

Installing and operating the ILC 2250 BI and ILC 2250 BI-L Inline controllers

User manual

UM EN ILC 2250 BI

User manual

Installing and operating the ILC 2250 BI and ILC 2250 BI-L Inline controllers

UM EN ILC 2250 BI, Revision 02 2026-06-09

This manual is valid for:

Designation	Version	Item No.
ILC 2250 BI	-	1541303
ILC 2250 BI-L	-	1535543
Emalytics	Version 1.11.2 or later	-

111927_en_02

Phoenix Contact GmbH & Co. KG • Flachsmarktstraße 8 • 32825 Blomberg • Germany
phoenixcontact.com

Table of contents

1 For your safety 5
1.1 Purpose of this user manual 5
1.2 Identification of warning notes 5
1.3 Qualification of users 5
1.4 Field of application of the product 6
1.4.1 Intended use 6
1.4.2 Product changes 6
1.5 General safety notes 6
1.6 Network security and cybersecurity 7
1.7 Interface security 8
1.8 Disposal 8

2 Description of the Inline controller 9
2.1 General description of the Inline controller 9
2.2 Processor core 9
2.3 Connection and operating elements 10
2.4 Diagnostic and status indicators 11
2.5 Internal basic circuit diagram 14
2.6 Interfaces 15
2.6.1 Ethernet 15
2.6.2 Serial interfaces 16
2.6.3 LON (ILC 2250 BI-L only) 18
2.6.4 USB interfaces 18
2.6.5 Inline local bus interface 21
2.7 Software 22
2.7.1 I/O server 22
2.7.2 Web-based management 22
2.7.3 Niagara daemon 22
2.8 Inline controller dimensions 23
2.9 Mounting and removing the Inline controller 24
2.10 Power supply 28
2.10.1 Calculating the power dissipation 31
2.10.2 Calculating the maximum permissible ambient temperature (derating) 31
2.10.3 Calculating the current consumption of an Inline station 33
2.10.4 Safety equipment, 24 V segment supply and 24 V main supply 33

3 Software for configuring the Inline controller 35
3.1 General information on software 35

3.2 Configuration tools ... 35
3.2.1 Web-based management ... 35
3.3 Startup ... 37
3.3.1 Assigning the IP address ... 37
3.3.2 Setting the time zone and time ... 37
3.3.3 Network settings, manual reset of IP addresses, access data ... 38
3.3.4 Hardware data point test ... 39
3.4 Ethernet switch for flexible network topologies ... 40
3.5 Integration with the Niagara Framework® ... 42
3.5.1 Local I/O access ... 42
3.5.2 Serial interfaces ... 43
3.6 Open source software ... 45
3.6.1 Licensing information ... 45
3.6.2 Requesting the source code ... 45

4 Technical data and ordering data ... 47
4.1 Technical data ... 47
4.2 Ordering data ILC 2250 BI(-L) ... 50

A Technical appendix ... 51
A 1 Fault avoidance ... 51
A 2 Diagnostics ... 53
A 3 Fault causes and remedies ... 54

B Appendixes ... 55
B 1 List of figures ... 55
B 2 List of tables ... 57
B 3 Index ... 59

1 For your safety

Read this manual carefully and keep it for future reference.

1.1 Purpose of this user manual

This manual will help you to start up and operate the ILC 2250 BI (item no. 1541303) and ILC 2250 BI-L (item no. 1535543) Inline controllers. Hereinafter, this document uses the general term controller, Inline controller, or ILC 2250BI(-L).

1.2 Identification of warning notes

This symbol indicates hazards that could lead to personal injury.

There are three signal words indicating the severity of a potential injury.

DANGER
Indicates a hazard with a high risk level. If this hazardous situation is not avoided, it will result in death or serious injury.

WARNING
Indicates a hazard with a medium risk level. If this hazardous situation is not avoided, it could result in death or serious injury.

CAUTION
Indicates a hazard with a low risk level. If this hazardous situation is not avoided, it could result in minor or moderate injury.

This symbol together with the **NOTE** signal word warns the reader of actions that might cause property damage or a malfunction.

Here you will find additional information or detailed sources of information.

1.3 Qualification of users

The use of products described in this manual is oriented exclusively to:

– Electrically skilled persons or persons instructed by them. The users must be familiar with the relevant safety concepts of automation technology as well as applicable standards and other regulations.
– Qualified application programmers and software engineers. The users must be familiar with the relevant safety concepts of automation technology as well as applicable standards and other regulations.

1.4 Field of application of the product

1.4.1 Intended use

The Inline controller is a modular small-scale controller, which has been specially designed for automation applications in building infrastructure. The device corresponds to degree of protection IP20. The device is designed for use in closed control cabinets or control boxes (junction boxes) with IP54 degree of protection or higher.

The device is designed for applications in building infrastructure and in industrial applications.

1.4.2 Product changes

Modifications to hardware and firmware of the device are not permitted.

Incorrect operation or modifications to the device can endanger your safety or damage the device. Do not repair the device yourself. If the device is defective, please contact Phoenix Contact.

1.5 General safety notes

Observe the country-specific installation, safety, and accident prevention regulations.

During startup and maintenance work, proceed in accordance with the five safety rules of DIN EN 50110-1. In general, the rules should be observed in the order indicated below:

– Disconnect from power source
– Secure against being switched on again
– Determine absence of voltage
– Ground and short-circuit
– Cover or safeguard adjacent live parts

Once the work is complete, perform the above steps again in reverse order.

NOTE: Property damage due to impermissible stress
The IP20 degree of protection (IEC 60529/EN 60529) requires that the device be used in a clean and dry environment. If you use the device outside of the specified limits, this may cause damage to the device.

Do not subject the device to mechanical and/or thermal stress that exceeds the specified limits.

1.6 Network security and cybersecurity

Warning: Risk of unauthorized network access:
As soon as devices are connected to a network, there is a risk of unauthorized access. To ensure the security of your systems, technical and organizational measures should be combined.

General Security Measures

- **Disable communication channels:** Turn off unused interfaces and services.
- **Use strong passwords:** Use complex passwords with a limited lifespan in accordance with current best practices.
- **Restrict access rights:** Only authorized personnel should have access to devices—ideally as few as necessary.
- **Keep firmware up to date:** Always install the latest firmware version, available on the Phoenix Contact product page.
- **Observe IT security requirements:** Follow applicable standards and implement protective measures such as firewalls or virtual networks.
- **Defense-in-depth strategy:** Design your network with multiple layers of security to minimize attack surfaces.
- **Use security appliances:** For security-critical applications, the use of additional devices such as the mGuard series from Phoenix Contact is recommended.

Security Architecture of the Niagara Framework

The ILC 2250 BI fully integrates into the cybersecurity architecture of the Niagara Framework and offers the following protection mechanisms:

- **User roles and permissions:** Fine-grained access control prevents unauthorized access.
- **Data encryption:** Strong encryption secures communication between devices and servers.
- **PKI management:** Integrated Public Key Infrastructure (PKI) management tools enable secure authentication and authorization.
- **Network segmentation:** Critical systems are protected through logical separation.
- **Regular security updates:** The manufacturer provides regular security updates and patches to fix known vulnerabilities and protect the system against the latest threats.

Recommended Additional Measures

- **Security policies and procedures:** Define and enforce binding rules for users and devices.
- **Security awareness and training:** Promote awareness of cybersecurity threats through regular training and user awareness programs.
- **Security reviews and audits:** Regularly review the effectiveness of your protective measures to identify vulnerabilities and ensure that all security measures are effective and up to date.
- **Intrusion Detection/Prevention (IDS/IPS):** Use systems to detect and prevent attacks on the network.

Additional Resources

- **Application Note "INDUSTRIAL SECURITY"** (AH EN INDUSTRIAL SECURITY, 107913). The application note is available for download on the product website of the ILC 2250 BI(-L) (phoenixcontact.com/product/1541303).
- **PSIRT Website:** Security vulnerabilities in Phoenix Contact products are published at phoenixcontact.com/psirt.

1.7 Interface security

To prevent unauthorized eavesdropping and data transmission via the interfaces of the ILC 2250 BI(-L), implement the recommended measures.

Ethernet and USB Interfaces:

- Use secure IP protocols.
- Protect ports and cables from unauthorized physical access, e.g., by using a lockable control cabinet.

Inline Local Bus:

The data transmitted via the Inline Local Bus is not encrypted.

- Protect ports and cables from unauthorized physical access, e.g., by using a lockable control cabinet.

RS-485 Ports and LON Interface:

The data transmitted via the RS-485 ports is not encrypted when using common protocols (e.g., Modbus/RTU).

- Protect ports and cables from unauthorized physical access, e.g., by using a lockable control cabinet.

1.8 Disposal

Disposing of the controller:

The symbol with the crossed-out trash can indicates that this item must be collected and disposed of separately from other waste. Phoenix Contact or public collection sites will take the item back for free disposal. For information on the available disposal options, visit phoenixcontact.com. Delete personal data before returning the item.

Disposing of the packaging:

Dispose of packaging materials that are no longer needed (cardboard packaging, paper, bubble wrap sheets, etc.) with household waste in accordance with the currently applicable national regulations.

2 Description of the Inline controller

2.1 General description of the Inline controller

The ILC 2250 BI/ILC 2250 BI-L controllers look the same, differing in just a few details and functions. Any specific differences are indicated in the corresponding sections of the text where necessary.

The ILC 2250 BI(-L) Inline controller is a modular small-scale controller for Niagara. A special feature of the Inline controller is its scalability, which involves several aspects:

– **Scalable I/Os**

  The Inline controller is a head station for the modular Inline terminal system. You can connect up to 63 Inline terminals to an Inline controller. To this end, a variety of terminal types is available, ranging from digital and analog inputs and outputs with different numbers of channels as well as function terminals for DALI, M-Bus, or serial interfaces.

– **Scalable software**

  The Inline controller has been designed for use with the Niagara Framework® (hereinafter referred to as Niagara). Niagara applications, known as Niagara stations, are created with the Niagara Workbench software tool.
  Niagara's modular nature means its applications are able to fulfil an incredibly wide range of completely different project-specific requirements. If necessary, it is also possible to program your own separate modules and use them in the application.

– **Scalable licensing**

  The license model for Niagara is very flexible: a number of data points are licensed, which are integrated with the Inline controller.
  The license packages are available as initial licenses or as upgrade licenses.

– **Scalable IP network**

  The Inline controller has two IP interfaces that are logically separated from each other, and an integrated Ethernet switch with a total of four external interfaces. Thanks to the configurable assignment of Ethernet interfaces to the two IP interfaces that are separated from each other and the use of the spanning-tree protocol, flexible topologies such as daisy chains and redundant ring structures are possible in the backbone network and in the local controller network.

2.2 Processor core

For detailed information on the processor data, please refer to section "Processor core" (see "Technical data" on page 47).

2.3 Connection and operating elements

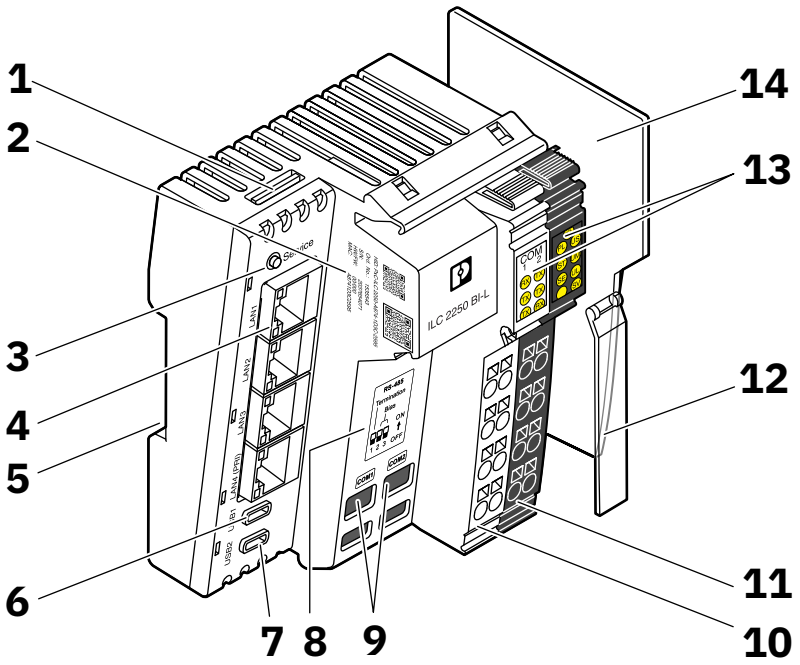


Figure 2-1 Structure of the Inline controller

1 MicroSD card slot

The microSD card slot allows application-specific access to a removable medium for application-specific use (JAVA programming required).

The microSD card is not supplied as standard with the Inline controller.

2 Imprint of the device-specific information
3 Service button
4 Ethernet interfaces (4 x 10/100/1000Base-T)
5 Grounding contacts [1]
6 USB-C interface 1 (OTG)
7 USB-C interface 2
8 Imprint showing assignment of DIP switches (RS-485 Termination/Bias)
9 DIP switches (RS-485 Termination/Bias)
10 Connector 1: bus connector
11 Connector 2: power connector
12 Marking field (2 x)
13 Diagnostic and status indicators
14 End plate

[1] On the rear device side, not visible in Figure 2-1

2.4 Diagnostic and status indicators

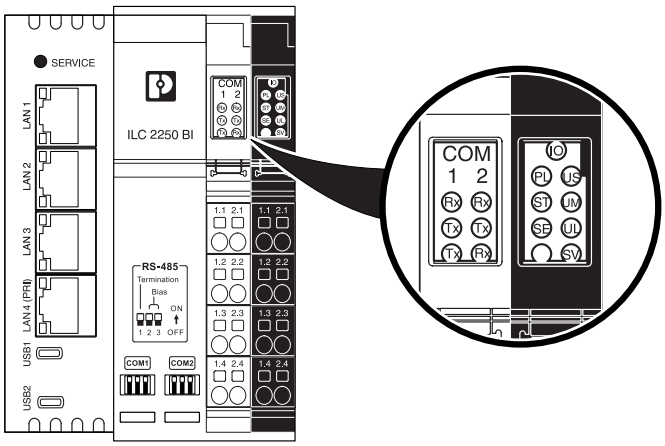


Figure 2-2 Diagnostic and status indicators

Table 2-1 Diagnostic and status indicators

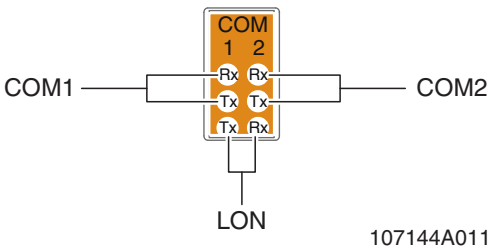
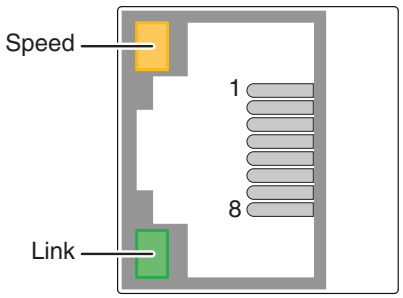
Des..	Color	Status	Meaning
Communication LED			
COM1, COM2, LON		Data traffic of the respective interface  107144A011	
COM1 Rx	Green	On	Data is being received via COM1.
COM1 Tx	Yellow	On	Data is being sent via COM1.
COM2 Rx	Green	On	Data is being received via COM2.
COM2 Tx	Yellow	On	Data is being sent via COM2.
LON Tx	Yellow	On	Data is being sent via LON. (ILC 2250 BI-L only)
LON Rx	Green	On	Data is being received via LON. (ILC 2250 BI-L only)

Table 2-1 Diagnostic and status indicators [...]

Des..	Color	Status	Meaning
I/O status LED			
IO		Status of the Niagara platform	
		Off	The I/O server has not started.
	Green	On	Communication with the Inline terminals is error-free.
	Yellow	On	Communication with the Inline terminals is interrupted. It is possible that no Inline terminals have been attached or that the Inline terminals are not correctly snapped in.
Process status LEDs			
PL	Yellow	Status of the Niagara platform	
		Off	The process has not started.
		Flashing with 2 s cycle duration, 10% (on): 90% (off)	The process is running and requires less than 10% of the processor time.
		Flashing with 2 s cycle duration, 50% (on): 50% (off)	The process is running and requires between 10% and 50% of the processor time.
		Flashing with 2 s cycle duration, 90% (on): 10% (off)	The process is running and requires more than 50% of the processor time.
ST	Yellow	Status of the Niagara application	
		Off	The process has not started.
		Flashing with 2 s cycle duration, 10% (on): 90% (off)	The process is running and requires less than 10% of the processor time.
		Flashing with 2 s cycle duration, 50% (on): 50% (off)	The process is running and requires between 10% and 50% of the processor time.
		Flashing with 2 s cycle duration, 90% (on): 10% (off)	The process is running and requires more than 50% of the processor time.
SE	Yellow	Status of the I/O server	
		Off	The process has not started.
		Flashing with 2 s cycle duration, 10% (on): 90% (off)	The process is running and requires less than 10% of the processor time.
		Flashing with 2 s cycle duration, 50% (on): 50% (off)	The process is running and requires between 10% and 50% of the processor time.
		Flashing with 2 s cycle duration, 90% (on): 10% (off)	The process is running and requires more than 50% of the processor time.
PL, ST and SE	Yellow	Running light	Software update is being performed.

Table 2-1 Diagnostic and status indicators [...]

Des..	Color	Status	Meaning
Supply LEDs			
US	Green	Off	No voltage present in the segment circuit.
		On	Voltage present in the segment circuit (+24 V DC).
UM	Green	Off	No voltage present in the main circuit.
		On	Voltage present in the main circuit (+24 V DC).
UL	Green	Off	U_{BK} (24 V supply), U_L (logic circuit) not OK
		On	U_{BK} (24 V supply), U_L (logic circuit) OK
Service-LED			
SV	Red	Off	Normal operation
		Flashing 5 Hz/on	See 3.3.3 and “Resetting to default settings” on page 38
Ethernet status LEDs			
Speed, Link		Each Ethernet interface (LAN 1 ... LAN 4) has two LEDs that signal the connection and communication status of the interface. 	
Speed	Yellow	Off	100/10 Mbps
		On	1 Gbps
Link	Green	Off	No electrical connection to network
		Briefly off	Package transmission
		On	Electrical connection to network

2.5 Internal basic circuit diagram

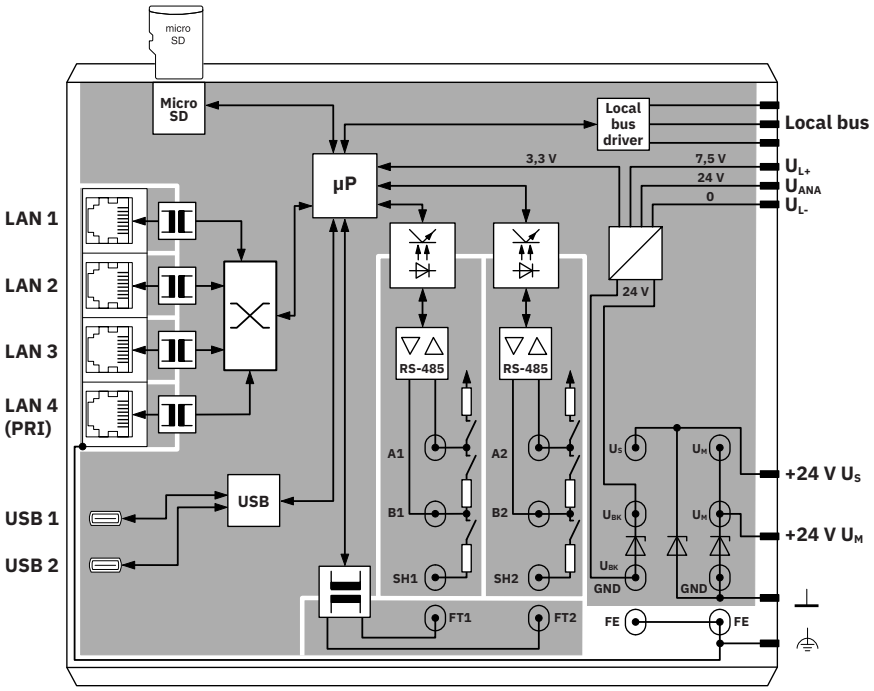


Figure 2-3 Internal basic circuit diagram

Key:

Ethernet switch

Microprocessor

Optocoupler

Power supply unit

Inputs/outputs, shown as RS-485 driver (generator/receiver)

Transmitter

Electrically isolated areas

The basic circuit diagram applies to the device without the power connector inserted (see “Connection and operating elements” on page 10). Please note that for the supplied power connector, terminal points 1.2 and 2.2, 1.3 and 2.3 as well as 1.4 and 2.4 are bridged in the connector and therefore the connections U_{BK} and U_M as well as the two GND connections are each connected to each other when the connector is inserted.

2.6 Interfaces

2.6.1 Ethernet

The integrated Ethernet switch has four external Ethernet interfaces, which can optionally be assigned to the two independent IP interfaces of the processor. In the delivery state, eth0 is connected to LAN 3 and LAN 4, and eth1 is connected to LAN 1 and LAN 2.

The Ethernet interfaces have the following properties:

– Shielded RJ45 ports
– 10/100/1000Base-T, automatic detection
– Automatic MDI/MDI-X crossover detection

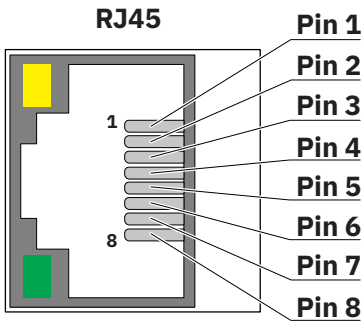


Figure 2-4 Connection assignment of Ethernet interfaces

Table 2-2 Connection assignment of Ethernet interfaces

Pin	10Base-T (10 Mbps)	100Base-T (100 Mbps)	1000Base-T (1000 Mbps)
1	TD+	TD+	BI_DA+
2	TD-	TD-	BI_DA-
3	RD+	RD+	BI_DB+
4			BI_DC+
5			BI_DC-
6	RD-	RD-	BI_DB-
7			BI_DD+
8			BI_DD-

The Ethernet interfaces are able to detect and correct an interchanged receive path pair (RD+/RD-). This means you can use crossover and patch cables regardless of whether the remote station is a further end device or a switch or hub.

The maximum range of 100 m between Ethernet devices is only ensured if you use Ethernet cables that comply with at least CAT 5 of IEEE 802.3.

Observe the bending radii of the Ethernet cables used.

2.6.2 Serial interfaces

The two RS-485 interfaces have switchable bias and termination resistors and are electrically isolated from each other and from the rest of the circuit.

The bus connector combines the connections for both RS-485 interfaces and the LON TP/FT-10 interface (ILC 2250 BI-L only).

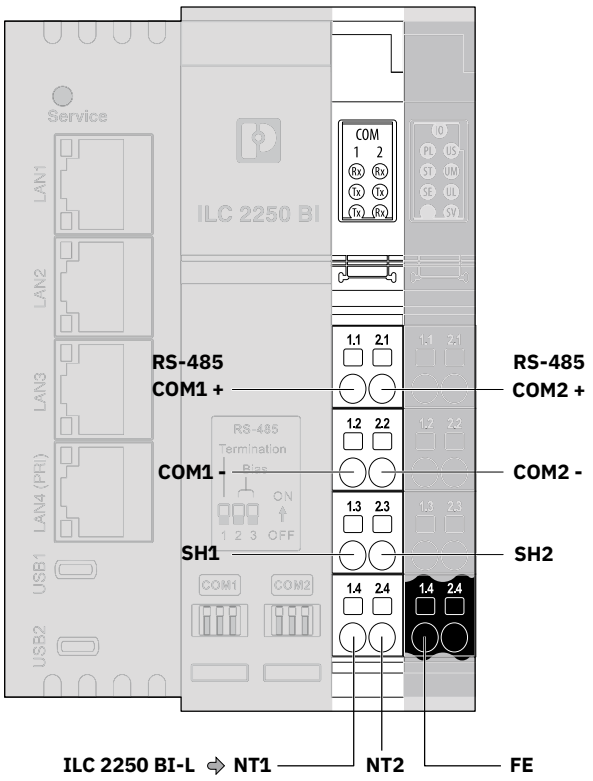


Figure 2-5 Connections of the bus connector

Table 2-3 Connection assignment of the bus connector

Terminal point	Designation	Function
1.1	COM1 +	COM1 RS-485 data signal + (positive)
1.2	COM1 -	COM1 RS-485 data signal – (negative)
1.3	SH1	COM1 shield connection
1.4	NT1	LON TP/FT-10 polarity-independent (ILC 2250 BI-L only)
2.1	COM2 +	COM2 RS-485 data signal + (positive)

Table 2-3 Connection assignment of the bus connector

Terminal point	Designation	Function
2.2	COM2 -	COM2 RS-485 data signal – (negative)
2.3	SH2	COM2 shield connection
2.4	NT2	LON TP/FT-10 polarity-independent (ILC 2250 BI-L only)

For the RS-485 interfaces, you must observe the polarity of the data cables and the correct wiring of the network with termination and bias resistors. The Inline controller has corresponding resistors, which can be switched on via DIP switches. The connections of the shield connections to the FE connection (functional ground) are capacitive.

You can add further serial interfaces in the form of Inline terminals (Modbus, RS-232, RS-485, RS-422; see also Section “Serial interfaces” on page 43).

RS-485 Termination/ Bias

RS-485 networks are executed in a bus topology and are terminated at both ends with a termination resistor between the data lines. Furthermore, the bus lines are brought once to a defined quiescent level with bias resistors. The Inline controller has resistor networks for termination (120 Ω) and quiescent potential setting (biasing of 510 Ω each) of the RS-485 networks connected with COM1 or COM2 according to BACnet MS/TP specifications. Each individual resistor can therefore be separately switched on via DIP switch.

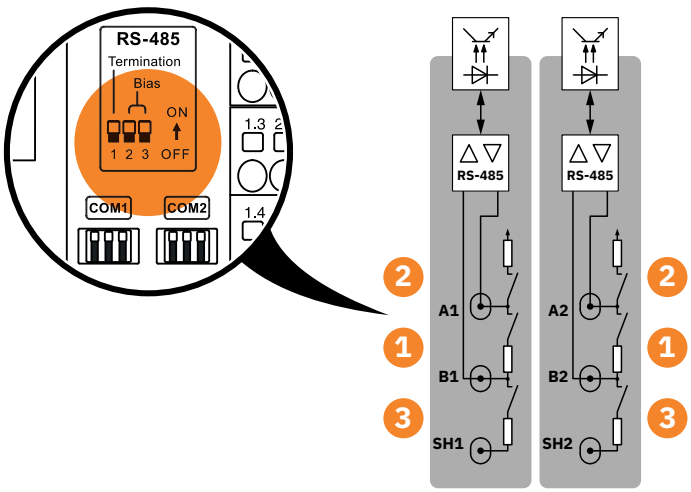


Figure 2-6 Assignment of DIP switches for RS-485 termination

2.6.3 LON (ILC 2250 BI-L only)

The ILC 2250 BI-L Inline controller has one LON interface in accordance with the CEA-709 standard for connecting to LON TP/FT-10 networks directly (Figure 2-5).

Ensure compliance with LonMark wiring guidelines (www.lonmark.org) when connecting devices featuring LonWorks technology. Attach network terminators that correspond to the network topology.

If using shielded cables, you can connect the shield to the FE connection of the supply terminal to prevent a static charge developing. You do not have to take the polarity of the data cable into account here.

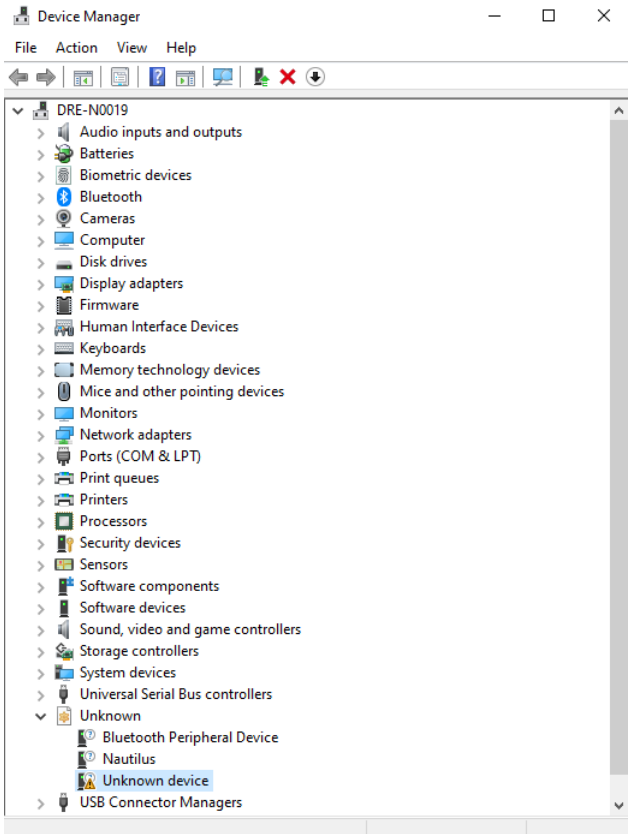
2.6.4 USB interfaces

Both USB-C interfaces can be used as USB hosts, e.g., for connecting a USB WLAN stick. USB 1 is also OTG-capable and therefore also enables local IP communication for access to web-based management and the Niagara Workbench. To do this, connect the USB 1 connection of the controller to a USB port on your PC. This causes a network adapter to be automatically installed under Windows 11 (USB NCM host device).

Manual installation of the USB NCM network adapter on Windows 10

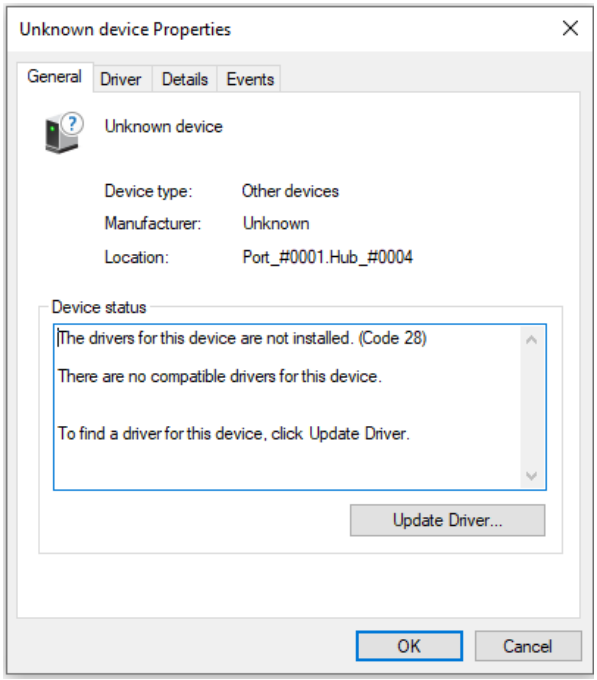
When the USB 1 connection is connected to a PC with Windows 10, the controller is detected as an *“Unknown device”*.

1 ILC 2250 BI(-L) controller is found as “*Unknown device*”

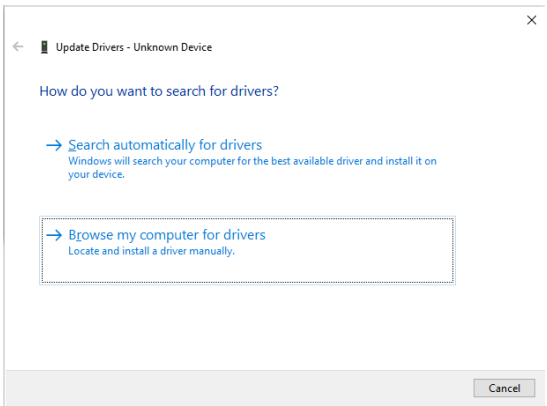


The driver must be installed manually with the following steps.

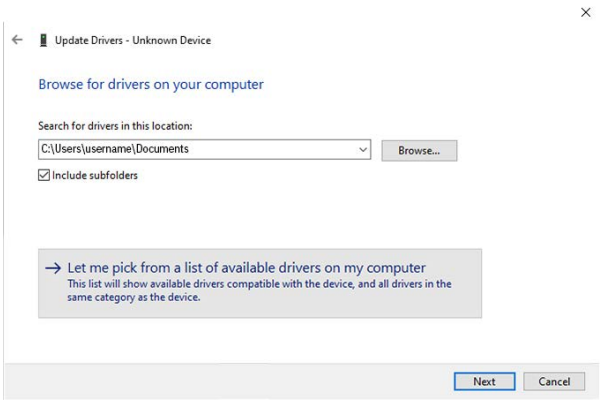
2 Right-click the device and select *“Update driver”*.



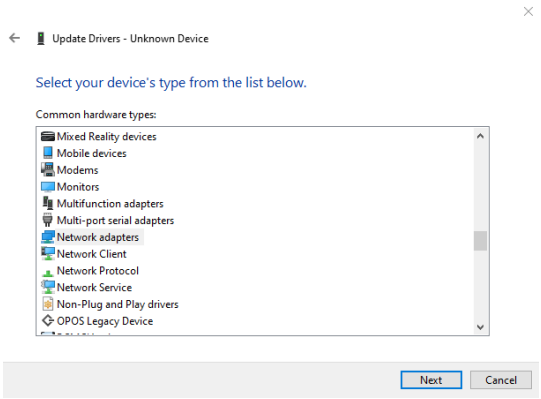
3 Select the option *“Browse my computer for drivers”*



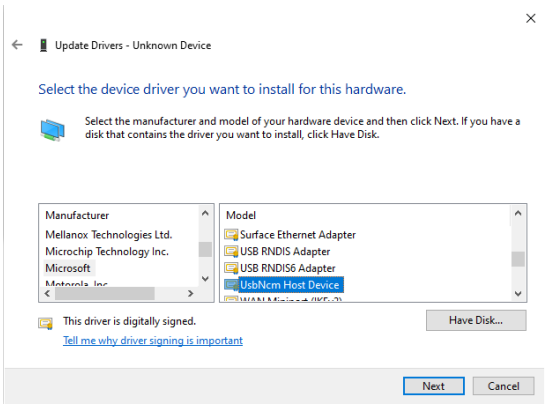
4 Select the option *“Let me pick from a list of available drivers on my computer”*



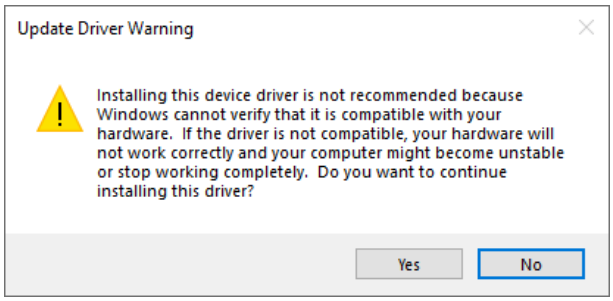
5 Select the *“Network adapter”* type.



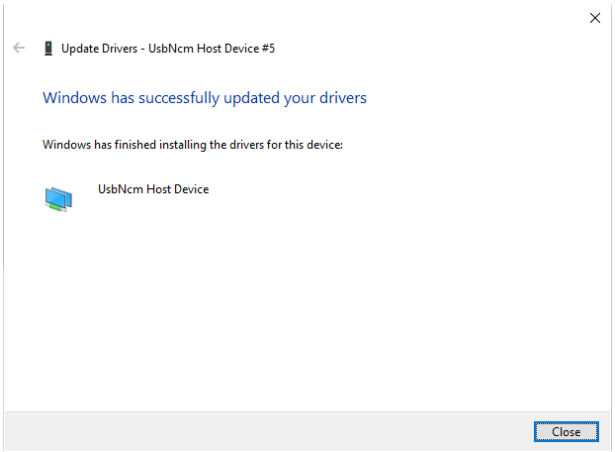
6 Navigate to the manufacturer “Microsoft” and select “UsbNcm Host Device” as the model.



7 Accept the warning and click “Yes”



8 The driver has been installed and the controller appears in the network status of the PC as an Ethernet adapter



2.6.5 Inline local bus interface

The Inline local bus interface enables up to 63 Inline terminals to be connected. It consists of the communication channel to the Inline terminals and the power supply to the Inline terminals as well as the connected sensors and actuators.

2.7 Software

A Linux operating system runs on the Inline controller, where multiple applications are executed in parallel.

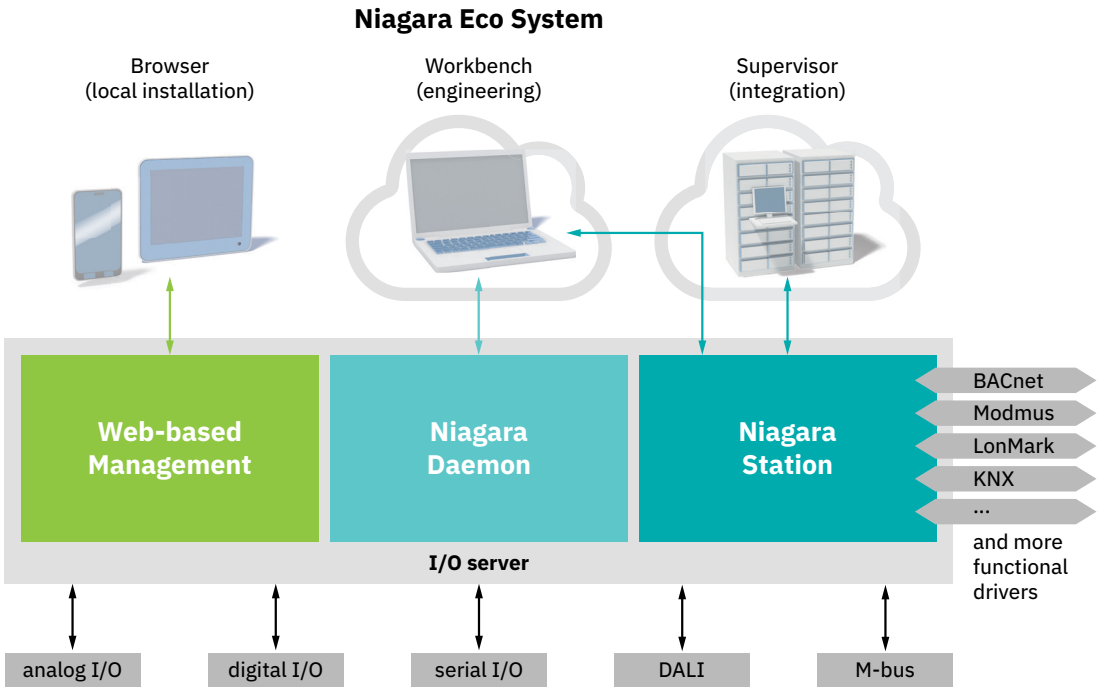


Figure 2-7 Structure of the Inline controller software

2.7.1 I/O server

The I/O server controls the terminals of the Inline controller and therefore the access to the hardware data points. Communication between Niagara and the I/O server takes place via a TCP connection.

2.7.2 Web-based management

The startup website can be accessed via Ethernet and USB 1. Here you can set IP addresses, switch configuration, date, time, and time zone, view operating parameters such as memory usage and CPU temperature, and perform software updates.

2.7.3 Niagara daemon

The Niagara daemon takes care of controller administration. With the Niagara Workbench and a platform connection to the Niagara daemon, you can configure the Inline controller and load software updates as well as a Niagara application (station). The Niagara application (station) can be started automatically by the Niagara daemon.

You can modify the application via an application connection to the Niagara Workbench. This allows you to use all the functions of the Niagara Framework®:

– Data point integration via a variety of (open) protocols (LON, BACnet, KNX, Modbus, and others) with data standardization
– System functions (time switch, alarms, trend recording)
– Web visualization
– etc.

2.8 Inline controller dimensions

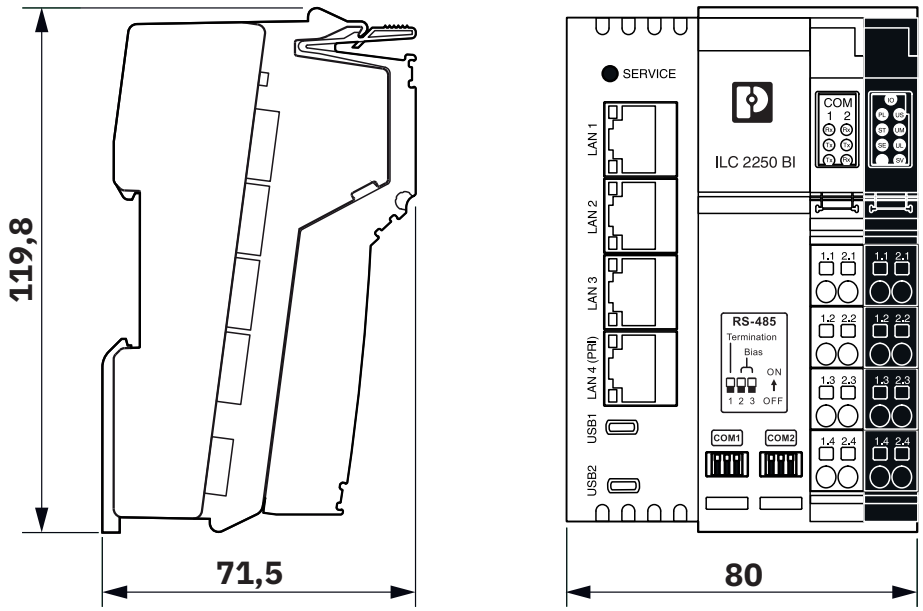


Figure 2-8 Inline controller dimensions [mm]

2.9 Mounting and removing the Inline controller

NOTE: Dangerous contact voltage

During any work on the controller, switch off the power supply to the Inline station and ensure the supply voltage is protected against unauthorized reactivation.

For notes and instructions on mounting and removing Inline terminals, please refer to the IB IL SYS PRO UM user manual (for INTERBUS), the IL SYS INST UM Inline installation manual, or the Inline system manual for your bus system.

An Inline station is set up by mounting the individual components side by side. No tools are required. Mounting the components side by side automatically creates potential and bus signal connections between the individual station components.

The components are mounted perpendicular to the DIN rail.

Mounting location

Like all other terminals in the Inline product family, the Inline controller has IP20 protection and is designed for use in a closed control cabinet or control box (junction box) with degree of protection IP54 or higher.

DIN rail

The Inline controller is mounted on a 35 mm standard DIN rail.

Fix the DIN rail on which the Inline controller is mounted in several places, especially in the area around the Inline controller controller. This makes it easier to remove the Inline controller.

End bracket

Mount end brackets on both sides of the Inline station. The end brackets ensure that the Inline station is correctly mounted. They secure the Inline station on both sides and keep it from moving from side to side on the DIN rail. Phoenix Contact recommends using CLIPFIX 35-5 end brackets (item no. 3022276).

End plate

The mechanical end of an Inline station is the end plate. It has no electrical function. It protects the station against ESD pulses and the user against dangerous contact voltages. The end plate is supplied with the Inline controller.

NOTE: Risk of damage during mounting and removal if an Inline terminal is left in position.

When mounting or removing the Inline controller, it must be tilted. Tilting the Inline controller when mounting or removing it can damage the locking clips and jumper contacts of the adjacent Inline terminal on the right.

- Before mounting or removing the Inline controller, detach the right-hand connector of the Inline controller and the adjacent Inline terminal on the right.

Mounting position

Mount the Inline controller horizontally (as shown in Figure 2-9 on page 25). The temperature range specified in “Ambient conditions” on page 49 is only guaranteed if the controller is mounted in this position.

The Inline controller must only be mounted or removed within a temperature range from -25°C to +55°C.

Mounting

When mounting the Inline controller, proceed as shown in Figure 2-9 and Figure 2-10:

- Disconnect the station from the power supply.
- Place the Inline controller onto the rail from above (Figure 2-9, A), then push it onto the rail fully (Figure 2-9, B).
- Next, mount all the electronic bases that will be required to set up the Inline station. Observe the information provided in the aforementioned user manuals.

Ensure that **all** the springs and slots of adjacent Inline terminals interlock properly.

- Once you have mounted all the electronic bases, attach the relevant connectors to them.
  First, insert the front connector catch into the front latching mechanism (Figure 2-10, A).
  Then push the connector toward the electronic base until it engages in the rear latching mechanism (Figure 2-10, B).

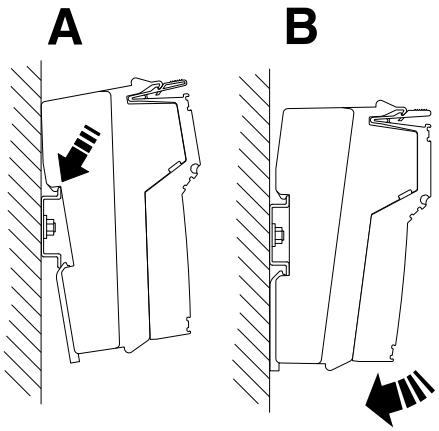


Figure 2-9 Mounting the Inline controller (1)

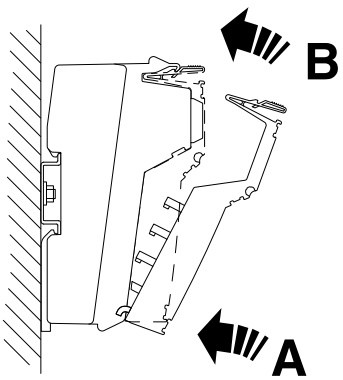


Figure 2-10 Mounting the Inline controller (2)

Removal

When removing the Inline controller from the DIN rail, proceed as shown in Figure 2-12:

- Disconnect the Inline station from the power supply.

NOTE: Risk of damage during mounting and removal if an Inline terminal is left in position.
When mounting or removing the Inline controller, it must be tilted. Tilting the Inline controller when mounting or removing it can damage the locking clips and jumper contacts of the adjacent Inline terminal on the right.

- Before mounting or removing the Inline controller, detach the right-hand connector of the Inline controller and the adjacent Inline terminal on the right.

- Detach all the connectors from the Inline controller.
  - Lever each of the connectors out by pressing on the rear connector catch (Figure 2-12, A).
  - Detach the connectors (Figure 2-12, B).
- If Inline terminals are mounted on the Inline controller (see Figure 2-11):
  - Detach the following connectors:
  – All connectors of the Inline terminal that are connected directly (A1 to A4)
  – The adjacent connector of the subsequent Inline terminal (B1).
  - Remove the directly adjacent Inline terminal (A).

Observe the information provided in the user manuals mentioned on page 24.

- Insert a tool in the base latches of the Inline controller and pull gently upwards (Figure 2-13, A). Pull out the Inline controller from the DIN rail (Figure 2-13, B, C).

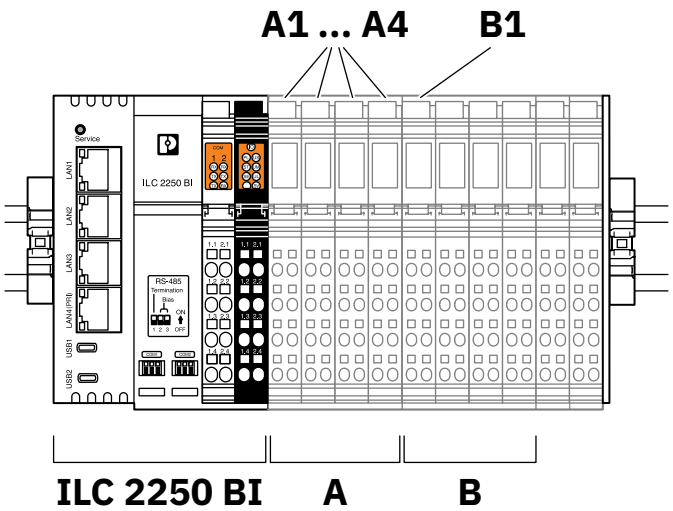


Figure 2-11 Connectors to be removed when Inline terminals are attached

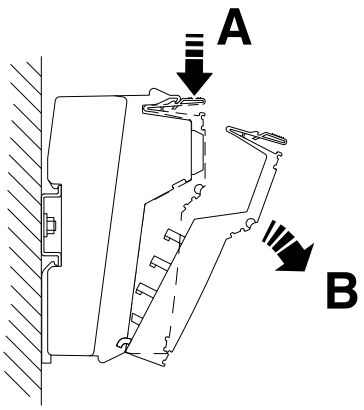


Figure 2-12 Removing the Inline controller (1)

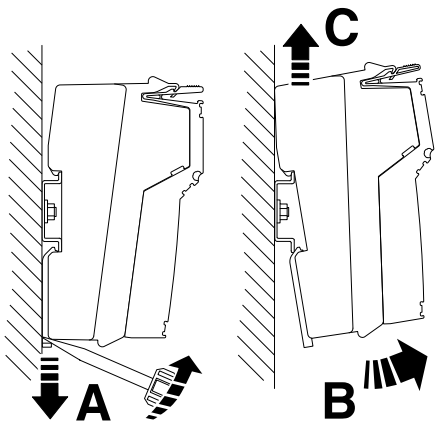


Figure 2-13 Removing the Inline controller (2)

Replacing an Inline controller

If you want to replace an Inline controller within an Inline station, proceed as described above (mounting and removing). Make sure to remove the adjacent Inline terminal on the right both when removing and mounting the Inline controller. Only attach this Inline terminal again when the Inline controller has been mounted.

Take special care to ensure that **all** the springs and slots of adjacent Inline terminals interlock properly.

2.10 Power supply

The Inline controller is operated using a 24 V DC voltage. From this 24 V DC, the Inline controller generates the communications voltage for the logic circuit and the analog voltage for the analog circuit. The logic circuit supplies power to the internal bus, including the communications chips of all connected Inline terminals. The analog circuit supplies an auxiliary voltage for analog signals.

WARNING: Danger of device failure due to thermal overload

Observe the derating of the communications power and the supply to the analog Inline terminals when connecting the Inline terminals, as well as the maximum current carrying capacity of the Inline terminals.

For more information on derating, please refer to Section “Calculating the maximum permissible ambient temperature (derating)” on page 31.

Furthermore, the Inline controller has connections to supply power to the main and segment voltage of the Inline station.

Figure 2-14 shows the basic circuit diagram for the connection of supply voltages. Table 2-3 contains the connection assignment of the power terminal when the power connector is inserted. Terminal points 1.2 and 2.2, 1.3 and 2.3 as well as 1.4 and 2.4 of the power connector are each bridged directly to each other in the connector.

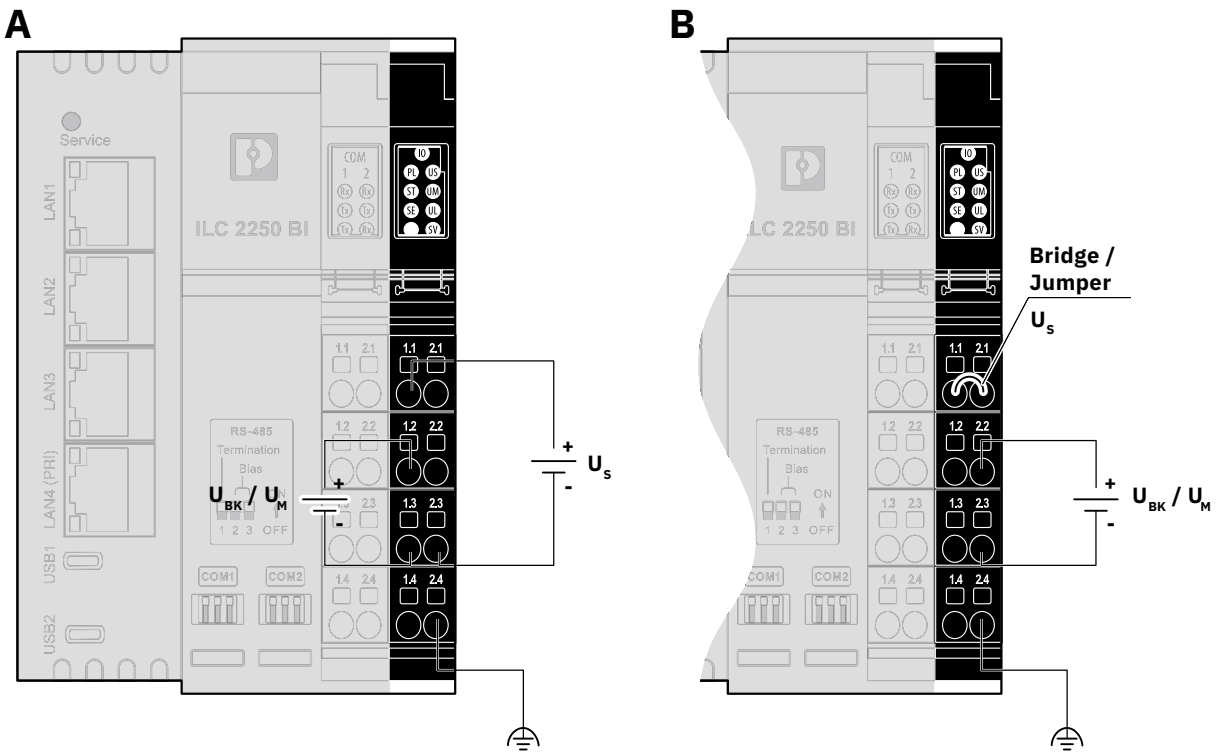


Figure 2-14 Supply U_M/U_{BK} and U_S from different voltage sources (A) and from one common voltage source (B)

WARNING: Danger of device failure due to thermal overload

Ensure that the current flowing through the Inline terminals and potential bridges does not exceed 8 A.

FE functional ground is routed to the potential bridges. The Inline controller is grounded automatically when it is mounted onto a grounded DIN rail. The functional ground serves to discharge interference.

The functional ground connection (terminal points 1.4 and 2.4) must also be connected to the DIN rail using a 1.5 mm^2 conductor and a grounding terminal (see Figure 2-15).

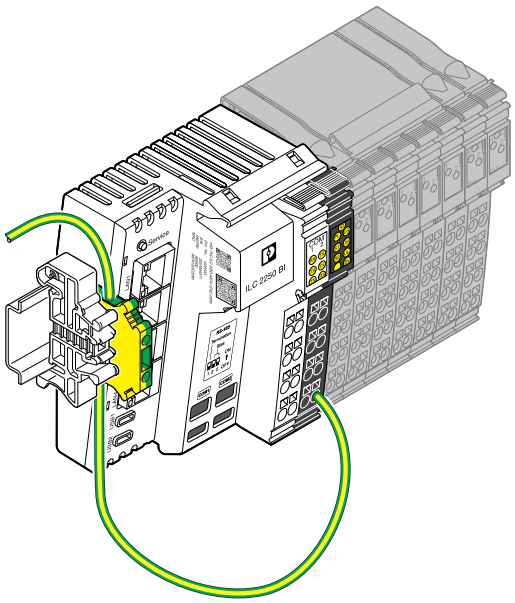


Figure 2-15 Schematic view of functional ground of the Inline controller

Table 2-4 Connection assignment of the power terminal

Terminal point	Designation	Function
1.1	U_S	24 V DC segment supply (segment circuit) The fed-in voltage is routed to the Inline terminals via the potential bridges.
2.1 1.2, 2.2	U_{BK}/U_M	U_{BK}: 24 V DC supply to the Inline controller and feed to the logic circuit and analog circuit U_M: 24 V DC main voltage (main circuit) The fed-in voltage is routed through the Inline terminals via the potential marshalling.
1.3, 2.3	GND	Reference ground for the internal bus and the Inline terminals (logic and analog circuit) as well as the main and segment supply (main and segment circuit).
1.4, 2.4	FE	Functional ground Functional ground must be connected to the 24 V power connector. The contacts are connected to the potential jumpers and the FE springs on the housing floor, so that when snapping onto a grounded DIN rail, the Inline controller is grounded.

2.10.1 Calculating the power dissipation

The power dissipation of the ILC 2250 BI(-L) Inline controller mainly consists of the following parameters:

– Power dissipation of the CPU (P_{CPU}), depending on the CPU load (L_{CPU})
– Power dissipation of the Ethernet interfaces (P_{ETH}), depending on their operating mode
– Power dissipation due to load on the logic circuit (P_L) and the USB ports (P_{USB})

$$\mathbf{P_V = P_{CPU} + P_{ETH} + P_L + P_{USB}}$$

$$\mathbf{P_{CPU} = 2.8\ W + 0.016\ W \times L_{CPU}\ [\%]}$$

The power dissipation of the Ethernet ports is:

$$\mathbf{P_{ETH} = (0.035x + 0.040y + 0.35z)\ W}$$

– x ... Number of ports in 100 Mbit EEE off operating mode
– y ... Number of ports in 1 GBit EEE on operating mode[1)]
– z ... Number of ports in 1 GBit EEE off operating mode

1) In this operating mode, the temperature rise depends on the volume of data. The factor is in the range from 0.04 to 0.35. 100% data utilization in corresponding operating mode *Energy Efficient Ethernet (EEE) off.*

Power dissipation due to load current at U_L (I_L) is:

$$\mathbf{P_L = 0.7\ V \times I_L}$$

The power dissipation of the USB ports (I_{USB}) is:

$$\mathbf{P_{USB} = 0.6\ V \times I}_{USB}$$

With a recommended maximum average CPU load of 50% and maximum load on all interfaces, the power dissipation is approx. 7 W.

2.10.2 Calculating the maximum permissible ambient temperature (derating)

The following information is only valid in horizontal mounting position. For other mounting positions, a safety reserve of 7 K must be taken into account.

The maximum ambient temperature is T_{max} = 55°C.

Depending on the load on the ILC 2250 BI(-L), it may be necessary to reduce the maximum ambient temperature so that a specific CPU temperature is not exceeded to protect the device. The CPU temperature can be displayed via web-based management. If the CPU temperature exceeds 100°C, the CPU power is automatically reduced.

The maximum permissible ambient temperature can be calculated based on the contributions of the most important heat sources in the device for temperature rise:

$$\mathbf{T_{max} = 70°C - T_{CPU} - T_{ETH} - T_L - T_{USB}}$$

The temperature rise due to CPU load is:

$$\mathbf{T_{CPU} = 0.137°C\ L_{CPU}\ [\%]}$$

– L_{CPU} ... CPU load

The temperature rise due to Ethernet operating mode is:

$$\mathbf{T_{ETH} = (0.15x + 0.5y + 2z)°C}$$

– x ... Number of ports in 100 Mbit EEE off operating mode
– y ... Number of ports in 1 GBit EEE on operating mode[1)]
– z ... Number of ports in 1 GBit EEE off operating mode

1) In this operating mode, the temperature rise depends on the volume of data. The factor is in the range from 0.5 to 2. 100% data utilization in corresponding operating mode *Energy Efficient Ethernet (EEE) off*.

The temperature rise due to load current U_L (I_L) is:

T_L = 2.6°C I_L [A]

The temperature rise due to USB current load (I_{USB}) is:

T_{USB} = 2.4°C I_{USB} [A]

2.10.2.1 Examples

Example 1:

L_{CPU} = 50%

4 ports 100 Mbit EEE off

I_L = 2 A, I_{USB} = 0

T_{max} = 70°C -T_{CPU} – T_{ETH} – T_L – T_{USB}

T_{max} = 70°C – 0.137°C x 50 – 0.15°C x 4 – 2.6°C x 2 – 2.4°C x 0

T_{max} = 70°C – 6.9°C – 0.6°C – 5.2°C = 57.3°C

Result: 57.3°C > 55°C, the ambient temperature does not have to be reduced.

Example 2:

L_{CPU} = 50%

2 ports 100 Mbit EEE off, 2 ports 1 Gbit EEE off

I_{UL} = 2 A, I_{USB} = 0.5 A

T_{max} = 70°C – 0.137°C x 50 – (0.15 x 2 + 2 x 2)°C – 2.6°C x 2 – 2.4°C x 0.5

T_{max} = 70°C – 6.9°C – 4.3°C – 5.2°C – 1.2°C = 52.4°C

Result: The ambient temperature must be reduced to 52°C.

2.10.3 Calculating the current consumption of an Inline station

For power supply unit dimensioning, you must determine the current consumption of the entire Inline station. It is calculated using:

$$\mathbf{I_{BK} = 0.245\ A + 0.24 \times I_{USB} + 0.35 \times I_L + I_{ANA}}$$

I_{BK} = Current consumption of the Inline station

I_{USB} = Power requirement of the connected USB devices (max. 500 mA per port)

I_L = Logic voltage U_L requirement of the connected Inline terminals (max. 2.0 A)

I_{ANA} = Analog voltage U_{ANA} requirement of the connected Inline terminals (max. 500 mA)

For the current consumption of the connected USB devices, Inline terminals, actuators, and sensors, refer to the respective data sheets. The current consumption is determined by the specific application.

In the interests of making an assessment, it will usually be sufficient to just check whether power can be supplied via the Inline controller, i.e., without power or boost terminals.

If no boost terminals are used and without taking the U_M and U_S circuits into account, the maximum current consumption of the Inline controller with Inline terminals connected is 1.7 A.

The power requirements of the actuators and sensors must be added to this figure, whereby the Inline terminals and potential bridges restrict the maximum current to 8 A.

Please plan sufficient reserves when selecting the power supply unit. Also consider that input capacitance will cause a momentary current rise several times greater than the nominal current at the point of switch-on. Power supply units with overcurrent shutdown must offer a sufficient response delay to prevent starting problems.

2.10.4 Safety equipment, 24 V segment supply and 24 V main supply

Surge voltage

Segment and main supply are protected against surge voltage by input protective diodes, which can be destroyed in the event of continuous overload.

Reverse polarity

Segment and main supply are protected against reverse polarity by polarity protection diodes, which cause the upstream fuses to melt due to high current in the event of an error.

The segment supply and the main supply have the same reference potential.

Each 24 V area must be fused externally. The power supply unit must be able to supply four times the nominal current of the external fuse; this is to ensure that it trips the fuse in the event of an error.

3 Software for configuring the Inline controller

3.1 General information on software

The Inline controller is configured and programmed via the Niagara Workbench.

Table 3-1 Software settings in the Inline controller delivery state

Ethernet:	eth0 – LAN 3/LAN 4	IP address 192.168.1.1 Subnet mask 255.255.255.0
	eth1 – LAN 1/LAN 2	Disabled
Login details for the Niagara platform:	User: phoenix Password: inline	

3.2 Configuration tools

3.2.1 Web-based management

Overview

The controller has web-based management for the most important settings and diagnostic information:

- Overview:
  - CPU, RAM, and program memory utilization
  - CPU and board temperature
- Network/General:
  - Energy Efficiency Ethernet (EEE) and host name
- Network/Switch:
  - Assignment of Ethernet connections to the network adapters, RSTP, transmission speed
- Network/LAN:
  - IP address settings for LAN interface, DNS, NAT
- Network/WAN:
  - IP address settings for WAN interface
- System & Update:
  - Restart once and with time control, reset to default settings
  - Firmware update
  - Date and time, NTP
  - Open source software licenses

Call

To access web-based management via LAN:

- Connect your PC to the Inline controller via LAN (see Section “Startup” on page 37)
- Open a web browser and call the following URL:
  https://<IP address>:8443
- Use the same access data as in Section “Network settings, manual reset of IP addresses, access data” on page 38

For access via USB, connect your PC to the Inline controller via USB 1 (see Section “USB interfaces” on page 18):

- Open a web browser and call the following URL: *https://169.254.252.10:8443*
- Log in with the Niagara access data.

Operation

After successfully logging in, you will be taken to the “Overview” page. Switch language via the globe icon in the header. Navigate to the individual categories via the navigation tree on the left-hand side.

Terminals

On the “Terminals” page you can see all connected Inline terminals. You can manually override the Inline terminals for data point tests (3.3.4 “Hardware data point test”).

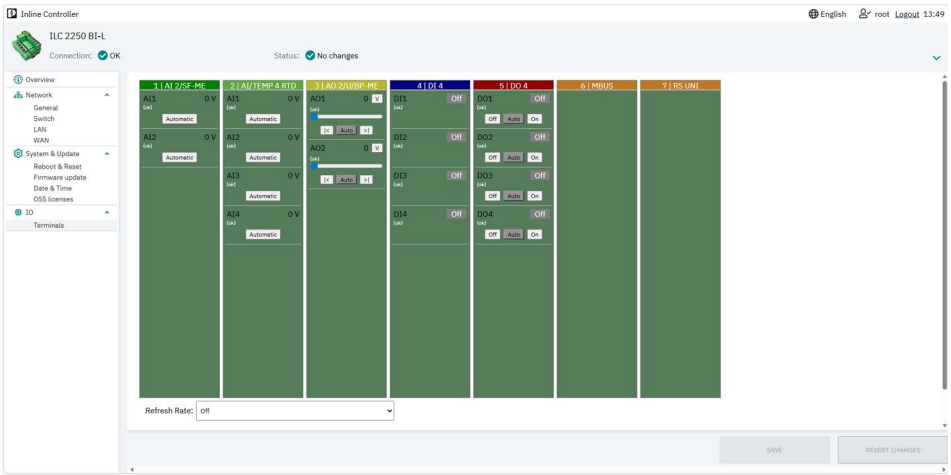


Figure 3-1 Commissioning page: “Terminals”

For a detailed description of the functions, click the information icon.

Note on firmware update

On the “System & Update, Firmware Update” page, you can perform firmware and software updates. Distribution files (Clean and Nre-Core) that match the device and have a valid signature are accepted.

3.3 Startup

In the delivery state, the Inline controller has a standard configuration. Settings such as IP address, time, and time zone must be specifically defined.

The following software components of the controller are active in the delivery state:

– Web-based management (WBM) for the most important basic settings.
– The Niagara daemon functions as a communication partner for a platform connection with the Niagara Workbench (user: “phoenix”, password: “inline”). However, no application is running – you can load this as part of Niagara commissioning.

A change to the IP addresses or time zone is only completely effective following a restart of the Inline controller.

3.3.1 Assigning the IP address

The default IP address of the first network adapter (LAN or eth0) of the Inline controller is 192.168.1.1, the subnet mask is 255.255.255.0. The second network adapter (WAN or eth1) is disabled in the delivery state. There are several ways of configuring the IP address:

– Web-based management (see 3.2.1 on page 35)
– Niagara Workbench via platform connection to the Niagara daemon under “TCP/IP Configuration”

Note: If no gateway is used when configuring the network settings, the entry depends on the controller used:

– **With the ILC 2250 BI(-L), the gateway fields remain empty in this case.**
– For controllers of the predecessor series ILC 2050 BI(-L), the value "0.0.0.0" must be entered for the gateway.

3.3.2 Setting the time zone and time

The time is held in a buffered real-time clock (RTC). The buffer capacitor is generally discharged on delivery, which means that the date, time, and time zone must be set. This can be done via web-based management or the Niagara Workbench:

– Start up web-based management (3.2.1 on page 35)
– Niagara Workbench via platform connection to the Niagara daemon under “Platform Administration, Change Date/Time”

3.3.3 Network settings, manual reset of IP addresses, access data

Enter network settings in the Niagara Workbench.

1. Connect the controller to the local network of your PC via the connections LAN 3 or LAN 4.
2. Start up the controller via the Niagara Workbench. To do this, open a connection to the Niagara platform. The following default settings apply:
   - IP address: 192.168.1.1
   - Subnet: 255.255.255.0
   - User: phoenix
   - Password: inline
3. After the first login, you will be prompted to assign a passphrase for controller encryption.
4. Then create a new user with a new password.
5. Edit the IP settings in the area “Platform/TCP/IP Configuration”.

Note: If no gateway is used when configuring the network settings, the entry depends on the controller used:

- **With the ILC 2250 BI(-L), the gateway fields remain empty in this case.**
- For controllers of the predecessor series ILC 2050 BI(-L), the value "0.0.0.0" must be entered for the gateway.

Store your access details securely. There is no way to reset the password without resetting the device to default settings.

Resetting to default settings

1. Disconnect the supply voltage.
2. Press the service button and reconnect the supply voltage.
3. Keep the button pressed after the service LED has started to flash red.
4. Keep the button pressed for approx. 3 s until the service LED lights up for approx. 1 s to start the reset process. You can now release the key.
5. The device boots with the default settings.

3.3.4 Hardware data point test

The commissioning of the hardware and the commissioning of the software are often carried out separately in terms of personnel and time. Ideally, the electrical installation (installation and cabling) is completed with a data point test and corresponding handover protocol. You can use the integrated commissioning page for the data point test. All input and output signals of the Inline terminals are clearly displayed here. If required, you can manually override outputs and terminal parameters such as measuring ranges on a channel-by-channel basis. This means that a data point test is also possible without application software. When leaving the commissioning page or logging out of web-based management (manually or after time-out), all overrides are automatically reset.

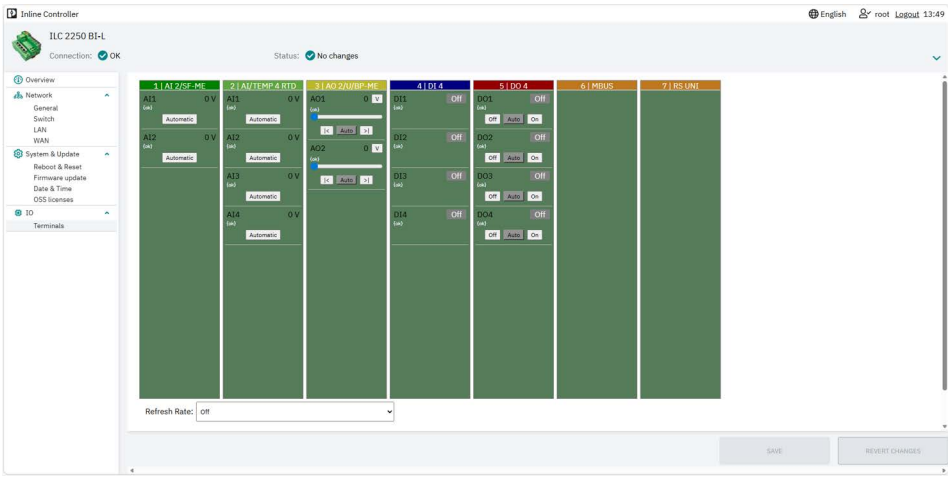


Figure 3-2 Data point test via commissioning page

3.4 Ethernet switch for flexible network topologies

The integrated Ethernet switch connects the two network adapters to the four external Ethernet connections of the controller and enables Ethernet cabling without additional switches. It supports:

– The optional assignment of the network adapters to external Ethernet connections
– The Rapid Spanning Tree Protocol (RSTP) for managing redundant Ethernet topologies

The Ethernet switch is configured via web-based management (see 3.2.1 on page 35)

3.4.0.1 Assignment of the network adapters to Ethernet connections

The two internal network adapters en0/LAN and en1/WAN are routed to the four external Ethernet connections LAN 1 to LAN 4 via the Ethernet switch.

See Table 3-2 to Table 3-5 for the possible combinations.

Table 3-2 LAN 1 ...LAN 4 at en0, en1 is disabled

LAN 1	en0/LAN
LAN 2	
LAN 3	
LAN 4	

Table 3-3 LAN 2 ... LAN 4 at en0, LAN 1 at en1

LAN 1	en1/WAN
LAN 2	en0/LAN
LAN 3	
LAN 4	

Table 3-4 LAN 3 ... LAN 4 at en0, LAN 1, LAN 2 at en1 (delivery state)

LAN 1	en1/WAN
LAN 2	
LAN 3	en0/LAN
LAN 4	

Table 3-5 LAN 4 at en0, LAN 1 ... LAN 3 at en1

LAN 1	en1/LAN
LAN 2	
LAN 3	
LAN 4	en0/WAN

If several Ethernet connections are assigned to a network adapter, the network adapter can be accessed via every Ethernet connection. Peer-to-peer communication is possible between the Ethernet interfaces, so several devices can be interconnected in a line topology, see Figure 3-3.

Ethernet communication is not possible between Ethernet connections belonging to different network adapters.

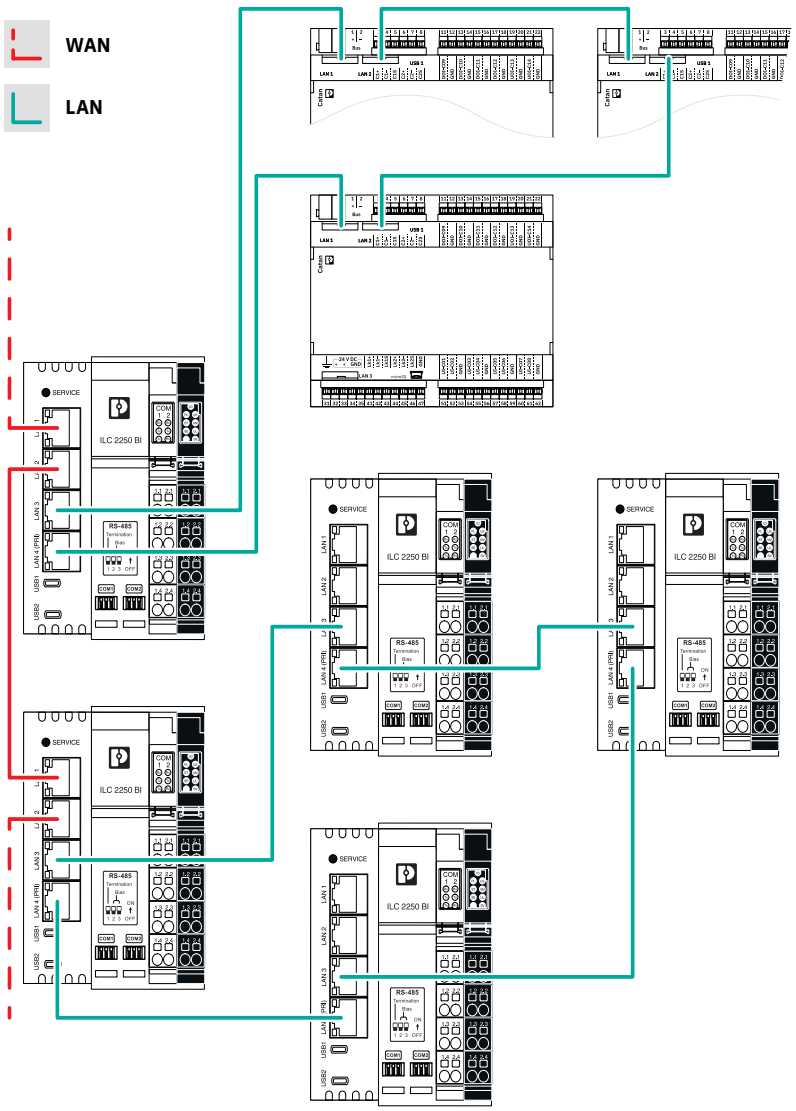


Figure 3-3 Example Ethernet cabling with ILC 2250 BI and Catan controllers

3.5 Integration with the Niagara Framework®

Communication protocols

The Niagara Framework® contains many communication protocols, which are also automatically available in the Inline controller:

- BACnet IP
- BACnet MS/TP (only on COM1 and COM2)
- LonWorks IP852
- LonMark TP/FT-10 (ILC 2250 BI-L only)
- Modbus/TCP
- Modbus/RTU, M-Bus
- KNX/IP
- SNMP
- oBIX
- etc.

You can integrate and link data points from different sources via the communication protocols. In addition, Niagara contains comprehensive processing and system functions such as trend log, alarming, time switch, web visualization, report generators, interfaces to email, SMS, databases, etc. Engineering is carried out with the Niagara Workbench.

3.5.1 Local I/O access

The components of the “SysMikScaIo” module allow you to access the Inline terminals. Here, the Niagara Driver Framework® “Network – Device – Point” approach is applied consistently: “SysMikScaNetwork – terminals – data points (I/O channels)”.

In the “Driver Manager“, standard view of “Station, Config, Drivers”, a “SysmikScaIoNetwork” is created via “New”.

“N Device Manager”

In “N Device Manager”, the standard view of the “SysmikScaIoNetwork”, you can read in the connected Inline terminals via “Discover”. Use “Add” to add the discovered Inline terminals into the application.

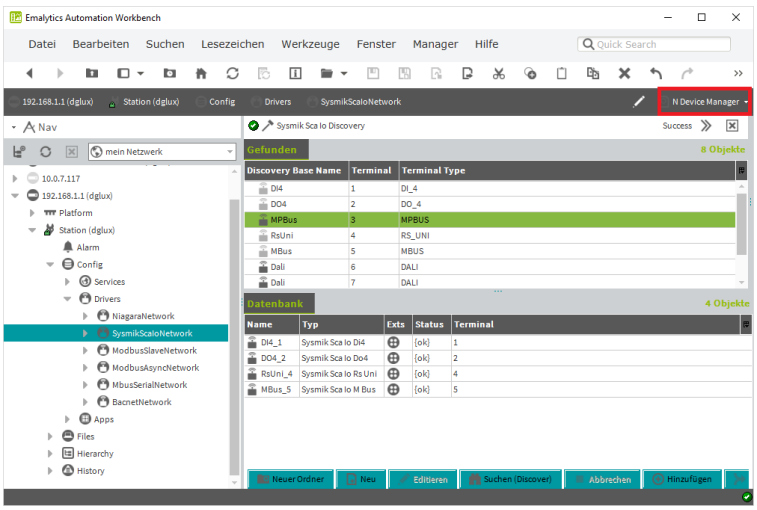


Figure 3-4 “N Device Manager” in the “SysMikScaIoNetwork”

“N Point Manager”

In “N Point Manager”, the standard view of the point folder of the terminal components, you can display the I/O channels available via “Discover”. You can add the available I/O channels into the application as proxy points using “Add”. Some data points have special functions:

– You can parameterize the measuring ranges of the analog input terminals via the additional Properties (Ai type) of the proxy extension.
– You can initialize count values of the counter terminal via the “Init Counter” action of the proxy extension.

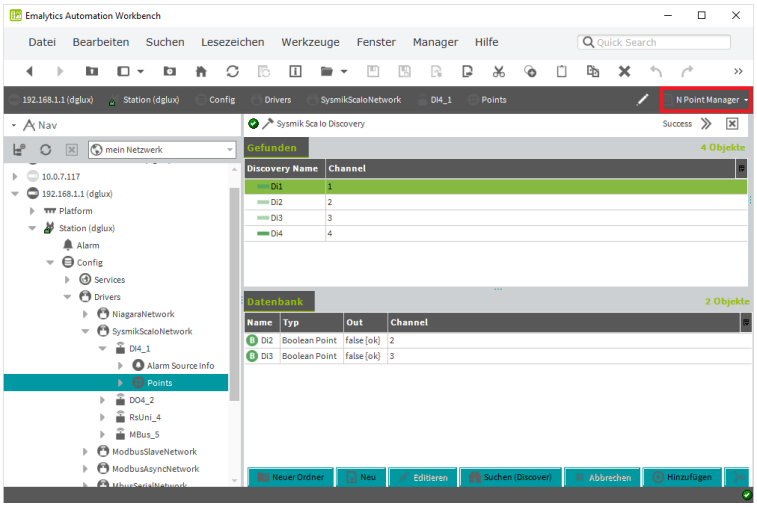


Figure 3-5 “N Point Manager” of a terminal component

3.5.2 Serial interfaces

The Inline controller has two serial RS-485 interfaces, which are also available for any serial protocols via the interface names COM1 and COM2 (see also Section “Serial interfaces” on page 16).

You can add further universal serial interfaces to the Inline controller by attaching Inline terminals of type IB IL RS UNI-PAC (article no. 2700893). These Inline terminals support the RS-232, RS-485, and RS-422 interface standards, which can be parameterized via corresponding terminal components in the SysMikScaNetwork with the Niagara Workbench.
These serial interfaces, added via Inline terminals, can be used for all serial protocols except BACnet MS/TP.

Inline terminals of type IB IL MBUS-PAC (article no. 2701927) extend the Inline controller with serial interfaces corresponding to the M-Bus standard for the connection of up to 30 M-Bus slaves and control by means of the Niagara M-Bus driver.

The interface names of the Inline terminals are issued according to their installation order, beginning with COM3. A summary of all serial interfaces, including their current use (“Owner”) is available under “Station, Config, Services, PlatformServices, SerialPortPlatformServiceNpsdk”.

Example

Figure 3-6 shows this overview for an Inline controller with a total of four serial interfaces – the two serial interfaces of the Inline controller and two further serial interfaces, which were added via Inline terminals:

– COM1: The first RS-485 interface on the Inline controller is occupied by the MS/TP port of the BACnetNetwork.
– COM2: The second RS-485 interface on the Inline controller is assigned to the ModbusSlaveNetwork.
– COM3: The IB IL MBUS-PAC Inline terminal in terminal position 5 is used as an interface of the MbusNetwork.
– COM4: The IB IL RS UNI-PAC Inline terminal in terminal position 4 serves as an interface for the ModbusAsyncNetwork; to this end, interface standard RS-485 is selected in the terminal component's property sheet, in the SysmikScaIoNetwork, under property Rs Type (see Figure 3-7).

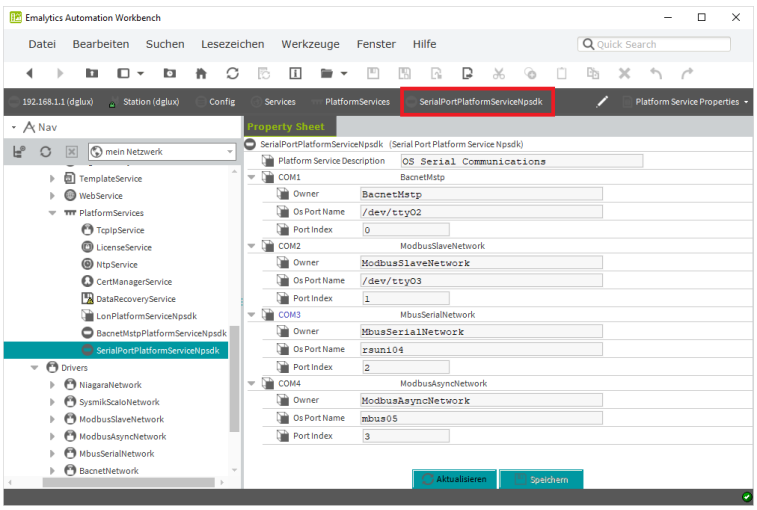


Figure 3-6 SerialPortPlatformServiceNpsdk

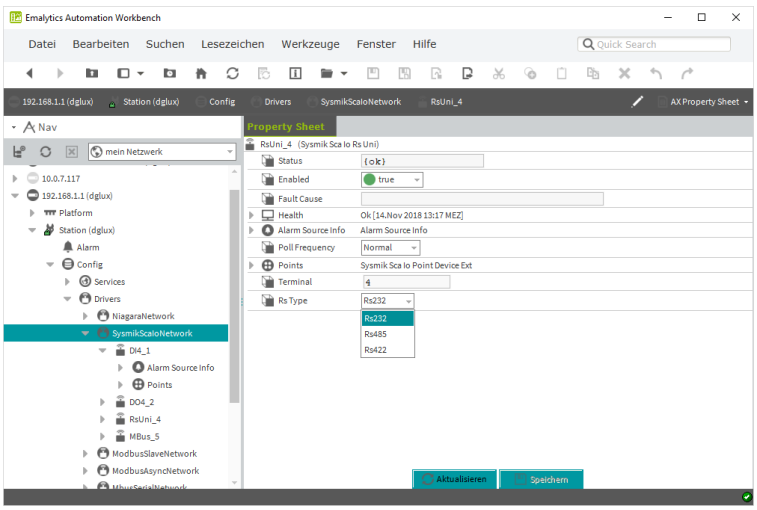


Figure 3-7 IB IL RS UNI-PAC interface parameterization

3.6 Open source software

3.6.1 Licensing information

The controller works with a Linux® operating system.

License information on open source software can be downloaded via web-based management of the ILC 2250 BI/ILC 2250 BI-L under “System, OSS Licenses”.

The archive contains a list of the open source software packages used, information on the applicable license, and the corresponding license texts.

Notes on LGPL software libraries

Any open source software used in the product is subject to the respective license terms, which are not affected by the Phoenix Contact Software License Terms (SLT) for the product. In particular, the licensee may modify the respective open source software in accordance with the applicable license terms. If the licensee wishes to modify an LGPL software library contained in this product, reverse engineering is permitted for debugging such modifications.

Note on OpenSSL

This product includes software developed by the OpenSSL Project for use in the OpenSSL Toolkit

(http://www.openssl.org/).

This product includes cryptographic software written by Eric Young (eay@cryptsoft.com).

3.6.2 Requesting the source code

This product contains software components which are licensed by the rights holder as free software or open source software under the GNU General Public License, version 2.

You can request the source code of these software components in the form of a CD or DVD-ROM for a processing fee of 50 euros within three years after delivery of the product.

To do this, please contact Phoenix Contact After Sales Service in writing at the following address:

Phoenix Contact GmbH & Co. KG

After Sales Service

Flachsmarktstraße 8

32825 Blomberg, Germany

Subject: Source code for ILC 2250 BI/ILC 2250 BI-L

4 Technical data and ordering data

4.1 Technical data

General data	
Dimensions	80 mm x 119.8 mm x 71.5 mm
Weight	Approx. 240 g
Connection data for connectors	
Connection method	Spring-cage connection
Conductor cross-section	
Single-wire/terminal point, rigid	0.08 mm^2 … 1.5 mm^2
Single-wire/terminal point, flexible	0.08 mm^2 … 1.5 mm^2
Single-wire/terminal point, AWG	28 to 16
	Phoenix Contact recommends using conductors with a conductor cross-section of 0.2 mm^2 to 1.5 mm^2.
Processor core	
Processor/clock	Quad ARM® Cortex®-A53/1.6 GHz
LPDDR4 SDRAM	2 GB
eMMC	5 GB
NVRAM	512 KiB non-volatile
RTC	Power reserve for 20 days

Network interface	
Ethernet connection (LAN 1/2/3/4)	4 x 10/100/1000 BASE-T
MDI/MDI-X crossover	Automatic
Aging time	330 s, typical
Electrical isolation LAN 1/2/3/4 to: – Local bus – U_{L+}, U_{L-}, U_{ANA} – +24 V U_S, +24 V U_M, GND – USB1, USB2	Test voltage 1500 V AC, 1 min[1]
Electrical isolation LAN 1 to LAN 2 to LAN 3 to LAN 4	Test voltage 1500 V AC, 1 min[1]
RS-485 connection	
Maximum number of bus devices	256 (1/8 unit load)
Maximum data rate	200 kbps
Electrical isolation RS-485 to (see Figure 2-3): – Local bus – U_{L+}, U_{L-}, U_{ANA} – +24 V U_S, +24 V U_M, GND – USB1, USB2	Test voltage 500 V AC, 50 Hz, 1 min[1)]
Electrical isolation RS-485 A1, B1, SH1 to RS-485 A2, B2, SH2	Test voltage 500 V AC, 50 Hz, 1 min[1)]
TP/FT-10 (ILC 2250 BI-L only)	2-wire twisted-pair bus connection for free topologies
Transceiver	TP/FT-10
Electrical isolation LON vs. (see Figure 2-3): – Local bus – U_{L+}, U_{L-}, U_{ANA} – +24 V U_S, +24 V U_M, GND – USB1, USB2	Test voltage 250 V AC, 50 Hz, 1 min[2)]

1 Separation of functions! The isolation is bridged for interference elimination with an RC filter and does not fulfil the safety regulations for protection against dangerous shock voltages.

2 Separation of functions! The isolation is bridged for interference elimination with a 300 V varistor and does not fulfil the safety regulations for protection against dangerous shock voltages.

Connection of Inline terminals	
Maximum number of Inline terminals in an Inline station	63
Maximum current of the bus controller in the logic range (UL)	2 A
Maximum current carrying capacity of the potential bridges (U_{ANA})	0.5 A
Maximum current carrying capacity of the potential bridges U_M, U_S, and GND (total current)	8 A

Controller supply	
Operating voltage U_{BK}	24 V DC
Maximum permissible voltage range	19.2 V DC ... 30 V DC
Typical current consumption I_{BK} at nominal voltage without local bus device	Approx. 170 mA (25% CPU load, 2 x 1000Base-T communication, without USB)
Current consumption I_{BK} at nominal voltage with local bus devices without U_M and U_S	≤ 1.6 A (load of the 7.5 V communications power with 2 A), load of the 24 V analog voltage with 0.5 A; without USB devices

Ambient conditions	
Degree of protection	IP20 (EN 60529:1991)
Ambient temperature (operating)	-25°C ... +55°C
Permissible temperature (storage/transport)	-25°C ... +85°C
Temperature class	T4
This temperature range is only guaranteed if the Inline controller is mounted horizontally – observe derating!	
Permissible humidity (operation/storage/transport)	0% ... 75%, in accordance with DIN EN 61131-2 (non-condensing, no ice formation)
Permissible air pressure (operation/storage/transport)	70 kPa ... 106 kPa (up to 3000 m above mean sea level)
Resistance of housing material to termites	Resistant
Resistance of housing material to fungal decay	Resistant

Conformance with EMC Directive 2014/30/EC

Immunity test in accordance with EN 61000-6-2

Electrostatic discharge (ESD)	EN 61000-4-2/ IEC 61000-4-2	Criterion B 6 kV contact discharge 8 kV air discharge
Electromagnetic fields	EN 61000-4-3 IEC 61000-4-3	Criterion A Field strength: 10 V/m
Fast transients (burst)	EN 61000-4-4/ IEC 61000-4-4	Criterion B Supply lines: 2 kV Signal/data lines: 1 kV
Transient overvoltage (surge)	EN 61000-4-5 IEC 61000-4-5	Criterion B Signal/data lines: 1 kV Supply lines line-to-line: 0.5 kV Supply lines line-to-earth: 1.0 kV

Conformance with EMC Directive 2014/30/EC		
Conducted disturbance	EN 61000-4-6 IEC 61000-4-6	Criterion A Test voltage 10 V
Noise emission test in accordance with EN 61000-6-3 (residential and commercial spaces)		
Emitted interference	EN 55022	Class B

NOTE: Radio interference

To comply with EMC requirements, please take the following notes into account when installing the device:

- Use USB cables with a maximum length of 3 m.
- The supply cables for the DC power supply must be less than 30 m long.
- Not intended for connection to a DC distribution grid.
- Use shielded cables for the RS-485 connections and ground the cable shields at the ILC 2250 BI(-L).
- In case of Ethernet communication faults, disable EEE mode.

Approvals

For information on the current approvals, visit phoenixcontact.com/product/1541303.

4.2 Ordering data ILC 2250 BI(-L)

Description	Type	Item No.	Pcs./Pkt.
The modular Inline controller for automation applications in infrastructure, energy, and buildings is based on the Niagara Framework®. Four LAN, two USB, and two RS-485 interfaces are integrated. The controller can be extended with numerous Inline I/O modules.	ILC 2250 BI	1541303	1
The modular Inline controller for automation applications in infrastructure, energy, and buildings is based on the Niagara Framework®. Four LAN, two USB, and two RS-485 interfaces as well as one LON interface (CEA-709) are integrated. The controller can be extended with numerous Inline I/O modules.	ILC 2250 BI-L	1535543	1

A Technical appendix

A 1 Fault avoidance

A 1.1 Performance and resource management

All software processes share the available resources (processor time, memory).

The complexity of the applications has a large impact on how resources are utilized, but so too do the interface definitions, particularly the connected I/O terminals. On the one hand, every data point consumes resources simply by existing. On the other hand, each data point is normally processed within the application, thus increasing the application's size.

None of the quantitative data given below is warranted; it serves only as a guide for estimating the load due to connected Inline terminals. Always take the conditions of your specific application into account.

Inline terminals

Up to 63 Inline terminals can be connected to one controller (input/output terminals, function terminals). This is a theoretical maximum number, which is already restricted by the mechanical overall width of the complete station. The more Inline terminals connected, the longer it takes to exchange data between the controller and Inline terminals. Digital input and output terminals have the least significant impact.

If 63 digital input/output terminals are connected, each with 32 channels, the station would have 2016 data points and an overall width of over 3 m. Boost and segment terminals would make the Inline station even wider.

IB IL DALI/PWR-PAC, IB IL DALI-PAC, IB IL DALI/MM-PAC

A DALI terminal can address up to 81 data points (64 individual addresses, 16 group addresses, one broadcast). The amount of resources required will vary, depending on the number of DALI devices and type of control (required resources listed here in ascending order):

– Broadcast addressing (one data point, no status), using scenes where applicable
– Group addressing (few data points, which can only be written when being modified, no status)
– Random addressing (many data points, which can only be written when being modified)
– Random addressing with evaluation of lamp status (many data points, which are polled cyclically)
– Random or group addressing with additional use of DALI sensors

Although, for example, broadcast addressing does not need many resources and so would allow for the maximum of 63 DALI terminals, if the DALI buses are being utilized at a higher level, no more than eight DALI terminals should be connected to an Inline controller. When using DALI sensors in particular, the desired response time is a crucial factor.

IB IL RS UNI-PAC, IB IL RS 232-ECO, IB IL RS 485-ECO, IB IL MBUS-PAC

These Inline terminals act as an interface to a serial bus, to which up to 30 devices (M-Bus) or even more can be connected. The limiting factor here is the required polling or response speed.

In theory, a maximum of 16 serial Inline terminals could be connected. However, no more Inline terminals (e.g., input/output terminals) could then be connected after that. We therefore recommend connecting a maximum of eight serial Inline terminals.

With Modbus/RTU, the maximum number of approximately four to five messages per second can be achieved if one Inline terminal of type IB IL RS UNI-PAC is connected. If eight Inline terminals of type IB IL RS UNI-PAC are connected, the number of messages drops to approximately two per second for each connected Inline terminal.

Showing the available resources

You can use the Niagara Workbench to show the available resources via all the access points:

Platform: “Platform Administration”

Station: “Views, Resource Manager”

The system capacity should not be at 100%, as in this case the time specifications (cycle times) can no longer be fulfilled.

- In this event, optimize your application, e.g., by increasing the intervals (e.g., poll intervals) of the Niagara application.
- Bear in mind that every type of communication during operation generates a processor load. Leave a reserve for this.

A 1.2 Reliability of the nonvolatile flash memory

The Inline controller contains an integrated flash memory for use in an industrial temperature range. The reliability of the flash memory is physically restricted by the frequency of writing operations and the ambient temperature. If large amounts of data are written frequently, this will cause the flash memory to age faster, while a high ambient temperature will reduce the guaranteed data retention time.

Due to the system, the memory load caused by write access is strongly dependent on the application. Write access required when programming or performing software updates can result in large amounts of data being written to the flash memory. However, these amounts are negligible compared to the data volumes generated during regular program-related sequences (such as when saving history data and carrying out a “StationSave”).

The write load created by history data can be ascertained under “Station, Config, Services, PlatformServices, DataRecoveryService”. The size and write frequency of history data should be selected such that a data recovery block is not saved more than once per minute.

“StationSave” should take place much less than once an hour.

With regard to the ambient temperature, the maximum values specified in Section “Technical data” on page 47, taking the mounting position into account (see Section “Mounting and removing the Inline controller” on page 24), should never be exceeded.

A 2 Diagnostics

The most frequent faults arise in conjunction with other devices or components. Therefore, when a fault occurs the Inline controller should not be isolated straightaway; instead, it should be viewed as part of the system as a whole.

Various tools are available for fault localization; these are explained in Section “Diagnostic and status indicators” on page 11:

- Supply LEDs
- Process status LEDs
- I/O status LED
- Communication LEDs
- Service LED
- Ethernet status LEDs

Niagara also features wide-ranging diagnostic tools for analyzing communication in connected automation networks.

Before carrying out a detailed analysis of any fault, ensure that the device is properly wired, is being supplied with power, and has booted up. Pay particular attention to the following:

- All spring terminals and snap-in latches are properly engaged.
- The DIN rail is correctly grounded.
- The functional ground connection of the Inline controller is connected to the DIN rail via a 1.5 mm² conductor with a grounding terminal.
- The UM, US, and UL LEDs are permanently lit.
- The supply voltage is within the specified tolerances (see also 2.10 on page 28 and 4.1 on page 47).

The process status LEDs provide a reliable indication of the operating state (see Section “Diagnostic and status indicators” on page 11). The boot process is only complete when these flash steadily with a brief light-up duration.

A 3 Fault causes and remedies

Table A-1 Fault causes and remedies

Fault	Cause	Remedy
The IP address is unknown.	–	The Inline controller IP addresses can be displayed and modified via the startup website. The access point via the local USB connection operates independently of the IP addresses. • Check the IP settings and adapt them to your application, if necessary (see Section “Assigning the IP address” on page 37).
IP communication is not working.	–	• Use the Ethernet status LEDs to check that the Inline controller is connected correctly. • Check the Ethernet connection between two devices via a ping command. To do this, activate “SFTP/SSH enabled” in “Platform Administration”, “Advanced Options”. • Check the IP addresses and subnet masks of the devices that are supposed to be communicating with one another. In particular, ensure that each IP address is only assigned once and appropriate subnets are assigned.
Access data for the Niagara platform is unknown.	–	If you do not have the access data for the Niagara platform, proceed as follows: • Reset the controller to factory default settings (see 3.3.3 on page 38).

B Appendixes

B 1 List of figures

Section 1

Section 2

Figure 2-1: Structure of the Inline controller 10
Figure 2-2: Diagnostic and status indicators 11
Figure 2-3: Internal basic circuit diagram 14
Figure 2-4: Connection assignment of Ethernet interfaces 15
Figure 2-5: Connections of the bus connector 16
Figure 2-6: Assignment of DIP switches for RS-485 termination 17
Figure 2-7: Structure of the Inline controller software 22
Figure 2-8: Inline controller dimensions [mm] 23
Figure 2-9: Mounting the Inline controller (1) 25
Figure 2-10: Mounting the Inline controller (2) 25
Figure 2-11: Connectors to be removed when Inline terminals are attached 26
Figure 2-12: Removing the Inline controller (1) 27
Figure 2-13: Removing the Inline controller (2) 27
Figure 2-14: Supply UM/UBK and US from different voltage sources (A) and from one common voltage source (B) 29
Figure 2-15: Schematic view of functional ground of the Inline controller 30

Section 3

Figure 3-1: Commissioning page: “Terminals” 36
Figure 3-2: Data point test via commissioning page 39
Figure 3-3: Example Ethernet cabling with ILC 2250 BI and Catan controllers .. 41
Figure 3-4: “N Device Manager” in the “SysMikScaIoNetwork” 42
Figure 3-5: “N Point Manager” of a terminal component 43
Figure 3-6: SerialPortPlatformServiceNpsdk 44
Figure 3-7: IB IL RS UNI-PAC interface parameterization 44

Section 4

Appendix A

Appendix B

B 2 List of tables

Section 1

Section 2

Table 2-1: Diagnostic and status indicators 11
Table 2-2: Connection assignment of Ethernet interfaces 15
Table 2-3: Connection assignment of the bus connector 16
Table 2-4: Connection assignment of the power terminal 30

Section 3

Table 3-1: Software settings in the Inline controller delivery state 35
Table 3-2: LAN 1 ...LAN 4 at en0, en1 is disabled 40
Table 3-3: LAN 2 ... LAN 4 at en0, LAN 1 at en1 40
Table 3-4: LAN 3 ... LAN 4 at en0, LAN 1, LAN 2 at en1 (delivery state) 40
Table 3-5: LAN 4 at en0, LAN 1 ... LAN 3 at en1 40

Section 4

Appendix A

Table A-1: Fault causes and remedies 54

Appendix B

B 3 Index

B

Basic circuit diagram 14

C

Connection elements 10
Current consumption 33

D

Data point test 39
Diagnostic indicators 11
Dimensions 23
DIN rail 24

E

End bracket 24
End plate 24
Ethernet 15

F

Flash memory 52

I

I/O server 22
Interface 15
IP address 37

L

Local bus interface 21
LON 18
LonMark 18

M

Mounting 25
Mounting location 24
Mounting position 24

N

Niagara daemon 22

O

Operating elements 10
Ordering data 50

P

Performance management 51
Power dissipation 31
Power supply 28
Processor core 9

R

Removal 25
Resource management 51
Reverse polarity 33
RS-232 43
RS-422 43
RS-485 16

S

Safety equipment 33
Serial interfaces 16, 43
Startup 37
Status indicators 11
Surge voltage 33

T

Technical data 47
Time and time zone 37

W

Web-based management 22, 35

Please observe the following notes

General terms and conditions of use for technical documentation

Phoenix Contact reserves the right to alter, correct, and/or improve the technical documentation and the products described in the technical documentation at its own discretion and without giving prior notice, insofar as this is reasonable for the user. The same applies to any technical changes that serve the purpose of technical progress.

The receipt of technical documentation (in particular user documentation) does not constitute any further duty on the part of Phoenix Contact to furnish information on modifications to products and/or technical documentation. You are responsible to verify the suitability and intended use of the products in your specific application, in particular with regard to observing the applicable standards and regulations. All information made available in the technical data is supplied without any accompanying guarantee, whether expressly mentioned, implied or tacitly assumed.

In general, the provisions of the current General Terms and Conditions of Phoenix Contact apply exclusively, in particular as concerns any warranty liability.

This manual, including all illustrations contained herein, is copyright protected. Any changes to the contents or the publication of extracts of this document is prohibited.

Phoenix Contact reserves the right to register its own intellectual property rights for the product identifications of Phoenix Contact products that are used here. Registration of such intellectual property rights by third parties is prohibited.

Other product identifications may be afforded legal protection, even where they may not be indicated as such.

How to contact us

Internet

Up-to-date information on Phoenix Contact products and our Terms and Conditions can be found on the Internet at:
phoenixcontact.com

Make sure you always use the latest documentation.
It can be downloaded at:
phoenixcontact.net/products

Subsidiaries

If there are any problems that cannot be solved using the documentation, please contact your Phoenix Contact subsidiary.
Subsidiary contact information is available at phoenixcontact.com.

Published by

Phoenix Contact GmbH & Co. KG
Flachsmarktstraße 8
32825 Blomberg
GERMANY

Phoenix Contact Development and Manufacturing, Inc.
586 Fulling Mill Road
Middletown, PA 17057
USA

Should you have any suggestions or recommendations for improvement of the contents and layout of our manuals, please send your comments to:
tecdoc@phoenixcontact.com

Phoenix Contact GmbH & Co. KG
Flachsmarktstraße 8
32825 Blomberg, Germany
Phone: +49 5235 3-00
Email: info@phoenixcontact.com
phoenixcontact.com



© Phoenix Contact 2026-06-09

111927_de_02
Item No. – 02