Installing and operating the ILC 131 ETH, ILC 151 ETH, ILC 171 ETH 2TX, ILC 191 ETH 2TX, ILC 131 ETH/XC, and ILC 151 ETH/XC Inline controllers

User manual

PHOENIX CONTACT
INSPIRING INNOVATIONS

User manual

Installing and operating the ILC 131 ETH, ILC 151 ETH, ILC 171 ETH 2TX, ILC 191 ETH 2TX, ILC 131 ETH/XC, and ILC 151 ETH/XC Inline controllers

2015-10-09

Designation: UM EN ILC 1X1

Version: 02

Order No.: —

This user manual is valid for:

Designation	As of version (HW)	As of version (FW)	Order No.
ILC 131 ETH	00	4.00	2700973
ILC 151 ETH	00	4.00	2700974
ILC 171 ETH 2TX	00	4.00	2700975
ILC 191 ETH 2TX	00	4.00	2700976
ILC 131 ETH/XC	00	4.00	2701034
ILC 151 ETH/XC	00	4.00	2701141

Please observe the following notes

User group of this manual

The use of products described in this manual is oriented exclusively to qualified electricians or persons instructed by them, who are familiar with applicable standards and other regulations regarding electrical engineering and, in particular, the relevant safety concepts.

Explanation of symbols used and signal words

This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety measures that follow this symbol to avoid possible injury or death.

There are three different categories of personal injury that are indicated with a signal word.

DANGER This indicates a hazardous situation which, if not avoided, will result in death or serious injury.

WARNING This indicates a hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION This indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

This symbol together with the signal word **NOTE** and the accompanying text alert the reader to a situation which may cause damage or malfunction to the device, hardware/software, or surrounding property.

This symbol and the accompanying text provide the reader with additional information or refer to detailed sources of information.

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

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Table of contents

1 Foreword

1.1 Purpose of this user manual

This user manual helps you to start up and operate the following Inline controllers:

– ILC 131 ETH,
– ILC 151 ETH,
– ILC 171 ETH 2TX,
– ILC 191 ETH 2TX,
– ILC 131 ETH/XC or
– ILC 151 ETH/XC.

1.2 Hardware and software requirements

HW/SW	Description					
Inline controller	ILC 131 ETH	ILC 151 ETH	ILC 171 ETH 2TX	ILC 191 ETH 2TX	ILC 131 ETH/XC	ILC 151 ETH/XC
Parameterization memory, plug-in	For ordering data, see Section “Accessories” on page 95	For ordering data, see Section “Accessories” on page 95	For ordering data, see Section “Accessories” on page 95	For ordering data, see Section “Accessories” on page 95	For ordering data, see Section “Accessories” on page 95	For ordering data, see Section “Accessories” on page 95
Ethernet cable	Ethernet cable for connecting the Inline controller to a PC					
Connecting cable	Connecting cable for connecting the Inline controller to a PC (RS-232 cable, optional)					
Automation software versions (Service Pack = SP)						
PC Worx	≥ 6.20 *	≥ 6.20 *	≥ 6.20 SP 1 **	≥ 6.20 SP 1 **	≥ 6.20 *	≥ 6.20 *
PC Worx Express	≥ 6.20 *	≥ 6.20 *	≥ 6.20 SP 1 **	≥ 6.20 SP 1 **	≥ 6.20 *	≥ 6.20 *

* Part of the AUTOMATIONWORX Software Suite 2012 1.70

** Part of the AUTOMATIONWORX Software Suite 2012 1.70 Service Pack 1

For the ordering data for hardware, software, and additional documentation, please refer to Section “Technical data and ordering data” on page 87.

PROFINET device function

The PROFINET device function of the controllers is not supported by the PC Worx Express software.

1.3 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 specified order:

– Disconnect safely
– Ensure power cannot be switched on again
– Verify safe isolation from the supply
– Ground and short circuit
– Cover or safeguard adjacent live parts

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

NOTE:

The IP20 degree of protection (IEC 60529/EN 60529) of the device is intended for a clean and dry environment. Do not subject the device to mechanical and/or thermal loads that exceed the specified limits.

NOTE: Risk of unauthorized network access

Connecting devices to a network via Ethernet always entails the risk of unauthorized access to the network.

Please check your application for any option of deactivating active communication channels (for instance SNMP, FTP, BootP, DCP, etc.), or setting passwords to prevent third parties from unauthorizedly accessing the controller and modifying the system.

With regard to the controller's communication interfaces, we recommend not to use the controller in safety-critical applications unless using additional security devices.

So, please take additional protective measures according to the IT security requirements and the standards applicable to your application (for instance virtual networks (VPN) for remote maintenance access, firewalls, etc.) for protection against unauthorized network access.

For the protection of networks for remote maintenance via VPN, Phoenix Contact offers the mGuard product series security devices which you can find described in the latest Phoenix Contact catalog (phoenixcontact.net/products).

1.4 Intended use

The Inline controller is a modular small-scale controller that can be used for small and medium-size applications. The device corresponds to IP20 protection and can be used in closed control cabinets or in control boxes (terminal boxes) with IP54 protection or higher. This device is designed for use in industrial environments.

1.5 Disposal

Do not dispose of the device with household waste, it should instead be disposed of in accordance with the currently applicable national regulations. The device can also be returned to Phoenix Contact.

2 Description of the Inline controller

2.1 General description of the Inline controller

The Inline controller is a modular small-scale controller with integrated Ethernet and INTERBUS connections.

The ILC 131 ETH, ILC 151 ETH, ILC 171 ETH 2TX, ILC 191 ETH 2TX, ILC 131 ETH/XC, and ILC 151 ETH/XC Inline controllers have the same appearance and numerous identical functions.

The main difference lies in the varying memory sizes, which are available to the user.

The ILC 171 ETH 2TX and ILC 191 ETH 2TX Inline controllers also have a second Ethernet interface.

The ILC 131 ETH/XC and ILC 151 ETH/XC Inline controllers are approved for use under extreme ambient conditions. Observe the notes in Section “Ambient conditions” on page 93 and in Section “Tested successfully: use under extreme ambient conditions” on page 101.

In the following, the term Inline controller is used in general. Differences between the controllers are explicitly mentioned where necessary.

For additional information about the different memory sizes, please refer to Section 5.1, “Technical data”.

IEC 61131 controller performance

The Inline controller is consistently configured and programmed in accordance with IEC 61131 using the PC Worx automation software. PC Worx can be operated via the network (Ethernet). The powerful processor can be programmed in all five IEC 61131 programming languages and ensures quick control task processing.

Integrated Ethernet connection

The integrated Ethernet connection (via twisted pair cable) ensures Ethernet connectivity. Throughout the Ethernet network, the Inline controller can be accessed via TCP/IP or UDP/IP. A standardized Ethernet interface is available for each of the ILC 131 ETH, ILC 151 ETH, ILC 131 ETH/XC and ILC 151 ETH/XC Inline controllers. The ILC 171 ETH 2TX and ILC 191 ETH 2TX controllers have two fully implemented Ethernet connections, which are switched inside the device.

Integrated communication functions enable direct and effective data exchange via Ethernet. The Ethernet network provides universal options for communicating with the Inline controller. Using the IP_USEND and IP_URCV communication blocks, information, such as required coupling variables, can be exchanged between Inline controllers via Ethernet. This enables distributed, modular automation solutions to be configured.

The existing IEC 61131-5 blocks have therefore been extended to include a transparent TCP/IP mode and a transparent UDP/IP mode.

When using the AX OPC server provided in the AUTOMATIONWORX Software Suite Version 1.30 or later, Inline controller data is available in the Ethernet network in a standardized format and can be used for the different visualization packages.

PROFINET device functionality

The PROFINET protocol can be used via the Ethernet interfaces of the Inline controllers. In this case, the Inline controllers can be used as a PROFINET device. All the Inline controllers listed in Section 1.1 support this function from hardware version “01”/firmware version “4.10” or later together with the PC Worx software version 6.20 Service Pack 1 or later.

For information on how to configure the Inline controllers as a PROFINET device in the PC Worx software, please refer to Section “The Inline controller as a PROFINET device” on page 49.

Modbus functionality

The Modbus/TCP (UDP) communication protocol can be used via the Ethernet interfaces of the Inline controller. The Inline controller can be used as a Modbus/TCP client and/or as a Modbus/TCP server (as of firmware version 4.40 and AUTOMATIONWORX Software Suite Version 1.82 AddOn V1).
For additional information, please refer to the AH EN MODBUS TCP application note.

MRP

The Media Redundancy Protocol MRP can be used via the Ethernet interfaces of the ILC 171 ETH 2TX and ILC 191 ETH 2TX Inline controllers. The controllers support the MRP client function, which can be enabled or disabled via PC Worx as an option. This function is disabled by default. If the function is enabled, it remains enabled after the supply voltage is switched off and on. If the controllers have been reset to the delivery state, the MRP client function will also be disabled again. In a ring with Media Redundancy Protocol, maximum switch-over times of up to 200 ms can be expected.

Integrated INTERBUS connection

An Inline local bus as well as an INTERBUS remote bus can be connected via the INTERBUS connection. In this way you can create a complete INTERBUS system (maximum of 4 remote bus levels) using the Inline controller as a distributed controller.

The I/O level is connected to the Inline controller via INTERBUS.

Please note: the ILC 131 ETH and ILC 131 ETH/XC controllers do not support connection of the INTERBUS remote bus.

RS-232 interface

This interface can be used to **either** assign the IP address of the Inline controller and to access the controller using the Diag+ diagnostics tool **or** to communicate with serial I/O devices via function blocks.

The Inline controller cannot be programmed via the RS-232 interface.

Parameterization memory/SD card

All Inline controllers can be operated using a plug-in parameterization memory in the form of an SD card. This memory can be used to save programs and configurations which belong to your project.
The plug-in parameterization memory is optional and is not required in order to operate the Inline controller.

The parameterization memory is not supplied as standard with the Inline controllers. Only use a parameterization memory provided by Phoenix Contact (for ordering data, see Section “Accessories” on page 95).

NOTE: Parameterization memory (SD card) – formatting note

The SD card is already formatted and is intended for use with Phoenix Contact devices. Make sure that the SD card is not reformatted.

2.2 Possible fields of application of the Inline controller

2.2.1 ILC 131 ETH and ILC 131 ETH/XC

The Inline controllers (ILC 131 ETH/ILC 131 ETH/XC) can be used as a distributed controller of an Inline station, which is connected to an Ethernet system. An Inline local bus (Figure 2-1) can then be connected to the Inline controller.

Inline local bus

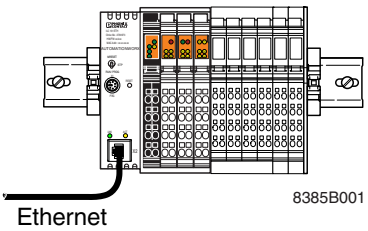

Figure 2-1 Connected Inline local bus

Please note: the Inline controllers (ILC 131 ETH / ILC 131 ETH/XC) do not support connection of the INTERBUS remote bus.

2.2.2 ILC 151 ETH, ILC 151 ETH/XC, ILC 171 ETH 2TX, and ILC 191 ETH 2TX

The Inline controllers (ILC 151 ETH/ILC 151 ETH/XC/ILC 171 ETH 2TX/ILC 191 ETH 2TX) can be used as a distributed controller of an Inline station, which is connected to an Ethernet system. A single Inline local bus (Figure 2-2) as well as a INTERBUS system with a maximum of 4 remote bus levels (Figure 2-3) can be connected to the Inline controller.

Inline local bus

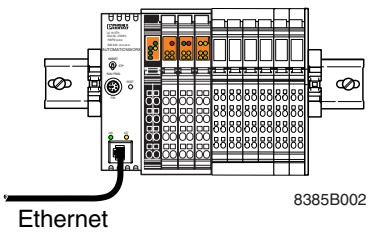

Figure 2-2 Connected Inline local bus

Remote bus levels

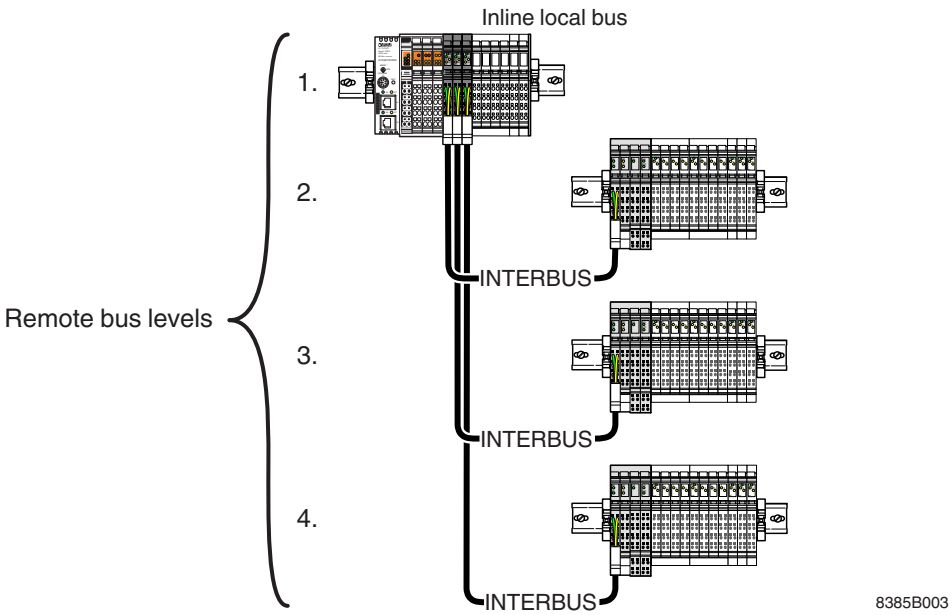

Figure 2-3 Remote bus levels

2.2.3 The Inline controller as a PROFINET device in a PROFINET network

The following figure shows the example of an ILC 171 ETH 2TX as a PROFINET device in a PROFINET network.

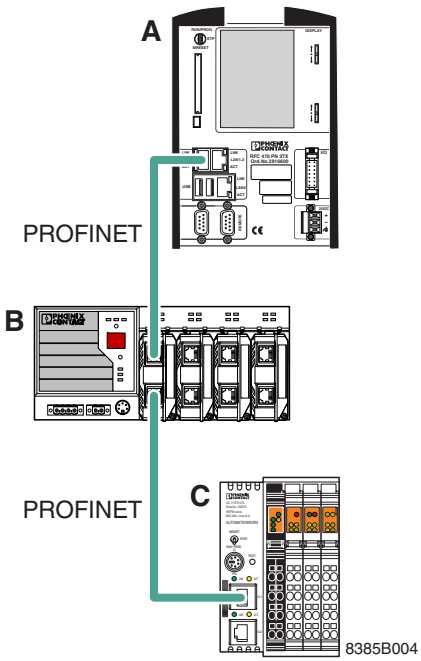

Figure 2-4 PROFINET device using the ILC 171 ETH 2TX as an example

Key:

A PROFINET controller (in the example: RFC 470 PN 3TX Remote Field Controller)

B Managed Switch

C PROFINET device (in the example: ILC 171 ETH 2TX)

For additional information on how to integrate the Inline controller into a PROFINET network as a PROFINET device, please refer to Section “The Inline controller as a PROFINET device” on page 49.

2.2.4 Applicative system redundancy with ILC 171 ETH 2TX or ILC 191 ETH 2TX

The following figure shows an example of applicative system redundancy. The example shows a PROFINET device with control function (ILC 171 ETH 2TX) that is connected to a PROFINET network by means of a switch. Identical application programs run on both higher-level PROFINET controllers. To achieve synchronization, both PROFINET controllers are connected via an Ethernet connection by means of a switch. PROFINET controller A operates as primary controller, PROFINET controller B operates as backup controller.

The ILC 191 ETH 2TX also supports applicative system redundancy.

Controllers with applicative (programmed) redundancy

Network redundancy with Media Redundancy Protocol (MRP)

PROFINET devices with Phoenix Redundancy Layer

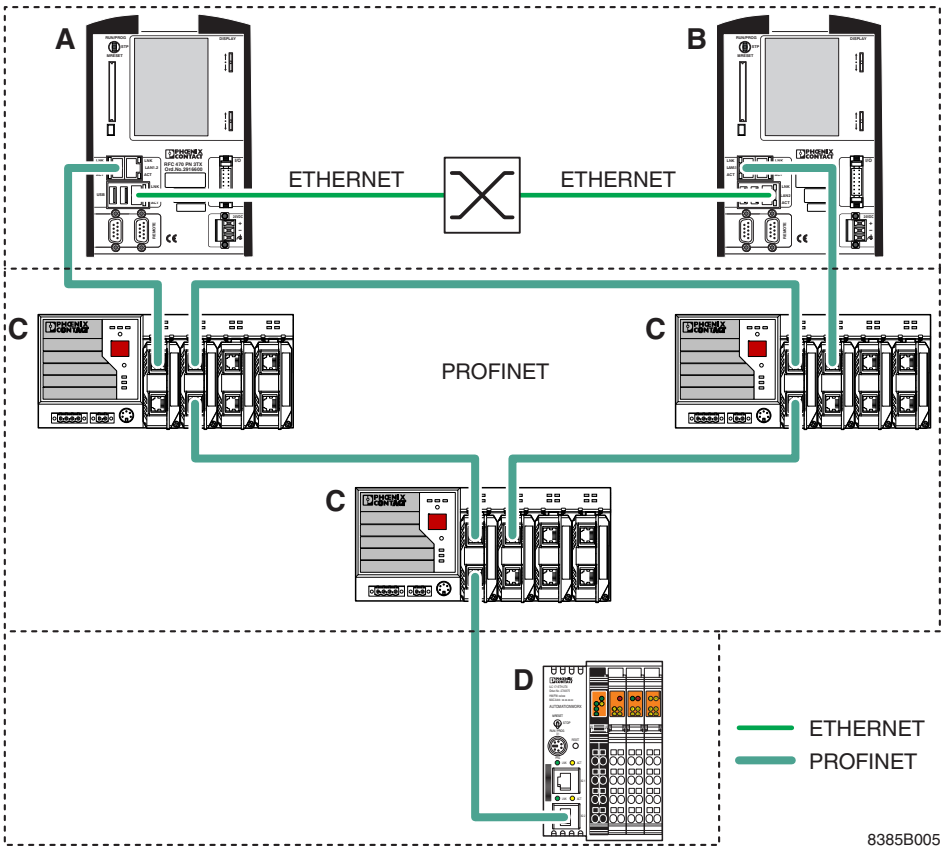

Figure 2-5 Applicative system redundancy – example

For additional information on applicative system redundancy, please refer to the AH EN APPLICATIVE SYSTEM REDUNDANCY application note. This application note can be downloaded at phoenixcontact.net/products.

A Primary controller (in the example: RFC 470 PN 3TX Remote Field Controller)

B Backup controller (in the example: RFC 470 PN 3TX Remote Field Controller)

C Managed Switches

D PROFINET device with control function (in the example: ILC 171 ETH 2TX with PROFINET device function and Phoenix Redundancy Layer)

2.3 Notes on using the Inline controller in potentially explosive areas

Approval according to directive 94/9/EC

II 3G Ex nA IIC T4 Gc X

WARNING: Explosion hazard
Make sure that the following notes and instructions are observed.

Installation notes

1. The Inline controller conforms to the requirements of protection type “n” and can be installed in a zone 2 potentially explosive area. The Inline controller is a category 3G item of electrical equipment.
   The Inline controller meets the requirements of EN 60079-0:2009 and EN 60079-15:2010.
2. The Inline controller must only be installed, started up, and maintained by qualified specialist personnel.
3. Please follow the installation instructions given in the user manual and the package slip.
4. When installing and operating the device, the applicable safety directives (including national safety directives), accident prevention regulations, as well as general technical regulations must be observed.
5. For the safety data, please refer to the corresponding documentation (user manual, package slip) and the certificates (declaration of conformity and other approvals, if applicable).
6. Access to the circuits inside the Inline controller is not permitted. Do not repair the Inline controller yourself but replace it with an approved controller of the same type.
   Repairs may only be performed by the manufacturer. The manufacturer is not liable for damage resulting from noncompliance.
7. The IP20 (EN 60529) degree of protection for the device is designed for a clean and dry environment.
8. Do not subject the Inline controller to mechanical strain and/or thermal loads that exceed the limits specified in the product documentation.
9. The Inline controller is not designed for use in potentially dust-explosive atmospheres. If dust is present, install the device in suitable, approved housing. Please note the surface temperature of the housing.

Installation in zone 2

1. Observe the specified conditions for use in potentially explosive areas.
2. Install the device in a suitable approved housing (with at least IP54 protection according to EN 60529) that meets the requirements of EN 60079-15.
3. In potentially explosive areas, only snap the device onto the DIN rail and remove it from the DIN rail and connect and disconnect the cables when the power is disconnected.
4. Connect the DIN rail to protective earth ground.
5. Only connect devices to the supply and signal circuits in zone 2 that are suitable for operation in potentially explosive areas of zone 2 and for the conditions at the installation location.
6. To ensure safe operation, the RJ45 connector needs to have a fully functioning locking clip. Repair any damaged connectors immediately.

7. For safe operation with the plug-in parameterization memory (SD card), this must be fully plugged and snapped in. In potentially explosive areas, use the SD card as main memory only. Don't insert or remove the SD card during operation.
8. The programming interface may only be used if there is no potentially explosive atmosphere.

Restrictions/limit values

1. **Only Inline terminals that are approved for use in potentially explosive areas may be snapped next to the Inline controller.**
   Before using the Inline terminal in a zone 2 potentially explosive area, check whether this Inline terminal has been approved for installation within this area.
   For a list of terminals that are approved for zone 2 potentially explosive areas, please refer to the AH EN IL EX ZONE 2 application note.
2. Please make sure that the maximum permissible current of 4 A flowing through potential jumpers U_M and U_S (total current) is not exceeded when using the Inline controller in potentially explosive areas.
3. Also make sure that the maximum permissible current of 2 A flowing through potential jumper U_L is not exceeded.
4. The maximum permissible current for each spring-cage contact is 2 A.

2.4 Unpacking the Inline controller

The Inline controller is supplied in an ESD bag together with a package slip with installation instructions. Read the complete package slip carefully before unpacking the Inline controller.

NOTE: Electrostatic discharge

The Inline controller contains components that can be damaged or destroyed by electrostatic discharge. When handling the Inline controller, observe the necessary safety precautions against electrostatic discharge (ESD) according to EN 61340-5-1 and IEC 61340-5-1.

NOTE:

To avoid possible damage to the module, unpack and pack the Inline controller in accordance with the ESD regulations.

2.5 Connection and operating elements

ILC 131 ETH,
ILC 151 ETH,
ILC 131 ETH/XC,
ILC 151 ETH/XC

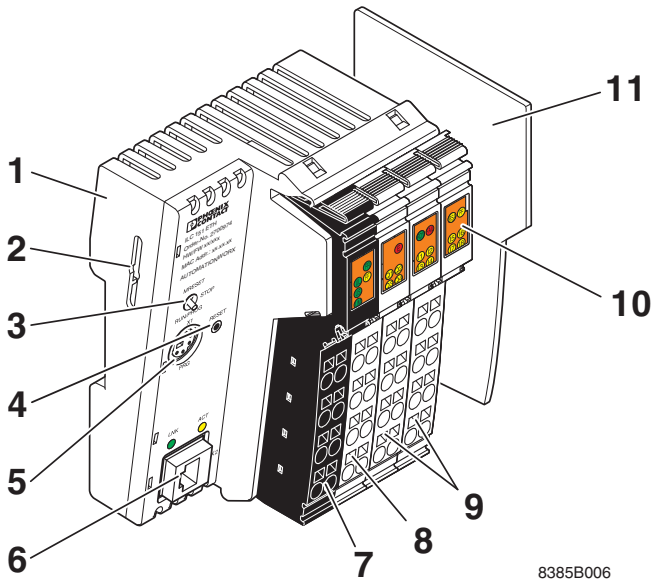

Figure 2-6 Structure of the Inline controller (ILC 131 ETH, ILC 151 ETH, ILC 131 ETH/XC, ILC 151 ETH/XC; shown in the figure: ILC 151 ETH)

The Inline controller consists of the following components:

1 Electronics base

2 Slot for the parameterization memory/card holder (SD card)

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

Please refer to the ordering data in Section “Accessories” on page 95.

3 Mode selector switch

4 Reset button

5 RS-232 interface

6 Ethernet connection

7 Connector 1: terminal points for voltage supply

8 Connector 2: output terminal points

9 Connectors 3 and 4: input terminal points

10 Diagnostics and status indicators

11 End plate

ILC 171 ETH 2TX, ILC 191 ETH 2TX

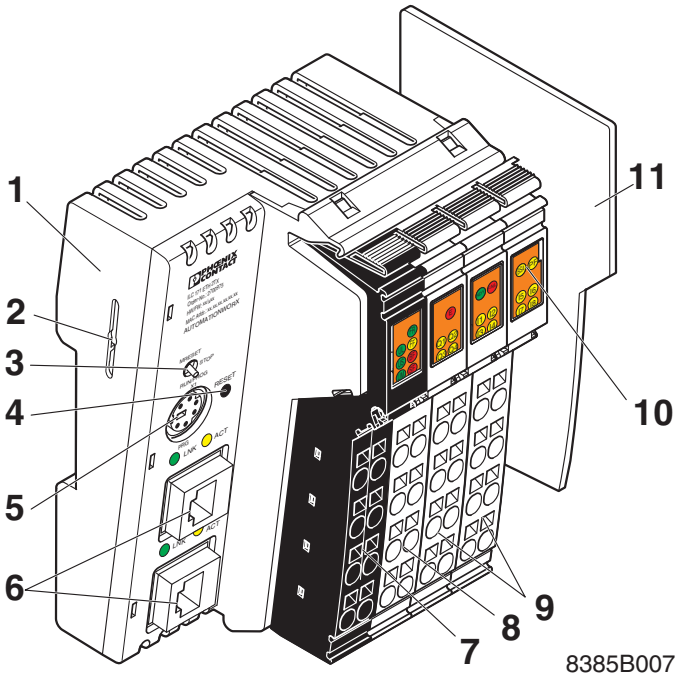

Figure 2-7 Structure of the Inline controller (ILC 171 ETH 2TX, ILC 191 ETH 2TX; shown in the figure: ILC 171 ETH 2TX)

The Inline controller consists of the following components:

1 Electronics base

2 Slot for the parameterization memory/card holder (SD card).

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

Please refer to the ordering data in Section “Accessories” on page 95.

3 Mode selector switch

4 Reset button

5 RS-232 interface (X1)

6 Ethernet interfaces (X2.1/X2.2)

7 Connector 1: terminal points for voltage supply

8 Connector 2: output terminal points

9 Connectors 3 and 4: input terminal points

10 Diagnostics and status indicators

11 End plate

2.6 Diagnostics and status indicators

The descriptions for diagnostic and status indicators apply to all the Inline controllers listed on the inner cover page of this user manual.

The diagnostics and status indicators are used for quick local error diagnostics.

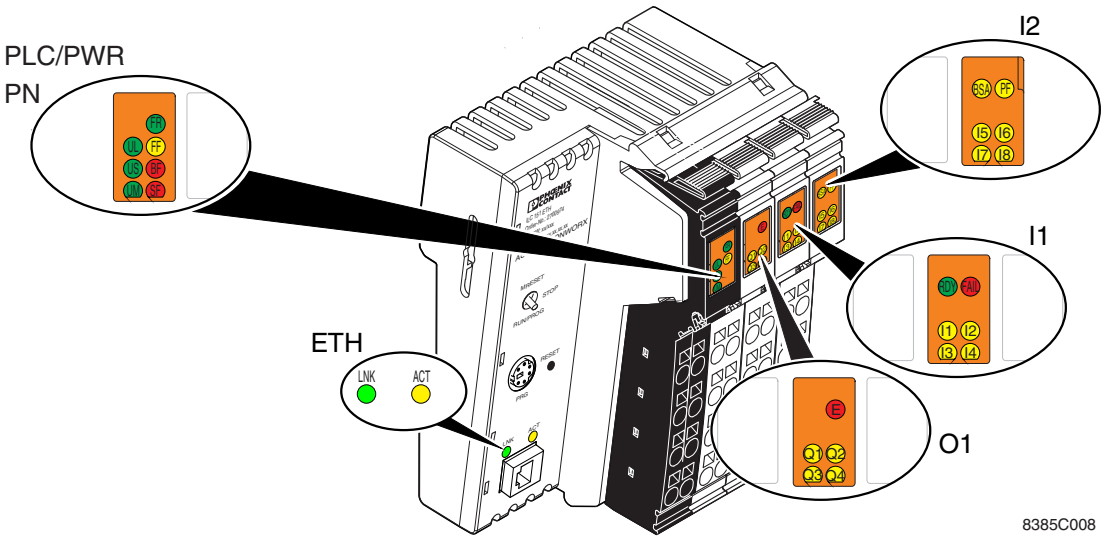

Figure 2-8 Diagnostics and status indicators

Local diagnostics and status indicators

Des.	Color	Status	Meaning
ETH: state of the Ethernet interface (applies to both interfaces (X2.1, X2.2) for the ILC 171 ETH 2TX/ILC 191 ETH 2TX)			
LNK	Green	Off	Connection not established successfully
		On	Connection established successfully (link): the Inline controller is able to contact another network device.
ACT	Yellow	Off	Data transmission inactive
		On	Data transmission active (activity): the Ethernet interface is sending or receiving data
PN: PROFINET (for ILC 131 ETH(/XC) and ILC 151 ETH(/XC) from HW version 0.1 or later and FW version 4.10 or later)			
BF	Red		Status of PROFINET communication/communication error (BusFail)
		Off	The higher-level PROFINET controller has established an active communication connection to the PROFINET device.
		On	The PROFINET device has not established an active communication connection to a higher-level PROFINET controller.
		Flashing	The higher-level PROFINET controller establishes a communication connection to the PROFINET device.

Des.	Color	Status	Meaning
SF	Red		Group error (PROFINET)
		Off	PROFINET diagnostics not present.
		On	PROFINET diagnostics present.
PLC: diagnostics of the Inline controller			
FR	Green		Inline controller running
		Off	IEC 61131 runtime system not ready to operate.
		Flashing	IEC 61131 runtime system successfully initialized. Control function is in the READY/STOP state, program not processed.
		On	IEC 61131 runtime system successfully initialized and a program is running. Control function is in the RUN state.
FF	Yellow		Failure
		On	A runtime error has occurred in the IEC 61131 runtime system program.
		Off	No runtime error has occurred in the IEC 61131 runtime system program.
PWR: supply voltage (see also Section “Remote bus” on page 36)			
UL	Green		24 V supply U_{ILC} for generating voltages U_L and U_{ANA}
		Off	Supply voltage not present
		On	Supply voltage is present (the presence of the 24 V supply voltage U_{ILC} is indicated)
US	Green		24 V supply for segment circuit
		Off	Supply voltage not present
		On	Supply voltage is present.
UM	Green		24 V supply for main circuit
		Off	Supply voltage not present
		On	Supply voltage is present.
IL: INTERBUS diagnostics			
RDY	Green		INTERBUS master ready to operate/data transmission active (INTERBUS ready/running)
		Off	The INTERBUS master is not ready to operate.
		Flashing	The INTERBUS master is in the READY or ACTIVE state.
		On	The INTERBUS master is in the RUN state.
FAIL	Red		Failure
		Off	No error occurred:
		On	One of the following errors has occurred: – Bus error in the connected bus (remote bus/local bus) – Controller error.
BSA	Yellow		Bus segment aborted
		Off	Bus segment(s) in the connected bus not switched off.
		On	One or more bus segments in the connected bus are switched off.

Des.	Color	Status	Meaning
PF	Yellow		Peripheral fault
		Off	No peripheral fault on a device in the connected bus.
		On	Peripheral fault on a device in the connected bus (local bus or remote bus).
I/O: digital inputs and outputs			
I1 to I8	Yellow		Inputs 1 to 8
		Off	Corresponding input is not set.
		On	Corresponding input is set.
E	Yellow		Error
		Off	No short circuit/overload at one or more outputs
		On	Short circuit/overload at at least one of the outputs (1 to 4).
Q1 to Q4	Yellow		Outputs 1 to 4
		Off	Corresponding output is not set.
		On	Corresponding output is set.

2.7 Mode selector switch

The mode selector switch is used to define the operating state of the controller.

The RUN/PROG and STOP positions have a latching function and the MRESET position has a momentary-action function. After releasing the switch in the MRESET position, it returns to STOP.

Table 2-1 Inline controller operating modes

Operating mode	Explanation
RUN/PROG	The controller is in the RUN state. The application program is being processed. The PC Worx/PC Worx Express software can be used for program and configuration modifications as well as for the online monitoring function. The application program is not processed if a controller error has occurred or if the application program has been stopped by PC Worx/PC Worx Express.
STOP	The controller is in the STOP state. Application program processing has been stopped.
MRESET	Retain data and the application program are deleted. Set the mode selector switch in the following sequence to delete the retain data and the application program: • Set the switch to the MRESET position for three seconds. • Release the switch for less than three seconds. • Set the switch to the MRESET position for three seconds.

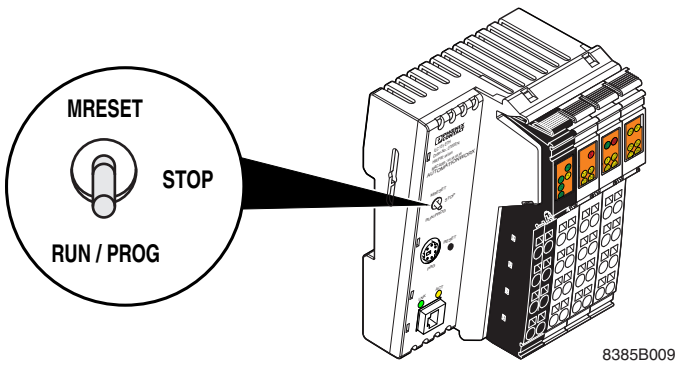

Figure 2-9 Mode selector switch

2.8 Reset button (concealed)

The reset button on the Inline controller (see item 4 in Figure 2-6 on page 19/item 4 in Figure 2-7 on page 20) can only be operated with a pointed object (such as a pen) and is therefore protected against accidental activation.

If you carry out a voltage reset simultaneously as you press the reset button, this resets the Inline controller to its default settings.

How to proceed

Hold down the reset button and switch the supply voltage of the Inline controller off and on again. Release the reset button only after the FF (yellow) LED starts flashing.

The Inline controller has been initialized successfully and reset to its default settings only after the FR (green) and RDY (green) LEDs are flashing. The control function is in the READY/STOP state, a program is not processed. This process may take around 1 minute.

2.9 Parameterization memory

The parameterization memory can be used to save programs and configurations which belong to your project. In addition, application-specific data can also be stored on the parameterization memory. Refer to the Section “Parameterization memory and Internet Explorer” on page 62.

The Inline controller has an integrated parameterization memory.
In addition, it is possible to use a plug-in parameterization memory in the form of an SD card. The SD card can be used as the main or additional memory of the Inline controller, refer to Section 3.7.
The SD card is optional and not required to operate the Inline controller.

NOTE: Parameterization memory (SD card) – formatting note

The SD card is already formatted and is intended for use with Phoenix Contact devices.

- Make sure that the SD card is not reformatted.

NOTE: Using the parameterization memory (SD card)

Only use a parameterization memory provided by Phoenix Contact (for ordering data, see Section “Accessories” on page 95).

2.9.1 Inserting/removing the parameterization memory

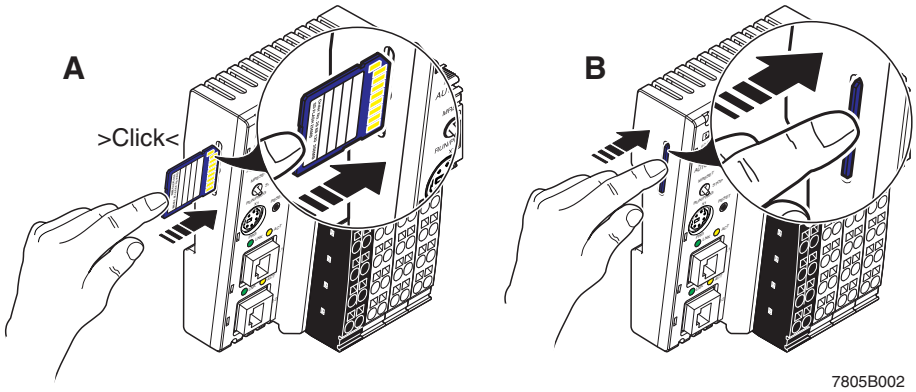

Figure 2-10 Inserting (A) and removing (B) the parameterization memory

Inserting the SD card

The Inline controller has an SD card holder with push/push technology.

- Insert the parameterization memory (SD card) into the slot as shown in Figure 2-10 (A).
- Gently push the parameterization memory into the slot until it engages with a click in the card holder.

Removing the SD card

- Gently push the parameterization memory into the slot in the direction shown in Figure 2-10 (B) until the snap-on mechanism releases the parameterization memory and partially ejects it from the slot. Remove the parameterization memory.

For additional information on the parameterization memory, please refer to Section “Functions of the plug-in parameterization memory (SD card)” on page 56 and Section “Parameterization memory and Internet Explorer” on page 62.

2.10 Internal basic circuit diagram

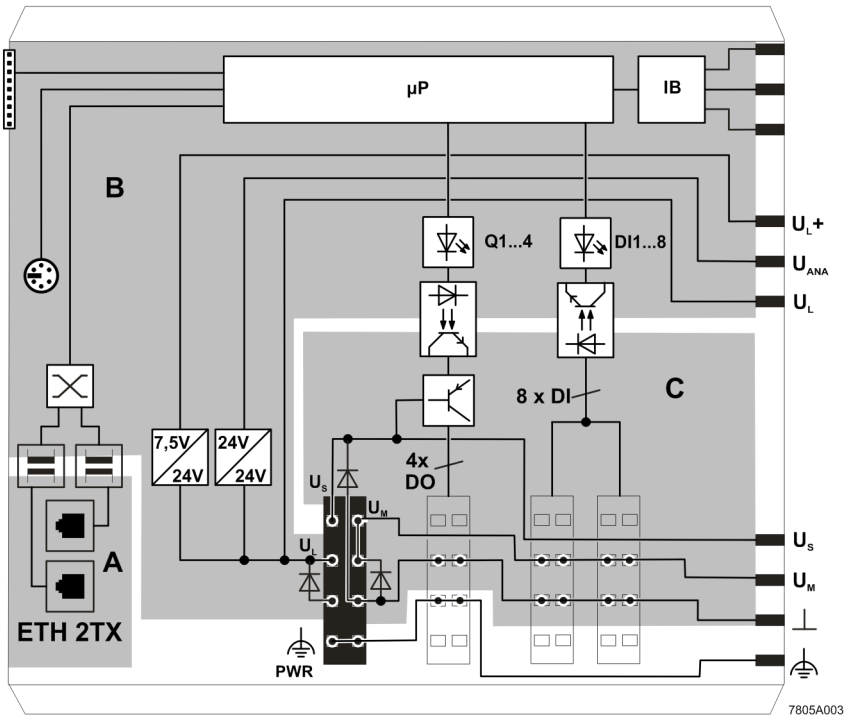

Figure 2-11 Internal basic circuit diagram (ILC 171 ETH 2TX)

Key:

µP	Microprocessor		Inverter
IB	Protocol chip		LED
	RS-232 interface		Optocoupler
	Transmitter		NPN transistor
	RJ45 socket		Ethernet switch
	SD card holder (the SD card is not supplied as standard)		

The gray areas in the basic circuit diagram represent electrically isolated areas:

A: Ethernet interface
B: Logic
C: I/O

Other symbols used are explained in the IL SYS INST UM E user manual.

2.11 Mounting and removing the Inline controller

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

NOTE:
Before mounting or removing the controller, make sure that the supply voltage is switched off and cannot be switched on again by unauthorized persons.

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 controller is mounted perpendicular to the DIN rail.

Mounting location

Like all other terminals in the Inline product range, the Inline controller has IP20 protection and is designed for use in a closed control cabinet or control box (terminal box) with IP54 protection 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 several times, especially in the area around the Inline controller. This makes it easier to remove the Inline controller.

End brackets

Mount end brackets on both sides of the Inline station. The end brackets ensure that the Inline station is correctly mounted. End brackets 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 (Order 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 together with the Inline controller and does not need to be ordered separately.

NOTE:
When mounting or removing the Inline controller it must be tilted. This means that no Inline terminal should be installed directly to the right of the Inline controller during mounting and removal. The terminal must be removed prior to mounting or removing the Inline controller. Otherwise, the snap-in hooks and jumper contacts will be damaged.

Mounting position

Mount the Inline controller horizontally (as shown in Figure 2-12 on page 29). The temperature range specified in Section “Ambient conditions” on page 93 is only guaranteed if the Inline controller is mounted in this position.

The Inline controller must only be mounted or removed within a temperature range from -5°C to +55°C (ILC 131 ETH, ILC 151 ETH, ILC 171 ETH 2TX, ILC 191 ETH 2TX) or from -5°C to +60°C (ILC 131 ETH/XC, ILC 151 ETH/XC).

Mounting

When mounting the Inline controller, proceed as shown in Figure 2-12 and Figure 2-13:

- Disconnect the power to the station.
- Place the Inline controller onto the DIN rail from above (Figure 2-12, A) and push down (Figure 2-12, B).
- Then attach all the electronics bases required to set up the station. Observe the information provided in the aforementioned user manuals.

Make sure that **all** featherkeys and keyways on adjacent terminals are securely interlocked.

- Once all the bases have been snapped on, insert the connectors in the corresponding bases.
  First, place the front connector shaft latching in the front snap-on mechanism (Figure 2-13, A).
  Then press the top of the connector towards the base until it snaps into the back snap-on mechanism (Figure 2-13, B).

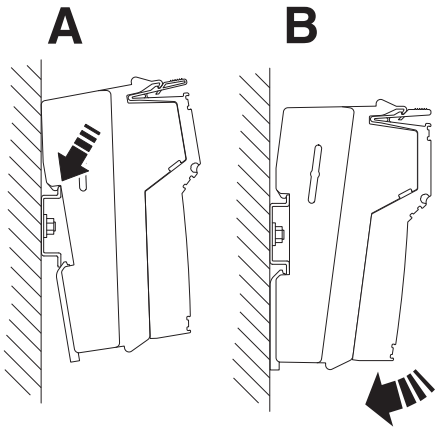

Figure 2-12 Snapping on the Inline controller (1)

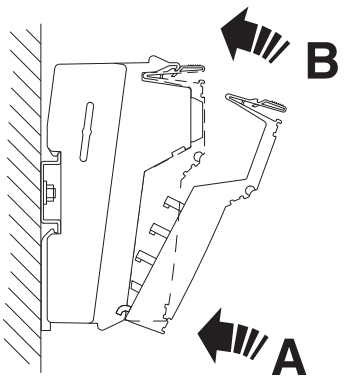

Figure 2-13 Snapping on the Inline controller (2)

Removal

When removing the Inline controller from the DIN rail, proceed as shown in Figure 2-15 on page 31:

- Disconnect the power to the station.

Unlike other Inline terminals, the Inline controller is removed by tilting it away from the DIN rail. This requires the Inline terminal to the right to be removed prior to removing the Inline controller. The right connector of the Inline controller must also be removed.

Remove the third and fourth connectors to access the right base latch.

It is therefore recommended that all connectors be removed prior to removing the Inline controller.

- If the connectors cause trouble during removal:
  Remove all the connectors of the Inline controller.
  - Lever up each connector by pressing on the back connector shaft latching (Figure 2-15, A).
  - Remove the connectors (Figure 2-15, B).
- If Inline terminals are installed next to the Inline controller (see Figure 2-14):
  - Remove the following connectors:
    - All connectors of the terminal that is directly connected (A1 to A4)
    - The adjacent connector of the following terminal (B1)
  - Remove the directly adjacent Inline terminal (A).

Observe the information provided on Page 28 of the above user manuals.

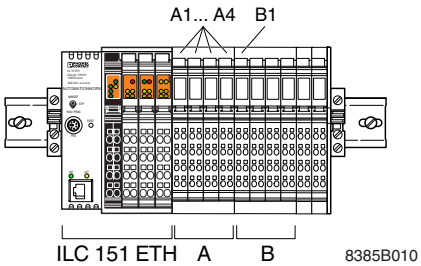

Figure 2-14 Connectors to be removed if terminals are installed next to the Inline controller

- Insert a tool in the base latches of the Inline controller and pull gently upwards (Figure 2-16, A). Pull out the Inline controller from the DIN rail (Figure 2-16, B, C).

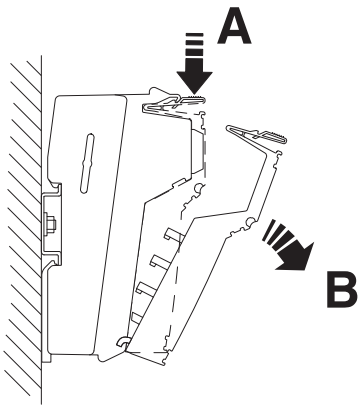

Figure 2-15 Removing the Inline controller (1)

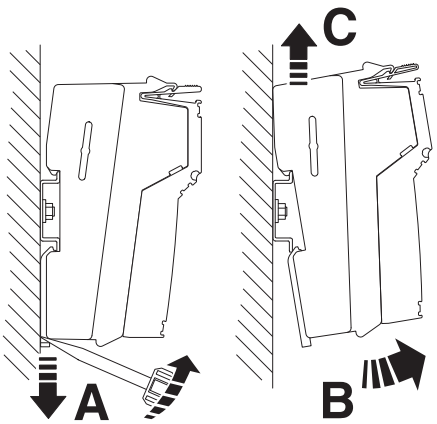

Figure 2-16 Removing the Inline controller (2)

Replacing an Inline controller

If you want to replace an Inline controller within an Inline station, proceed as described above (removing and mounting). Make sure that the terminal to the right is not installed when removing and mounting the Inline controller. Only reinstall this terminal once the Inline controller is mounted.

In particular, make sure that **all** featherkeys and keyways on adjacent terminals are securely interlocked.

Observe the following when replacing an Inline controller:
Enter the new MAC address when using the BootP server.

2.12 Communication paths

The communication path to the Inline controller must be determined before communication with the Inline controller can take place.

The following communication paths are available on the Inline controller:

ILC 131 ETH, ILC 151 ETH, ILC 131 ETH/XC, ILC 151 ETH/XC:	(A1)	1 x Ethernet	10/100Base-T(X)
ILC 171 ETH 2TX, ILC 191 ETH 2TX:	(A2)	2 x Ethernet	X2.1/X2.2: 10/100Base-T(X) (internally switched)
ILC 131 ETH, ILC 151 ETH, ILC 171 ETH 2TX, ILC 191 ETH 2TX, ILC 131 ETH/XC, ILC 151 ETH/XC:	(B)	PRG	The serial interface of your PC is directly connected to the Inline controller (not for programming). For additional information on using the serial interface (e.g., IP address assignment), please refer to Section “Serial PRG interface - function blocks” on page 35.

The Inline controller cannot be programmed via the RS-232 PRG interface.

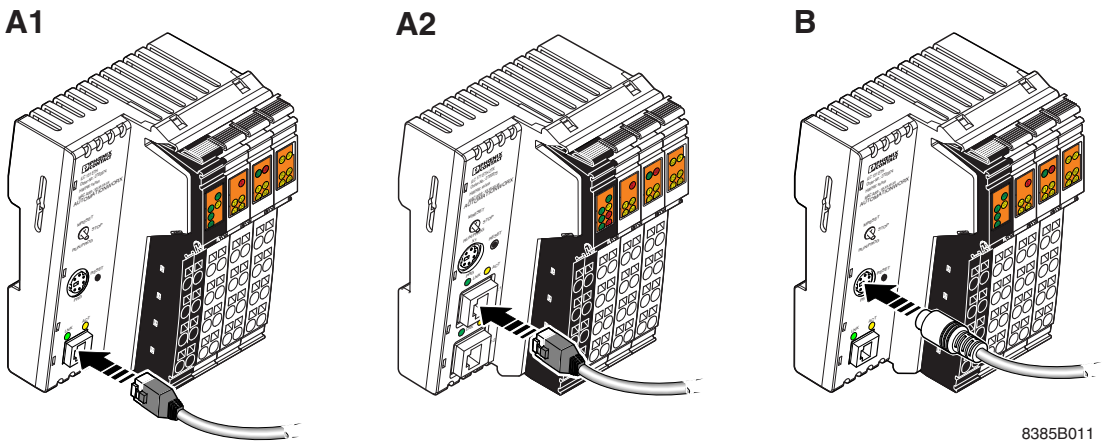

Figure 2-17 Communication paths: (A1/A2) Ethernet (B) PRG

2.12.1 Ethernet

For connecting the Ethernet network, a standardized Ethernet interface is available on each of the ILC 131 ETH, ILC 151 ETH, ILC 131 ETH/XC and ILC 151 ETH/XC Inline controllers. Using the ILC 171 ETH 2TX and ILC 191 ETH 2TX Inline controllers, two standardized Ethernet interfaces (X2.1/X2.2) are provided for connection to the Ethernet network.

The Ethernet network is connected via RJ45 sockets.

Use an Ethernet cable which corresponds to CAT5 of IEEE 802.3 at least.
Observe the bending radii of the Ethernet cables used.

The contact assignment of the interface is as follows:

Transmit data +	T +	1
Transmit data -	T -	2
Receive data +	R +	3
–		4
–		5
Receive data -	R -	6
–		7
–		8

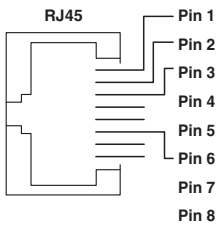

Figure 2-18 Ethernet interface

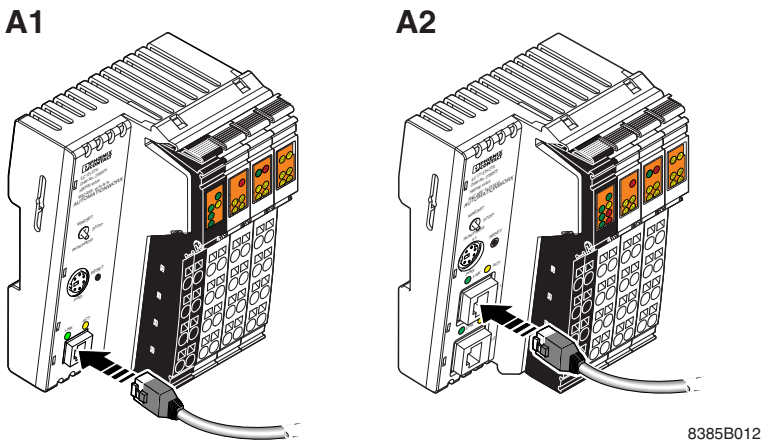

Figure 2-19 Connecting the Ethernet cable to the Inline controller
A1: ILC 131 ETH, ILC 151 ETH, ILC 131 ETH/XC, ILC 151 ETH/XC
A2: ILC 171 ETH 2TX, ILC 191 ETH 2TX

The interface is able to switch over the transmitter and receiver automatically (auto cross-over).

2.12.2 Serial PRG interface (mini-DIN socket)

In addition to providing the Ethernet interface, this serial interface enables communication with the Inline controller from a PC.

A connecting cable is required for direct connection of the Inline controller to a PC with PC Worx via the serial PRG interface. Connect the connecting cable to the programming interface of the Inline controller (PRG designation) and the serial interface of the PC.

This interface can be used to **either** assign the IP address of the Inline controller and to access the Inline controller using the Diag+ diagnostics tool **or** to communicate with special I/O devices via function blocks (see Section 2.12.3, “Serial PRG interface - function blocks”).

The Inline controller cannot be programmed via the RS-232 interface.

Assembly instruction

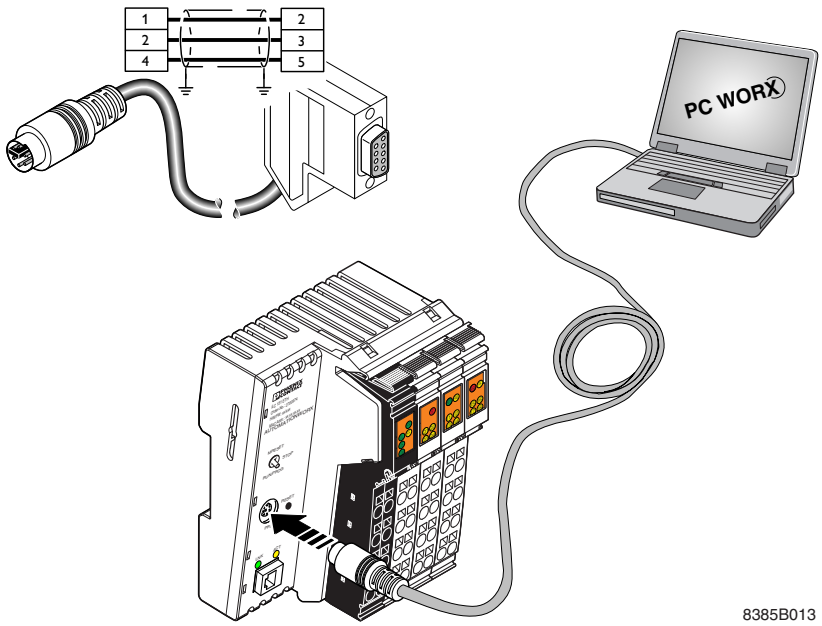

Figure 2-20 Connecting cable between PC and Inline controller

Ordering data:
Connecting cable for connecting the Inline controller to a PC (RS-232) for PC Worx, length 3 m (Designation COM CAB MINI DIN, Order No. 2400127).

2.12.3 Serial PRG interface - function blocks

This interface can be used to:

– Assign the IP address or work with Diag+
– Communicate with input/output devices via function blocks

The following function blocks are available in the PC Worx/PC Worx Express software:

Table 2-2 Function block overview

Function block	Short description
RS232_INIT	Parameterization of the serial interface. You can use this function block to specify the following parameters of the serial interface: – Protocol: transparent – Baud rate: 1200, 2400, 4800, 9600, 19200, 38400, 57600 or 115200 – Data width: 8 data bits, even parity – Number of stop bits: 1 – Hardware flow control: not supported
RS232_RECEIVE	Reading the internal receive memory of the serial interface.
RS232_SEND	Data transmission to the internal transmit memory of the serial interface.

Once the RS232_INIT function block has been activated, the interface is parameterized accordingly so that it is only possible to communicate with the connected input or output devices.

Deactivating the RS232_INIT function block or performing another cold restart or warm start enables the IP address to be assigned and the controller to be accessed with Diag+.

For additional information on the function blocks, please refer to the online help for the PC Worx/PC Worx Express software.

I/O devices that can be connected

Various I/O devices (e.g., modem, printer, barcode scanner) can be connected to the Inline controller via the serial PRG interface. The connected devices are addressed from the application program using function blocks.

2.13 INTERBUS

The descriptions for INTERBUS apply to all Inline controllers listed on the inner cover page of this user manual.

Observe the information in the “Configuring and installing the INTERBUS Inline product range” user manual IB IL SYS PRO UM E when creating an Inline system (local bus and/or remote bus).

Please note that the Inline controller does not support the following functions:

– Switching of devices
– Single-channel diagnostics
– Fiber optic diagnostics/optical regulation
– Logical addressing

Only INTERBUS devices with SUPI 3 and SUPI 3 OPC protocol chip or later can be used with INTERBUS as local bus/remote bus devices.

2.13.1 Local bus

The local bus is automatically created by directly connecting I/O modules to the Inline controller.

2.13.2 Remote bus

Please note: the ILC 131 ETH and ILC 131 ETH/XC controllers do not support connection of the INTERBUS remote bus.

Connect the remote bus to the Inline Controller using the IBS IL 24 RB-T-PAC branch terminal (Order No. 2861441; including accessories).

The **first branch terminal** must always be placed directly after the Inline controller. In terms of topology, it opens a **remote bus**.

If **additional branch terminals** are used after the first branch terminal, they must be installed directly one after the other (see also notes in the terminal-specific data sheet). In terms of topology, the additional branches are **remote bus branches** with the branch terminal being the first device in the corresponding remote bus branch.

A maximum of 3 branch terminals can be connected to the Inline controller, each of which opens a remote bus (see Figure 2-3 on page 14).

2.14 Power supply

The descriptions for the power supply apply to all the Inline controllers listed on the inner cover page of this user manual.

2.14.1 Sizing of the power supply

Choose a power supply unit that is suitable for the currents in your application. The selection depends on the bus configuration, the resulting maximum currents, and the type of supply (separate supply of U_{ILC}, U_M, and U_S, or supply from a power supply unit).

A **power supply without a fall-back characteristic curve** must be used for correct operation of the Inline controller (see Figure 2-22).
When the Inline controller is switched on, an increased switch-on current is temporarily triggered. The Inline controller behaves like a capacitive load when it is switched on.

Some electronically controlled power supplies have a fall-back characteristic curve (see Figure 2-21). They are not suitable for operation with capacitive loads.

A primary-switched power supply (without fall-back characteristic curve) from the QUINT POWER series (see current catalog from Phoenix Contact) is recommended for Inline controller operation.

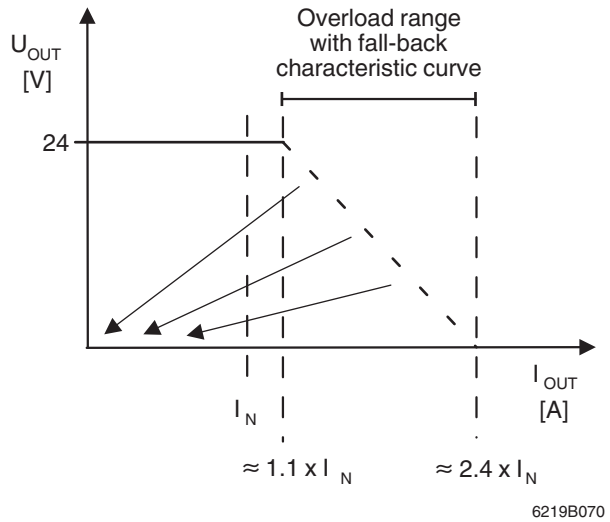

Figure 2-21 Overload range **with** fall-back characteristic curve

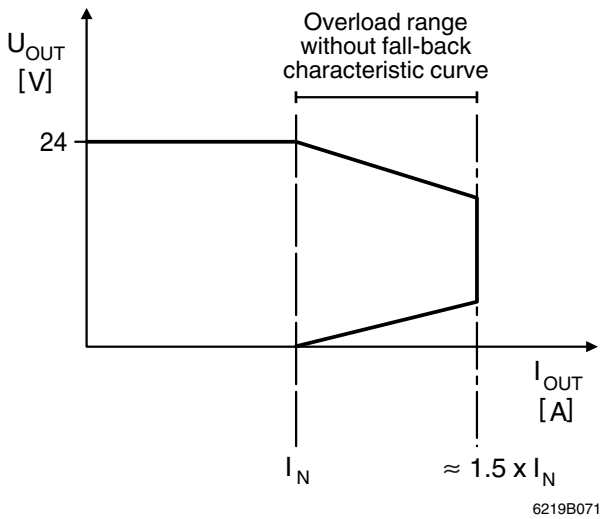

Figure 2-22 Overload range **without** fall-back characteristic curve

2.14.2 Connecting the power supplies

Supply the Inline controller using external 24 V DC voltage sources. The permissible voltage ranges from 19.2 V DC to 30 V DC (ripple included).

Only use power supplies that are suitable for operation with capacitive loads (increased switch-on current) (see Section “Sizing of the power supply” on page 37).

1. Connect the power supplies to the connector for power supply as shown in Figure 2-23.
2. Insert the connector in the Inline controller.
3. Switch on the power supplies.
4. The UL, UM, and US LEDs light up and, after around 10 seconds, the FR and RDY LEDs start flashing.

The Inline controller is now fully initialized.

If the LEDs do not light up or start flashing, there is a serious fault on the Inline controller. In this case, please contact Phoenix Contact.

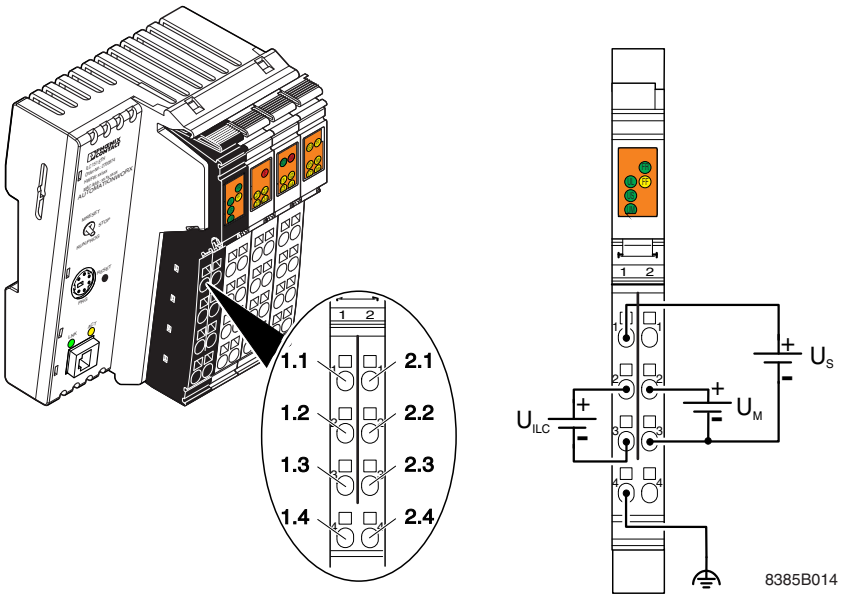

Figure 2-23 Supply voltage connection

Terminal point	Assignment		Note
Connector 1	**Power connectors**		
1.1	24 V DC (U_S)	24 V segment voltage supply	The supplied voltage is directly routed to the potential jumper. **NOTE:** Protect the supply voltage externally according to the connected load (local bus devices) with **8 A, maximum**. Make sure the external fuse blows in the event of an error.
1.2	24 V DC (U_{ILC})	24 V supply	The 7.5 V communications power (U_L) for the ILC and the connected local bus devices is generated from this voltage. The 24 V analog voltage (U_{ANA}) for the local bus devices is also generated. **NOTE:** Protect the supply voltage externally according to the connected load (local bus devices) with **2 A, maximum**. Make sure the external fuse blows in the event of an error.
2.1, 2.2	24 V DC (U_M)	24 V main voltage supply	The main voltage is routed to the local bus devices via the potential jumpers. **NOTE:** Protect the supply voltage externally according to the connected load (local bus devices) with **8 A, maximum**. Make sure the external fuse blows in the event of an error.
1.3	LGND	Logic ground reference potential	The potential serves as the reference ground for the communications power.
2.3	SGND	Segment ground reference potential	The reference potential is directly routed to the potential jumper and is, simultaneously, reference ground for the main and segment supply.
1.4, 2.4	FE	Functional earth ground (FE)	Functional earth ground must be connected through the power supply. The contacts are directly connected to the potential jumper and FE springs on the bottom of the housing. The Inline controller is grounded when it is snapped onto a grounded DIN rail. Functional earth ground is only used to discharge interference.

NOTE:
The **maximum total current** flowing through the potential jumpers is **8 A**.

2.14.3 24 V segment supply/24 V main supply

The segment supply and main supply must have the same reference potential. An electrically isolated voltage area is not possible.

2.14.4 24 V segment supply

There are several ways of providing the segment voltage at connector 1:

1. The segment voltage can be supplied separately at terminal points 1.1 and 2.3 (GND) (see Figure 2-23 on page 38).
2. Connections 1.1 and 2.1 (or 2.2) can be jumpered to ensure that the segment circuit is supplied from the main circuit.
3. A switched segment circuit can be created with a switch between terminal points 1.1 and 2.1 (or 2.2).

NOTE:

The 24 V segment supply has elements for protection against polarity reversal and transient surge voltage.

It does not have short-circuit protection.

The user must provide short-circuit protection. The rating of the fuse connected upstream must be such that the maximum permissible load current of 8 A is not exceeded (total current at U_M and U_S).

2.14.5 24 V main voltage

NOTE:

The 24 V main supply has elements for protection against polarity reversal and transient surge voltage.

It does not have short-circuit protection.

The user must provide short-circuit protection. The rating of the fuse connected upstream must be such that the maximum permissible load current of 8 A is not exceeded (total current at U_M and U_S).

2.14.6 24 V ILC supply

NOTE:

The 24 V ILC supply has elements for protection against polarity reversal and transient surge voltage. These protective elements are only used to protect the power supply unit.

The rating of the fuse connected upstream must be such that the maximum permissible load current of 2 A is not exceeded.

2.14.7 Jumpering

Terminals 1.3 and 2.3 on connector 1 can be jumpered if the communications power and the segment voltage are not to be electrically isolated.

2.15 Digital inputs and outputs

The descriptions for digital inputs and outputs apply to all the Inline controllers listed on the inner cover page of this user manual.

There are eight 24 V DC inputs and four 24 V DC outputs.

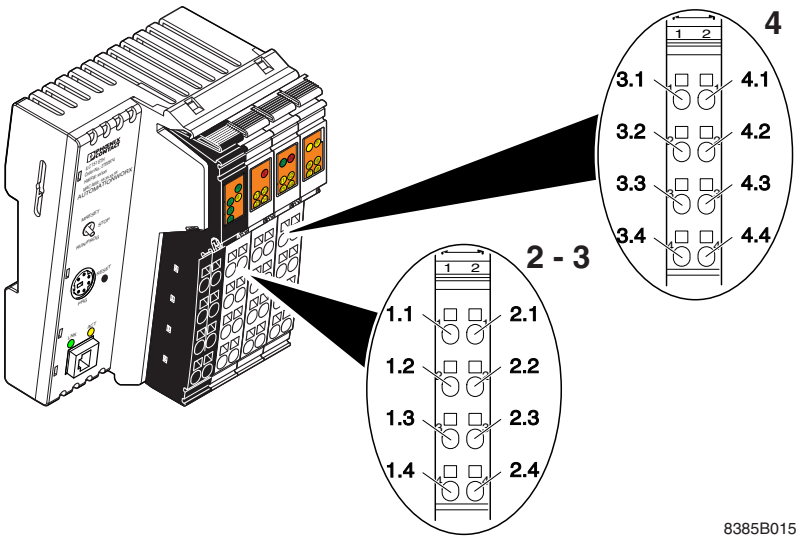

Figure 2-24 Assignment of terminal points of connectors 2 to 4

Table 2-3 Terminal point assignment

Terminal point	Assignment	Note
Connector 2	**Output terminal points**	
1.1	Q1	Output 1
2.1	Q2	Output 2
1.2, 2.2	GND	Ground connection for 2 and 3-conductor connection
1.3, 2.3	FE	Functional earth ground for 3-conductor connection
1.4	Q3	Output 3
2.4	Q4	Output 4
The outputs are supplied with 24 V DC from the segment supply (U_S).		
Connector 3	**Input terminal points**	
1.1	I1	Input 1
2.1	I2	Input 2
1.2, 2.2	24 V	Supply voltage U_M for 2 and 3-conductor connection
1.3, 2.3	GND	Ground connection for 3-conductor connection
1.4	I3	Input 3

Table 2-3 Terminal point assignment [...]

Terminal point	Assignment	Note
2.4	I4	Input 4
Connector 4	**Input terminal points**	
3.1	I5	Input 5
4.1	I6	Input 6
3.2, 4.2	24 V	Supply voltage U_M for 2 and 3-conductor connection
3.3, 4.3	GND	Ground connection for 3-conductor connection
3.4	I7	Input 7
4.4	I8	Input 8

The inputs are supplied with 24 V DC from the main supply (U_M).

The outputs have protection against ground connection interrupt and must be wired accordingly.

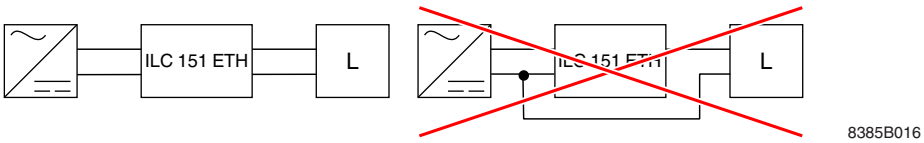

Figure 2-25 Basic wiring of an output with a load (L)
(shown using the ILC 151 ETH as an example)

Phoenix Contact recommends that connectors for digital 4-channel or 16-channel Inline terminals are used to connect sensors or actuators in 3-wire technology (not supplied as standard, see Section “Accessories” on page 95).

3 The Inline controller under PC Worx/PC Worx Express

3.1 Software version

Using the Inline controller requires the following PC Worx/PC Worx Express version or later:

Table 3-1 Software version information

Inline controller	Firmware version ≥ 4.0		
	Software versions (Service Pack = SP, Hotfix = HF)		
	PC Worx	PC Worx Express	AUTOMATIONWORX Software Suite
ILC 131 ETH	≥ 6.20		2012 1.70
ILC 151 ETH	≥ 6.20		2012 1.70
ILC 171 ETH 2TX	≥ 6.20 SP 1		2012 1.70 SP 1
ILC 191 ETH 2TX	≥ 6.20 SP 1		2012 1.70 SP 1
ILC 131 ETH/XC	≥ 6.20		2012 1.70
ILC 151 ETH/XC	≥ 6.20		2012 1.70

PROFINET device function

The PROFINET device function of these controllers is not supported by the PC Worx Express software.

For information on installing and using PC Worx/PC Worx Express, please refer to the corresponding quick start guide. It can be downloaded at phoenixcontact.net/products and is supplied with the software.

3.2 Creating a new project

Before making the settings described below, create a new project in the PC Worx/PC Worx Express software.

- Select the “New Project...” command from the “File” menu to create a new project using a template.
- In the “New Project” dialog, select the “ILC 1...” template according to the version of the Inline controller you are using.
- Save the project using an appropriate name (in the example in Figure 3-1: “UM_ILC_1X1”).

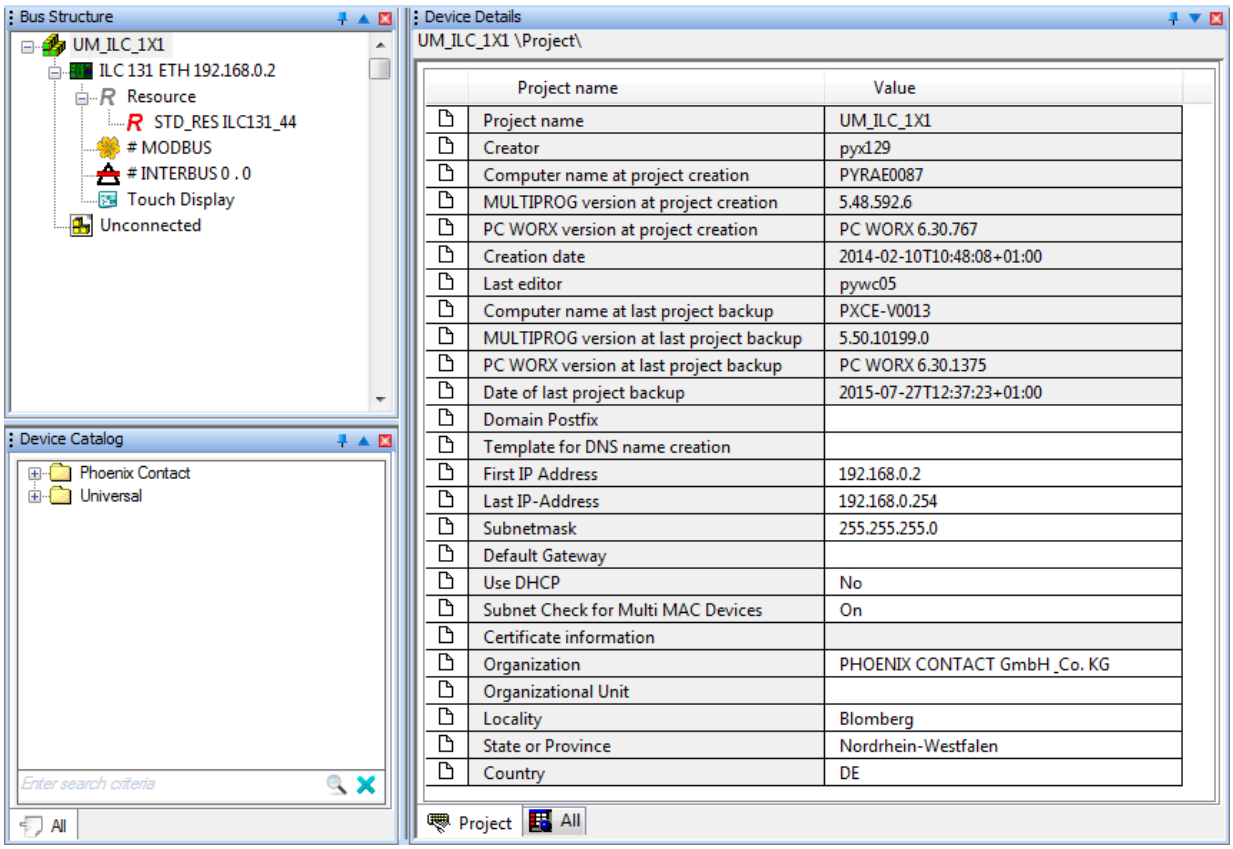

Figure 3-1 Project information after creating a new project

3.3 Assigning the IP address for the controller

The procedure for assigning the IP address is essentially the same in PC Worx and PC Worx Express for all Inline controllers described in this user manual.

By default, the Inline controller has no preset IP address. Initial setting of the IP address can be carried out with the PC Worx/PC Worx Express software manually via the serial interface, using the DCP protocol, or by means of a BootP server. The IP address can be changed later with the PC Worx/PC Worx Express software via the serial connection, Ethernet, or the DCP protocol.

3.3.1 Dynamic Configuration Protocol (DCP)

The Inline controllers support the DCP protocol from firmware version 4.20 or later and from PC Worx version 6.30.767 or later (part of the AUTOMATIONWORX Software Suite 1.81 including AddOn V1).

The IP address is assigned via the DCP protocol in the PC Worx/PC Worx Express software via the “Device Details” window:

- Select the “IP Settings” tab.
- Enter the IP address of the Inline controller.

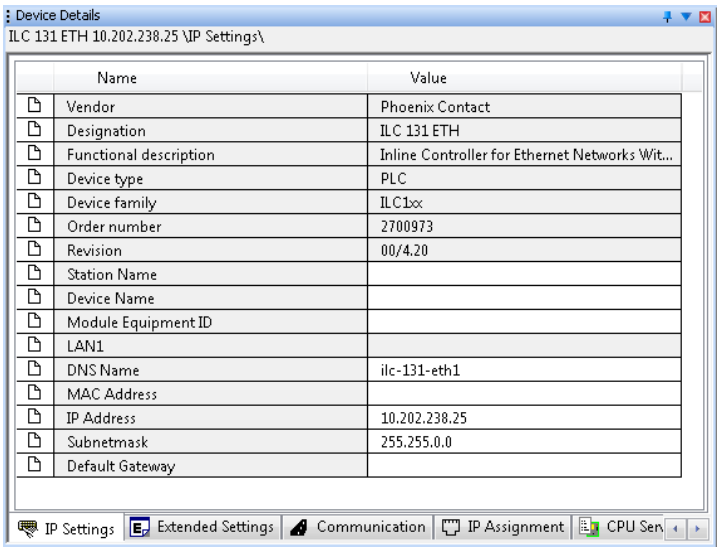

Figure 3-2 DCP: setting the IP address

The “IP Assignment” tab is used for the actual IP address assignment with DCP.

- Select the “IP assignment” tab.

After selecting the “IP Assignment” tab, the PROFINET network is searched for DCP devices.

- Click on “Assign IP” to start IP address assignment with DCP.

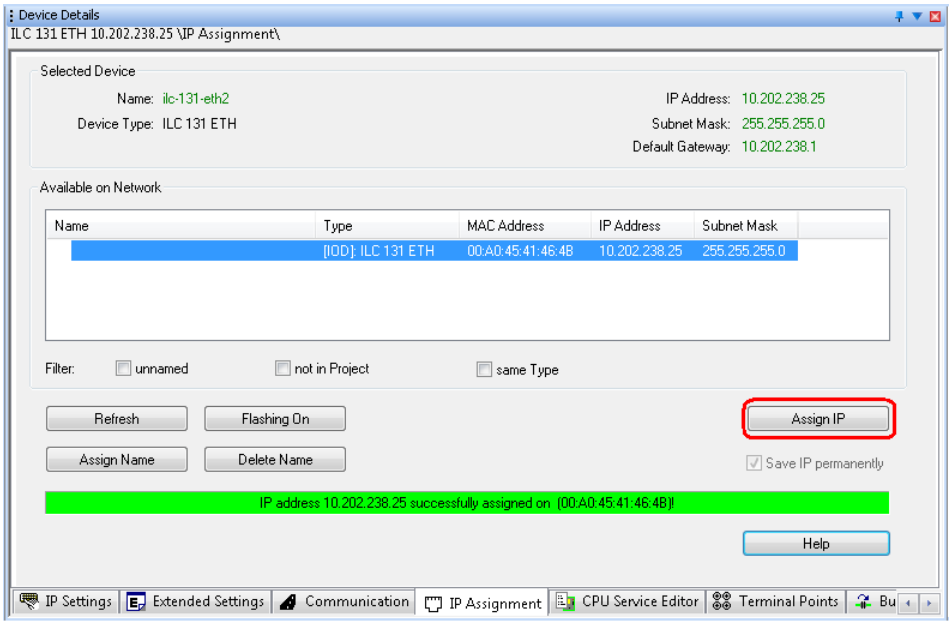

Figure 3-3 Starting IP address assignment via DCP

A green status indicator indicates successful IP address assignment.

The PROFINET device name is assigned in the same way.

3.3.2 BootP server

The following example describes IP address assignment using a BootP server in PC Worx Express for the ILC 151 ETH.

Bootstrap protocol (BootP)

In an Ethernet network, BootP is used to assign an IP address to a BootP client using a BootP server. For this example (delivery state of the ILC 151 ETH), the ILC 151 ETH (BootP client) sends a Boot_Request as a broadcast in the network. The MAC address of the transmitter is sent with the Boot_Request to provide unique identification. If the BootP server has been activated in PC Worx Express, PC Worx Express responds with a Boot_Reply. PC Worx Express uses this Boot_Reply to inform the ILC 151 ETH of its IP address and subnet mask. Please ensure that:

– The BootP server knows the MAC address sent by the BootP client.
– A corresponding IP address and subnet mask have been assigned in PC Worx Express for the MAC address.

Once the IP data has been transferred to the ILC 151 ETH successfully, PC Worx Express sends a corresponding acknowledgment message.

PC/network adapter

To determine whether your network permits the IP settings used in the example project (see Figure 3-4 on page 47), proceed as follows:

- In the Windows Control Panel, check the settings for your PC network adapter.
- If necessary, adjust these settings so that the ILC 151 ETH can be accessed in your network via the IP address used in the example project.

If your network does not permit the use of the IP address used in the example project, adjust the settings in the project information accordingly (see Figure 3-1 on page 44).

Changes to project information are not applied automatically

If any modifications are made to the project information (see Figure 3-1) that affect the IP settings for the controller, a warning is displayed. However, the modification is not implemented automatically.
When a new project is created, the default settings are specified under “IP Settings”.

Assigning IP settings

To set the IP address in PC Worx/PC Worx Express, proceed as described below.

Please note that BootP is preset on the Inline controller by default.

The IP address that is assigned here for the controller is also implemented as the IP address for the communication path via TCP/IP.

After assigning the IP address, PC Worx Express automatically creates a link via TCP/IP as a communication path to the Inline controller.

- Establish an Ethernet connection between your PC and the controller.
- Switch to the bus configuration workspace.
- Select the controller node (in the example: “ILC 151 ETH”).
- In the “Device Details” window, select the “IP Settings” tab.
- Enter the MAC address of the controller (see Figure 3-4). It is printed on the device (“00.A0.45.xx.xx.xx”).

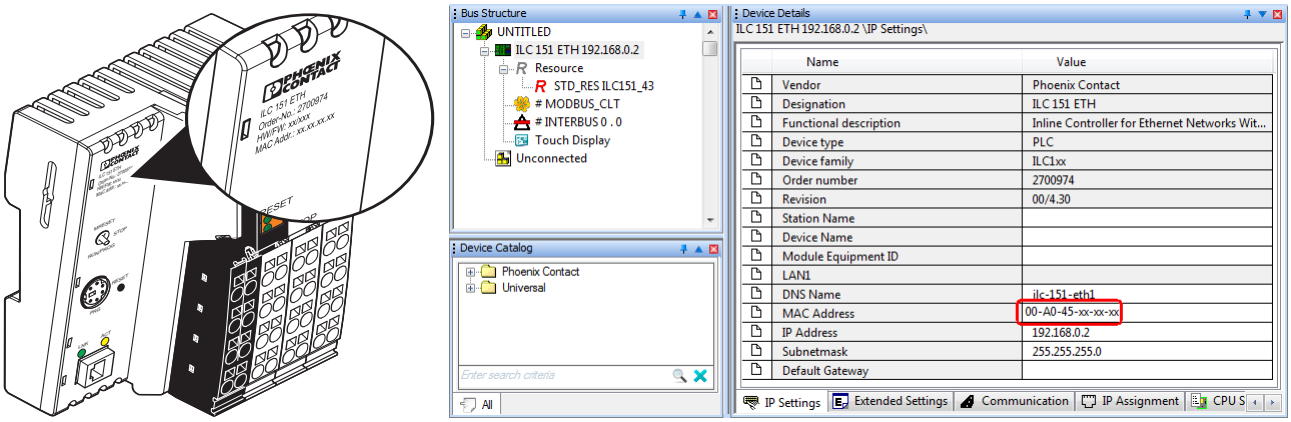

Figure 3-4 Entering the MAC address

- In the PC Worx Express menu bar, select the “Extras, BootP/SNMP/TFTP-Configuration...” menu.

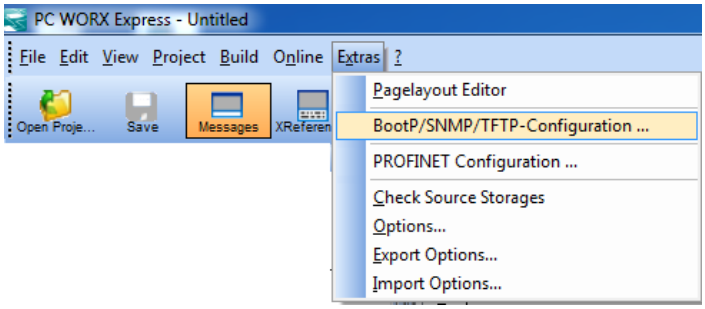

Figure 3-5 “Extras, BootP/SNMP/TFTP-Configuration...” menu

- Click on the “Activate BootP” button.

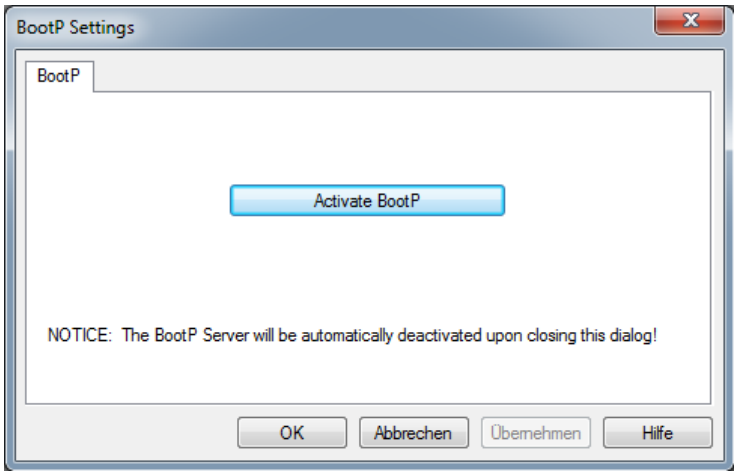

Figure 3-6 “Activate BootP” button

- Perform a cold restart for the controller. To do this, switch the supply voltage off and then on again after about 2 seconds.

The controller is assigned the IP address which is specified in the project for the controller. The following message appears in the message window in the “Bus Configurator” tab.

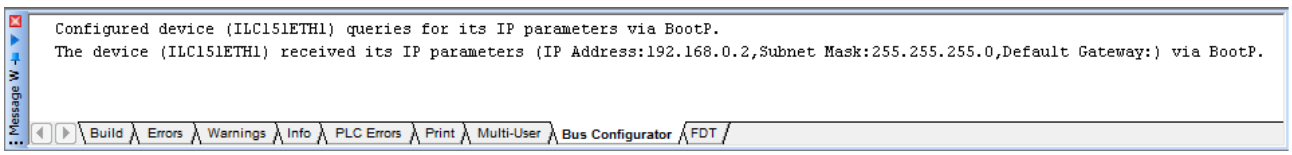

Figure 3-7 Message window following BootP

The IP address is now permanently stored on the controller's internal parameterization memory.

For additional information on setting the IP address with PC Worx/PC Worx Express, please refer to the quick start guides for the software used.

3.4 The Inline controller as a PROFINET device

Please note that it is only possible to integrate the Inline controller into the **PC Worx** software as a **PROFINET device**.

The PROFINET device function of the Inline controller can also be activated in the PC Worx Express software.

This section uses an example to describe how to integrate the ILC 131 ETH as a PROFINET device. This procedure applies to all the Inline controllers listed in Section Section 1.1.

The PROFINET-specific system variables can be found in Section 4.5 on page 82.

Activating the PROFINET device function of the ILC 131 ETH

You can activate the PROFINET device function once you have assigned an IP address for the ILC 131 ETH as described in Section “Assigning the IP address for the controller” on page 45 (in the following example: 192.168.161.155).

- In the “Device Details” window, select the “PROFINET device activation” item under “Extended Settings”.
- Under “Settings”, select “PROFINET device activated”.

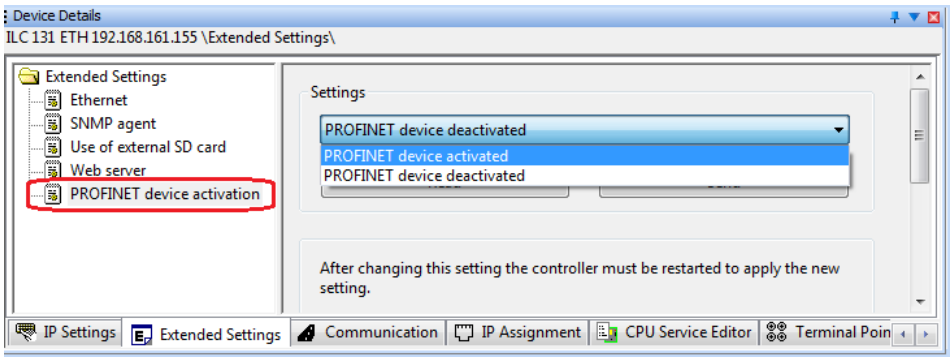

Figure 3-8 Switching on the PROFINET device function

- Click “Send” (hidden by the drop-down list in Figure 3-8).
- In the “Settings Communication Path” dialog, confirm the suggested IP address or the one you have set according to your application with “OK”.

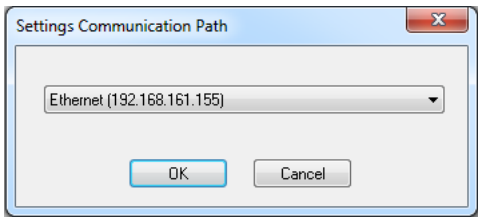

Figure 3-9 “Settings Communication Path” dialog

Successful execution of the service will be displayed in the status window.

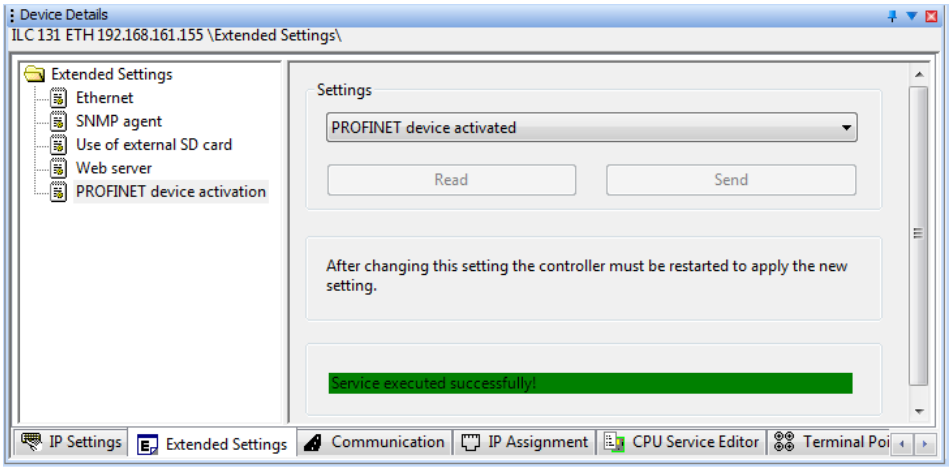

Figure 3-10 PROFINET device function/settings - Send: Service executed successfully

To apply the network settings, you have to restart the controller.

- In the “Device Details” window, select the “Ethernet” setting under “Extended Settings” (refer to Figure 3-11).
- In the “Activate Network Settings” area, click on the “Restart Controller” button (see Figure 3-11).

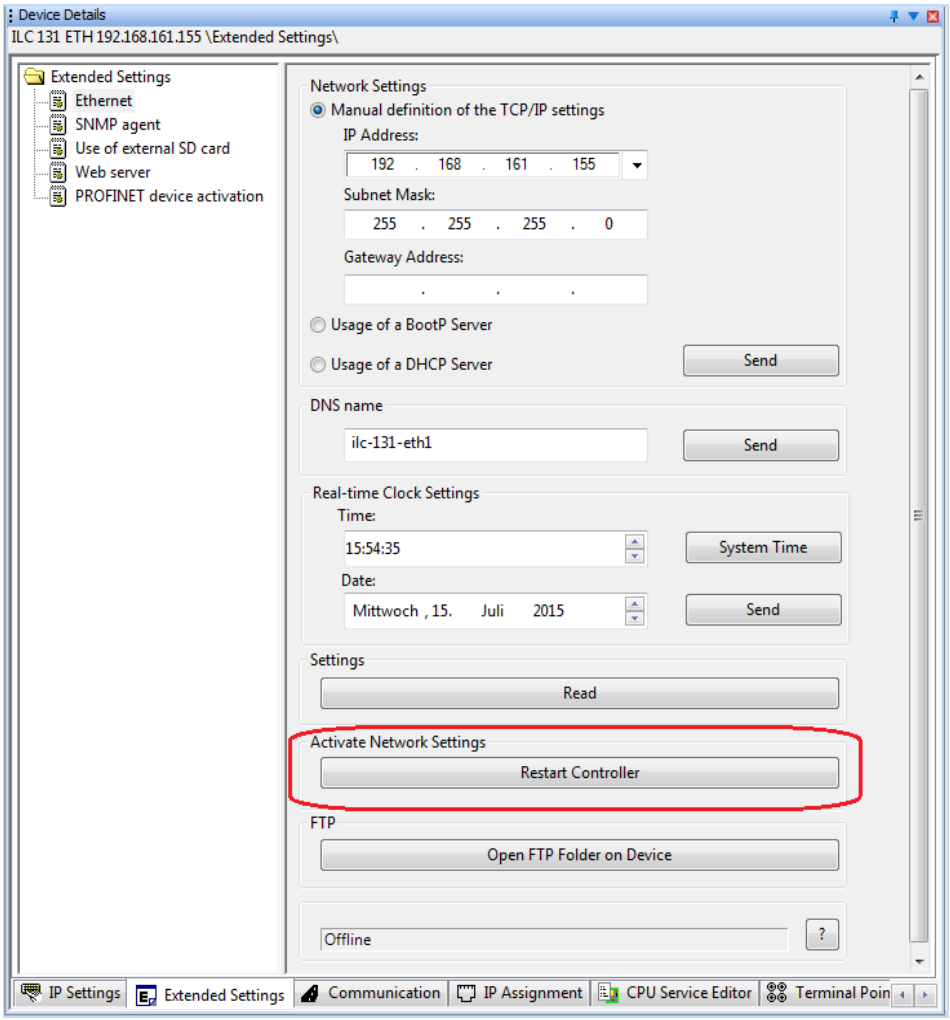

Figure 3-11 Activate Network Settings: Restart Controller

- In the “Settings Communication Path” dialog, confirm the suggested IP address or the one you have set according to your application with “OK”.

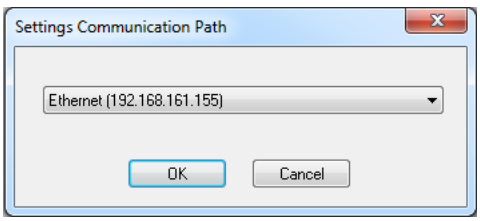

Figure 3-12 “Settings Communication Path” dialog

Successful execution of the service will be displayed in the status window.

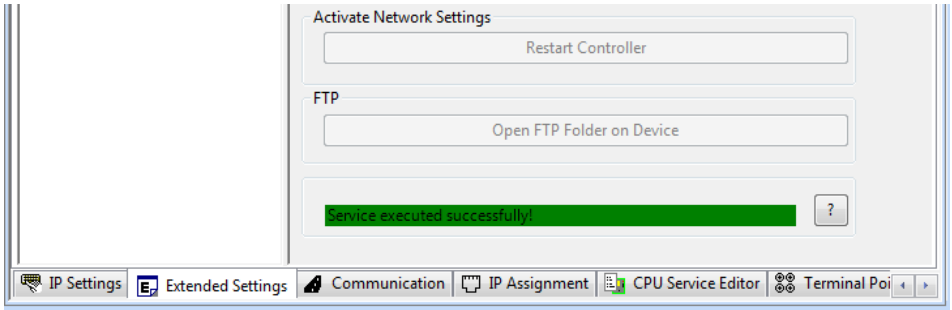

Figure 3-13 Activating the network settings: service executed successfully

Now you can read in the ILC 131 ETH as a PROFINET device in a PC Worx project.

Integrating the ILC 131 ETH as a PROFINET device

The following section describes how to read in the ILC 131 ETH as a PROFINET device in the PC Worx software.

Alternatively, you can also create the PC Worx project by selecting devices from the device catalog. For additional information on creating a PC Worx project, please refer to the online help or the quick start guide for the software.

The following conditions apply for the example project:

- Higher-level controller: AXC 1050
- Controller settings:
  - IP address: 192.168.161.162
  - Subnet mask: 255.255.255.0
  - PROFINET device name (“DNS name”) axc-10501
- Settings of the ILC 131 ETH as a PROFINET device:
  - IP address: 192.168.161.155
  - Subnet mask: 255.255.255.0
  - PROFINET device name (“DNS name”) ilc131eth

You can read in the ILC 131 ETH as a PROFINET device after you have done the following:

- Activated the PROFINET device function of the ILC 131 ETH
- Installed the PROFINET controller and the PROFINET devices (ILC 131 ETH and other PROFINET devices according to your application)
- Created a project in PC Worx and
- Configured the PROFINET controller according to your application.

• In the “Bus Structure” window, select the “Read PROFINET...” setting in the PROFINET context menu.

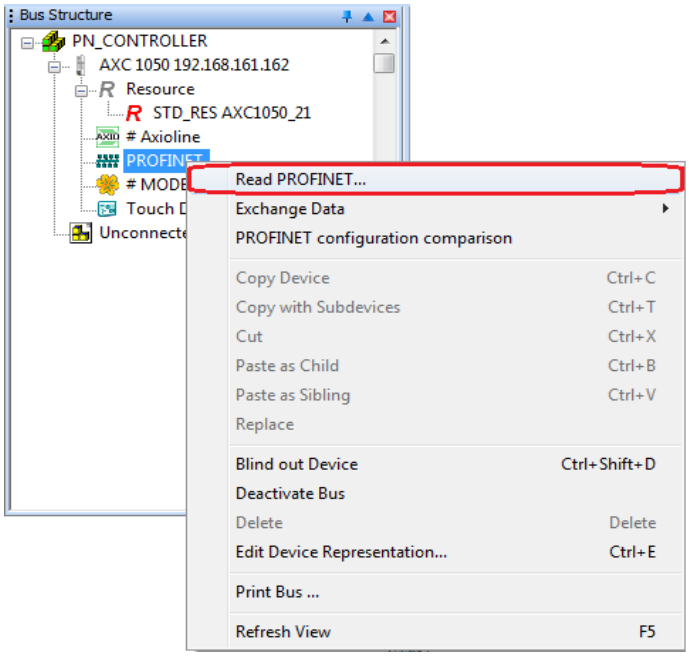

Figure 3-14 Bus Structure: PROFINET context menu “Read PROFINET...”

The “Read PROFINET” dialog that opens shows the PROFINET devices that have been detected in the connected network.

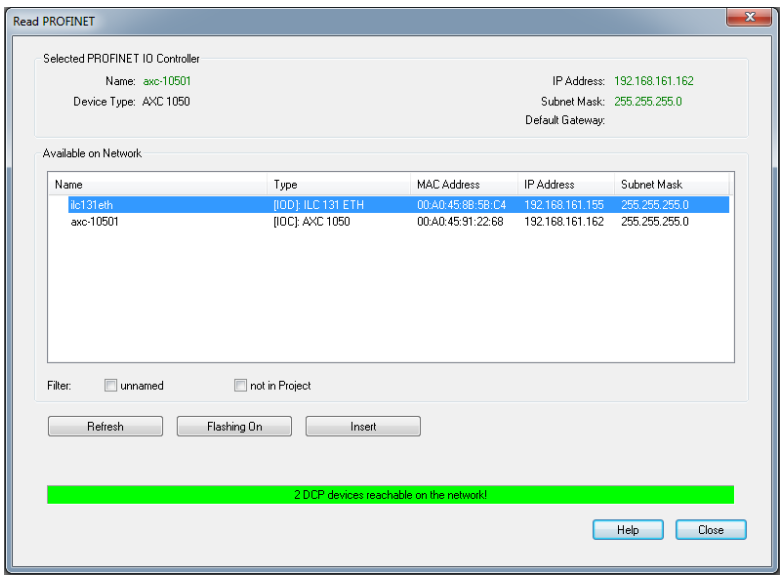

Figure 3-15 “Read PROFINET” dialog

- Select the ILC 131 ETH and insert it as a PROFINET device by clicking “Insert”.
- Close the dialog by clicking on the “Close” button.

The PROFINET device inserted earlier will be displayed in the “Bus Structure” window.

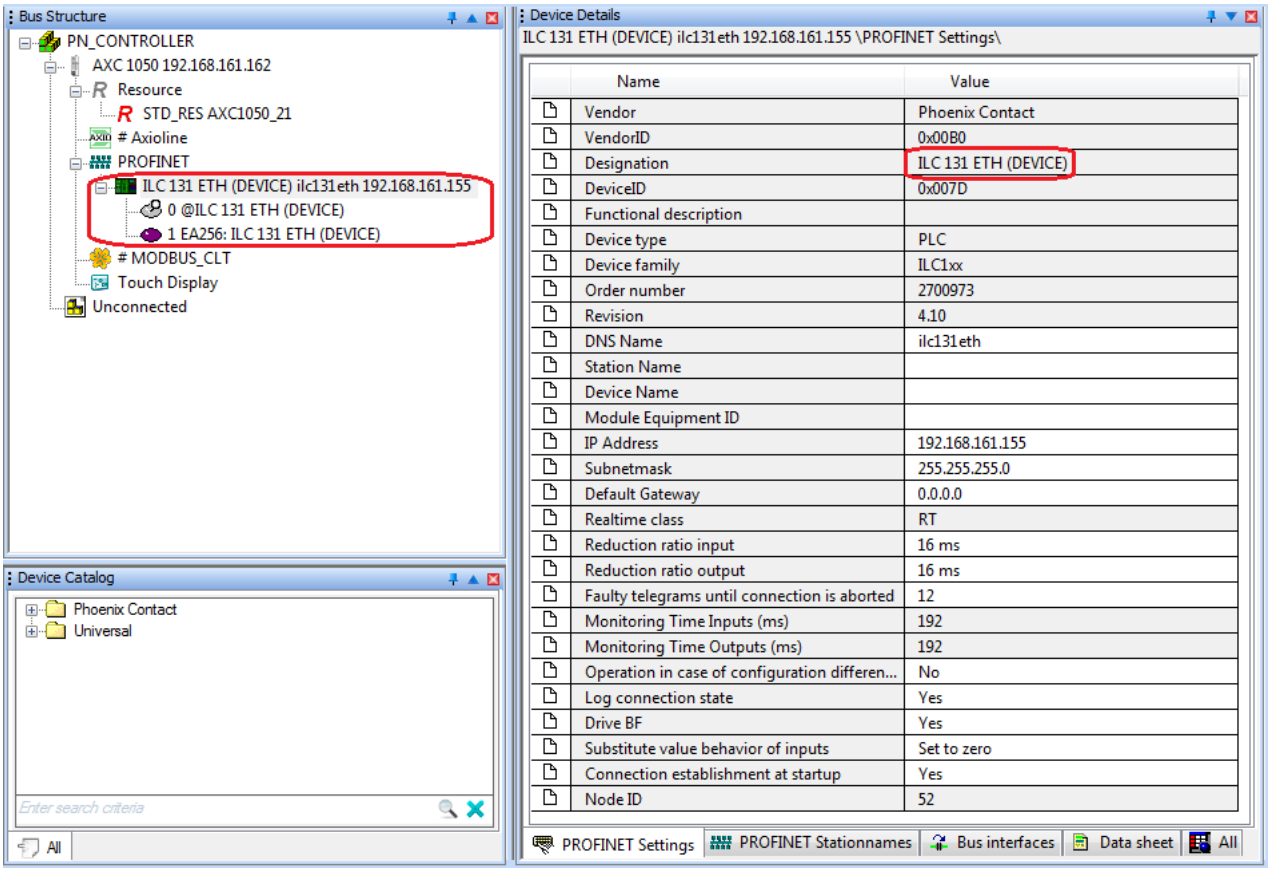

Figure 3-16 ILC 131 ETH inserted as a PROFINET device

The process data of the PROFINET device will be displayed on the “Process Data” tab in the “Device Details” window.

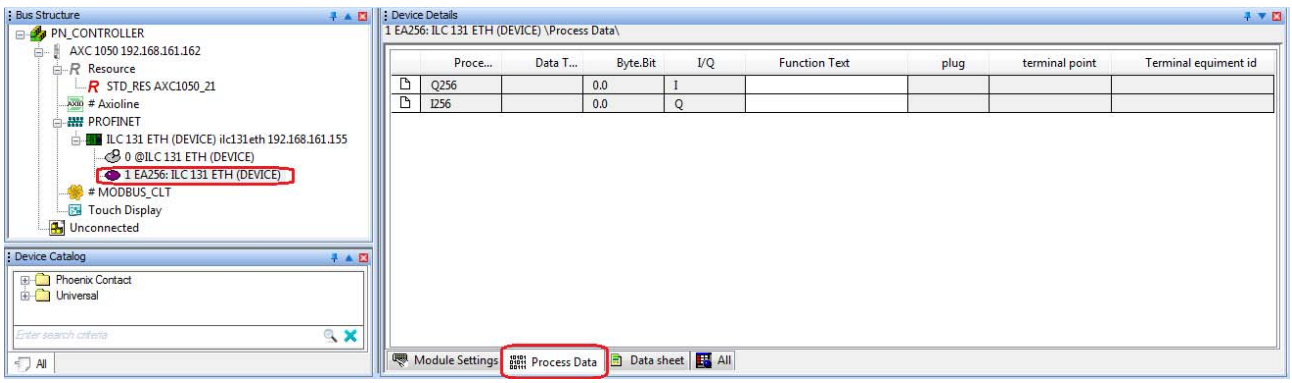

Figure 3-17 ILC 131 ETH as a PROFINET device: Process Data

The ILC 131 ETH is now available as a PROFINET device in the PC Worx project.

3.5 Setting the realtime clock under PC Worx Express

The procedure for setting the realtime clock is essentially the same in PC Worx and PC Worx Express. The following example describes the setting in PC Worx Express.

The time and date for the internal system clock of the Inline controller can be set under “Extended Settings” in the “Device Details” window for the controller in PC Worx Express.

To set the realtime clock, proceed as described in the quick start guide for the PC Worx Express version used.

3.6 Download changes

The “Download Changes” function supports the following Inline controllers from the specified device versions together with the specified versions of the PC Worx/PC Worx Express software tools.

Table 3-2 Version information for “Download Changes”

Inline controller	Firmware version	PC Worx/PC Worx Express
ILC 131 ETH	≥ 4.00	≥ 6.20
ILC 151 ETH	≥ 4.00	≥ 6.20
ILC 171 ETH 2TX	≥ 4.00	≥ 6.20 Service Pack 1
ILC 191 ETH 2TX	≥ 4.00	≥ 6.20 Service Pack 1
ILC 131 ETH/XC	≥ 4.00	≥ 6.20
ILC 151 ETH/XC	≥ 4.00	≥ 6.20

3.7 Functions of the plug-in parameterization memory (SD card)

The function is available for Inline controllers with firmware versions ≥ 4.40 as of AUTOMATIONWORX Software Suite Version 1.82 AddOn V1.

The plug-in parameterization memory can be used as a main or additional memory.

Figure 3-18 shows how to proceed to use the SD card as the main or additional memory.

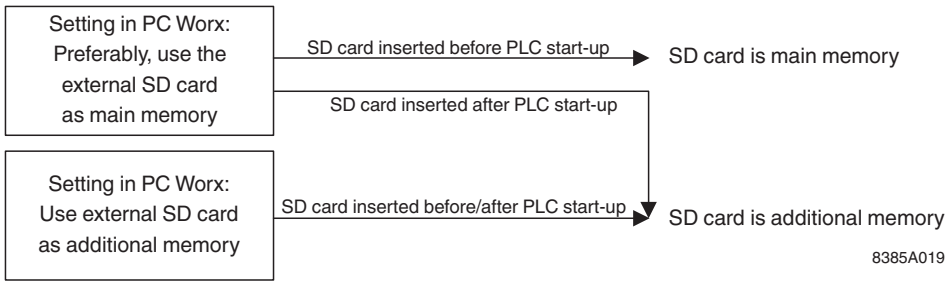

Figure 3-18 Procedure for using the external SD card as main or additional memory

Information on using the SD card as main or additional memory can be found in the following sections.

3.7.1 Main memory

The function is available for Inline controllers with firmware versions ≥ 4.40 as of AUTOMATIONWORX Software Suite Version 1.82 AddOn V1.

If the SD card is used as the main memory, all application-specific data is stored on the SD card.

The SD card is recognized during initialization of the Inline controller.

- Ensure that the SD card is inserted **before switching on the controller**, if it is to be used by the controller as the main memory.

Removing the SD card during operation

The SD card must not be removed while the Inline controller is in operation.

NOTE: Potential data loss

If you remove the SD card during operation, this could cause data loss.

- Do not remove the SD card during operation.

Should the SD card be accidentally removed during operation, the Inline controller will report an error, stop processing the application program, and switch to the READY state. The FAIL LED indicates an error. If an online connection to PC Worx is established, the message window will indicate that the SD card was unintentionally inserted or removed.

Changing operating modes

To change operating modes (operating the Inline controller with/without SD card), please note the following:

Change: operation without SD card → operation with SD card

To change the Inline controller mode from “operation without SD card” to “operation with SD card”, proceed as follows:

- Switch off the supply voltage of the Inline controller.
- Insert the SD card, see Section 2.9.1 “Inserting/removing the parameterization memory”.
- Switch on the supply voltage of the Inline controller.

NOTE: Delete all data on the internal parameterization memory

When the Inline controller is switched on, all application-specific data is deleted from the internal parameterization memory. PC Worx projects and IP configurations stored on the parameterization memory are no longer available.
The Inline controller accesses the data stored on the SD card.

Change: operation with SD card → operation without SD card

To change the Inline controller mode from “operation with SD card” to “operation without SD card”, proceed as follows:

- Switch off the supply voltage of the Inline controller.
- Remove the SD card, see Section 2.9.1 “Inserting/removing the parameterization memory”.
- Switch on the supply voltage of the Inline controller.

NOTE: No data on the internal parameterization memory

Once the Inline controller has been operated with the SD card, there is no data available on the internal parameterization memory. The Inline controller therefore does not have an IP address.

- Assign the Inline controller an IP address as described in Section Section 3.3.

Settings in PC Worx

Figure 3-19 shows the settings in PC Worx required to use the SD card as the main memory.

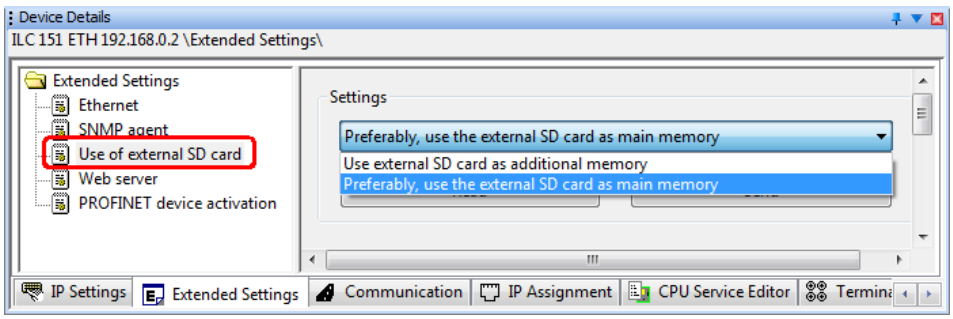

Figure 3-19 Setting the SD card as main memory

- In the “Device Details” window, select the “Use of external SD card” setting under “Extended Settings”.
- In the “Settings” area, in the drop-down list, select the setting “Preferably, use the external SD card as main memory”.
- Click “Send” (hidden by the drop-down list in Figure 3-19), to send the setting to the Inline controller.
- Restart the Inline controller.

Default setting

The setting “Preferably, use the external SD card as main memory” is activated by default in PC Worx.
If you do not change this setting, the following applies:

– If the SD card is **already inserted before starting up** the Inline controller (also refer to Figure 3-18 on page 56), the SD card is used as the **main memory**. All application-specific data is stored on the SD card.
– If the SD card **is only inserted after starting up** the Inline controller (also refer to Figure 3-18 on page 56), the SD card is used as an **additional memory** (also refer to Section 3.7.2). All application-specific data is stored on the internal parameterization memory of the Inline controller.

3.7.2 Additional memory

The function is available for Inline controllers with firmware versions ≥ 4.40 as of AUTOMATIONWORX Software Suite Version 1.82 AddOn V1.

WARNING: Explosion hazard

In potentially explosive areas, the SD card must not be used as additional memory. Use the SD card as main memory only. Don't insert or remove the SD card during operation.

If the SD card is used as an additional memory, all application-specific data is stored on the internal parameterization memory of the Inline controller. If an SD card with license key is used, the license is used despite this.

NOTE: In some circumstances, function blocks are no longer executed

If an SD card with license keys for the function block libraries (SD FLASH XXX APPLIC A) is removed from the Inline controller for longer than 60 minutes, function blocks that are required to execute a license are required may no longer be executed.
If the SD card is removed and then inserted once again in the Inline controller before 60 minutes have passed, all function blocks will continue to run.

- Never remove an SD card with license keys for function block libraries from the Inline controller for longer than 60 minutes.

Use as additional memory

The SD card is used as an additional memory (also refer to Figure 3-18 on page 56), if

– The SD card is inserted **after starting up** the Inline controller
  or
– The setting “Use external SD card as additional memory” (default setting) has been selected in PC Worx.

Inserting/removing the SD card

The SD card can be inserted or removed before starting up or while the Inline controller is operating.

NOTE: Potential data loss

If you remove the SD card while read and/or write access to the SD card is activated, this could cause data loss.

- Only remove the SD card when it is not being accessed.

Settings in PC Worx

Figure 3-20 shows the settings in PC Worx required to use the SD card as the additional memory.

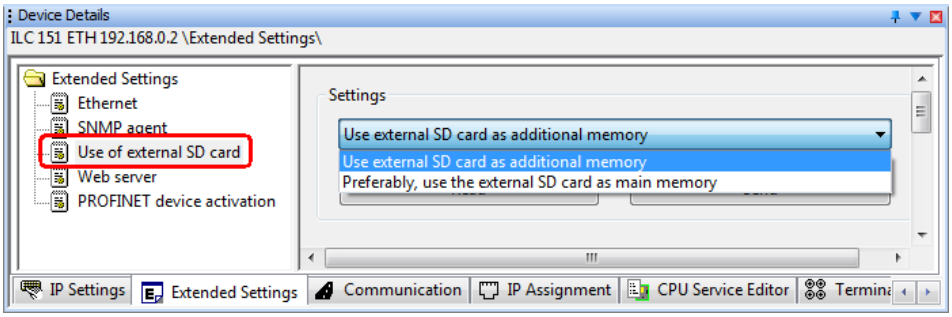

Figure 3-20 Setting the external SD card as additional memory

- In the “Device Details” window, select the “Use of external SD card” setting under “Extended Settings”.
- In the “Settings” area, select the “Use the external SD card as additional memory” setting in the drop-down list.
- Click “Send” (hidden by the drop-down list in Figure 3-20), to send the setting to the Inline controller.

In order for the settings to take effect on the Inline controller, it must be restarted.

3.7.2.1 SD card as memory for log files

The SD card can be used as memory for log files.

On the SD card, the contents of the “cfroot” directory are displayed in the “sddisk” directory. You can view the directories on the SD card by accessing the Inline controller via FTP (see Section “Parameterization memory and Internet Explorer” on page 62).

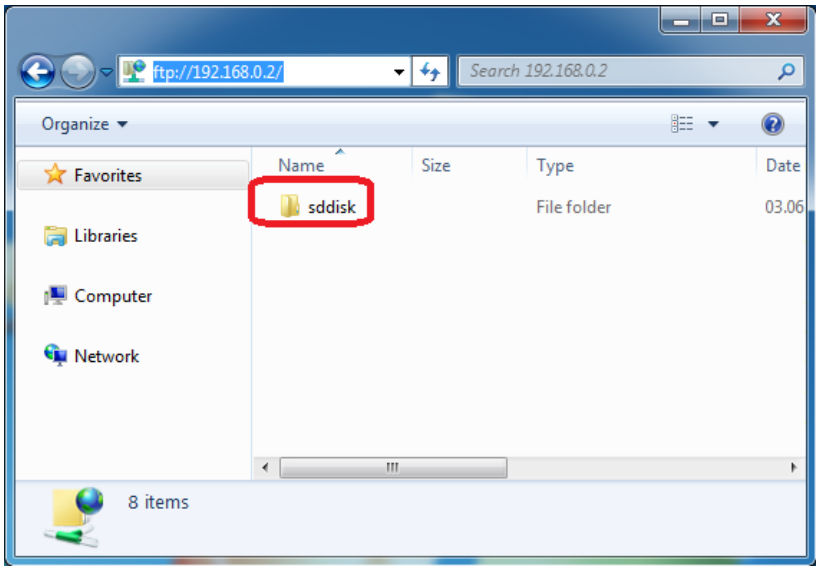

Figure 3-21 “sddisk” directory on the SD card

It is useful to create a new directory in the “sddisk” directory, in which the log files can be stored:

- Access the Inline controller via FTP.
- Open the “sddisk” directory by double clicking.
- In the “sddisk” directory, open the context menu by right clicking, and select “New, Folder”.
- Enter a name for the directory you are creating (in the example in Figure 3-22 “Logfile”).

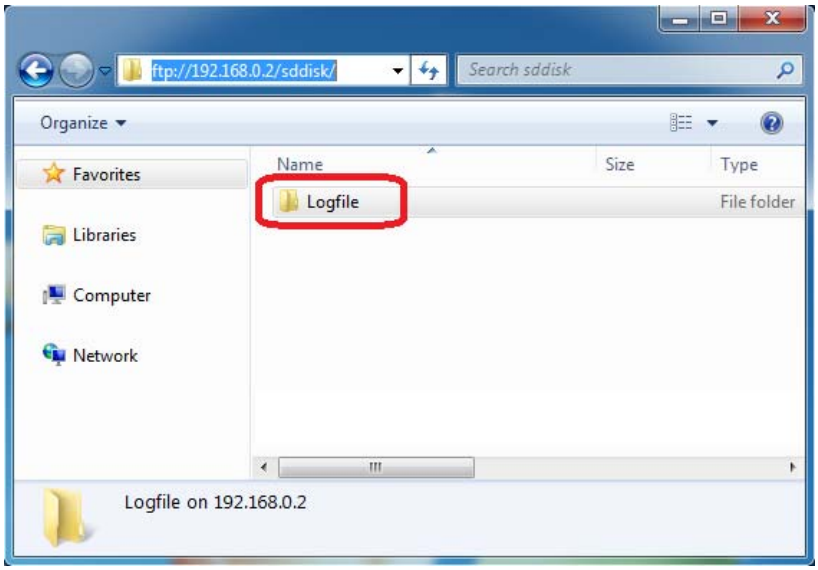

Figure 3-22 Newly created “Logfile” directory in the “sddisk” directory

To access the directories on the SD card, use the FILE function blocks in PC Worx (refer to Section 3.13 and online help on PC Worx).
If you program your application program accordingly, the log data is saved in the “Logfile.txt” file and stored in the “Logfile” directory. You can then access the file with the FILE_OPEN function block.

Figure 3-23 shows a FILE_OPEN function block for opening the “Logfile.txt” file in the “\sddisk\Logfile” directory.

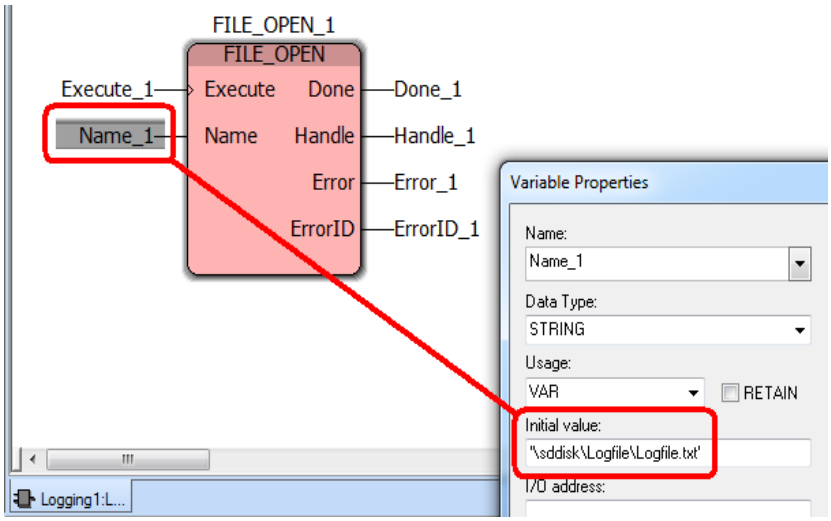

Figure 3-23 Opening the “Logfile.txt” file via the FILE_OPEN function block

- In the “Variable Properties” dialog, (seen on the right in Figure 3-23) always enter the full path and file name.

3.8 Parameterization memory and Internet Explorer

To delete files or store user-specific files on the internal parameterization memory, proceed as follows:

The FTP functionality must be activated in Internet Explorer. See Section “Internet Explorer FTP functionality” on page 63.

- Switch to the bus configuration workspace in PC Worx.
- Select the controller, e.g., “ILC 151 ETH”, in the “Bus Structure” window.
- Select the "Extended Settings" tab in the "Device Details" window.
- Open Internet Explorer from this window by clicking on the “Open FTP Folder on Device” button.

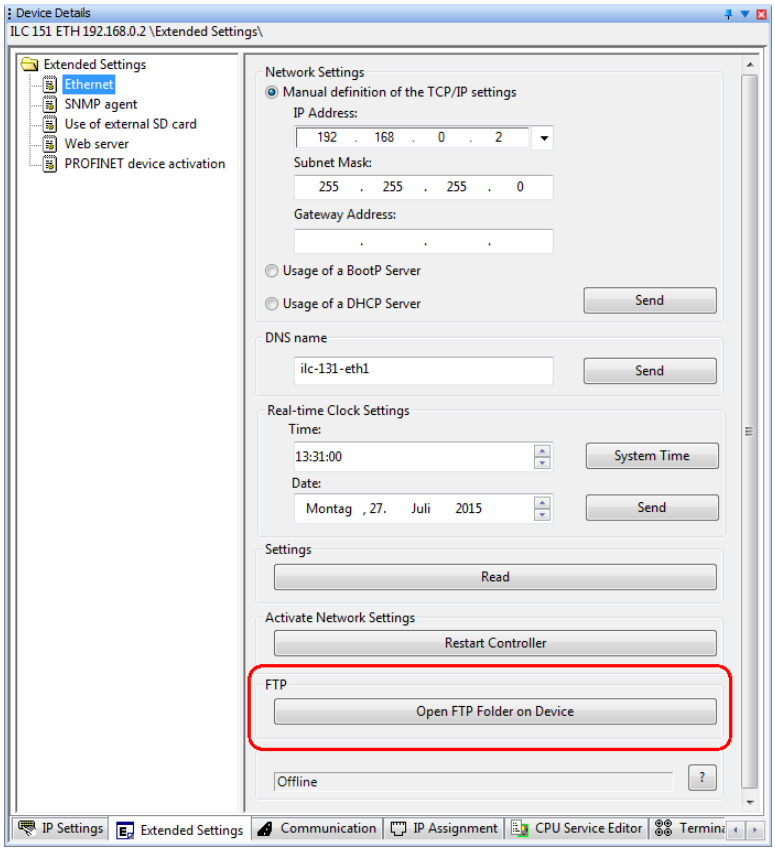

Figure 3-24 Extended Settings: Open FTP Folder on Device

The file structure, which is stored on the parameterization memory, is displayed in the Internet Explorer window.

Data may only be copied or deleted on the parameterization memory. Do not edit any files as Internet Explorer does not store modified data.

For the current state to be displayed, refresh the display after every action by means of the “View, Refresh” command.

3.8.1 Internet Explorer FTP functionality

- Activate this setting in Internet Explorer under “Tools, Internet Options, Advanced”.

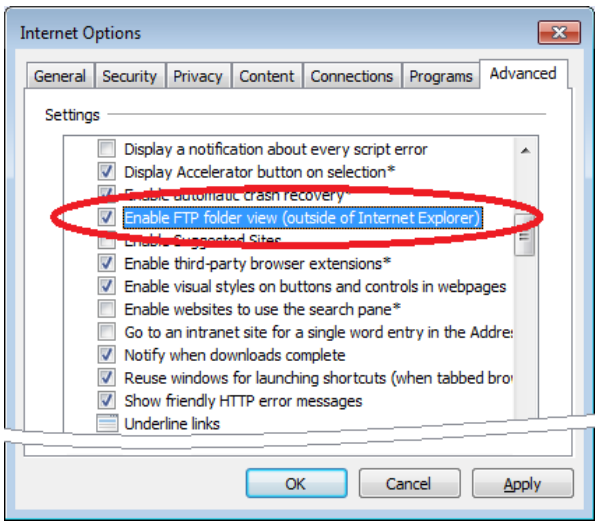

Figure 3-25 Internet Options: Enable FTP folder view

3.8.2 Activating/deactivating the FTP server

To protect the Inline controller against unauthorized access, it may be necessary to deactivate the FTP server. The CPU_Set_Value_Request service with Var ID 0172_{hex} is used for this. This service can be used to activate or deactivate the FTP server. The FTP server is deactivated immediately, once the corresponding service has been executed.
If you activate the FTP server, the setting is only applied once the controller has been restarted. The set FTP server state is stored retentively and mapped to the ETH_SRV_FTP_ACTIVE system variable.

Value range for the CPU_Set_Value_Request service:

Var Count	1	
Var ID	0172_{hex}	
Value	0000_{hex}	Deactivate FTP server
	0001_{hex}	Activate FTP server

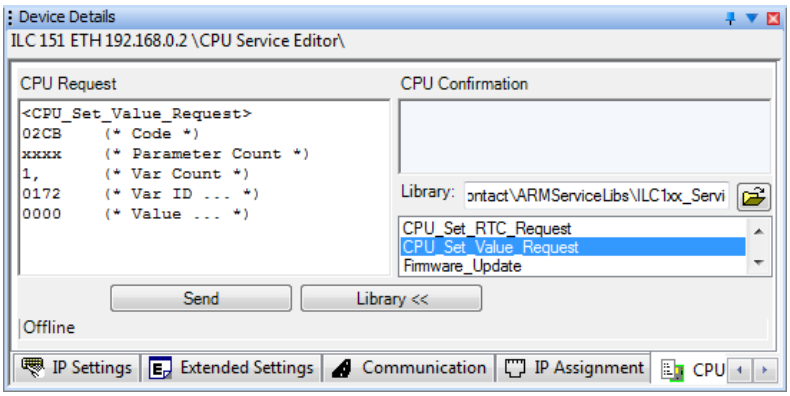

Figure 3-26 Deactivating the FTP server

3.8.3 Access restriction for FTP access

The function is available for Inline controllers with firmware versions ≥ 4.40 as of AUTOMATIONWORX Software Suite Version 1.82 AddOn V1.

To prevent unauthorized FTP access to the parameterization memory, you can specify a username (max. 12 characters) and a password (max. 12 characters). By default upon delivery, the Inline controller is set to the username “anonymous” and no password (“”) is set. This setting is also restored if you return the Inline controller to the default state upon delivery.
The CPU_Set_Value_Request service with Var ID 019A$_{hex}$ is used to specify the username and password.

Specifying the username and password

To specify a username and password, proceed as follows:

- Switch to the bus configuration workspace in PC Worx.
- Select the controller, e.g., “ILC 151 ETH”, in the “Bus Structure” window.
- Select the “CPU Service Editor” tab in the “Device Details” window.
- Open the “ILC1xx_Service_Common.slb” library.
- Double-click to select the CPU_Set_Value_Request service.

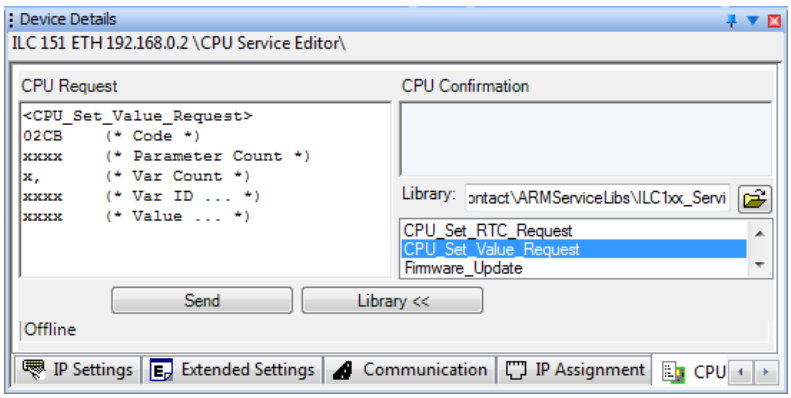

Figure 3-27 Open the library and select the service

- In the “CPU Request” area for (* Var Count *) enter the value “1”.
- In the “CPU Request” area for (* Var ID ... *) enter the value “019A”.
- In the “CPU Request” area for (* Value ... *) (changed to (* length username & username *) and (* length password & password *) in Figure 3-28) enter the desired username and password.

  In doing so, the length of the username must be entered followed by the individual characters of the username in hexadecimal ASCII format. Following this, the length of the password must also be entered followed by the individual characters of the password in hexadecimal ASCII format.

Example (refer to Figure 3-28): username “USER” (length “04”), password “PASS” (length “04”)

Character	ASCII	Character	ASCII
U	55	P	50
S	53	A	41
E	45	S	53
R	52	S	53

For the example, for the username USER, the ASCII characters “0455 5345 52” must be entered (length of the username followed by the individual characters of the username) and subsequently, for the password PASS, the ASCII characters “04 5041 5353” must be entered (length of the password followed by the individual characters of the password).

Figure 3-28 shows the settings for defining the username “USER” and the password “PASS” in the “CPU Request” area.

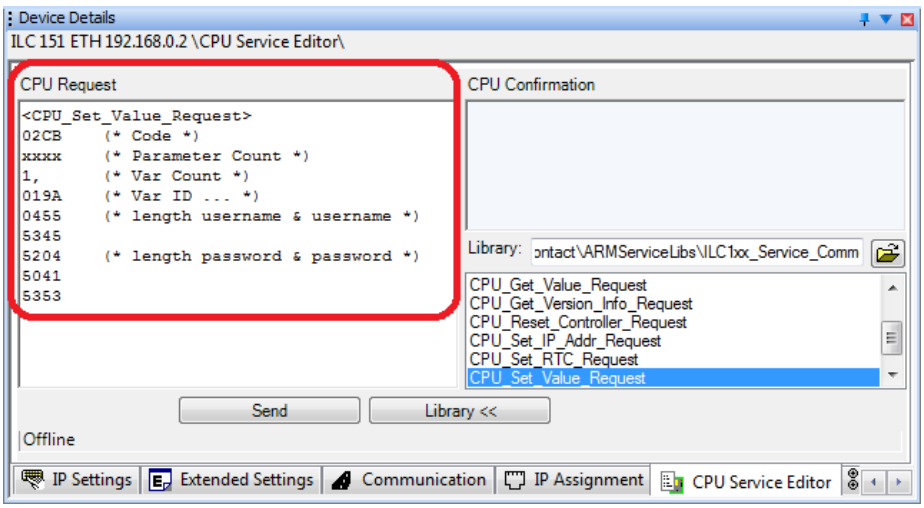

Figure 3-28 Specifying username and password for FTP access

- Click “Send” to send the settings to the Inline controller.

The new username and password are set.
Successful execution of the service is acknowledged as follows in the “CPU Confirmation” area:

<Cnf: CPU_Set_Value_Request>

82CB (*W1 : Confirmation_Code*)

0001 (*W2 : Parameter_Count*)

0000 (*W3 : Result*)

- Carry out a voltage reset on the Inline controller.

If the parameterization memory is accessed via FTP, a dialog now appears in which the username and password must be entered.
The content of the parameterization memory is only displayed if the username and password are entered correctly.

Recommended:
If you wish to access the parameterization memory by means of a web browser, turn the cache off in the web browser.

Otherwise, in some circumstances, the contents of the parameterization memory may be displayed despite active access protection, as the data from the previous access attempt without access protection is still stored in the web browser cache.

Removing a username and password

To remove a username and password, proceed as described above, however in the “CPU Request” area, for (* Value ... *) enter the value “0000”, refer to Figure 3-29.

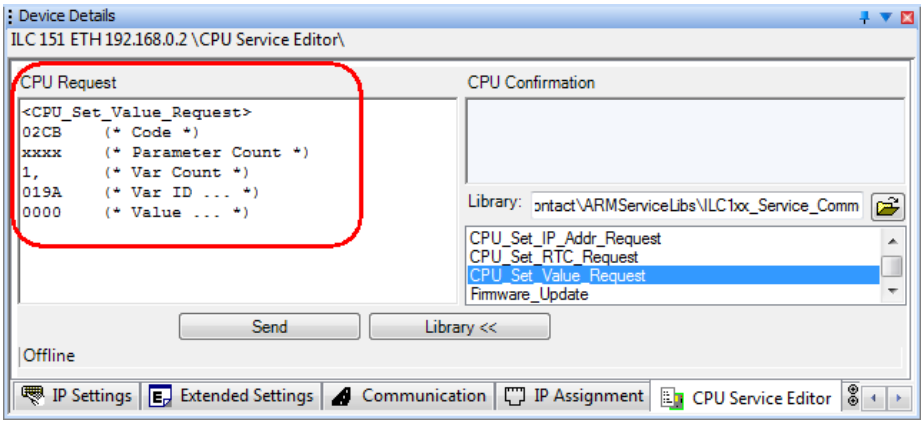

Figure 3-29 Removing the username and password for FTP access

3.8.4 Activating/deactivating the HTTP server

This function is supported by Inline controllers from firmware version 4.20 or later and from PC Worx version 6.30.767 or later (part of the AUTOMATIONWORX Software Suite 1.81 including AddOn V1).

Deactivating

To protect the Inline controller against unauthorized access, it may be necessary to deactivate the HTTP server. To do this, proceed as follows:

- Switch to the bus configuration workspace in PC Worx.
- Select the controller, e.g., “ILC 151 ETH”, in the “Bus Structure” window.
- Select the "Extended Settings" tab in the "Device Details" window.
- Select the “Web server” setting under “Extended Settings”.
- Select the setting “Disabled” from the drop-down list.
- Click “Send” (hidden by the drop-down list in Figure 3-30) to transmit the setting to the Inline controller.
- Restart the Inline controller.

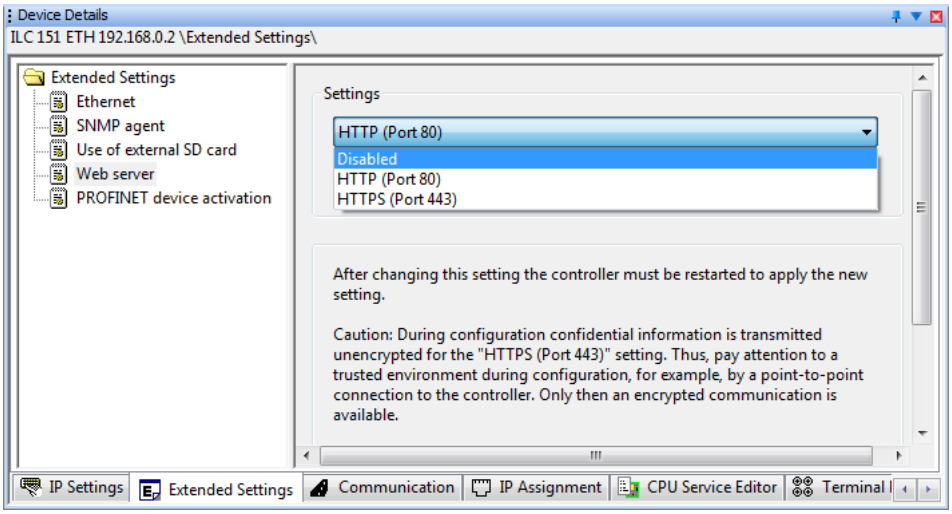

Figure 3-30 Disabling HTTP

If you have selected the “Disabled” function, the HTTP server (web server) is deactivated. HTTPS is also deactivated (refer to Section 3.8.5).

Activating

Proceed as follows to activate the HTTP server:

- Select the setting “HTTP (Port 80)” from the drop-down list.
- Click “Send” (hidden by the drop-down list in Figure 3-30) to transmit the setting to the Inline controller.
- Restart the Inline controller.

3.8.5 Using the Hypertext Transfer Protocol Secure (HTTPS)

The Inline controllers support the Hypertext Transfer Protocol Secure (HTTPS) from firmware version 4.20 or later and from PC Worx version 6.30.767 or later (part of the AUTOMATIONWORX Software Suite 1.81 including AddOn V1).

Hypertext Transfer Protocol Secure (HTTPS) can be used for the HTTP server communication.
The settings for using HTTPS are made via the “Device Details” window.

- Switch to the bus configuration workspace in PC Worx.
- Select the controller, e.g., “ILC 151 ETH”, in the “Bus Structure” window.
- Select the "Extended Settings" tab in the "Device Details" window.
- Select the “Web server” setting under “Extended Settings”.
- Select the setting “HTTPS (Port 443)” from the drop-down list.
- Click “Send” (hidden by the drop-down list in Figure 3-31) to transmit the setting to the Inline controller.
- Restart the Inline controller.

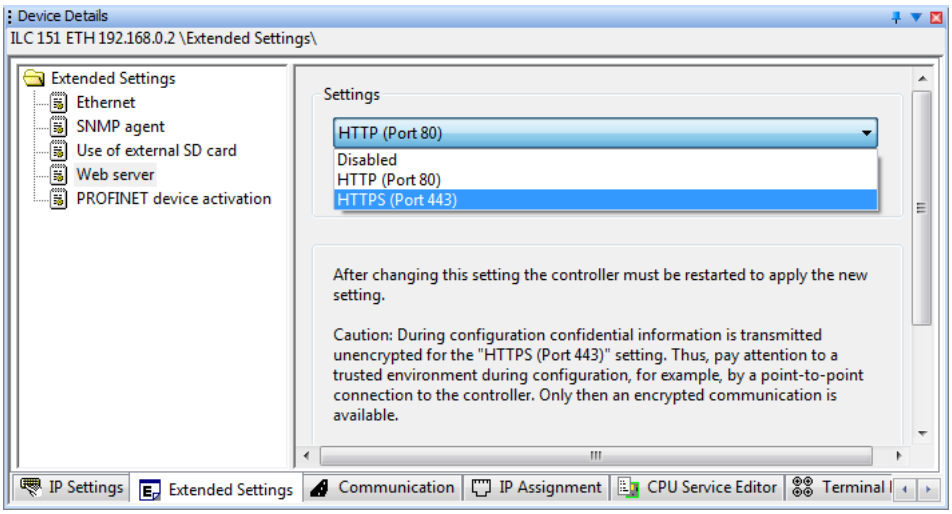

Figure 3-31 Setting HTTPS

3.9 Sending secure e-mails

You can use the SMTPS method (e-mail transmission via SMTP with SSL/TLS) to send e-mails securely. In order to use the SMTPS method, you need to import the IT library (≥ version 1_34) function block library. It can be downloaded via the product at phoenixcontact.net/products.
For more detailed information on the function block library, please refer to the online help for PC Worx.

Security certificates from the mail server are always accepted by the Inline controller and not checked.

3.10 Enabling/disabling specific ports

The function is available for Inline controllers with firmware versions ≥ 4.40 as of AUTOMATIONWORX Software Suite Version 1.82 AddOn V1.

Depending on your application, it may be necessary to disable certain ports. The CPU_Set_Value_Request service is used for this, with various Var IDs for the individual ports. This service can be used to enable or disable a port. The port is disabled immediately, once the corresponding service has been executed.
If you enable a port, the setting is only applied once the controller has been restarted.

Port 7

Value range for the CPU_Set_Value_Request service at port 7 (port for echo server):

Var Count	1	
Var ID	0214_{hex}	
Value	0000_{hex}	Disable port 7
	0001_{hex}	Enable port 7

If you disable port 7, the Inline controller will not be found by the AX OPC Server.

Port 1962

Value range for the CPU_Set_Value_Request service at port 1962 (port for communication with PC Worx):

Var Count	1	
Var ID	0213_{hex}	
Value	0000_{hex}	Disable port 1962
	0001_{hex}	Enable port 1962

Port 41100

Value range for the CPU_Set_Value_Request service at port 41100 (port for OPC and debug mode in PC Worx):

Var Count	1	
Var ID	0192_{hex}	
Value	0000_{hex}	Disable port 41100
	0001_{hex}	Enable port 41100

NOTE: Access to the Inline controller not possible

If you disable port 1962 and/or port 41100, you can no longer access the Inline controller from PC Worx.

- Only disable port 1962 and/or port 41100, if you no longer need to access the Inline controller from PC Worx.

Once you have disabled port 1962 and/or port 41100, these can only be re-enabled by resetting the Inline controller to factory defaults.

3.11 Activating/deactivating the journaling function

The file system of the Inline controller supports the journaling function. As a result, voltage failures during write processes do not destroy the file system. However, the access speed becomes slower.

The journaling function is deactivated by default.

It can be activated or deactivated via the CPU_Set_Value_Request service with Var ID 0194_{hex}.

Value range for the CPU_Set_Value_Request service:

Code	$02CB_{hex}$	
Var Count	0001_{hex}	
Var ID	0194_{hex}	
Value	0001_{hex}	Activate journaling function
	0000_{hex}	Deactivate journaling function

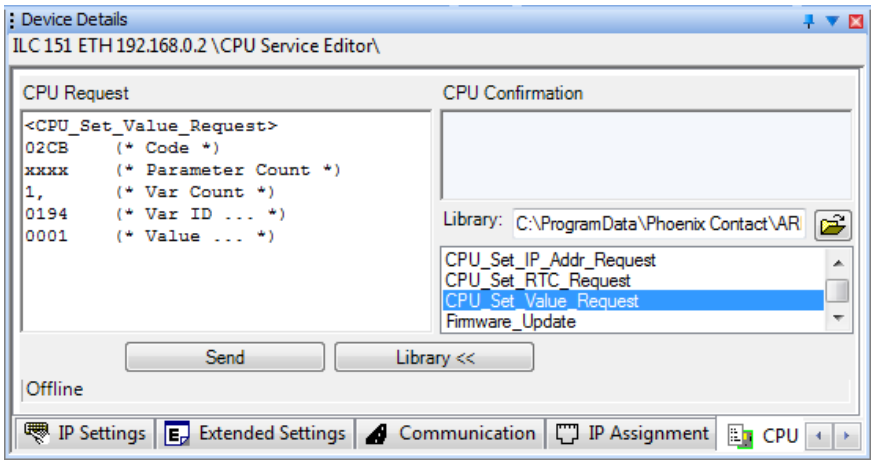

Figure 3-32 Activating the journaling function

3.12 Activating/deactivating the MRP client function

The Media Redundancy Protocol MRP can be used via the Ethernet interfaces of the ILC 171 ETH 2TX and ILC 191 ETH 2TX Inline controllers. The controllers support the MRP client function, which can be enabled or disabled via PC Worx as an option. This function is disabled by default. If the function is enabled, it remains enabled after the supply voltage is switched off and on. If the controllers have been reset to the delivery state, the MRP client function will also be disabled again. In a ring with Media Redundancy Protocol, maximum switch-over times of up to 200 ms can be expected.

To activate/deactivate the MRP client function, proceed as follows:

- Switch to the bus configuration workspace.
- Select the controller node (in the example: “ILC 171 ETH 2TX 192.168.0.2”).
- Select the "Extended Settings" tab in the "Device Details" window.
- In the “Device Details” window, select the “MRP Client” setting under “Extended Settings”.
- Under “Settings”, select “activated” to activate the MRP client function.

  or
- Under “Settings”, select “deactivated” to deactivate the MRP client function.
- Click “Send”.

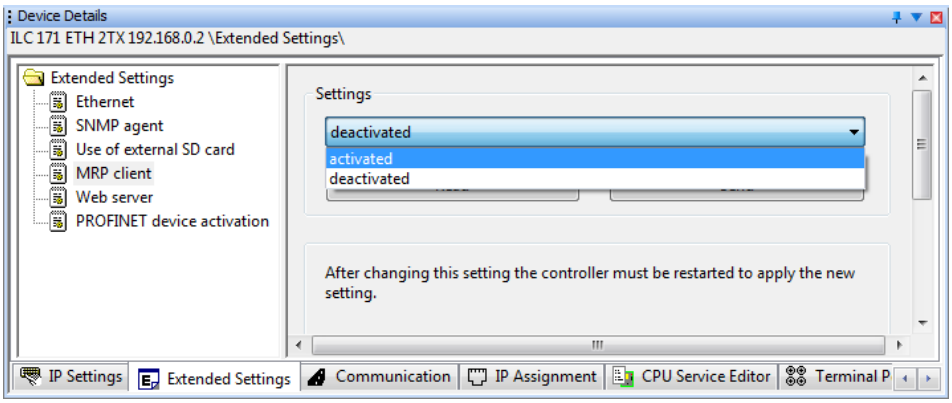

Figure 3-33 Activating the MRP client function

3.13 Function blocks for handling files on the parameterization memory

The function blocks are used to access files from within the application program. Some of the blocks support multiple instantiation. This means that it is possible to work with a number of different files within the same project. The blocks perform the standard functions that are required for typical file access operations.

The FILE_NOTIFY block is available in addition to the blocks for typical file access operations. This block can be used to detect files that have been modified in a directory containing user files. These modifications may include:

– Deletion of one or more files
– Writing one or more new files
– Modification of one or more existing files

Both modifications made to this directory via FTP (remote) and modifications made locally via function blocks or firmware services can be detected.

All file operations are subject to the following restrictions:
No directory hierarchies are supported. All file operations only affect the root directory of the parameterization memory.

The functional blocks are valid for:

Order designation	As of hardware version	As of firmware version
ILC 131 ETH	00	4.00
ILC 151 ETH	00	4.00
ILC 171 ETH 2TX	00	4.00
ILC 191 ETH 2TX	00	4.00
ILC 131 ETH/XC	00	4.00
ILC 151 ETH/XC	00	4.00

Table 3-3 Overview of the function blocks

Function block	Short description
FILE_OPEN	Opens a file with a specific name
FILE_CLOSE	Closes a file with a specific handle
FILE_READ	Reads from a file with a specific handle
FILE_WRITE	Writes to a file with a specific handle
FILE_REMOVE	Deletes a file with a specific name
FILE_TELL	Determines the current position of the file pointer in a file
FILE_SEEK	Moves the current file pointer to a new position
FILE_NOTIFY	Displays files that have recently been created, deleted or modified

The function blocks for handling files on the parameterization memory are described in the PC Worx online help.

3.14 Function blocks for Ethernet communication

The function blocks are used to establish Ethernet communication between two communication partners.

The IP communication blocks listed below enable IEC 61131-5-compliant communication between controllers via Ethernet or communication between controllers and Ethernet devices via TCP/IP or UDP/IP.

Implement all time and connection monitoring in the application program.

The function blocks are valid for the Inline controllers listed in the table below in the specified hardware/firmware versions and enable the specified maximum number of TCP/IP or UDP/IP communication connections:

Order designation	Blocks	As of hardware version (HW)	As of firmware version (FW)	Ethernet connections to other communication partners (maximum)
ILC 131 ETH	IEC 61131-5 TCP/IP UDP/IP	00	4.00	8
ILC 151 ETH	IEC 61131-5 TCP/IP UDP/IP	00	4.00	8
ILC 171 ETH 2TX	IEC 61131-5	00	4.00	8
	TCP/IP UDP/IP			16
ILC 191 ETH 2TX	IEC 61131-5	00	4.00	8
	TCP/IP UDP/IP			16
ILC 131 ETH/XC	IEC 61131-5 TCP/IP UDP/IP	00	4.00	8
ILC 151 ETH/XC	IEC 61131-5 TCP/IP UDP/IP	00	4.00	8

Table 3-4 Overview of the function blocks

Function block	Short description
IP_CONNECT	Establishes a connection between two communication partners
IP_USEND	Sends data to a communication partner
IP_URCV	Receives data from a communication partner

The communication blocks are described in the PC Worx online help.
The extensions for the TCP/IP and UDP/IP function blocks are described in the “TCP/UDP COMMUNICATION” application note.

3.15 Function blocks for PCP communication

The function blocks are used to establish PCP communication between the Inline controller and PCP devices in INTERBUS.

The function blocks are valid for the Inline controllers listed in the table below in the specified hardware/firmware versions and enable the specified maximum number of PCP communication connections:

Order designation	As of hardware version (HW)	As of firmware version (FW)	Connections to PCP devices (maximum)
ILC 131 ETH	00	4.00	8
ILC 151 ETH	00	4.00	16
ILC 171 ETH 2TX	00	4.00	24
ILC 191 ETH 2TX	00	4.00	24
ILC 131 ETH/XC	00	4.00	8
ILC 151 ETH/XC	00	4.00	16

Table 3-5 Overview of the function blocks

Function block	Short description
PCP_CONNECT	This block can be used to set up communication connections to each PCP device in INTERBUS.
PCP_WRITE	This block enables PCP objects to be written.
PCP_READ	This block enables data to be read from PCP objects.
PCP_SERVER	This block enables PCP service indications to be received and responses to be sent.

The communication blocks are described in the PC Worx online help.

3.16 Alignment

The alignment of the data elements in the Inline controller memory can result in “data gaps” when storing data in the memory. The compiler automatically fills these gaps with padding bytes during the compilation process in order to prevent incorrect processing.

The disadvantage of the “automatic” filling of data gaps becomes apparent when data is transmitted from the Inline controller to another controller. If this controller does not know the memory algorithm of the Inline controller, it will interpret the received data incorrectly.

It is therefore useful to program the filling of data gaps in your application program. Alternatively, you can use the PACK and UNPACK function blocks (see online help in PC Worx). Data transmissions to other controllers can therefore be taken into consideration. For example, use byte arrays with an even number of bytes and/or word arrays in order to avoid data gaps in your application program.

Please observe the following notes for program creation:

– Create data types in flat structures, i.e., do not nest user-defined data types.
– Insert padding bytes manually in order to ensure the uniform size and layout of the data types.
– When inserting padding bytes, observe the memory alignment method of the controllers used in the application (1-byte, 2-byte, or 4-byte alignment).

Program example with data gaps

The following program example shows how data gaps are filled.

```
1   TYPE
2       Struct1 :
3       STRUCT
4           ByteElement :   BYTE;
5           WordElement :   WORD;
6       END_STRUCT:
7
8       Struct2 :
9       STRUCT
10          WordElement :   WORD;
11          ByteElement :   BYTE;
12      END_STRUCT:
13
14      Struct3 :
15      STRUCT
16          ByteElement1    :   BYTE;
17          ByteElement2    :   BYTE;
18      END_STRUCT:
19
20      Struct4 :
21      STRUCT
22          Struct2Element  :   Struct2;
23          Struct3Element  :   Struct3;
24      END_STRUCT:
25
26      Array1  :   ARRAY   [0..1]  OF  Struct2;
27  END_TYPE
```

Figure 3-34 Example programming

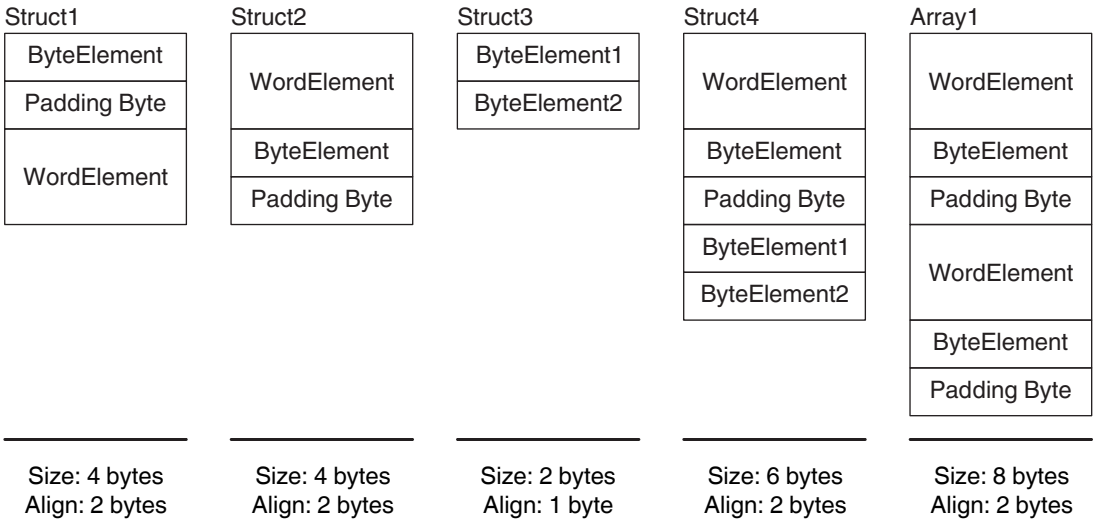

Figure 3-35 Alignment - padding bytes in data gaps

Struct1 receives a padding byte after the ByteElement so that the WordElement is at a WORD address (address that can be divided by 2 leaving no remainder). The alignment of the overall structure is based on the data type used with maximum alignment. In this case, the WordElement specifies the alignment.

The size of Struct2 is calculated based on the elements used and the resulting alignment. The corresponding number of padding bytes is inserted so that the size of the data type with the value of the alignment can be divided by 2 leaving no remainder (data type size modulo alignment = 0).

Struct3 does not receive any padding bytes as the maximum alignment corresponds to one byte.

Due to the padding byte that belongs to the Struct2 structure, the Struct3 structure starts at an even address in Struct4.

Array1 receives 2 padding bytes corresponding to two consecutive Struct2 structures.

Program example without data gaps

The following program shows an example of how to fill data gaps in your application program. Fill data gaps, which are to be expected due to the memory alignment, with application data (padding bytes in Figure 3-36).

```
1   TYPE
2       Struct1 :
3       STRUCT
4           ByteElement :   BYTE;
5           ByteElement :   BYTE;   (*Padding-Byte*)
6           WordElement :   WORD;
7       END_STRUCT:
8
9       Struct2 :
10      STRUCT
11          WordElement :   WORD;
12          ByteElement :   BYTE;
13          ByteElement :   BYTE;   (*Padding-Byte*)
14      END_STRUCT:
15
16      Struct3 :
17      STRUCT
18          ByteElement1    :   BYTE;
19          ByteElement2    :   BYTE;
20      END_STRUCT:
21
22      STRUCT4 :
23      STRUCT
24          Struct2Element  :   Struct2;
25          Struct3Element  :   Struct3;
26      END_STRUCT:
27
28      Array1  :   ARRAY   [0..1]  OF  Struct2;
29  END_TYPE
```

Figure 3-36 Example programming with padding bytes

4 System variables and status information

4.1 General notes

This section describes the special program functions of the PC Worx/PC Worx Express software that are available for the Inline controller.

The following descriptions of system variables and status information apply to PC Worx and PC Worx Express.

The Inline controller has a register set, which is used for diagnostics and easy control of the bus system. The diagnostic data is stored in the diagnostic status register and the diagnostic parameter register. These registers are available to the application program as system variables (system flags, global variables).

Operating states, error states, and additional information about the INTERBUS system can be evaluated in the application program.

For additional information on diagnostics, please refer to the following user manual:
– INTERBUS diagnostics guide
IBS SYS DIAG DSC UM E Order No. 2747293

4.2 Status register for local digital inputs and outputs

The following system variables can be used to read the local digital input and output states and to write the local digital output states.

Table 4-1 System variables of the status register for local digital inputs and outputs

System variable	Type	Meaning
ONBOARD_INPUT	WORD	State of all local inputs
ONBOARD_INPUT_BIT0	BOOL	State of local input IN1
ONBOARD_INPUT_BIT1	BOOL	State of local input IN2
ONBOARD_INPUT_BIT2	BOOL	State of local input IN3
ONBOARD_INPUT_BIT3	BOOL	State of local input IN4
ONBOARD_INPUT_BIT4	BOOL	State of local input IN5
ONBOARD_INPUT_BIT5	BOOL	State of local input IN6
ONBOARD_INPUT_BIT6	BOOL	State of local input IN7
ONBOARD_INPUT_BIT7	BOOL	State of local input IN8
ONBOARD_OUTPUT_BIT0	BOOL	State of local output OUT1
ONBOARD_OUTPUT_BIT1	BOOL	State of local output OUT2
ONBOARD_OUTPUT_BIT2	BOOL	State of local output OUT3
ONBOARD_OUTPUT_BIT3	BOOL	State of local output OUT4
ONBOARD_OUTPUT_OVERLOAD_0_3	BOOL	Overload at at least one of the local outputs

4.3 Diagnostic status register

Information on the operating state of the Inline controller is stored in the diagnostic status register. Every bit in the diagnostic status register is assigned a certain Inline controller state.

The following system variables can be used to read the diagnostic status register information.

Table 4-2 System variables of the diagnostic status register

System variable	Type	Meaning
MASTER_DIAG_STATUS_REG_USER	BOOL	User error/parameterization error
MASTER_DIAG_STATUS_REG_PF	BOOL	I/O error
MASTER_DIAG_STATUS_REG_BUS	BOOL	Bus error
MASTER_DIAG_STATUS_REG_CTRL	BOOL	Error on Inline controller/hardware fault
MASTER_DIAG_STATUS_REG_DTC	BOOL	Diagnostic routine is active
MASTER_DIAG_STATUS_REG_RUN	BOOL	Data transmission is active
MASTER_DIAG_STATUS_REG_ACT	BOOL	Selected configuration is ready to operate
MASTER_DIAG_STATUS_REG_RDY	BOOL	Inline controller is ready to operate
MASTER_DIAG_STATUS_REG_BSA	BOOL	Bus segment aborted
MASTER_DIAG_STATUS_REG_SYSFAIL	BOOL	System failure
MASTER_DIAG_STATUS_REG_RES	BOOL	Standard function processed negatively
MASTER_DIAG_STATUS_REG_SYNCRES	BOOL	Synchronization error occurred
MASTER_DIAG_STATUS_REG_DCR	BOOL	Faulty data cycles
MASTER_DIAG_STATUS_REG_WARN	BOOL	Defined warning time exceeded
MASTER_DIAG_STATUS_REG_QUAL	BOOL	Defined error density exceeded
MASTER_DIAG_STATUS_REG_SSINFO	BOOL	A message is present
MASTER_DIAG_STATUS_REG_HI	BYTE	Master diagnostic status register, high byte
MASTER_DIAG_STATUS_REG_LOW	BYTE	Master diagnostic status register, low byte

4.4 Diagnostic parameter register

The diagnostic parameter register provides additional information on the error indicated in the diagnostic status register. The following information is stored in the diagnostic parameter register:

– Error location
– Error code

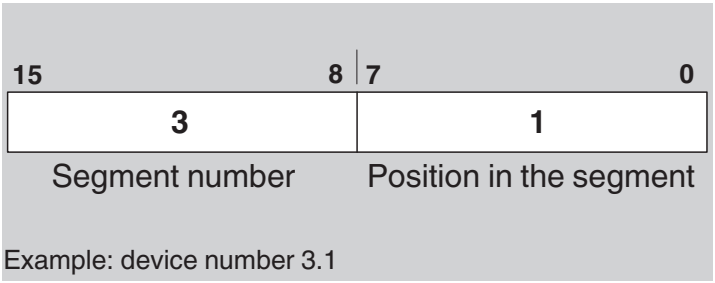

Figure 4-1 Error location in the diagnostic parameter register

Special case: if an interface error cannot be located, the value 128 is indicated in the diagnostic parameter register, i.e., bit 7 is set.

The diagnostic parameter register is rewritten whenever an error occurs. The diagnostic parameter register contains the value “0” if no errors are detected.

Table 4-3 System variables of the diagnostic parameter register

System variable	Type	Meaning
MASTER_DIAG_PARAM_REG_HI	BYTE	Diagnostic parameter register, high byte
MASTER_DIAG_PARAM_REG_LOW	BYTE	Diagnostic parameter register, low byte
MASTER_DIAG_PARAM_2_REG_HI	BYTE	Extended diagnostic parameter register, high byte
MASTER_DIAG_PARAM_2_REG_LOW	BYTE	Extended diagnostic parameter register, low byte

4.5 PROFINET register

The PC Worx Express software does not support this function.

Table 4-4 PROFINET system variables (PROFINET device function)

System variable	Type	Meaning
PND_S1_PLC_RUN	BOOL	Status of the higher-level controller/PROFINET controller Information indicating whether the higher-level controller is active. The value is TRUE if the higher-level controller is in the RUN state (program). The display only applies when there is an existing PROFINET connection (PND_S1_VALID_DATA_CYCLE).
PND_S1_VALID_DATA_CYCLE	BOOL	The higher-level controller/higher-level PROFINET controller has established the connection. Information indicating whether a connection exists and cyclic data is being exchanged between the PROFINET controller and PROFINET device and whether the last frame received contained valid data.
PND_S1_OUTPUT_STATUS_GOOD	BOOL	IOP status of the higher-level controller/higher-level PROFINET controller Information indicating whether the IN process data of the PROFINET device (PND_S1_INPUTS) was received by the PROFINET device with “valid” status. The value is TRUE if the output data of the higher-level controller is valid (provider status).
PND_S1_DATA_LENGTH	WORD	Process data length that was configured for the PROFINET device.
PND_S1_OUTPUTS	PND_IO_256	OUT process data Memory area for OUT process data that the PROFINET device sends to the higher-level controller/higher-level PROFINET controller.
PND_S1_INPUTS	PND_IO_256	IN process data Memory area for IN process data that the PROFINET device receives from the higher-level controller/higher-level PROFINET controller.
PND_IO_DRIVEN_BY_PLC	INT	Applicative system redundancy Specifies from which higher-level PROFINET controller the data in the PROFINET device originates (refer to Figure 2-5 on page 16) 0: No PROFINET controller 1: Controller A 2: Controller B

4.6 IEC 61131 runtime system

There is a separate group of system variables for the IEC 61131 runtime system.

Table 4-5 System variables of the IEC 61131 runtime system

System variable	Type	Meaning
PLCMODE_ON	BOOL	PLC status ON: the runtime system on the Inline controller is ready to operate.
PLCMODE_RUN	BOOL	PLC status RUN: the application program is running.
PLCMODE_STOP	BOOL	PLC status STOP: the application program is currently not running.
PLCMODE_HALT	BOOL	PLC status HALT: the application program was stopped at an unspecified point.
PLCDEBUG_BPSET	BOOL	Breakpoint set: at least one breakpoint has been set in the application program.
PLCDEBUG_FORCE	BOOL	Variable(s) forced: at least one variable is being continuously overwritten (forced).
PLCDEBUG_POWERFLOW	BOOL	Powerflow ON: in “Powerflow” mode, you can see which parts of your application program are being processed. This bit indicates whether “Powerflow” mode is active.
PLC_TICKS_PER_SEC	INT	System ticks per second: this variable shows how many pulses the system clock of the Inline controller delivers per second.
PLC_SYS_TICK_CNT	DINT	Number of system ticks: this variable shows the total number of pulses delivered by the system clock since the last startup.
PLC_TASK_AVAILABLE	INT	Number of available PLC tasks
PLC_SYSTASK_AVAILABLE	INT	Number of available system tasks
PLC_MAX_ERRORS	DINT	Maximum number of “errors, warnings, and logging events”. If this maximum number is reached, the controller is stopped.
PLC_ERRORS	DINT	Number of “errors, warnings, and logging events” currently entered.
PLC_TASK_DEFINED	INT	Number of tasks used
PLC_TASK_1	Record, elements = 17	Information regarding task 1
:	:	:
PLC_TASK_8	Record, elements = 9	Information regarding task 8

4.7 Control processor

The system variables listed below show the states of the diagnostic status register on the control processor of the Inline controller.

Table 4-6 System variables of the control processor

System variable	Type	Meaning
COP_DIAG_STATUS_REG_RT_ERR	BOOL	A runtime error (out of realtime) has occurred on the control processor.
COP_DIAG_STATUS_REG_FAT_ERR	BOOL	A fatal error has occurred on the control processor. Division by zero, for example, leads to a fatal error.
COP_DIAG_STATUS_REG_WARN	BOOL	A warning has been issued on the control processor.
COP_DIAG_STATUS_REG_PON	BOOL	Power ON (COP): the control processor is ready to operate.
COP_DIAG_STATUS_REG_FC_RUN	BOOL	Runtime system RUN
COP_DIAG_STATUS_REG_FC_STOP	BOOL	Runtime system STOP
COP_DIAG_STATUS_REG_FC_HALT	BOOL	Runtime system HALT
COP_DIAG_STATUS_REG_FC_LDG	BOOL	Runtime system LOADING
COP_DIAG_STATUS_REG_FC_DBG	BOOL	Runtime system DEBUG
COP_DIAG_STATUS_REG_FC_RDO	BOOL	Runtime system READONLY
COP_DIAG_PARAM_REG	WORD	Diagnostic parameter register of the control processor
COP_DIAG_PARAM_2_REG	WORD	Extended diagnostic parameter register of the control processor

4.8 Power storage, realtime clock

The realtime clock of the ILC 131 ETH/XC and ILC 151 ETH/XC Inline controllers has no power storage. When switching on the power supply, the realtime clock must be synchronized again. The SNTP function blocks from the IT library are required for synchronization. The IT library can be downloaded at phoenixcontact.net/products.

Table 4-7 System variables of the power storage and realtime clock

System variable	Type	Meaning
RTC_BATTERY_LOW	BOOL	Low capacity of the power storage for the realtime clock. TRUE: Power storage device is being charged. FALSE: Power storage device is fully charged. The charging process is complete.
RTC_DATA_INVALID	BOOL	The realtime clock data is invalid.

4.9 Power supplies

Table 4-8 System variables of the power supplies

System variable	Type	Meaning
POWER_SUPPLY_MAIN_OK	BOOL	The 24 V main power supply is OK.
POWER_SUPPLY_INPUTS_OK	BOOL	The 24 V power supply for the local inputs is OK.
POWER_SUPPLY_OUTPUTS_0_3_OK	BOOL	The 24 V power supply for the local outputs is OK. (Bits 0 to 3)

4.10 Mode selector switch

Table 4-9 System variables of the mode selector switch

System variable	Type	Meaning
KEY_SWITCH_RESET	BOOL	The mode selector switch is in the MRESET position.
KEY_SWITCH_STOP	BOOL	The mode selector switch is in the STOP position.
KEY_SWITCH_RUN_PROG	BOOL	The mode selector switch is in the RUN_PROG position.

4.11 System time

Table 4-10 System variables of the system time

System variable	Type	Meaning
RTC_HOURS	INT	System time (hours)
RTC_MINUTES	INT	System time (minutes)
RTC_SECONDS	INT	System time (seconds)
RTC_DAY	INT	System time (day)
RTC_MONTH	INT	System time (month)
RTC_YEAR	INT	System time (year)

5 Technical data and ordering data

5.1 Technical data

General data	
Dimensions	80 mm x 119.8 mm x 71.5 mm
Weight	285 g, approximately (ILC 131 ETH, ILC 151 ETH, ILC 131 ETH/XC, ILC 151 ETH/XC) 295 g, approximately (ILC 171 ETH 2TX, ILC 191 ETH 2TX)
Connection data for connectors	
Connection method	Spring connection
Conductor cross section	
Single-wire/terminal point, solid	0.08 mm^2 to 1.5 mm^2
Single-wire/terminal point, stranded	0.08 mm^2 to 1.5 mm^2
Single-wire/terminal point, AWG	28 to 16
	We recommend using a conductor cross section of 0.2 mm^2 to 1.5 mm^2.
Coated PCBs	ILC 131 ETH/XC and ILC 151 ETH/XC only

General supply

Use a **power supply without fall-back characteristic curve** (see Section “Sizing of the power supply” on page 37).

24 V main supply U_M	
Connection technology	Spring-cage terminal blocks
Nominal value	24 V DC
Tolerance	-15%/+20% (according to EN 61131-2)
Ripple	±5%
Current consumption at nominal voltage (typical)	6 mA + 7 mA for each input set
Current consumption at nominal voltage (maximum)	8 A DC
Continuation	Through potential routing
Protective measures	
Surge voltage	Input protective diodes (can be destroyed by permanent overload) Pulse loads up to 1500 W are short circuited by the input protective diode.
Polarity reversal	Parallel diodes for protection against polarity reversal; in the event of an error the high current flowing through the diodes causes the fuse connected upstream to blow.

NOTE:

Provide external protection for the 24 V area. The power supply unit must be able to supply 4 times (400%) the nominal current of the external fuse, to ensure that the fuse blows safely in the event of an error.

24 V segment supply U_S	
Connection technology	Spring-cage terminal blocks
Nominal value	24 V DC
Tolerance	-15%/+20% (according to EN 61131-2)
Ripple	±5%
Current consumption at nominal voltage (typical)	10 mA + 10 mA for each output set + load
Current consumption at nominal voltage (maximum)	8 A
Continuation	Through potential routing
Protective measures	
Surge voltage	Input protective diodes (can be destroyed by permanent overload) Pulse loads up to 1500 W are short circuited by the input protective diode.
Polarity reversal	Parallel diodes for protection against polarity reversal; in the event of an error the high current flowing through the diodes causes the fuse connected upstream to blow.

NOTE:

Provide external protection for the 24 V area. The power supply unit must be able to supply 4 times (400%) the nominal current of the external fuse, to ensure that the fuse blows safely in the event of an error.

24 V supply U_{ILC}	
Connection technology	Spring-cage terminal blocks
Nominal value	24 V DC
Tolerance	-15%/+20% (according to EN 61131-2)
Ripple	±5%
Permissible range	19.2 to 30 V DC
Current consumption at nominal voltage (minimum)	80 mA (no-load operation, i.e., no local bus devices connected, bus inactive)
Current consumption at nominal voltage (typical)	210 mA
Current consumption at nominal voltage (maximum)	870 mA (370 mA communications power + 500 mA analog power supply)
Protective measures	
Surge voltage	Input protective diodes (can be destroyed by permanent overload) Pulse loads up to 1500 W are short circuited by the input protective diode.
Polarity reversal	Serial diode in the lead path of the power supply unit; in the event of an error only a low current flows. In the event of an error, no fuse trips within the external power supply unit.

NOTE:

Observe the current consumption of the Inline terminals

Observe the logic current consumption of each device when configuring an Inline station. It is specified in every terminal-specific data sheet. The current consumption can differ depending on the individual terminal. The permissible number of devices that can be connected therefore depends on the specific station structure.

Protection by the external power supply unit

Ensure protection of 2 A through the external power supply unit.

7.5 V communications power U_L (potential jumper)	
Nominal value	7.5 V DC
Tolerance	±5%
Ripple	±1.5 %
Maximum output current	0.8 A DC, observe derating (internally protected against short circuit)
Derating	See Section “Derating” on page 99.

24 V analog supply U_{ANA} (potential jumper)	
Nominal value	24 V DC
Tolerance	-15 %/+20%
Ripple	±5%
Maximum output current	0.5 A DC, observe derating (see Section “Derating” on page 99)
Protective measures	Electric short-circuit protection

PROFINET	
Type	PROFINET device
Specification	2.2
Performance class	RT
Update rate	≥ 1 ms
Number of slots	1
Vendor ID	
ILC 131 ETH	$00B0_{hex}/176_{dec}$
ILC 151 ETH	$00B0_{hex}/176_{dec}$
ILC 171 ETH 2TX	$00B0_{hex}/176_{dec}$
ILC 191 ETH 2TX	$00B0_{hex}/176_{dec}$
ILC 131 ETH/XC	$00B0_{hex}/176_{dec}$
ILC 151 ETH/XC	$00B0_{hex}/176_{dec}$
Device ID	
ILC 131 ETH	$007D_{hex}/125_{dec}$
ILC 151 ETH	$007E_{hex}/126_{dec}$
ILC 171 ETH 2TX	$007A_{hex}/122_{dec}$
ILC 191 ETH 2TX	$007B_{hex}/123_{dec}$
ILC 131 ETH/XC	$007D_{hex}/125_{dec}$
ILC 151 ETH/XC	$007E_{hex}/126_{dec}$

INTERBUS	
Number of I/O points	4096, maximum
Number of data words	256, maximum
Transmission speed	500 kbps or 2 Mbps

This speed is automatically set according to the connected Inline terminals. Only use terminals with a uniform transmission speed in the overall connected Inline system (local bus and remote bus).

Transmission reliability	CR check (Hamming distance: 4)
Protocol	EN 50254

Number of devices in the INTERBUS system

Total number of bus devices	
ILC 131 ETH, ILC 131 ETH/XC	63, maximum
ILC 151 ETH, ILC 151 ETH/XC, ILC 171 ETH 2TX, ILC 191 ETH 2TX	128, maximum
Number of remote bus devices	
ILC 131 ETH, ILC 131 ETH/XC	–
ILC 151 ETH, ILC 151 ETH/XC, ILC 171 ETH 2TX, ILC 191 ETH 2TX	32, maximum
Number of devices with parameter channel (PCP)	See Section 3.15.
ILC 131 ETH, ILC 131 ETH/XC	8
ILC 151 ETH, ILC 151 ETH/XC	16
ILC 171 ETH 2TX	24
ILC 191 ETH 2TX	24
Number of remote bus levels	See Section 2.2.
ILC 131 ETH, ILC 131 ETH/XC	–
ILC 151 ETH, ILC 151 ETH/XC, ILC 171 ETH 2TX, ILC 191 ETH 2TX	4, maximum

Please note: the ILC 131 ETH and ILC 131 ETH/XC controllers do not support connection of the INTERBUS remote bus.

Network interface

Type	
ILC 131 ETH, ILC 151 ETH, ILC 131 ETH/XC, ILC 151 ETH/XC	1 x Ethernet; 10Base-T and 100Base-T(X)
ILC 171 ETH 2TX, ILC 191 ETH 2TX	2 x Ethernet; 10Base-T and 100Base-T(X)
Transmission speed	10 Mbps (10Base-T), 100 Mbps (100Base-T(X)) half duplex, full duplex, auto negotiation

This speed cannot be set manually. It is set automatically by means of auto negotiation.

Connection technology	CAT5 twisted pair cable Twisted pair cable with a conductor cross section of 0.14 mm^2 to 0.22 mm^2 8-pos. RJ45 socket

Inline local bus

Interface	Inline local bus
Electrical isolation	No
Number of devices	
ILC 131 ETH, ILC 131 ETH/XC	63, maximum
ILC 151 ETH, ILC 151 ETH/XC, ILC 171 ETH 2TX, ILC 191 ETH 2TX	128, maximum

NOTE: Observe the current consumption of the Inline terminals

Observe the logic current consumption of each device when configuring an Inline station. It is specified in every terminal-specific data sheet. The current consumption can differ depending on the individual terminal. The permissible number of devices that can be connected therefore depends on the specific station structure.

Modbus/TCP

Number of I/O points	8192, maximum (internal Modbus/TCP client) (only ILC 131 ETH(/XC)) 16384, maximum (internal Modbus/TCP client) (only ILC 151 ETH(/XC)) 32768, maximum (internal Modbus/TCP client) (only ILC 171 ETH 2TX) 32768, maximum (internal Modbus/TCP client) (only ILC 191 ETH 2TX)

INTERBUS

Number of I/O points	4096, maximum
Number of data words	256, maximum
Transmission speed	500 kbps or 2 Mbps

This speed is automatically set according to the connected Inline terminals. Only use terminals with a uniform transmission speed in the overall connected Inline system (local bus and remote bus).

Transmission reliability	CR check (Hamming distance: 4)
Protocol	EN 50254

Diagnostic interface

Connection technology	6-pos. MINI-DIN socket (PS/2)
Interface type	RS-232
Transmission speed	9600 baud
Electrical isolation	No

Digital inputs

Quantity	8
Input design	According to EN 61131-2 type 1
Definition of the switching thresholds	
Maximum low-level voltage	5 V DC
Minimum high-level voltage	15 V DC
Nominal input voltage	24 V DC
Permissible range	-0.5 V < U_{IN} < +30 V DC
Nominal input current at 24 V	7 mA, typical; 15 mA, maximum
Hardware filter times, typical	
Inputs I1 to I8	
Signal change 0 -> 1 Signal change 1 -> 0	5 ms 5 ms
Permissible cable length to the sensor	30 m (to ensure conformance with EMC Directive 2004/108/EC)
Use of AC sensors	AC sensors in the voltage range < U_{IN} are limited in application (according to the input design)

Digital outputs

Quantity	4
Output design	Protected outputs according to EN 61131-2
Nominal output voltage	24 V DC
Nominal output current	500 mA
Nominal current I_{nom} per channel	0.5 A
Total current	2 A
Nominal load	
Ohmic	12 W
Lamp	12 W
Inductive	12 VA (1.2 H)
Switching frequency with nominal inductive load	0.5 Hz (1.2 H), maximum
Behavior in the event of nominal inductive load	Output may be damaged

Diagnostics and status indicators	
IEC 61131 runtime system (PLC)	FR, FF
Ethernet (ETH)	LINK, ACT
INTERBUS diagnostics (IL)	RDY, BSA, FAIL, PF
Digital inputs and outputs	I1 to I8, E, Q1 to Q4
Supply voltages	US, UM, UL
PROFINET (ILC 171 ETH 2TX, ILC 191 ETH 2TX)	BF, SF

IEC 61131 runtime system	ILC 131 ETH, ILC 131 ETH/XC	ILC 151 ETH, ILC 151 ETH/XC	ILC 171 ETH 2TX	ILC 191 ETH 2TX
Programming system	PC Worx	PC Worx	PC Worx	PC Worx
Processing speed				
1 K mixed instructions	1.7 ms	1.5 ms	1.5 ms	1.3 ms
1 K bit instructions	90 µs	90 µs	90 µs	90 µs
Shortest cycle time (for cyclic task)	1 ms	1 ms	1 ms	1 ms
Program memory	192 kbytes, 16 K instructions (IL)	256 kbytes, 21 K instructions (IL)	512 kbytes, 43 K instructions (IL)	1 Mbyte, 86 K instructions (IL)
Mass storage	192 kbytes	256 kbytes	512 kbytes	1 Mbyte
Retentive mass storage	8 kbytes, NVRAM	8 kbytes, NVRAM	48 kbytes, NVRAM	48 kbytes, NVRAM
Number of data blocks	Depends on mass storage	Depends on mass storage	Depends on mass storage	Depends on mass storage
Number of control tasks	8	8	8	8
Parameterization memory				
Integrated	4 Mbytes Flash memory (100,000 write access operations per sector, typical)	4 Mbytes Flash memory (100,000 write access operations per sector, typical)	4 Mbytes Flash memory (100,000 write access operations per sector, typical)	4 Mbytes Flash memory (100,000 write access operations per sector, typical)
Plug-in, SD card	256 Mbytes/2 Gbytes (1,000,000 write access operations per sector, typical), see Section “Accessories” on page 95	256 Mbytes/2 Gbytes (1,000,000 write access operations per sector, typical), see Section “Accessories” on page 95	256 Mbytes/2 Gbytes (1,000,000 write access operations per sector, typical), see Section “Accessories” on page 95	256 Mbytes/2 Gbytes (1,000,000 write access operations per sector, typical), see Section “Accessories” on page 95

Please note that the number of write access operations to the parameterization memory is limited.

We recommend that you limit the number of write access operations to the parameterization memory in your application program by first storing data on the data memory and/or the memory for retentive data (NVRAM). Write access operations to the parameterization memory for small volumes of data (bits, bytes) should not be possible in your application program. Data should only be transferred from the mass storage/memory for retentive data to the parameterization memory if the mass storage/memory for retentive data is full, i.e., data must be deleted first to enable further write access operations.

Realtime clock	
Accuracy	1 min./week, maximum
Power reserve	10 days
Power storage charging time	24 hr.

Ambient conditions	ILC 131 ETH, ILC 151 ETH, ILC 171 ETH 2TX, ILC 191 ETH 2TX	ILC 131 ETH/XC, ILC 151 ETH/XC
Degree of protection	IP20 (EN 60529:1991)	IP20 (EN 60529:1991)
Ambient temperature (operation)	-25°C to +55°C	-40°C to +55°C (see also Appendix A 5 “Tested successfully: use under extreme ambient conditions”)
Ambient temperature (operation)		-40°C to +60°C (with US < 24.5 V, see also Appendix A 5 “Tested successfully: use under extreme ambient conditions”) For derating information, see Appendix A 4.2 “ILC 131 ETH/XC and ILC 151 ETH/XC derating”
Permissible temperature (storage/transport)	-25°C to +85°C	-40°C to +85°C
Temperature class	T4	T2, -40°C to +55°C, IEC 50155
This temperature range is only guaranteed if the Inline controller is mounted horizontally.		
Permissible humidity (operation/storage/transport)	10% to 95%, according to DIN EN 61131-2 No condensation, no ice formation	10% to 95%, according to DIN EN 61131-2 No condensation, no ice formation
Permissible air pressure (operation/storage/transport)	70 kPa to 106 kPa (up to 3000 m above sea level)	
Gases that may endanger functions according to DIN 40046-36, DIN 40046-37		
Sulfur dioxide (SO_2)	Concentration 10 ±0.3 ppm Ambient conditions - Temperature: 25°C (±2°C) - Humidity: 75% (±5%) - Test duration: 10 days	
Hydrogen sulfide (H_2S)	Concentration 1 ±0.3 ppm Ambient conditions - Temperature: 25°C (±2°C) - Humidity: 75% (±5%) - Test duration: 4 days	
Resistance of housing material to termites	Resistant	
Resistance of housing material to fungal decay	Resistant	

Mechanical tests

Vibration resistance according to EN 60068-2-6, IEC 60068-2-6	Operation: 5g
Shock test according to EN 60068-2-27, IEC 60068-2-27	25g

Conformance with EMC Directive 2004/108/EC

Noise immunity test according to 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: 2 kV
Surge test	EN 61000-4-5 IEC 61000-4-5	Criterion B Signal/data lines: 1 kV Supply lines: 0.5 kV

Conformance with EMC Directive 2004/108/EC		
Conducted disturbance variables	EN 61000-4-6 IEC 61000-4-6	Criterion A Test voltage: 10 V

Noise emission test according to EN 61000-6-4

Noise emission of housing	EN 55011	Class A

Approvals

For the latest approvals, please visit phoenixcontact.com or phoenixcontact.net/products.

5.2 Ordering data

5.2.1 Modules

Description	Type	Order No.	Pcs./Pkt.
Inline controller, including accessories (connectors and labeling fields)	ILC 131 ETH	2700973	1
Inline controller, including accessories (connectors and labeling fields)	ILC 151 ETH	2700974	1
Inline controller, including accessories (connectors and labeling fields)	ILC 171 ETH 2TX	2700975	1
Inline controller, including accessories (connectors and labeling fields)	ILC 191 ETH 2TX	2700976	1
Inline controller, including accessories (connectors and labeling fields)	ILC 131 ETH/XC	2701034	1
Inline controller, including accessories (connectors and labeling fields)	ILC 151 ETH/XC	2701141	1

5.2.2 Accessories

Description	Type	Order No.	Pcs./Pkt.
Inline connector set for Inline bus coupler with connected I/Os	IL BKDIO-PLSET	2878599	1
Connecting cable for connecting the Inline controller to a PC (RS-232) cable	COM CAB MINI DIN	2400127	1
Program and configuration memory, plug-in, 512 Mbytes	SD FLASH 512MB	2988146	1
Program and configuration memory, plug-in, 512 Mbytes, with license key for function block libraries, e.g., for: SNMP, SQL, wireless, motion functions, etc.	SD FLASH 512MB APPLIC A	2701799	1
Program and configuration memory, plug-in, 2 Gbytes	SD FLASH 2GB	2988162	1
Program and configuration memory, plug-in, 2 Gbytes with license key for function block libraries, e.g., for: SNMP, SQL, wireless, motion functions, etc.	SD FLASH 2GB APPLIC A	2701190	1
QUINT POWER power supplies	See current catalog from Phoenix Contact phoenixcontact.net/products		

5.2.3 Software

Description	Type	Order No.	Pcs./Pkt.
PC Worx Express automation software	PC WORX EXPRESS	2988670	1
PC Worx automation software	See current catalog from Phoenix Contact phoenixcontact.net/products		

5.2.4 Documentation

Description	Type	Order No.	Pcs./Pkt.
“Modbus TCP with Phoenix Contact controllers” application note	AH EN MODBUS/TCP	–	1
“Configuring and installing the INTERBUS Inline product range” user manual	IB IL SYS PRO UM E	–	1
“Automation terminals of the Inline product range” user manual	IL SYS INST UM E	–	1
“PC Worx Express Version 5.20 or later” quick start guide	UM QS EN PC WORX EXPRESS	–	1
“PC Worx Version 6.10 or later” quick start guide	UM QS EN PC WORX	–	1

Description	Type	Order No.	Pcs./Pkt.
“PROFINET basics” user manual	UM EN PROFINET SYS	–	1
“PROFINET controller/device functions” user manual	UM EN PROFINET CTRL DEV	–	1
“Applicative system redundancy” application note	AH EN APPLICATIVE SYSTEM REDUNDANCY	–	1

A Appendix: service, maintenance, derating, and ambient conditions

A 1 Error causes and remedies

Table A-1 Installation error causes and remedies

Error	Cause	Remedy
No outputs can be set.	The power supply U_S is not present (see diagnostics LED).	Connect the power supply.
The devices connected to the Inline controller cannot be read in.	The power supply U_S is not present (see diagnostics LED).	Connect the power supply.
The IEC 61131 program is not running.	Mode selector switch in STOP position.	Set mode selector switch to RUN/PROG position.
The serial interface is not operating.	The connector pin assignment of the connecting cable or of the connector adapter used is incorrect.	Use the COM CAB MINI DIN connecting cable for the Inline controller, with Order No. 2400127.
The devices on the remote bus cannot be started up.	The IBS IL 24 RB-T-PAC Inline terminal is not installed directly after the Inline controller.	Insert the terminal as the first Inline terminal directly next to the Inline controller.
The diagnostics LED of a device is flashing quickly.	The device has not been assembled correctly.	Check the connection to the previous module (bus contacts).
The Inline controller cannot be addressed via the IP address.	The IP address on the Inline controller has been changed or does not match the IP settings of the network devices involved.	Check the IP settings and adapt them to your application, if necessary (see also Section “Assigning the IP address for the controller” on page 45).

A 2 Updating the Inline controller firmware

The firmware (integrated software on the Inline controller) can be updated using the Ethernet interface. Such firmware updates are exclusively used for adding new functions that are implemented within the scope of continuous product improvement. No firmware update is required for normal system operation.

To update the firmware, please proceed as described in the “Firmware update ILC 1.../3..., RFC 4...” application note. It can be downloaded at phoenixcontact.net/products.

A 3 Connecting unshielded cables

Unshielded cables are used to connect the I/O devices and the supply voltage to the Inline controller.

Connect these cables to the relevant Inline connectors using the spring-cage connection method. You may connect cables with a connection cross section of 0.2 mm^2 to 1.5 mm^2 (24 - 16 AWG).

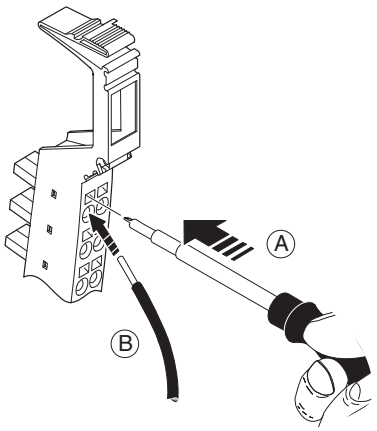

Figure A-1 Connecting unshielded cables

Wire the connectors according to your application.

When wiring, proceed as follows:

- Strip 8 mm off the cable.

Inline wiring is normally carried out without ferrules. However, it is possible to use ferrules. If using ferrules, make sure they are properly crimped.

- Push a screwdriver into the actuation shaft of the appropriate terminal point (Figure A-1, A) so that you can insert the wire into the spring opening.
  Phoenix Contact recommends the SFZ 1-0,6x3,5 screwdriver (Order No. 1204517).
- Insert the wire (Figure A-1, B). Remove the screwdriver from the opening. This clamps the wire.

After installation, the wires and the terminal points should be marked.

A 4 Derating

A 4.1 ILC 131 ETH, ILC 151 ETH, ILC 171 ETH 2TX, and ILC 191 ETH 2TX derating

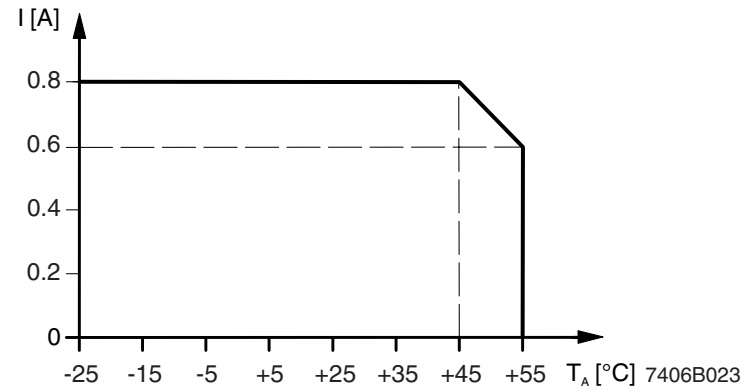

Figure A-2 ILC 131 ETH, ILC 151 ETH, ILC 171 ETH 2TX, and ILC 191 ETH 2TX derating

Key:

I [A]	Logic current in A
T_A [°C]	Ambient temperature in °C

A 4.2 ILC 131 ETH/XC and ILC 151 ETH/XC derating

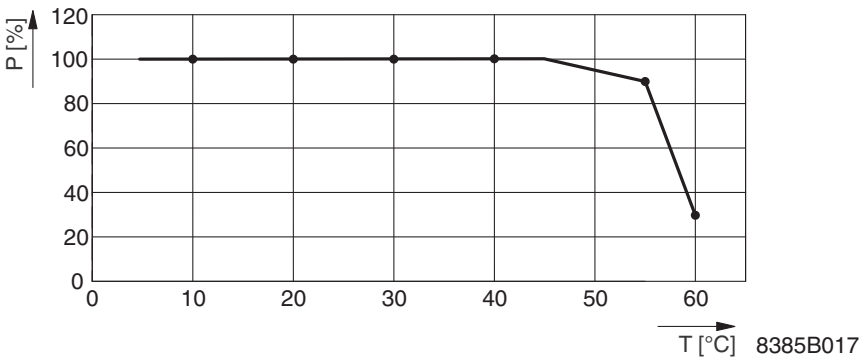

Figure A-3 ILC 131 ETH/XC and ILC 151 ETH/XC derating

Key:

P [%]	Power dissipation as a percentage
T [°C]	Ambient temperature in °C

The specifications refer to a supply voltage of 24 V.

When working with a voltage from the upper voltage range (e.g., 30 V), the percentage values increase. In this case, multiply the percentage values by 1.25 (30 V/24 V = 1.25).

The various functions of the Inline controller have different percentage shares of the power dissipation.

For the percentage shares, please refer to the following table:

Function	Percentage shares of power dissipation as a %
Inputs	24
Outputs	13
U_M	27
U_{ANA}	4
U_L	32

A 5 Tested successfully: use under extreme ambient conditions

The Inline controllers (ILC 131 ETH/XC, ILC 151 ETH/XC) have been tested successfully over 250 temperature change cycles according to IEC 61131-2 in the range from -40°C to +70°C.

The following conditions were observed:

– The Inline devices for all connecting cables were connected with a minimum conductor cross section of 0.5 mm^2.
– The Inline controller was installed on a wall-mounted horizontal DIN rail.
– Fans were used to ensure continuous movement of air in the control cabinet.
– The Inline controller was not exposed to vibration or shock.
– The Inline controller was operated with a maximum of 24.5 V (ensured by using electronically regulated power supply units).

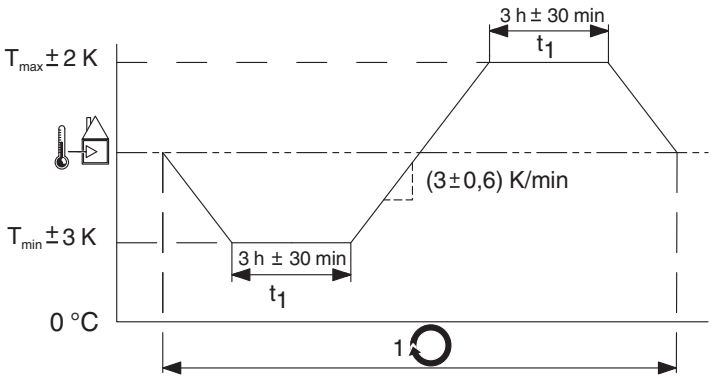

Figure A-4 Temperature change cycle

Temperature in the control cabinet/ambient temperature

Cycle

WARNING:
The Inline controllers (ILC 131 ETH/XC, ILC 151 ETH/XC) are not approved for use in safety technology.

B Appendix for document lists

B 1 List of figures

Section 2

Section 3

Section 4

Appendix A

B 2 List of tables

Section 2

Section 3

Section 4

Appendix A

B 3 Index

M

O

P

R

S

T