problems, the relay outputs will move to the safety positions you have configured using the engineering tool, see relay output point description in the CARE – User Guide, EN2B-0182GE51 / 74-5587.

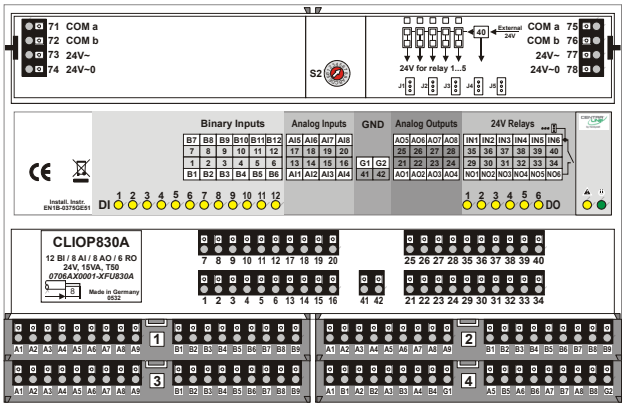


Fig. 55. Mixed I/O Module (CLIOP830A shown with aux. terminal packages)

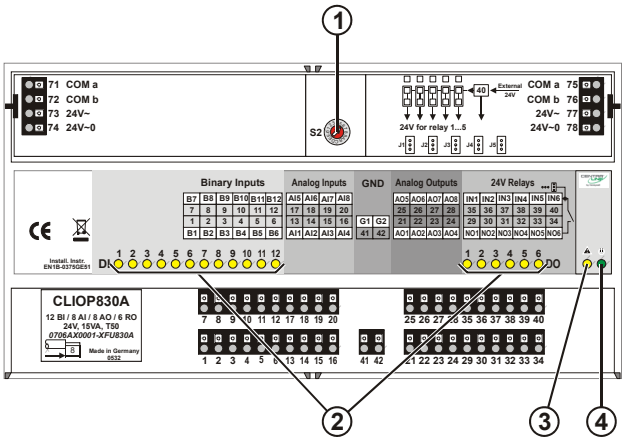


Fig. 56. Mixed I/O Module features (CLIOP830A shown)

Legend

1 Hex switch S2
2 Status LEDs
3 Service LED
4 Power LED

Functionality of service LED and power LED: see Table 57 to Table 59 on page 56.

⚠ WARNING

Risk of electric shock or equipment damage!
It is not permitted to wire the relays of the mixed Panel Bus I/O modules for anything other than low voltage.

Permissible Loads

Table 46. Permissible loads of mixed Panel Bus I/O modules

	max. load	min. load
per module (total for all relay contacts)	**19…29 VAC, 1…29 VDC** 3 A resistive or inductive, cos φ ≥ 0.6, no capacitive load, protected by fuse F4	–
per normally open contact	**19…29 VAC, 1…29 VDC** 0.5 A resistive or inductive, cos φ ≥ 0.6, no capacitive load	>50 mW, 0.05 A res./ind., cos φ ≥ 0.6

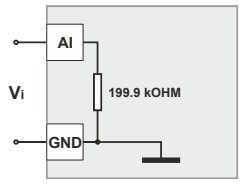


Fig. 57. Analog input high impedance (input circuit for voltage input for active sensors)

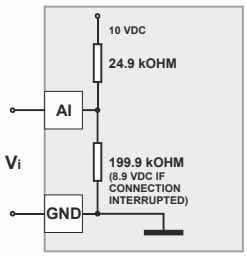


Fig. 58. Analog input impedance setpoint (input circuit for NTC10kΩ, NTC20kΩ, wall module setpoint)

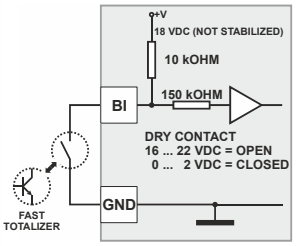


Fig. 59. Configuration of a binary input as a fast totalizer

Terminals

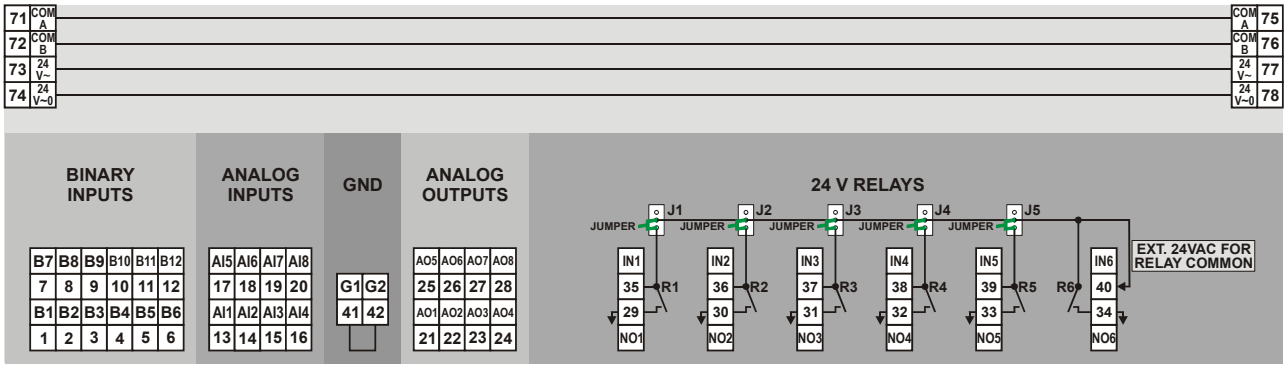


Fig. 60. Terminal assignment and internal connections of mixed Panel Bus I/O module terminals

Table 47. Description of mixed Panel Bus I/O module terminals

Terminal	Signal	LED	Comment
71, 75	COM a	status	2-wire communication bus (Panel Bus)
72, 76	COM b	status	2-wire communication bus (Panel Bus)
73, 77	24 V~	power	Power supply
74, 78	24 V~0	power	Power supply
1…7	BI1…7	1…7	Binary inputs 1…7
8…12	BI8…12	24…28	Binary inputs 8…12
13…20	AI1…8	--	Analog inputs 1…8
41, 42	GND	--	Ground. Both grounds are internally connected to each other and to 24 VAC0.
21…28	AO1…AO8	--	Analog outputs 1…8
29…34	NO1…6	29…34	Relays 1…6, normally-open contacts
35…39	IN1…5	--	Common contacts of relays 1…5. May be set to common supply voltage via terminal 40 by inserting jumpers J1…J5 into their ***lower*** positions. When, in contrast, a jumper is in the ***upper*** position (the so-called “parking position” = default setting), the corresponding relay receives no supply voltage from terminal 40.
40	IN6	--	Common contact of relay 6, internally connected to the middle contact of jumpers J1…J5. May be used to connect common supply voltage.

Table 48. Mixed Panel Bus I/O module specifications

Analog Inputs	Analog Outputs	Binary Inputs	Relay Outputs
Number: 8 **Configurable types:** ▪ NTC20kΩ (-30…+110 °C) (default) ▪ Linear Graph ▪ 0..10 VDC with pull-up ▪ 0(2)…10 VDC without pull-up **Also configurable as:** ▪ binary inputs (static, dry contact, only) **Features:** ▪ 10-bit resolution ▪ configurable offset per input	**Number:** 8 **Configurable types:** ▪ 0…11 VDC / ± 1 mA (default) **Also configurable as:** ▪ binary outputs (0 V / 10 V) **Features:** ▪ 10-bit resolution (default) ▪ Safety position (remain, 0%, 50%, 100%)	**Number:** 12 (requiring a gold contact or open collector) **Configurable types:** ▪ Static binary inputs (default: static, dry contact) ▪ ON: < 1.6 kΩ to GND or < 2.5 V to GND, OFF: > 90 kΩ to GND or > 4 V to GND **Also configurable as:** ▪ totalizers (15 Hz) **Features:** ▪ 1 yellow LED per input	**Number:** 6 **Configurable types:** ▪ Relay outputs (default) **Features:** ▪ Voltage: 24 VAC/DC, P>50 mW ▪ max. total current: 3 A (AC/DC) ▪ current per relay: 500 mA ▪ normally-open contacts: P > 50 mW, voltage: 24 V (AC/DC) ▪ 1 yellow LED per output

Connection Example

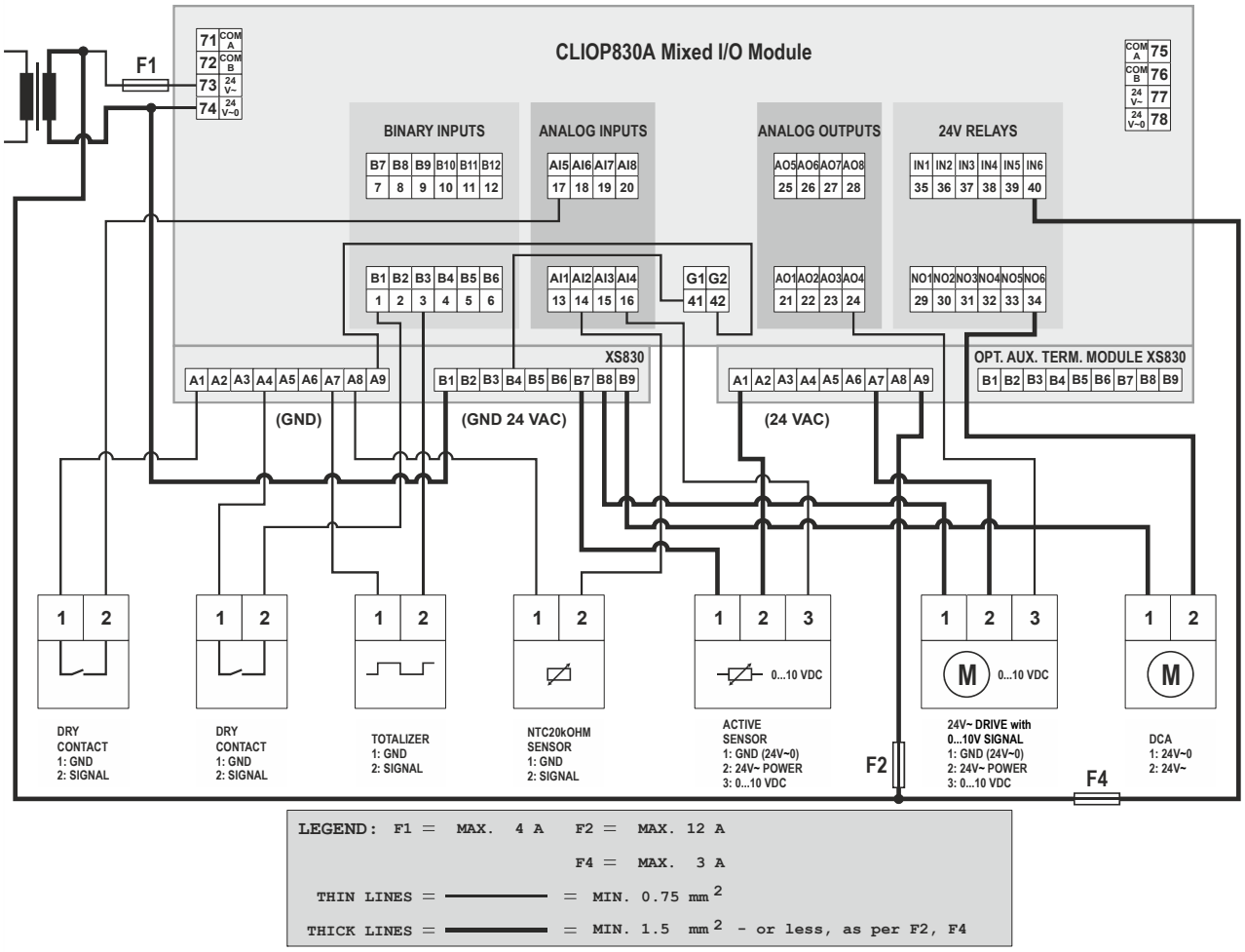


Fig. 61. CLIOP830A Connection example

For fusing specifications see section "Fusing Specifications" on page 8. For internal connections of auxiliary terminal modules, see section “XS830 Auxiliary Terminal Package” and section “XS831 Auxiliary Terminal Package” on page 49.

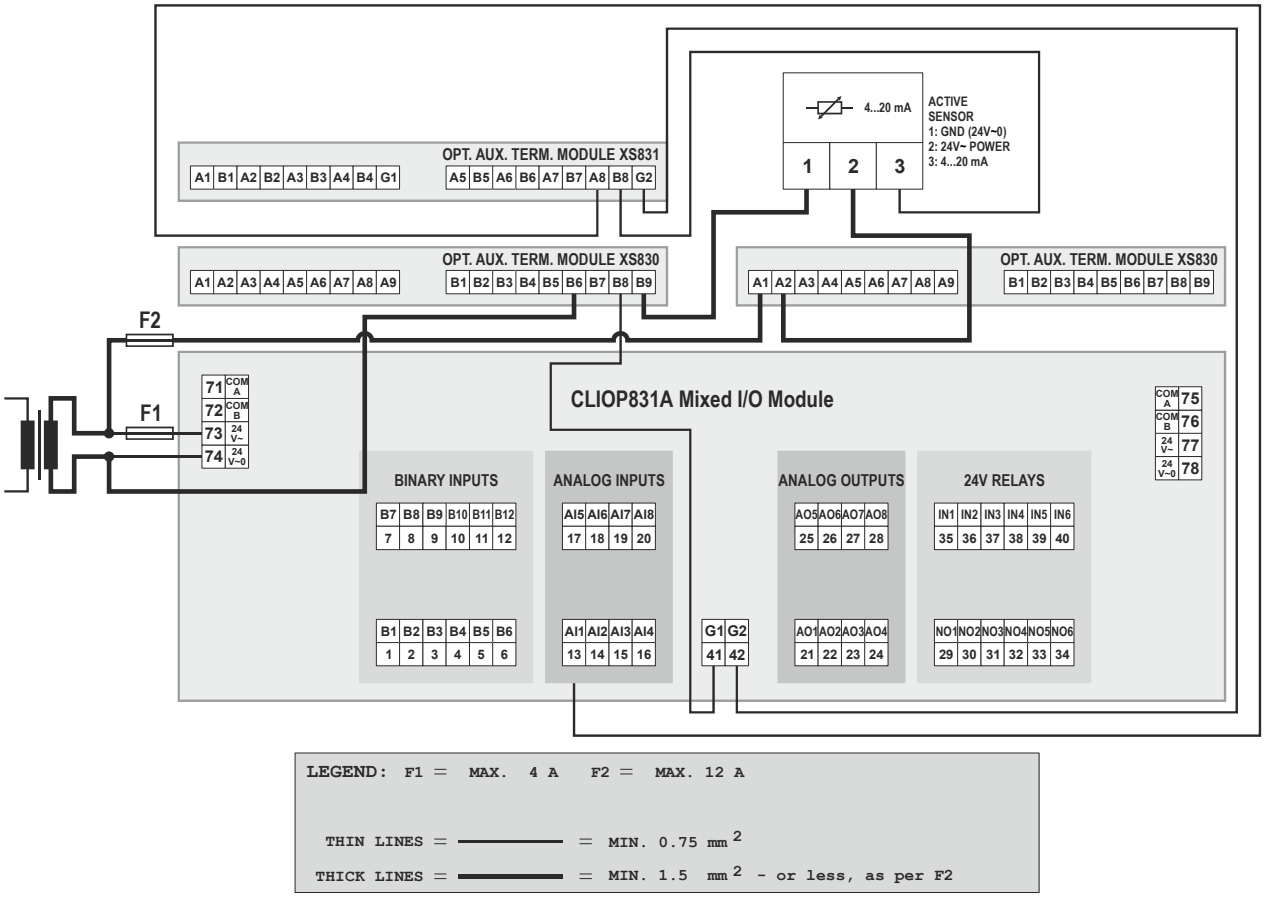


Fig. 62. CLIOP831A Connection example (for current inputs)

Description of Extra Parts

XS814 Auxiliary Terminal Package

Features

- Type: XS814 Auxiliary Terminal Package
- For mounting onto already installed pluggable I/O modules in order to equip them with additional terminals.
- Each unit consists of two terminal blocks (the "A" block and the "B" block), each with seven push-in terminals with a max. load of 12 A.
- For wiring specifications, see also Table 21 on pg. 16.

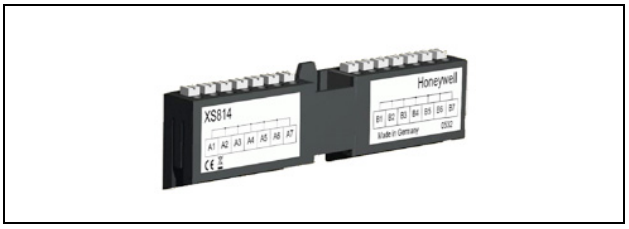


Fig. 63. XS814 Auxiliary Terminal Package

Terminal Assignment

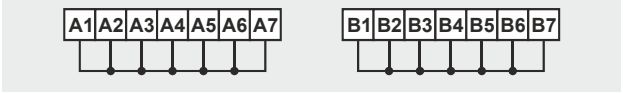


Fig. 64. Terminal assignment and internal connections of XS814 Auxiliary Terminal Package

XS830 Auxiliary Terminal Package

Features

- Type: XS830 Auxiliary Terminal Package
- For mounting onto the top and/or bottom of already-installed mixed I/O modules in order to equip them with additional terminals.

NOTE: While the CLIOP830A can be equipped with up to two rows of XS830 auxiliary terminal blocks on the top and/or bottom, the CLIOP831A can be equipped with up to two rows of XS830 auxiliary terminal blocks on the top, only.

- Each unit consists of two groups of terminal blocks (the "A" block and the "B" block), each with nine internally-connected push-in terminals with a max. load of 12 A.
- For wiring specifications, see also Table 21 on pg. 16.

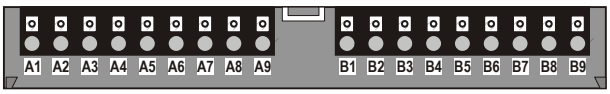


Fig. 65. XS830 Auxiliary Terminal Package

Terminal Assignment

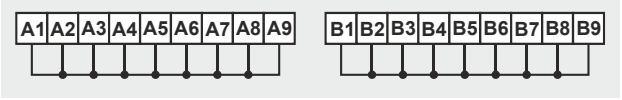


Fig. 66. Terminal assignment and internal connections of XS830 Auxiliary Terminal Package

XS831 Auxiliary Terminal Package

Features

- Type: XS831 Auxiliary Terminal Package
- For mounting onto the top and/or bottom of already-installed mixed I/O modules in order to equip them with additional terminals.

NOTE: While the CLIOP830A can be equipped with up to two rows of XS831 auxiliary terminal blocks on the top and/or bottom, the CLIOP831A can be equipped with up to two rows of XS831 auxiliary terminal blocks on the top, only.

- Each unit consists of two groups of four pairs of push-in terminals (A1B1, A2B2, … A8B8, each with a 499Ω resistor to GND) for converting 0…20 mA signals (max. load per resistor = 25 mA) into 0…10 VDC signals, and one push-in ground terminal per group. See also Fig. 68.
- For wiring specifications, see also Table 21 on pg. 16.

NOTE: The ground side of each of the eight incoming 0…20 mA signals (A1B1, A2B2, … A8B8) must be connected to a ground terminal.

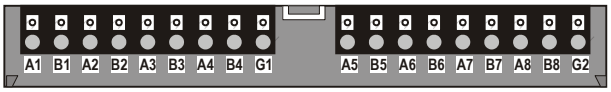


Fig. 67. XS831 Auxiliary Terminal Package

Terminal Assignment

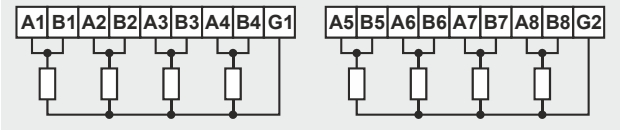


Fig. 68. Terminal assignment and internal connections of XS831 Auxiliary Terminal Package

XS815 Cross Connectors

Features

- For connecting the common terminals of all 6 relays of the CLIOL824A and CLIOLR824A Relay Output Modules and the CLIOLR825A Floating Output Module. This is permitted when all six relays carry the same voltage
- Long, red
- Supplied with the terminal socket

Fig. 69. XS815 Cross Connector

XAL10 Swivel Label Holders

- Type: XAL10 Swivel Label Holder.
- Supplied with the terminal socket.
- For applying self-adhesive labels with application information generated using the engineering tool to the pluggable I/O modules.
- For use with standard commercially-available labels, e.g., AVERY 6572 or 6578

XAL11 Swivel Label Holders

- Type: XAL11 Swivel Label Holder.
- Supplied with the mixed I/O modules.
- For applying self-adhesive labels with application information generated using the engineering tool to the mixed I/O modules.
- For use with standard commercially-available labels, e.g., AVERY 5444, 5523, 8253, 16163, or 15513.
- Phased out.

XS816 Bridge Connectors

- Type: XS816 Bridge Connectors.
- Bridge connectors transmit both communication signals and power supply between CentraLine I/O modules (exc. CLIOP831A).
- Supplied with the terminal socket / mixed I/O modules (exc. CLIOP831A).

LonWorks Software Interface Description

Overview

LonTalk Protocol

CentraLine LONWORKS Bus I/O Modules use a LONTALK protocol communication with other nodes on the LONWORKS network, with commissioning tools und supervisory devices.

Features

- Network variables for communications between nodes, but no explicit messages
- Configuration network variables
- LONMARK FPT protocol for downloading a CentraLine LONWORKS Bus I/O Module firmware via LONWORKS: loadable apbG file (supported by CARE and EXCELON)

Addressing, binding, and commissioning

CentraLine LONWORKS Bus I/O Modules are addressed, bound, and commissioned using CARE or any other standard LONWORKS commissioning tool based on LNS 2.0 and higher, e.g., LonMaker for Windows.

Configuration

CentraLine LONWORKS Bus I/O Modules are configured using CARE or COACH.

CLIOL821A Analog Input Module

For the CLIOL821A Analog Input Module the LONMARK Profile 520 "Analog Input" has been assigned per input.

Each input object has its own configuration properties, except for heartbeat configuration, which will be shared among all objects.

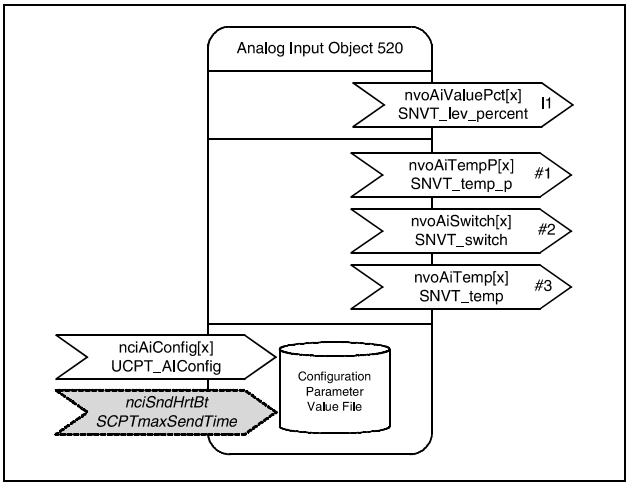


Fig. 70. LONMARK analog input object

Input types and corresponding NVs

Table 49. Input types and corresponding NVs

Input type	NV used
NTC10kΩ NTC20kΩ PT1000-1 NI1000TK5000 PT3000 BALCO500	nvoAiTempP
PT1000-2	nvoAiTemp
0(2)…10V	nvoAiValuePct
Slow binary input	nvoAiSwitch
Other Sensors	INVALID
Sensor break/short circuit	

Transmission/Updates

These variables are transmitted immediately when their value has been changed by a higher rate than the configured "send on delta" (default: 0.3 K).

These variables are also transmitted as heartbeat output (default: 60 sec) on a regular basis as dictated by the max. send time (nciSndHrtBt) configuration variable.

Default Service Type

The default service type of these variables is unacknowledged.

Analog Sensor Output – nvoAiValuePct[ ]

This network variable output represents the percentage level for the appropriate input, if configured for voltage input.

Valid Ranges for 0 … 10 V Input

Table 50. Analog input values: 0 … 10 V

Value	Representation
< 0 V	0 %
0 V … 10 V	0 … 100 %
> 10 V	100 %

Valid Ranges for 2 … 10 V Input

Table 51. Analog input values: 2 … 10 V

Value	Representation
< 1.5 V	Sensor break/short circuit
1.5 V … 2 V	0 %
2 V … 10 V	0 … 100 %
> 10 V	100 %

Default Value

The default value is set after power-up or reset and remains until the module has measured a valid value.

nvoAiValuePct = INVALID = 0x7FFF (=163.835 %)

The sensor failure behavior can be configured for 2 … 10 V.

Temperature Sensor Output – nvoAiTempP[ ]

If configured for temperature sensor input (but not from PT1000-2 temperature sensors), this network variable output represents the temperature for the appropriate input.

Range: see Table 29 and Table 30 on page 23.

Default Value

The default value is set after power-up or reset and remains until the module has measured a valid value.

nvoAiTempP = INVALID = 0x7FFF (= 327.67 °C)

Slow Digital Input – nvoAiSwitch[ ]

This network variable output represents a slow digital input connected to the universal input terminals.

Valid Range

Table 52. Slow digital input values

Sensor	Value	State
Enabled	100 %	1
Disabled	0 %	0
Not configured	0 %	-1

Temperature#2 Sensor Output – nvoAiTemp[ ]

If configured for temperature sensor input (from PT1000-2 temperature sensors, only), this network variable output represents the temperature for the appropriate input.

Range: see Table 29 and Table 30 on page 23.

Default Value

The default value is set after power-up or reset and remains until the module has measured a valid value.

nvoAiTemp = INVALID = 0xFFFF (= 6279.5 °C)

CLIOL(R)822A Analog Output Module

For the CLIOL822A/CLIOLR822A Analog Output Module, the LONMARK open-loop actuator object has been assigned per output.

Each analog output object has its own configuration properties, except for heartbeat configuration and nciAoConfig, which will be shared among all objects.

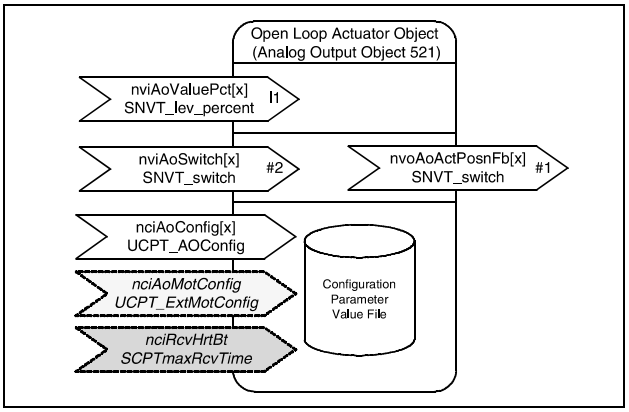


Fig. 71. LONMARK analog output object

Receive Heartbeat

The default configuration for “Receive Heartbeat” is 300 sec. If no nvi update is received during this time, the actuators will go to their configured safety positions.

Start-up Behavior

At start-up, i.e., power-up or reset, all nvi's will be initialized with INVALID, and after 1 minute, the actuators will go to their configured safety positions.

Analog Output Control Level – nviAoValuePct[ ]

This network variable is used to drive the analog output to 0 … 100 %.

If both nviAoSwitch[ ] and nviAoValuePct[ ] receive valid values, nviAoValuePct[ ] will have priority.

Valid Ranges

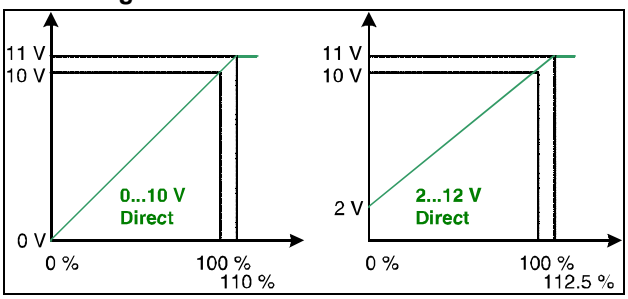


Fig. 72. Analog output control levels – direct actuator

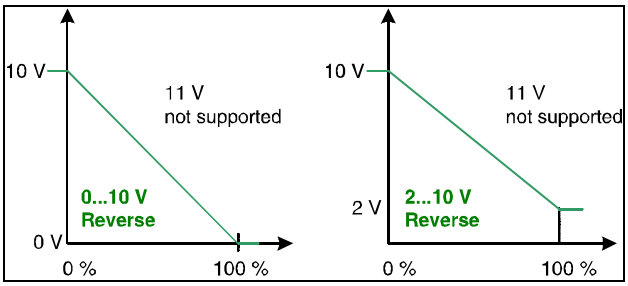


Fig. 73. Analog output control levels – reverse actuator

Default Value

nvoAoValuePct = INVALID = 0x7FFF (=163.835 %)

This will cause the actuator to adopt a predefined position defined for failure behavior.

Analog Output Feedback – nvoAoPosnFb[ ]

This value represents the current status of the analog output including feedback related to manual override initiated from the manual override.

This is typically used for monitoring purposes at a supervisory station or for diagnostic purposes.

Valid Range

Table 53. Analog output feedback range

Value	State	Current analog output position
0.5 … 100 %	1	Analog output position due to normal control by nviAoSwitch or nviAoValuePct
0 % (OFF)	0	
0 … 100 %	-1	Manual override position via the manual override panel
0xFF	-1	Current position unknown or synchronization active, analog output not configured

Transmission

This variable is transmitted immediately when the corresponding network input variable has changed more than 1 % or immediately as an answer to an nviAoValuePct[ ] or nviAoSwitch[ ] update.

Default Service Type

The default service type is unacknowledged.

Analog Output Command – nviAoSwitch[ ]

This network variable is used to drive the analog output to 0 … 100 %.

It is typically bound to a LONWORKS control device issuing an output level 0 … 100 %.

If both nviAoSwitch[ ] and nviAoValuePct[ ] receive valid values, nviAoValuePct[ ] will have priority.

Default Value

Value = 0

State = –1

CLIOL823A Binary Input Module

One instance of the LONMARK open-loop sensor object has been assigned per input of the CLIOL823A Binary Input Module.

Each digital input object has its own configuration properties, except for heartbeat configuration, which will be shared among all objects.

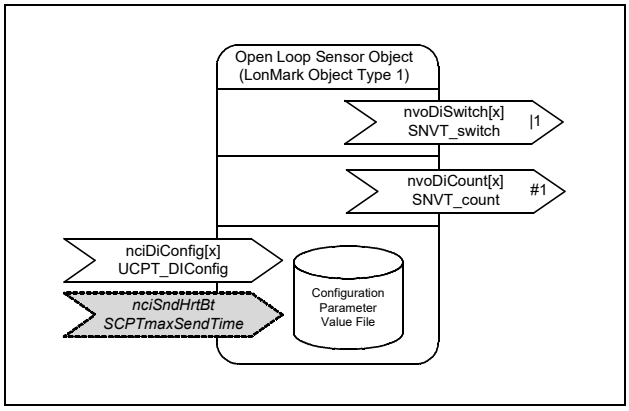


Fig. 74. LONMARK digital input object

Transmission

These variables are transmitted immediately when its value has been changed by a higher rate than the configured "send on delta" (in the case of the totalizer, “send on delta” has a default value of 5 counts).

These variables are also transmitted as a heartbeat output on a regular basis as dictated by the max. send time (nciSndHrtBt) (default = 0 = disabled) configuration variable.

Default Service Type

The default service type of these variables is unacknowledged.

Fast Binary Input – nvoDiSwitch[ ]

This network variable output represents the logical state of a fast binary input connected to the binary input terminals.

Valid Range

Table 54. Slow digital input values

Logical input state	Value	State
ON	100 %	1
OFF	0 %	0
Not configured	0 %	-1

Default Value

The default value is set after power-up or reset and remains until the module has measured a valid value.

Value = 0

State = -1

Totalizer Count – nvoDiCount[ ]

This network variable output indicates the total number of transitions from 0 to 1 since the last reset due to power-up or network reset.

Valid Range

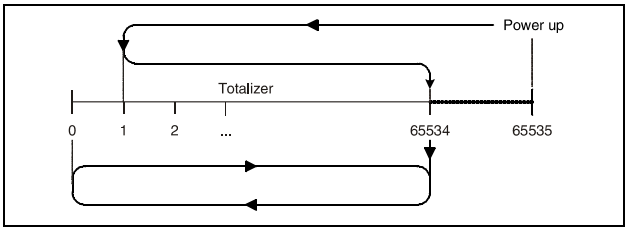


Fig. 75. Totalizer

Table 55. Totalizer counts

State	Value
For totalizer counts	0 … 65534
For power-up/reset	65535

Power-up/Reset

After power-up and reset, the value 0xFFFF = 65535 will be sent to the network to indicate that previous count values have been lost due to a reset.

CLIOL(R)824A Relay Output Module

One instance of the LONMARK open-loop sensor object has been assigned per input of the CLIOL824A/CLIOLR824A Relay Output Module.

Each output object has its own configuration properties, except for heartbeat configuration, which will be shared among all objects.

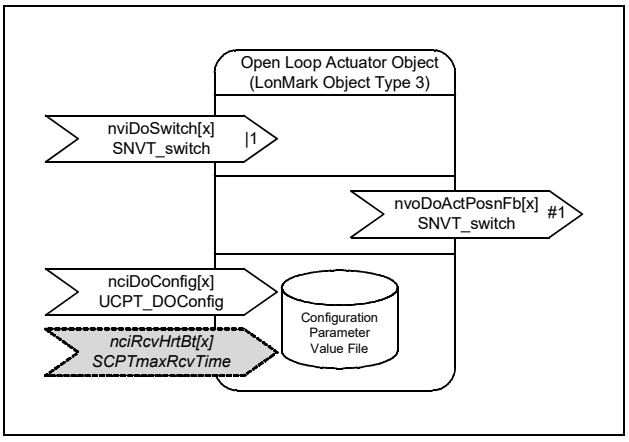


Fig. 76. LONMARK output object

Relay Output Command – nviDoSwitch[ ]

This network variable is used to drive the relay output.

It is typically bound to a LONWORKS control device issuing an output level ON/OFF, respectively 0 … 100 %.

Valid Range

Table 56. Relay output command values

Value	State	Action
N/a	0	OFF
0	1	OFF
0.5 … 100 %	1	Outputs are switched according to actual output type configuration
N/a	-1	INVALID: as defined for failure behavior

Default Value

Value = 0

State = -1

Start-up Behavior

At start-up, i.e., power-up or reset, all nvi's will be initialized with INVALID, leading the actuator to drive to the configured safety position after 1 minute.

Receive Heartbeat

The default configuration for “Receive Heartbeat” is 300 sec. If no nvi update is received during this time, the field devices will go to their configured safety positions.

Troubleshooting

Testing Wiring Connections

Push-in terminals feature small holes (1 mm in diameter) which can be used to measure the signals.

► Insert a probe (1) as shown on the right.

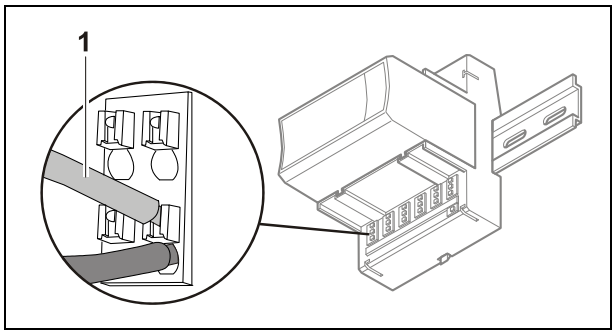


Fig. 77. Testing wiring connections

CentraLine I/O Module Troubleshooting

► Check if the power supply voltage level is OK and that there is no high voltage (> 24 VAC or > 40 VDC) connected to the inputs/outputs of the …821A, …822A, …823A I/O modules.

► Replace the problem I/O module with another module of the same kind.

– If the problem persists, this is an indication that the problem is caused by the application or incorrect wiring.

– If the problem is solved, this is an indication that the I/O module was defective.

For troubleshooting purposes, the following features can be used:

- Power LED (all CentraLine I/O modules)
- Service LED (all CentraLine I/O modules)
- Service button (pluggable CentraLine I/O modules, only)

In addition, a module-specific troubleshooting may be necessary.

Power LED of CentraLine I/O Modules

Table 57. Power LED of CentraLine I/O modules

case	Power LED	Meaning	Remedy
1	**ON**	I/O module is powered	No action necessary
2	**OFF**	No power	► Check power supply
3	**Flashing continuously**	If the I/O module's service LED is likewise flashing, the I/O module is in the boot mode	► Wait until rebooting (firmware download) has been completed

Service LED of CentraLine I/O Modules

Table 58. Service LED of CentraLine I/O modules

case	Service LED	Meaning	Remedy
1	LED remains OFF after power-up	If the power LED is also OFF, then – Defective device hardware – Possible power supply problems, clock problems, or defective processor	► Replace hardware
2	LED is lit continuously after first power-up	• LONWORKS Bus I/O modules: – Defective hardware • Panel Bus I/O modules: – I/O module has not yet been configured by the controller – Boot loader is active – Failure during last firmware download – Checksum error	LONWORKS Bus I/O modules: ► Replace hardware Panel Bus I/O modules: ► Set the hex address to the position configured with CARE ► Check the Panel Bus wiring: - Check for cable breaks - Check for cable short-circuits - If using separate transformers: Check ground connection ► Eliminate any mixture of Panel Bus I/Os and LonWorks I/Os on same wire ► Allow controller to configure I/O module ► Unplug and replug the module ► If problem persists, replace hardware
3	Alternating flash between service LED and power LED	Panel Bus I/O modules, only: Download error or application checksum error. Boot loader is running	► Panel Bus I/O modules, only: Wait until rebooting (firmware download) has been completed
4	LED flashes at power up, goes OFF, and then is lit continuously	LONWORKS Bus I/O modules, only: The LONWORKS Bus I/O module lacks application	► Download application
5	LED repeatedly blinks ON for 1 sec and OFF for 1 sec	LONWORKS Bus I/O modules, only: The LONWORKS Bus I/O module is unconfigured, but has an application	► Set module to configured mode
6	LED remains OFF after a short ON duration	I/O module is configured and running normally	No action necessary
7	LED flashes continuously in following pattern: 4 x ON/OFF followed by pause	Sensor failure of analog input module (in the case of LONWORKS Bus I/O modules, this behavior can occur only if the appropriate NV has been bound)	► Check sensor or connection ► Check sensor configuration
8	LED flashes continuously in following pattern: 5 x ON/OFF followed by pause	LONWORKS Bus I/O modules, only: LONWORKS I/O Bus module has received the wink command from network, physical outputs are unaffected	No action necessary
9	LED flashes continuously in following pattern: 6 x ON/OFF followed by pause	Boot loader problem or hardware defect	► Replace hardware
10	LED flashes continuously in following pattern: 7 x ON/OFF followed by pause	Communications failure	► Check bus wiring ► Ensure that LONWORKS Bus I/O modules and Panel Bus I/O modules are not sharing the same bus ► In case of Panel Bus I/O modules, only: Check for incorrect HEX addresses (2 Panel Bus I/O modules using the same HEX address) ► In case of LONWORKS Bus I/O modules, only: Check heartbeat

LED Test for CentraLine I/O Modules (pluggable I/O modules, only)

► Press the service button S1 of the pluggable I/O module using, e.g., a paperclip.

– The service LED and all other LEDs of that pluggable I/O module light up for as long as the service button is pressed.

Table 59. Effects of pressing and holding down service button of pluggable I/O modules

LED	Correct behavior
Power LED	ON continuously (if it flashes, check the 24 VAC power supply)
Service LED	ON continuously
Analog output module status LEDs	ON continuously
Relay output module status LEDs	ON continuously
Digital input module status LEDs	Red -> green -> yellow -> red -> green -> yellow, cyclically every 0.5 sec

An LED is defective if it is not lit as shown above.

Analog Input Modules Troubleshooting

Table 60. Failure modes of analog input modules

case	Problem	Possible causes	Remedy
1	Incorrect sensor measurement	Wrong sensor configuration	► Reconfigure sensor
		Incorrect wiring	► Rewire
		Sensor failure	► Replace sensor
		Negative voltage on at least one channel	► Check polarity of active sensor inputs.
2	Unstable sensor measurements	Incorrect grounding of active sensors	► Ground active sensors individually (see Fig. 33 and Fig. 34 on page 25 and following)
3	a voltage of about 8.88 V(*) is measured (with an external volt-meter) at an open analog input configured for: NTC20kΩ or Pt1000-1/-2 or Pt3000 or Balco 500 or NTC10kΩ or NI1000TK5000.	Sensor is not connected	► Connect the configured sensor
4	a voltage of about 8.88 V(*) is measured (with an external voltmeter) at an open analog input configured for: 0…10V with pull-up or slow Digital Input	Normal value for open input that is configured to listed types	► No action necessary
(*): voltage may differ slightly depending on the input impedance of the used voltmeter			

Analog Output Modules Troubleshooting

Table 61. Failure modes of analog output modules

case	Problem	Possible causes	Remedy
1	All outputs always have zero voltage	Manual override settings	► Check manual override settings
		Outputs are in safety position	► Check communication
		Software problem	► Power down and then power up ► If the problem persists, replace hardware
		Internal undervoltage detection has been activated	► Replace hardware
2	Unstable output voltage	Incorrect grounding of actuators	► Ground actuators individually (see Fig. 38 on page 29)

Binary Input Modules Troubleshooting

Table 62. Failure modes of binary input modules

case	Problem	Possible causes	Remedy
1	Unexpectedly, all status LEDs are always OFF	Internal overload protection has been activated	► Power down and then power up

Relay Output Modules Troubleshooting

Table 63. Failure modes of relay output modules

case	Problem	Possible causes	Remedy
1	Unexpectedly, all outputs are in unpowered position	Improper manual override settings	► Check manual override settings
		Outputs are in safety position	► Check communication
		Software problem	► Power down and then power up ► If the problem persists, replace hardware
		Internal undervoltage detection has been activated	► Replace hardware

Floating Output Modules Troubleshooting

Table 64. Failure modes of floating output modules

case	Problem	Possible causes	Remedy
1	Unexpectedly, all outputs are in unpowered position	Improper manual override settings	► Check manual override settings to check outputs
		Outputs are in safety position	► Check communication
		Software problem	► Power down and then power up ► If the problem persists, replace hardware
		Internal undervoltage detection has been activated	► Replace hardware

Appendix: Sensor Characteristics

NOTE: The following sensor characteristics 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.

BALCO 500

Temp. [°C]	Resistance [Ω]	Terminal voltage [V]
-30.0	397	0.157
-29.0	399	0.158
-28.0	401	0.158
-27.0	403	0.159
-26.0	404	0.160
-25.0	406	0.160
-24.0	408	0.161
-23.0	410	0.162
-22.0	412	0.163
-21.0	413	0.163
-20.0	415	0.164
-19.0	417	0.165
-18.0	419	0.165
-17.0	421	0.166
-16.0	423	0.167
-15.0	425	0.168
-14.0	426	0.168
-13.0	428	0.169
-12.0	430	0.170
-11.0	432	0.171
-10.0	434	0.171
-9.0	436	0.172
-8.0	438	0.173
-7.0	440	0.174
-6.0	442	0.174
-5.0	444	0.175
-4.0	445	0.176
-3.0	447	0.176
-2.0	449	0.177
-1.0	451	0.178
0.0	453	0.179
1.0	455	0.179
2.0	457	0.180
3.0	459	0.181
4.0	461	0.182
5.0	463	0.183
6.0	465	0.183
7.0	467	0.184
8.0	469	0.185
9.0	471	0.186
10.0	473	0.186
11.0	475	0.187
12.0	477	0.188
13.0	479	0.189
14.0	481	0.190
15.0	483	0.190
16.0	485	0.191
17.0	487	0.192
18.0	489	0.193
19.0	491	0.193
20.0	493	0.194
21.0	495	0.195
22.0	497	0.196
23.0	499	0.196
24.0	501	0.197
25.0	503	0.198
26.0	506	0.199
27.0	508	0.200
28.0	510	0.201
29.0	512	0.201
30.0	514	0.202
31.0	516	0.203
32.0	518	0.204
33.0	520	0.205
34.0	522	0.205
35.0	524	0.206
36.0	527	0.207
37.0	529	0.208
38.0	531	0.209
39.0	533	0.210
40.0	535	0.210
41.0	537	0.211
42.0	539	0.212
43.0	542	0.213
44.0	544	0.214
45.0	546	0.215
46.0	548	0.215
47.0	550	0.216
48.0	553	0.217
49.0	555	0.218
50.0	557	0.219
51.0	559	0.220
52.0	561	0.220
53.0	564	0.221
54.0	566	0.222
55.0	568	0.223
56.0	570	0.224
57.0	572	0.225
58.0	575	0.226
59.0	577	0.226
60.0	579	0.227
61.0	581	0.228
62.0	584	0.229
63.0	586	0.230
64.0	588	0.231
65.0	590	0.231
66.0	593	0.233
67.0	595	0.233
68.0	597	0.234
69.0	600	0.235
70.0	602	0.236
71.0	604	0.237
72.0	607	0.238
73.0	609	0.239
74.0	611	0.240
75.0	614	0.241
76.0	616	0.241
77.0	618	0.242
78.0	621	0.243
79.0	623	0.244
80.0	625	0.245
81.0	628	0.246
82.0	630	0.247
83.0	632	0.248
84.0	635	0.249
85.0	637	0.249
86.0	639	0.250
87.0	642	0.251
88.0	644	0.252
89.0	647	0.253
90.0	649	0.254
91.0	651	0.255
92.0	654	0.256
93.0	656	0.257
94.0	659	0.258
95.0	661	0.259
96.0	664	0.260
97.0	666	0.261
98.0	668	0.261
99.0	671	0.262
100.0	673	0.263
101.0	676	0.264
102.0	678	0.265
103.0	681	0.266
104.0	683	0.267
105.0	686	0.268
106.0	688	0.269
107.0	691	0.270
108.0	693	0.271
109.0	696	0.272
110.0	698	0.273
111.0	701	0.274
112.0	703	0.275
113.0	706	0.276
114.0	708	0.276
115.0	711	0.278
116.0	713	0.278
117.0	716	0.280
118.0	718	0.280
119.0	721	0.281
120.0	724	0.283

NTC 20 kΩ

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
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
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
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

PT 1000

Temp. [°C]	Resistance [Ω]	Terminal voltage [V]
-50.0	803	0.312
-49.0	807	0.314
-48.0	811	0.315
-47.0	815	0.317
-46.0	819	0.318
-45.0	823	0.320
-44.0	827	0.321
-43.0	831	0.323
-42.0	835	0.324
-41.0	839	0.326
-40.0	843	0.327
-39.0	847	0.329
-38.0	851	0.330
-37.0	855	0.332
-36.0	859	0.333
-35.0	862	0.335
-34.0	866	0.336
-33.0	870	0.338
-32.0	874	0.339
-31.0	878	0.341
-30.0	882	0.342
-29.0	886	0.344
-28.0	890	0.345
-27.0	894	0.347
-26.0	898	0.348
-25.0	902	0.350
-24.0	906	0.351
-23.0	910	0.353
-22.0	914	0.354
-21.0	918	0.356
-20.0	922	0.357
-19.0	926	0.359
-18.0	929	0.360
-17.0	933	0.361
-16.0	937	0.363
-15.0	941	0.364
-14.0	945	0.366
-13.0	949	0.367
-12.0	953	0.369
-11.0	957	0.370
-10.0	961	0.372
-9.0	965	0.373
-8.0	969	0.375
-7.0	973	0.376
-6.0	977	0.378
-5.0	980	0.379
-4.0	984	0.380
-3.0	988	0.382
-2.0	992	0.383
-1.0	996	0.385
0.0	1000	0.386
1.0	1004	0.388
2.0	1008	0.389
3.0	1012	0.391
4.0	1016	0.392
5.0	1020	0.394
6.0	1023	0.395
7.0	1027	0.396
8.0	1031	0.398
9.0	1035	0.399
10.0	1039	0.401
11.0	1043	0.402
12.0	1047	0.404
13.0	1051	0.405
14.0	1055	0.406
15.0	1058	0.408
16.0	1062	0.409
17.0	1066	0.411
18.0	1070	0.412
19.0	1074	0.413
20.0	1078	0.415
21.0	1082	0.416
22.0	1086	0.418
23.0	1090	0.419
24.0	1093	0.420
25.0	1097	0.422
26.0	1101	0.423
27.0	1105	0.425
28.0	1109	0.426
29.0	1113	0.428
30.0	1117	0.429
31.0	1121	0.431
32.0	1124	0.432
33.0	1128	0.433
34.0	1132	0.435
35.0	1136	0.436
36.0	1140	0.438
37.0	1144	0.439
38.0	1148	0.441
39.0	1152	0.442
40.0	1155	0.443
41.0	1159	0.445
42.0	1163	0.446
43.0	1167	0.448
44.0	1171	0.449
45.0	1175	0.451
46.0	1179	0.452
47.0	1182	0.453
48.0	1186	0.455
49.0	1190	0.456
50.0	1194	0.458
51.0	1198	0.459
52.0	1202	0.461
53.0	1205	0.462
54.0	1209	0.463
55.0	1213	0.465
56.0	1217	0.466
57.0	1221	0.467
58.0	1225	0.469
59.0	1229	0.470
60.0	1232	0.471
61.0	1236	0.473
62.0	1240	0.474
63.0	1244	0.476
64.0	1248	0.477
65.0	1252	0.479
66.0	1255	0.480
67.0	1259	0.481
68.0	1263	0.483
69.0	1267	0.484
70.0	1271	0.486
71.0	1275	0.487
72.0	1278	0.488
73.0	1282	0.490
74.0	1286	0.491
75.0	1290	0.493
76.0	1294	0.494
77.0	1297	0.495
78.0	1301	0.497
79.0	1305	0.498
80.0	1309	0.499
81.0	1313	0.501
82.0	1317	0.502
83.0	1320	0.503
84.0	1324	0.505
85.0	1328	0.506
86.0	1332	0.508
87.0	1336	0.509
88.0	1339	0.510
89.0	1343	0.512
90.0	1347	0.513
91.0	1351	0.515
92.0	1355	0.516
93.0	1358	0.517
94.0	1362	0.519
95.0	1366	0.520
96.0	1370	0.522
97.0	1374	0.523
98.0	1377	0.524
99.0	1381	0.525
100.0	1385	0.527
101.0	1389	0.528
102.0	1393	0.530
103.0	1396	0.531
104.0	1400	0.532
105.0	1404	0.534
106.0	1408	0.535
107.0	1412	0.537
108.0	1415	0.538
109.0	1419	0.539
110.0	1423	0.541
111.0	1427	0.542
112.0	1430	0.543
113.0	1434	0.545
114.0	1438	0.546
115.0	1442	0.547
116.0	1446	0.549
117.0	1449	0.550
118.0	1453	0.551
119.0	1457	0.553
120.0	1461	0.554
121.0	1464	0.555
122.0	1468	0.557
123.0	1472	0.558
124.0	1476	0.560
125.0	1479	0.561
126.0	1483	0.562
127.0	1487	0.564
128.0	1491	0.565
129.0	1494	0.566
130.0	1498	0.567
131.0	1502	0.569
132.0	1506	0.570
133.0	1510	0.572
134.0	1513	0.573
135.0	1517	0.574
136.0	1521	0.576
137.0	1525	0.577
138.0	1528	0.578
139.0	1532	0.580
140.0	1536	0.581
141.0	1539	0.582
142.0	1543	0.584
143.0	1547	0.585
144.0	1551	0.586
145.0	1554	0.587
146.0	1558	0.589
147.0	1562	0.590
148.0	1566	0.592
149.0	1569	0.593
150.0	1573	0.594
151.0	1577	0.596
152.0	1581	0.597
153.0	1584	0.598
154.0	1588	0.600
155.0	1592	0.601
156.0	1596	0.602
157.0	1599	0.603
158.0	1603	0.605
159.0	1607	0.606
160.0	1610	0.607
161.0	1614	0.609
162.0	1618	0.610
163.0	1622	0.612
164.0	1625	0.613
165.0	1629	0.614
166.0	1633	0.615
167.0	1636	0.617
168.0	1640	0.618
169.0	1644	0.619
170.0	1648	0.621
171.0	1651	0.622
172.0	1655	0.623
173.0	1659	0.625
174.0	1662	0.626
175.0	1666	0.627
176.0	1670	0.629
177.0	1674	0.630
178.0	1677	0.631
179.0	1681	0.632
180.0	1685	0.634
181.0	1688	0.635
182.0	1692	0.636
183.0	1696	0.638
184.0	1699	0.639
185.0	1703	0.640
186.0	1707	0.642
187.0	1711	0.643
188.0	1714	0.644
189.0	1718	0.645

Temp. [°C]	Resistance [Ω]	Terminal voltage [V]
190.0	1722	0.647
191.0	1725	0.648
192.0	1729	0.649
193.0	1733	0.651
194.0	1736	0.652
195.0	1740	0.653
196.0	1744	0.655
197.0	1747	0.656
198.0	1751	0.657
199.0	1755	0.658
200.0	1758	0.659
201.0	1762	0.661
202.0	1766	0.662
203.0	1769	0.663
204.0	1773	0.665
205.0	1777	0.666
206.0	1780	0.667
207.0	1784	0.669
208.0	1788	0.670
209.0	1791	0.671
210.0	1795	0.672
211.0	1799	0.674
212.0	1802	0.675
213.0	1806	0.676
214.0	1810	0.678
215.0	1813	0.679
216.0	1817	0.680
217.0	1821	0.681
218.0	1824	0.683
219.0	1828	0.684
220.0	1832	0.685
221.0	1835	0.686
222.0	1839	0.688
223.0	1843	0.689
224.0	1846	0.690
225.0	1850	0.692
226.0	1854	0.693
227.0	1857	0.694
228.0	1861	0.695
229.0	1865	0.697
230.0	1868	0.698
231.0	1872	0.699
232.0	1875	0.700
233.0	1879	0.702
234.0	1883	0.703
235.0	1886	0.704
236.0	1890	0.705
237.0	1894	0.707
238.0	1897	0.708
239.0	1901	0.709
240.0	1905	0.711
241.0	1908	0.712
242.0	1912	0.713
243.0	1915	0.714
244.0	1919	0.716
245.0	1923	0.717
246.0	1926	0.718
247.0	1930	0.719
248.0	1934	0.721
249.0	1937	0.722

Temp. [°C]	Resistance [Ω]	Terminal voltage [V]
250.0	1941	0.723
251.0	1944	0.724
252.0	1948	0.726
253.0	1952	0.727
254.0	1955	0.728
255.0	1959	0.729
256.0	1962	0.730
257.0	1966	0.732
258.0	1970	0.733
259.0	1973	0.734
260.0	1977	0.736
261.0	1980	0.737
262.0	1984	0.738
263.0	1988	0.739
264.0	1991	0.740
265.0	1995	0.742
266.0	1998	0.743
267.0	2002	0.744
268.0	2006	0.746
269.0	2009	0.747
270.0	2013	0.748
271.0	2016	0.749
272.0	2020	0.750
273.0	2024	0.752
274.0	2027	0.753
275.0	2031	0.754
276.0	2034	0.755
277.0	2038	0.757
278.0	2042	0.758
279.0	2045	0.759
280.0	2049	0.760
281.0	2052	0.761
282.0	2056	0.763
283.0	2060	0.764
284.0	2063	0.765
285.0	2067	0.766
286.0	2070	0.768
287.0	2074	0.769
288.0	2077	0.770
289.0	2081	0.771
290.0	2085	0.773
291.0	2088	0.774
292.0	2092	0.775
293.0	2095	0.776
294.0	2099	0.777
295.0	2102	0.778
296.0	2106	0.780
297.0	2110	0.781
298.0	2113	0.782
299.0	2117	0.784
300.0	2120	0.785
301.0	2124	0.786
302.0	2127	0.787
303.0	2131	0.788
304.0	2134	0.789
305.0	2138	0.791
306.0	2142	0.792
307.0	2145	0.793
308.0	2149	0.794
309.0	2152	0.796

Temp. [°C]	Resistance [Ω]	Terminal voltage [V]
310.0	2156	0.797
311.0	2159	0.798
312.0	2163	0.799
313.0	2166	0.800
314.0	2170	0.802
315.0	2173	0.803
316.0	2177	0.804
317.0	2181	0.805
318.0	2184	0.806
319.0	2188	0.808
320.0	2191	0.809
321.0	2195	0.810
322.0	2198	0.811
323.0	2202	0.812
324.0	2205	0.814
325.0	2209	0.815
326.0	2212	0.816
327.0	2216	0.817
328.0	2219	0.818
329.0	2223	0.820
330.0	2226	0.821
331.0	2230	0.822
332.0	2234	0.823
333.0	2237	0.824
334.0	2241	0.826
335.0	2244	0.827
336.0	2248	0.828
337.0	2251	0.829
338.0	2255	0.830
339.0	2258	0.831
340.0	2262	0.833
341.0	2265	0.834
342.0	2269	0.835
343.0	2272	0.836
344.0	2276	0.838
345.0	2279	0.839
346.0	2283	0.840
347.0	2286	0.841
348.0	2290	0.842
349.0	2293	0.843
350.0	2297	0.845
351.0	2300	0.846
352.0	2304	0.847
353.0	2307	0.848
354.0	2311	0.849
355.0	2314	0.850
356.0	2318	0.852
357.0	2321	0.853
358.0	2325	0.854
359.0	2328	0.855
360.0	2332	0.856
361.0	2335	0.857
362.0	2339	0.859
363.0	2342	0.860
364.0	2346	0.861
365.0	2349	0.862
366.0	2353	0.863
367.0	2356	0.864
368.0	2360	0.866
369.0	2363	0.867

Temp. [°C]	Resistance [Ω]	Terminal voltage [V]
370.0	2367	0.868
371.0	2370	0.869
372.0	2373	0.870
373.0	2377	0.871
374.0	2380	0.872
375.0	2384	0.874
376.0	2387	0.875
377.0	2391	0.876
378.0	2394	0.877
379.0	2398	0.878
380.0	2401	0.879
381.0	2405	0.881
382.0	2408	0.882
383.0	2412	0.883
384.0	2415	0.884
385.0	2419	0.885
386.0	2422	0.886
387.0	2426	0.888
388.0	2429	0.889
389.0	2432	0.890
390.0	2436	0.891
391.0	2439	0.892
392.0	2443	0.893
393.0	2446	0.894
394.0	2450	0.896
395.0	2453	0.897
396.0	2457	0.898
397.0	2460	0.899
398.0	2463	0.900
399.0	2467	0.901
400.0	2470	0.902

NI1000TK5000

Temp. [°C]	Resistance [Ω]	Terminal voltage [V]
-30	871.7	0.338
-29	875.8	0.340
-28	880	0.341
-27	884.1	0.343
-26	888.3	0.344
-25	892.5	0.346
-24	896.7	0.348
-23	900.8	0.349
-22	905.1	0.351
-21	909.3	0.352
-20	913.5	0.354
-19	917.7	0.355
-18	922	0.357
-17	926.2	0.359
-16	930.5	0.360
-15	934.7	0.362
-14	939	0.363
-13	943.3	0.365
-12	947.6	0.367
-11	951.9	0.368
-10	956.2	0.370
-9	960.6	0.371
-8	964.9	0.373
-7	969.3	0.375
-6	973.6	0.376
-5	978	0.378
-4	982.4	0.380
-3	986.7	0.381
-2	991.2	0.383
-1	995.6	0.384
0	1000	0.386
1	1004.4	0.388
2	1008.9	0.389
3	1013.3	0.391
4	1017.8	0.393
5	1022.3	0.394
6	1026.7	0.396
7	1031.2	0.398
8	1035.8	0.399
9	1040.3	0.401
10	1044.8	0.403
11	1049.3	0.404
12	1053.9	0.406
13	1058.4	0.408
14	1063	0.409
15	1067.6	0.411
16	1072.2	0.413
17	1076.8	0.415
18	1081.4	0.416
19	1086	0.418
20	1090.7	0.420
21	1095.3	0.421
22	1100	0.423
23	1104.6	0.425
24	1109.3	0.427
25	1114	0.428
26	1118.7	0.430
27	1123.4	0.432
28	1128.1	0.433
29	1132.9	0.435
30	1137.6	0.437
31	1142.4	0.439
32	1147.1	0.440
33	1151.9	0.442
34	1156.7	0.444
35	1161.5	0.446
36	1166.3	0.447
37	1171.2	0.449
38	1176	0.451
39	1180.9	0.453
40	1185.7	0.455
41	1190.6	0.456
42	1195.5	0.458
43	1200.4	0.460
44	1205.3	0.462
45	1210.2	0.463
46	1215.1	0.465
47	1220.1	0.467
48	1225	0.469
49	1230	0.471
50	1235	0.473
51	1240	0.474
52	1245	0.476
53	1250	0.478
54	1255	0.480
55	1260.1	0.482
56	1265.1	0.484
57	1270.2	0.485
58	1275.3	0.487
59	1280.3	0.489
60	1285.4	0.491
61	1290.6	0.493
62	1295.7	0.495
63	1300.8	0.496
64	1306	0.498
65	1311.1	0.500
66	1316.3	0.502
67	1321.5	0.504
68	1326.7	0.506
69	1331.9	0.508
70	1337.1	0.510
71	1342.4	0.512
72	1347.6	0.513
73	1352.9	0.515
74	1358.2	0.517
75	1363.5	0.519
76	1368.8	0.521
77	1374.1	0.523
78	1379.4	0.525
79	1384.8	0.527
80	1390.1	0.529
81	1395.5	0.531
82	1400.9	0.533
83	1406.3	0.535
84	1411.7	0.537
85	1417.1	0.538
86	1422.5	0.540
87	1428	0.542
88	1433.4	0.544
89	1438.9	0.546
90	1444.4	0.548
91	1449.9	0.550
92	1455.4	0.552
93	1460.9	0.554
94	1466.5	0.556
95	1472	0.558
96	1477.6	0.560
97	1483.2	0.562
98	1488.8	0.564
99	1494.4	0.566
100	1500	0.568
101	1505.6	0.570
102	1511.3	0.572
103	1517	0.574
104	1522.6	0.576
105	1528.3	0.578
106	1534	0.580
107	1539.7	0.582
108	1545.5	0.584
109	1551.2	0.586
110	1557	0.589
111	1562.8	0.591
112	1568.5	0.593
113	1574.4	0.595
114	1580.2	0.597
115	1586	0.599
116	1591.8	0.601
117	1597.7	0.603
118	1603.6	0.605
119	1609.5	0.607
120	1615.4	0.609
121	1621.3	0.611
122	1627.2	0.613
123	1633.2	0.616
124	1639.1	0.618
125	1645.1	0.620
126	1651.1	0.622
127	1657.1	0.624
128	1663.1	0.626
129	1669.1	0.628
130	1675.2	0.630

NTC 10 kΩ

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
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
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
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

PT 3000

Temp. [°C]	Resistance [kΩ]	Terminal voltage [V]
-50	2.823	1.018
-45	2.868	1.033
-40	2.913	1.047
-35	2.957	1.061
-30	3.002	1.076
-25	3.046	1.090
-20	3.090	1.104
-15	3.134	1.118
-10	3.178	1.132
-5	3.222	1.146
0	3.266	1.160
5	3.310	1.173
10	3.353	1.187
15	3.397	1.200
20	3.440	1.214
25	3.484	1.227
30	3.527	1.241
35	3.570	1.254
40	3.613	1.267
45	3.656	1.280
50	3.699	1.293
55	3.742	1.306
60	3.784	1.319
65	3.827	1.332
70	3.869	1.345
75	3.912	1.358
80	3.954	1.370
85	3.996	1.383
90	4.038	1.395
95	4.080	1.408
100	4.122	1.420
105	4.164	1.433
110	4.206	1.445
115	4.247	1.457
120	4.289	1.469
125	4.330	1.481
130	4.371	1.493
135	4.413	1.505
140	4.454	1.517
145	4.495	1.529
150	4.536	1.541

Johnson A99 PTC Thermistor

Temp. [°C]	Resistance [kΩ]	Terminal voltage [V]
-40.0	613	0.240
-35.0	640	0.251
-30.0	668	0.261
-25.0	697	0.272
-20.0	727	0.284
-15.0	758	0.295
-10	789	0.307
-5	822	0.320
0	855	0.332
5	889	0.345
10	924	0.358
15	960	0.371
20	997	0.385
25	1035	0.399
30	1074	0.413
35	1113	0.428
40	1153	0.443
45	1194	0.458
50	1236	0.473
55	1279	0.489
60	1323	0.505
65	1368	0.521
70	1413	0.537
75	1459	0.554
80	1506	0.570
85	1554	0.587
90	1602	0.604
95	1652	0.622
100	1702	0.640
105	1753	0.658
110	1805	0.676
115	1857	0.694
120	1909	0.712

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