Operating Manual

(Translation of the original German Operating Manual)

PacDrive
Logic Motion Controller
LMC 100/101/106/201/212/216 C

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Schneider Electric

The information provided in this documentation contains general descriptions and/or technical characteristics of the performance of the products contained herein. This documentation is not intended as a substitute for and is not to be used for determining suitability or reliability of these products for specific user applications. It is the duty of any such user or integrator to perform the appropriate and complete risk analysis, evaluation and testing of the products with respect to the relevant specific application or use thereof. Neither Schneider Electric nor any of its affiliated or subsidiary companies are responsible or liable for a misuse of the information contained herein. If you have any suggestions for improvements or amendments or have found errors in this publication, please notify us.

All pertinent state, regional, and local safety regulations must be observed when installing and using this product. For reasons of safety and to help ensure compliance with documented system data, only the manufacturer should perform repairs to components.

When devices are used for applications with technical safety requirements, the relevant instructions must be followed.

Failure to use Schneider Electric software or approved software with our hardware products may result in injury, harm, or improper operating results.

Failure to observe this information can result in injury or equipment damage.

Contents

1 About this manual

1.1 Introduction

Read and understand the material contained in this manual before you work on the controller for the first time. Take particular note of the safety information (see 2.3 Residual risks). As described in section 2.2, only those persons who meet the "Selection and qualification of employees" are allowed to work at the controller.

A copy of this manual must be available for personnel who work at the controller.

This manual is supposed to help you use the capabilities of the controller safely and properly.
Follow the instructions within this manual to:

- avoid risks
- reduce repair costs and downtime of the controller
- increase the service life of the controller,
- increase reliability of the controller.

1.2 Symbols, designator and display format of safety messages

Important Information

NOTE Read these instructions carefully, and look at the equipment to become familiar with the device before trying to install, operate, or maintain it. The following special messages may appear throughout this documentation or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.

The addition of this symbol to a Danger or Warning safety label indicates that an electrical hazard exists, which will result in personal injury if the instructions are not followed.

This is the safety alert symbol. It is used to warn the user of potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

⚠ DANGER

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

⚠ WARNING

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

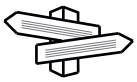
⚠ CAUTION

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

NOTICE

***NOTICE* is used to address practices not related to physical injury.**

The following symbols and designators are used in this document:

Symbol/Character	Meaning
	**Information Symbol:** After this symbol, you will find important information and useful tips on using the components.
	**Marker:** After this symbol, you will find references for further information.
▪	**Prerequisite symbol:** This symbol indicates a prerequisite you have to fulfill before you start to implement an instruction.
✕	**Problem symbol:** This symbol is followed by a description of the problem and an instruction how to solve the problem.
►	**Activity symbol:** After this symbol, you will find an instruction. Follow the instructions in sequence from top to bottom.
✓	**Result symbol:** The text after this symbol contains the result of an action.
(1), (2), (3)	**Image numbers** in the text always refer to the image numbers in the **referenced** figure.
	**Orientation aid:** Information serving as an orientation aid regarding the section's contents follows this symbol.
bold	If the descriptive text contains **keywords**, such as parameters, they are highlighted in bold.
`lBuffSelect`	**Program code** is written using a different font.

2 Safety information

This section contains information regarding working with the controller. Qualified personnel working on the controller must read and observe this information. The controller is conform to recognized technical safety regulations.

2.1 Proper use

The controller must only be installed in a closed electrical equipment (for example, control cabinet).

Provide for protective measures

Before installing the device, provide for appropriate protective devices in compliance with local and national standards. Do not commission components without suitable protective devices. After installation, commissioning, or repair, test the protective devices used.

Perform a risk evaluation concerning the specific use before operating the product and take appropriate security measures.

If circumstances occur that affect the safety or cause changes to the operating behavior of the controller, then immediately shut down the controller and contact your Schneider Electric contact person.

Use original-equipment only

Use only the accessories and mounting parts specified in the documentation and no third-party devices or components that have not been expressly approved by Schneider Electric. Do not change the controller inappropriately.

The components must not be used in the following environments:

Forbidden environments

- In hazardous (explosive) atmospheres
- In mobile, movable or floating systems
- In life support systems
- In domestic appliances
- underground

Installation and operating conditions

Only use the components in accordance with the installation and operating conditions described in this documentation. The operating conditions at the installation location must be inspected and maintained in accordance with the required technical data (performance data and ambient conditions). Commissioning is prohibited until the usable machine or system in which the controller is installed meets all requirements of EC guidelines 2006/42/EC (machinery directive).

In addition, the following standards, directives and regulations are to be observed:

- EN ISO 13849-1:2008 Safety of machinery - Safety-related parts of control systems - Part 1: General principles for design
- EN 60204-1 Safety of machinery - Electrical equipment of machines - Part 1: General requirements
- EN ISO 12100-1 - Safety of machines - Basic terms, general principles for design - Part 1: Basic terminology, methodology
- EN ISO 12100-2 - Safety of machines - Basic terms, general principles of design - Part 2: Technical guidelines
- EN 50178 - Electronic equipment for use in power installations
- EN 61800-3 Adjustable speed electrical power drive systems - Part 3: EMC requirements and specific test methods

- EN 61800-5-1:2007 Adjustable speed electrical power drive systems - Part 5-1: Safety requirements - Electrical, thermal and energy
- EN 61131-2:2007 Programmable controllers - Part 2: Equipment requirements and tests

- The generally applicable local and national safety and accident prevention regulations.
- The rules and regulations on accident prevention and environmental protection that apply in the country where the product is used.

2.2 Qualification of Personnel

Target audience for this manual

Electrical equipment must be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

Qualified person

A qualified person is one who has skills and knowledge related to the construction and operation of electrical equipment and the installation, and has received safety training to recognize and avoid the hazards involved.

The qualified personnel must be able to detect possible hazards that may arise from parameterization, changing parameter values and generally from mechanical, electrical or electronic equipment. The qualified personnel must be familiar with the standards, provisions and regulations for the prevention of industrial accidents, which they must observe when working on the drive system.

2.3 Residual risks

Health risks arising from the controller have been reduced. However a residual risk remains, since the controller works with electrical voltage and electrical currents.

If activities involve residual risks, a safety message is made at the appropriate points. This includes potential hazard(s) that may arise, their possible consequences, and describes preventive measures to avoid the hazard(s). The following types of warnings concerning residual risks which cannot be assigned to a specific handling. The structure of a warning instruction is identical to that of a safety label.

2.3.1 Electrical parts

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Operate electrical components only with a connected protective conductor.
- After the installation, verify the fixed connection of the protective conductor to all electrical devices to ensure that connection complies with the connection diagram.
- Before enabling the device, safely cover the live components to prevent contact.
- Do not touch the electrical connection points of the components when the unit is switched on.
- Provide protection against indirect contact (EN 50178:1999, Section 5.3.2).
- Disconnect/plug in Plug-in connectors of the cables and plug-in terminals on the device only when the system is disconnected from the power supply.

Failure to follow these instructions will result in death or serious injury.

2.3.2 Assembly and handling

⚠ WARNING

CRUSHING, SHEARING, CUTTING AND HITTING DURING HANDLING

- Observe the general construction and safety regulations for handling and assembly.
- Use suitable mounting and transport equipment correctly and use special tools if necessary.
- Prevent clamping and crushing by taking appropriate precautions.
- Cover edges and angles to protect against cutting damage.
- Wear suitable protective clothing (e.g. safety goggles, safety boots, protective gloves) if necessary.

Failure to follow these instructions can result in death or serious injury.

2.3.3 Hazardous movements

There can be different causes of hazardous movements:

- Missing or incorrect homing of the drive
- Wiring or cabling errors
- Errors in the application program
- Potential component errors
- Potential error in the measured value and signal transmitter

Provide for personal safety by primary equipment monitoring or measures. Do not rely only on the internal monitoring of the drive components. Adapt the monitoring or other arrangements and measures to the specific conditions of the installation in accordance with a risk and error analysis carried out by the system manufacturer.

⚠ DANGER

MISSING OR INADEQUATE PROTECTION DEVICE(S)

- Prevent entry to a zone of operation with, for example, protective fencing, mesh guards, protective coverings, or light barriers.
- Dimension the protective devices properly and do not remove them.
- Do not make any modifications that can degrade, incapacitate or in any way invalidate protection devices.
- Before accessing the drives or entering the zone of operation, bring the drives to a stop.
- Protect existing work stations and operating terminals against unauthorized operation.
- Position EMERGENCY STOP switches so that they are easily accessible and can be reached quickly.
- Validate the functionality of EMERGENCY STOP equipment before start-up and during maintenance periods.
- Prevent unintentional start-up by disconnecting the power connection of the drive using the EMERGENCY STOP circuit or using an appropriate lock-out tag-out sequence.
- Validate the system and installation before the initial start-up.
- Avoid operating high-frequency, remote control, and radio devices close to the system electronics and their feed lines and perform, if necessary, an EMC validation of the system.

Failure to follow these instructions will result in death or serious injury.

2.3.4 PELV circuits

The signal voltage and the control voltage of the devices are < 30 Vdc and have to be designed as PELV circuits. In this range the specification as PELV system, according to EN 61800-5-1 contains a protective measure against direct and indirect contact with dangerous voltage through a implemented safe separation in the system/ machine of the primary and the secondary side. We recommend to design the system/ machine with a safe separation (PELV Protective-Extra-Low-Voltage).

⚠ DANGER

HAZARD OF ELECTRIC SHOCK BY INADEQUATE PROTECTIVE SEPARATION

Only connect devices, electrical components or lines to the signal voltage connectors of these components that feature a sufficient, protective separation from the connected circuits in accordance with the standards (IEC 61800-5-1: Adjustable speed electrical power drive systems - safety requirements).

Failure to follow these instructions will result in death or serious injury.

- ► Achieve a safe separation in the entire process of the electric circuit.

2.3.5 Cyber Security

⚠ WARNING

UNAUTHENTICATED ACCESS AND SUBSEQUENT UNAUTHORIZED MACHINE OPERATION

- Evaluate whether your environment or your machines are connected to your critical infrastructure and, if so, take appropriate steps in terms of prevention, based on Defense-in-Depth, before connecting the automation system to any network.
- Limit the number of devices connected to a network to the minimum necessary.
- Isolate your industrial network from other networks inside your company.
- Protect any network against unintended access by using firewalls, VPN, or other, proven security measures.
- Monitor activities within your systems.
- Prevent subject devices from direct access or direct link by unauthorized parties or unauthenticated actions.
- Prepare a recovery plan including backup of your system and process information.

Failure to follow these instructions can result in death or serious injury.

3 System overview

The control system consists of several single components, depending on its application.

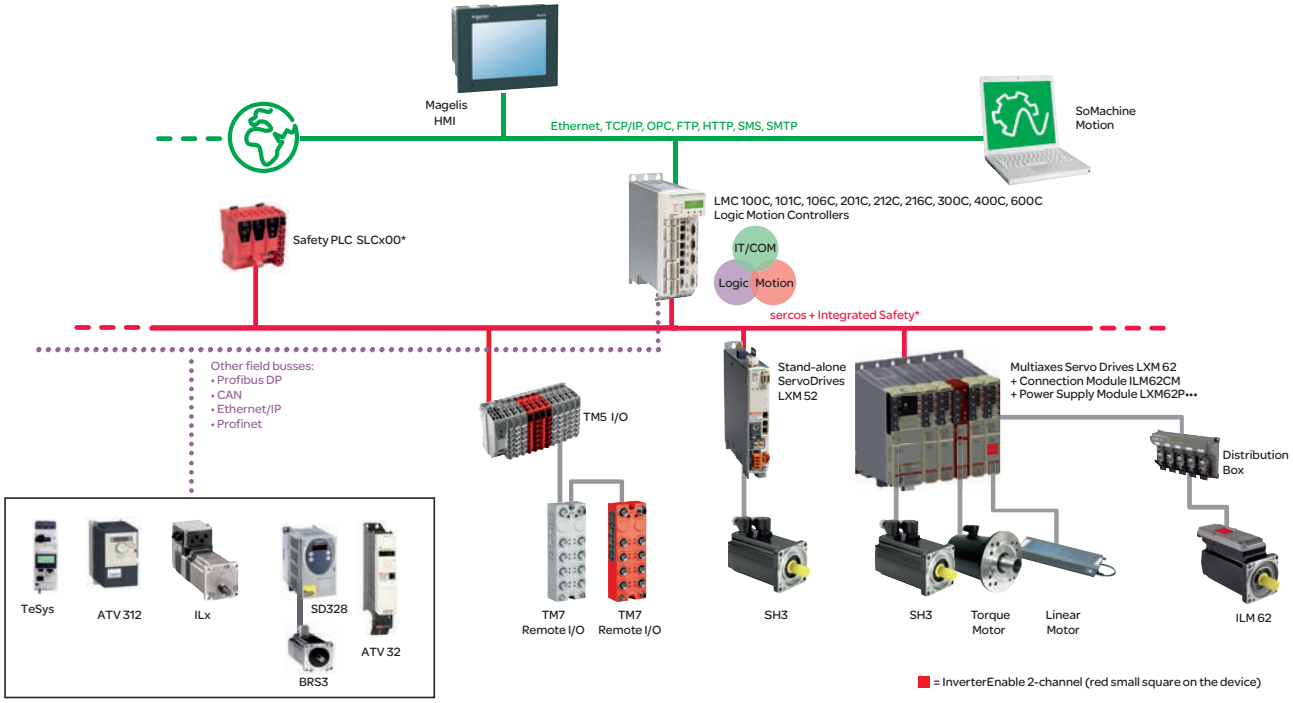


Figure 3-1: PacDrive 3 System overview

**Safety PLC* according to IEC 61508:2010 and EN ISO 13849:2008

3.1 Logic Motion Controller

The LMC (Logic Motion Controller), with a VxWorks real-time operating system, centrally implements the PLC (Programmable Logic Controller) and motion functions. A LMC synchronizes, coordinates and creates the motion functions of a machine for a maximum of:

- 0 Sercos servo drives (LMC 100C)
- 4 Sercos servo drives (LMC 101C)
- 6 Sercos servo drives (LMC 106C)
- 8 Sercos servo drives (LMC 201C)
- 12 Sercos servo drives (LMC 212C)
- 16 Sercos servo drives (LMC 216C)
- 8 Sercos servo drives (LMC 300C)
- 16 Sercos servo drives (LMC 400C)
- 99 Sercos servo drives (LMC 600C)

System performance

Logic Motion Controller	System performance[1)]	Sercos Cycle time	IEC cycle time
LMC 600C	200%	1 ms	4 ms
LMC 400C	150%	1 ms	4 ms
LMC 216C	100%	1 ms	4 ms
[1)] Percentage system performance based on the system performance of the Logic Motion Controller LMC216C			

Table 3-1: System performance for a simple CAM Motion Application (electronic cam disk) with 16 axes

Logic Motion Controller	Sercos Cycle time 1 ms		Sercos Cycle time 2 ms	
	Simple control[1)]	Control with velocity control[1)]	Simple control[1)]	Control with velocity control[1)]
LMC 600C	6	2	12	4
LMC 400C	3	1	4	2
LMC 216C	2	0	4	1
[1)] Number of controllable robots (4 axes per robot)				

Table 3-2: System performance for a Robotic application (contains reserves for further application components)

3.2 ILM62 system

The modular servo drive system ILM62 is designed for the operation of servo drives in a multi-axes system.

The power electronic components of the ILM62 are fitted inside the control cabinet.

Using a common DC bus, the central power supply unit Power Supply Module LXM62P••• supplies the connected servo converters with the power required.

The Connection Module ILM62CM supplies the ILM62 Servo Modules with DC voltage from the DC bus via a hybrid cable or via a power cable (Daisy Chain wiring). Additionally, the Connection Module ILM62CM provides the Inverter Enable and Sercos interface.

The ILM62 simplifies the wiring of the devices in relation to the initial start-up and in service cases. This also applies to the cable connection of the enclosed devices to the field. All the connectors that can be connected from the outside (power input, DC bus, 24 Vdc supply, Sercos, Ready and Inverter Enable) are designed such, that a fast and simple configuration without tools can be realized on the device.

3.2.1 ILM62DB Distribution Box

The Distribution Box ILM62DB is the link between Connection Module ILM62CM and ILM62 Servo Module. Depending on the number of drives, 1 to 4 ILM62 Servo Modules or daisy chain lines can be connected. When operating more than 4 drives, simply expand the system using one or more Distribution Box ILM62DB.

The highlights

- 1...4 connections for ILM62 Servo Modules or daisy chain lines or further Distribution Box ILM62DB
- easy wiring using pre-assembled hybrid cables or power cables (Daisy Chain wiring)
- easy to expand

3.2.2 ILM62 Servo Module

The innovative ILM62 Servo Module combines motor, power stage and digital servo controller for an axis in a space-saving housing. Due to its compact construction with the integrated controller, it is perfectly suitable for peripheral set-up. It is available with individual or multi-turn encoders and configures itself with the aid of the electronic nameplate in the ILM62 Servo Module.

The ILM62 Servo Modules are available in three different flange sizes:

- ILM070
- ILM100
- ILM140

The highlights:

- Compact type of construction
- 3.5 times peak torque
- Integrated Sercos interface
- High-resolution single or multi-turn encoder
- Degree of protection IP65
- Simple wiring

3.2.3 ILM62DC•000 Daisy Chain Connector Box

ILM62DCA000

ILM62DCB000

ILM62DCC000

The ILM62DC•000 Daisy Chain Connector Box is mounted on a standard ILM62 Servo Module in order to enable a daisy chain wiring. The ILM62 Servo Modules can be either directly connected to the Distribution Box ILM62DB or via a Connection Module ILM62CM. When connecting via a Distribution Box ILM62DB, a larger number of drives can be connected. At this first Distribution Box ILM62DB another Distribution Box ILM62DB can be connected.
Power (DC bus voltage/24V/Inverter Enable signals) and Sercos signals are distributed via separate cables. Each ILM62 Servo Module must be extended by a Daisy Chain Connector Box. If only one Distribution Box ILM62DB is used, then up to 4 daisy chain lines can be connected to it. If several Distribution Box ILM62DB are used, then on the first, up to the second to last Distribution Box ILM62DB respectively up to 3 daisy chain lines can be connected and on the last Distribution Box ILM62DB up to 4 daisy chain lines. A daisy chain line can consist of up to 9 ILM62 Servo Modules.

The connection between the ILM62 Servo Modules is established as follows:

- Power cable for power distribution (DC bus voltage/24V/Inverter Enable signals) with an M23 connector
- Sercos cable for distribution of the Sercos signals via M12 connector

The following ILM62 Servo Modules can be equipped with the Daisy Chain Connector Box in order to implement a daisy chain wiring:

- ILM070••
- ILM100••
- ILM140••

The Daisy Chain Connector Box is available in the following variants:

- ILM62DCA000 (suitable for ILM070••, ILM100•• and ILM140••)
- ILM62DCB000 (suitable for ILM070•• only)
- ILM62DCC000 (suitable for ILM100•• only)

3.3 Lexium LXM52

The stand-alone LXM52 Sercos servo amplifier is designed for servo drive solutions with independent single axes.

The power electronic components of the LXM52 are fitted inside the control cabinet.

The LXM52 is directly connected to the mains supply.

The drive provides the phase currents required for the position control of the connected servo motors. According to the different requirements in relation to the individual servo axes of the application, the LXM52 is available in different current classes.

The LXM52 simplifies the wiring in relation to the initial start-up and service cases. This also applies to the cable connection of the enclosed devices to the field. All the connectors that can be connected from the outside (power input, DC bus, 24 Vdc-supply, Sercos, motor, encoder, IOs, IO-supply, ready and inverter enable (STO)) are designed so that a fast, simple configuration on the device can be realized without tools.

3.4 Lexium LXM62

The modular servo drive system Lexium LXM62 is designed for the operation of servo drives in a multi-axis group.

The power electronic components of the LXM62 are fitted inside the control cabinet.

Using a common DC bus, the central power supply supplies the connected servo converters with the power required.

The servo converters - single and double drive, provide the necessary phase currents for the position control of the connected servo motors. According to the different requirements in relation to the individual servo axes of the application, the single- and double drives are available in different current classes.

The Lexium LXM62 simplifies the wiring of the devices in relation to the initial start-up and service cases. This also applies to the cable connection of the enclosed devices to the field. All the connectors that can be connected from the outside (power input, DC bus, 24 Vdc-supply, Sercos, motor, encoder, IOs, IO-supply, ready and inverter enable) are designed so that a fast, simple configuration on the device can be realized without tools.

3.5 SH3 Servo motor

The servo motors meet rigorous requirements of dynamics and precision. Five flange sizes with different torque outputs offer the right drive solution for application.

high dynamic AC servo motors

Because of the low inertia and a high overload capability, the motor SH3 fulfills the requirements concerning the accuracy, dynamics and efficiency.

The SH3 motors are available in five different flange sizes:

- SH3-055
- SH3-070
- SH3-100
- SH3-140
- SH3-205

The highlights:

- Developed for high dynamics and precision
- Single tooth winding
- compact size
- high power density
- Low internal moment of inertia
- high overload capability
- Low detent torque

3.6 TM5 System

The direct connection of the TM5 system to the LMC 100/101/106/201/212/216 C is not possible. The TM5 system can be connected via the Sercos bus interface.

3.7 Type code

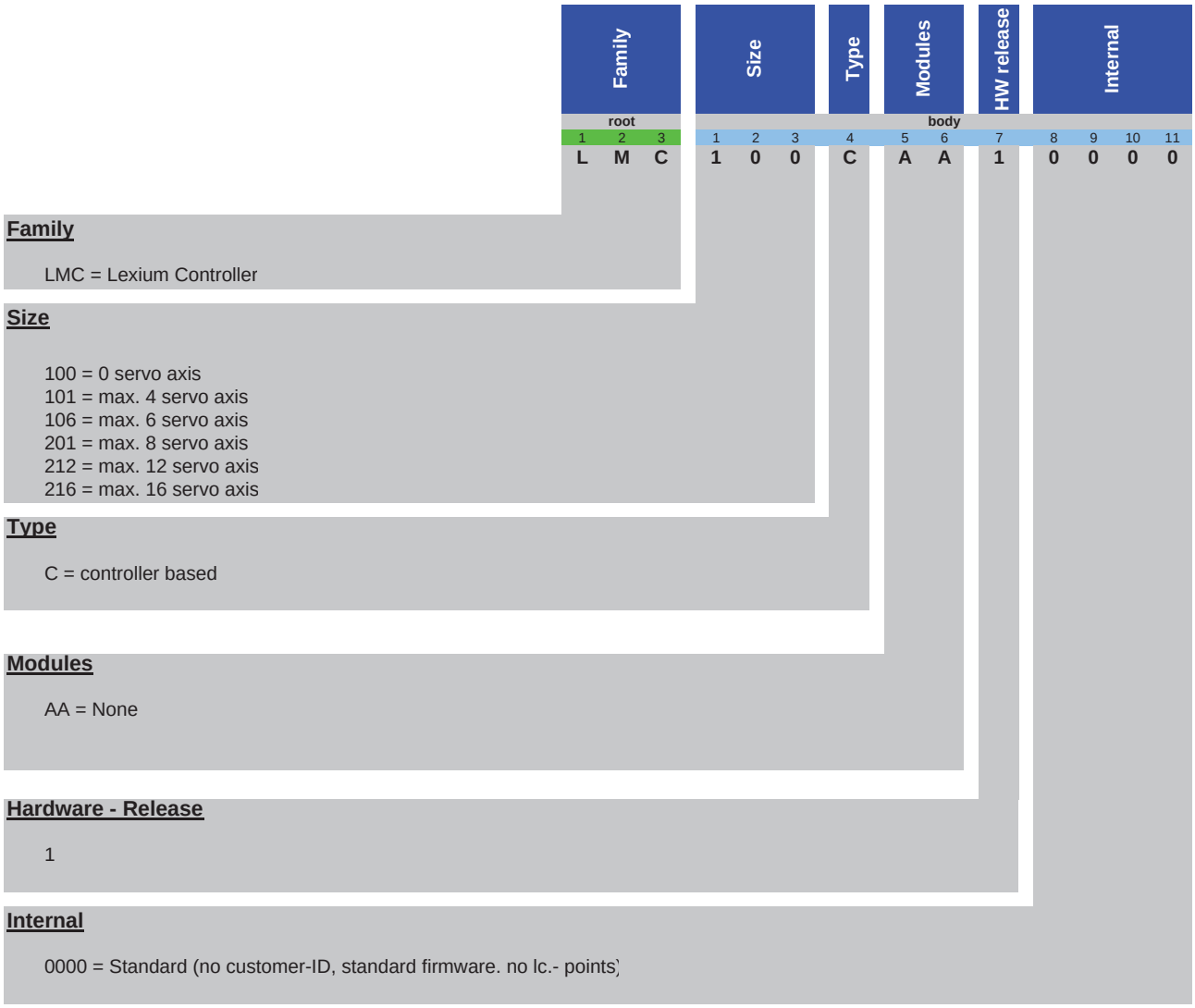
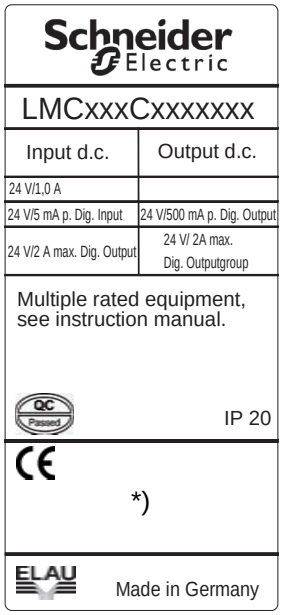


Figure 3-2: Type code LMC 100/101/106/201/212/216 C

3.8 Nameplate descriptions

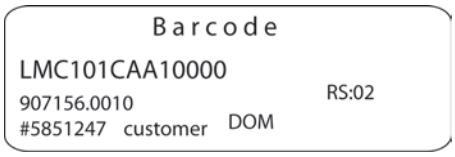
The technical nameplate of the Logic Motion Controller Drive is located on the left bottom side of the housing.



Label	Meaning
LMCxxxCxxxxxx	Device type and Unicode
Input d.c.	Digital inputs / input voltage and input current (per input)
Output d.c.	Digital outputs / output voltage and rated current (per input)
IP 20	Degree of protection
CE (symbol)	CE mark
*)	This field displays the symbols of certification.

Table 3-3: Explanation of the nameplate

The logistic nameplate of the LMC Logic Motion Controller is located on the bottom of the housing.



Label	Meaning
LMC101CAA10000	Device type and Unicode
907156.0010	Serial number
RS:02	Hardware revision status[1)]
DOM	Date of manufacture
[1)] When exchanging the device the hardware revision status for the previous and the new device should be identical so that the hardware compatibility between the two devices is guaranteed (see 5.7.1 Device replacement). The hardware revision status can also be read on the hardware code of the device (see 4.1.1 Liquid Crystal Display (LCD)).	

Table 3-4: Explanation of the nameplate

4 Indicators and control elements

4.1 Indicators of the controller

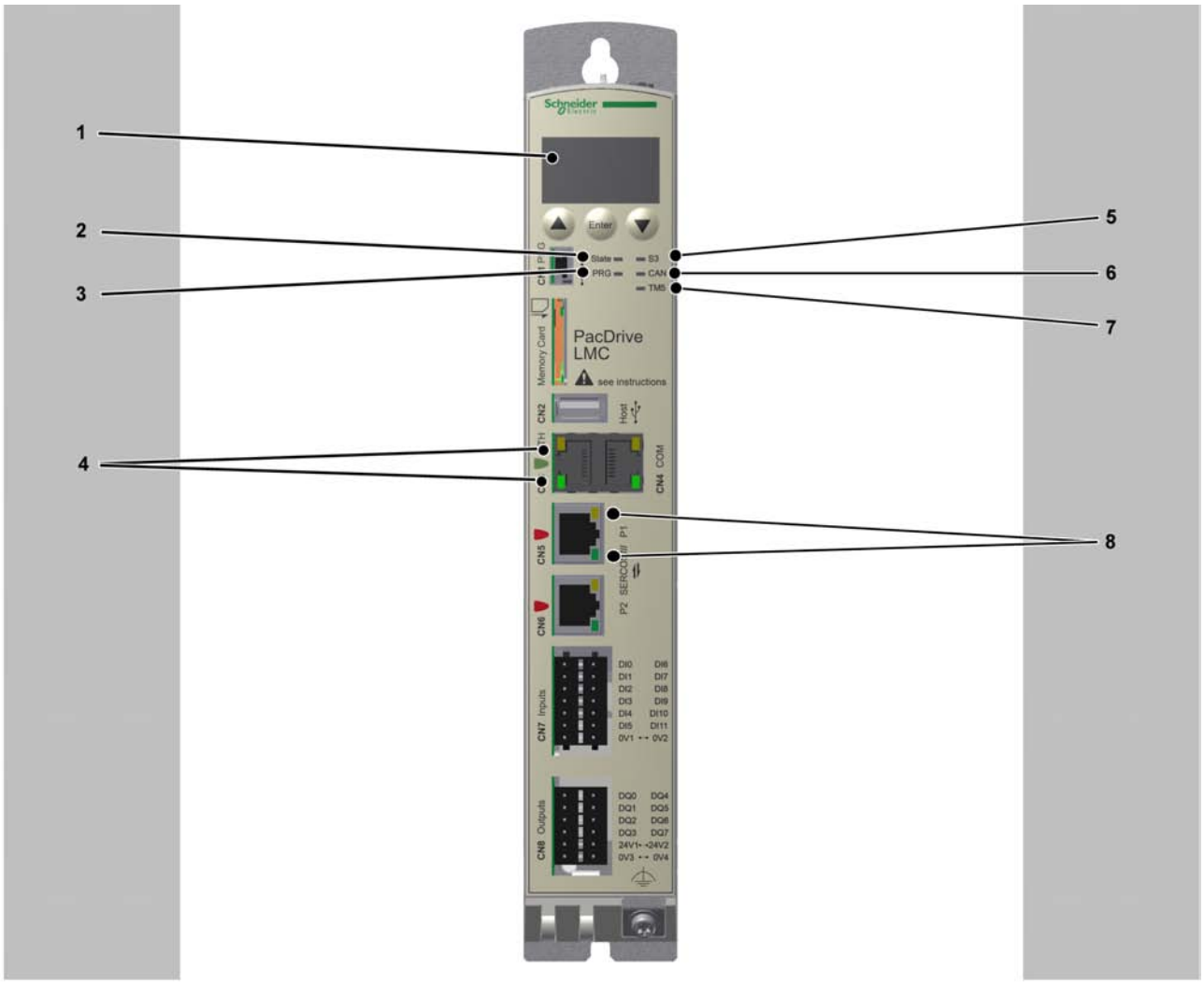
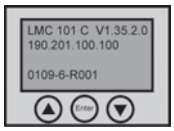


Figure 4-1: Operating unit of the LMC 100/101/106/201/212/216 C

1	Liquid Crystal Display (LCD)
2	State LED
3	PRG LED
4	Status LEDs Ethernet
5	S3 LED
6	CAN LED
7	TM5 LED
8	Status LEDs Sercos

4.1.1 Liquid Crystal Display (LCD)

Liquid Crystal Display (LCD)



In addition to the LED displays, further information about the operating status of the controller is given on the 4-line Liquid Crystal Display (LCD).

Line 1	Controller type and currently used firmware version
Line 2	Current IP address of the controller
Line 3	-
Line 4	PFPGA version/SFPGA version/BIOS version

Functions of the menu buttons

Under the Liquid Crystal Display (LCD), three menu buttons are located through which the user can open and navigate in the menu. For more information on the menu buttons, see section Menu buttons. (see 4.2.1 Menu buttons) The menu buttons feature the following functions:

first ▼ and then simultaneously Enter	Access of the menu
▲	Cursor up
▼	Cursor down
Enter	Open menu item
first ▲ and then simultaneously Enter	one level up in the menu

If an up or down arrow is displayed on the right display edge, this indicates that the current menu has more lines than can be shown on the display. In this case you can use the arrow buttons ▲ and ▼ to scroll up or down.

Menu navigation

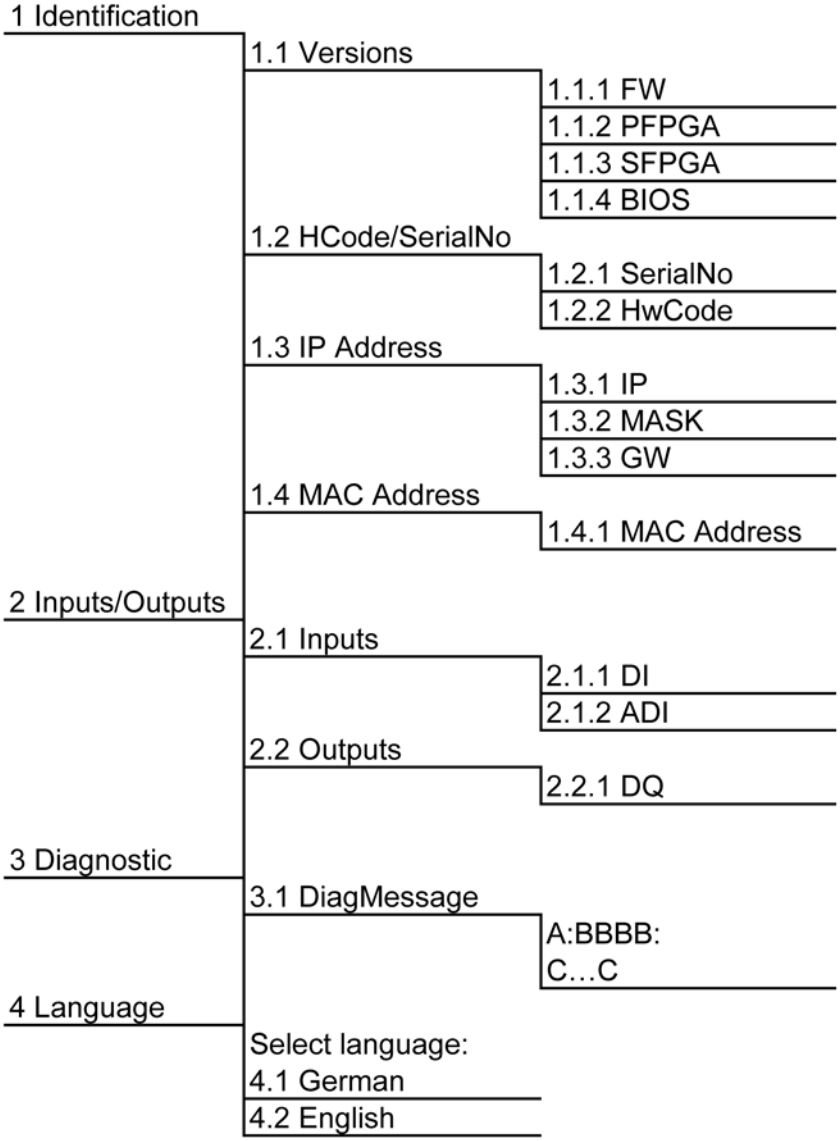


Figure 4-2: Menu navigation

Description of the menu navigation

The submenu "Versions" provides an overview of all the software and hardware versions installed on the controller.

FW	Currently used firmware version
PFPGA	Version of the PacDrive FPGA software
SFPGA	Version of the System FPGA software
BIOS	BIOS version

In the submenu "HCode/SerialNo." a serial number and the hardware code are displayed. The serial number is a unique number which is used to identify the controller. The hardware code indicates the revision status.

Serial number	Controller serial number
Hardware code:	Hardware code of the controller[1)]
[1)] The first two digits of the hardware code indicate the hardware revision status (for example, "02"). The hardware revision status is also indicated on the logistical nameplate (for example, "RS:02" (see 3.8 Nameplate descriptions)). By an exchange of the device the hardware revision status for the previous and the new device should be identical so that the hardware compatibility is guaranteed between the two devices.	

In the submenu "IP address" the IP address, the subnet mask and the gateway are displayed.

IP	IP address of the controller
MASK	Subnet mask
GW	Gateway

The MAC address is specified in the submenu "MAC address". The MAC address is a clear address of the device to identify the device in the network.

MAC address	MAC address

In the submenu "Inputs" the user can prompt the logic state of each input. The digital inputs correspond to the standard IEC61131-2 type 1. Touchprobes and fast inputs have a resolution of 10 µs. Fast inputs can be used to trigger an interrupt.

DI	Digital input
ADI	Advanced digital input

In the submenu "Outputs" the user can prompt the logic state of each output.

DQ	Outputs

In the submenu "DiagMessage" the diagnostic class, the diagnostic code and the diagnostic text are displayed. The system assigns each diagnostic message a specific diagnostic class when enabled. The diagnostic code is a code that encrypts a certain diagnostic. In the diagnostic text a diagnostic is described in detail.

A: BBBB: C...C	A: Diagnostic class BBBB: Diagnostic code C...C: Diagnostic text

In the submenu "Select language" the user can choose the display language.

Select language	
German	Display language is German
English	Display language is English

4.1.2 State LED

The State LED indicates whether a control voltage is applied, whether errors are detected by the controller and whether the controller performs a minimum boot.

OFF	The control voltage (24 Vdc) is missing or too low.
GREEN	Normal operation, control voltage in normal range
RED	system error detected, error is shown on the display
	Initialization active **after power on**
	an error is detected by the controller **after initialization**, for further information on the error, see the message logger
Quickly flashes RED	The controller performs a minimal boot

4.1.3 PRG LED

The PRG LED indicates the state of the USB communication on Prog Port (CN1).

OFF	no USB communication on Prog Port
GREEN	USB communication detected

The function to establish a connection to the controller via USB is currently not available.

4.1.4 S3 LED

The S3 LED indicates the state and the phases of the Sercos communication.

LED Color	LED Status	Meaning	Instructions/information for the user	Notes
	OFF	No Sercos communication	-	-
	ORANGE	The device is in a communication phase CP0 up to and including CP3.	-	SERC3.State = 0..3
	GREEN	Sercos communication in communication phase CP4 without error	-	SERC3.State = 4
	RED	Detected communication error	Reset condition: ■ DiagQuit	SERC3.State = 11

4.1.5 CAN LED

CAN-LED is a two-color light-emitting diode (LED), alternating between two states: a Run state (green color) and an Error state (red color). CAN-LED colors can be flickering (every 50ms), or blinking (every 200ms), or flashing (1, 2 or 3 flashes), or steady, as described below.

State	Color display mode	Meaning
Off	-	no power
Flickering green	the LED repeatedly flickers on for 50ms, then off for 50ms	autobaud detection in progress
Blinking green	the LED repeatedly flickers on for 200ms, then off for 200ms	pre-operational state
Flashing green	single flash: The LED flashes on for 200ms, then off for 1000ms	stopped state
Green	steady	operating state
Flashing red	single flash: The LED flashes on for 200ms, then off for 1000ms	limit to trigger diagnostic message reached
	double flash: The LED flashes on for 200ms, off for 200ms, on for 200ms, then off for 1000ms	a cyclic checking has detected an error
	triple flash: The LED flashes on for 200ms, off for 200ms, on for 200ms, off for 200ms, on for 200ms, then off for 1000ms	Synchronisation error detected. no Sync message received within the configured communication cycle time-out
red	steady	bus off

4.1.6 TM5 LED

The TM5 LED and TM5 Connector CN10 are intended for future evolutions of the product, and are currently inactive.

4.1.7 Status LED Ethernet

The ethernet connector has two LEDs. One LED is green, the other is yellow.

LED	State	Meaning
Green	On	Connection established
Green	Flashing	Data traffic
Green	Off	No connection, e. g. no cable connected or connected device has no power
Yellow	On	1 GBit/s connection
Yellow	On	100 MBit/s connection
Yellow	Off	10 MBit/s connection

4.1.8 Status-LED Sercos

Each Sercos connector has two LEDs. One LED is green, the other is yellow.

LED	State	Meaning
Yellow	On	Connection established
Yellow	Off	No cable connected or connected device has no power
Green	On	Current network traffic
Green	Off	No current network traffic

4.2 Operating elements of the controller

4.2.1 Menu buttons

Three menu buttons are located on the front side of the controller. With these menu buttons, the user can open and navigate through the menu.

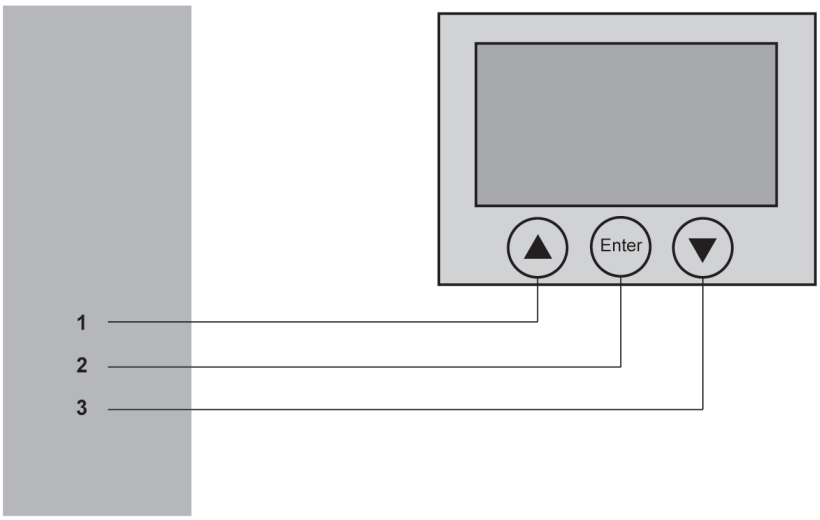


Figure 4-3: Overview of menu buttons

1	Up arrow button
2	Enter button
3	Down arrow button

4.2.2 SD card-slot

The SD card slot is located on the front side of the controller.

The SD card slot is the receptacle for the permanent data storage (SD card) of the controller.

General information on the SD card

NOTICE

LOSS OF APPLICATION DATA

- Do not store the SD Card where there is static electricity or probable electro-magnetic fields.
- Do not store the SD Card in direct sunlight, near a heater, or other locations where high temperatures can occur.
- Do not bend the SD Card.
- Do not drop or strike the SD Card against another object.
- Keep the SD Card dry.
- Do not touch the SD Card connectors.
- Do not disassemble or modify the SD Card.
- Use only SD Cards formatted using FAT or FAT32.

Failure to follow these instructions can result in equipment damage.

NOTICE

LOSS OF APPLICATION DATA

- Backup SD Card data regularly.
- Do not remove power or reset the controller, and do not insert or remove the SD Card while it is being accessed.
- Become familiar with the proper orientation of the SD card when inserting it into the controller.
- Use external UPS to bridge power supply failures.

Failure to follow these instructions can result in equipment damage.

The controller saves data up to 25ms after the loss of the power supply. To avoid data loss an external UPS should be used.

Function of the SD card

The operating system, the Schneider Electric firmware and an SoMachine Motion project is stored on the SD card. After the system run-up, the software is loaded on the controller. It is also possible to store license points for libraries on the SD card.

Only use SD cards approved by Schneider Electric for this device.

There is no display that shows that the SD card has been accessed.

Write protection of the SD card

With the slide switch on the side of the SD card, the write protection of the SD card can be activated.

Figure 4-4: Slide switch SD card

1	Slide switch

To activate the write protection, the slide switch has to be set to the position LOCK. To deactivate the write protection, the slide switch has to be set to the opposite position.

With an activated write protection, a download of an SoMachine Motion project onto the controller or writing of parameters on the SD card, is not possible during the operation.

Insert SD card

- The controller is switched off.

NOTICE

INCORRECTLY INSERTED SD CARD

- Do not insert the SD card when the controller is under power.
- Verify that you insert the SD card into the SD card slot correctly with the beveled corner forward and facing downwards.

Failure to follow these instructions can result in equipment damage.

► Insert the SD card carefully into the SD card slot with the beveled corner forward and looking downwards as shown on the figure until it snaps into place.

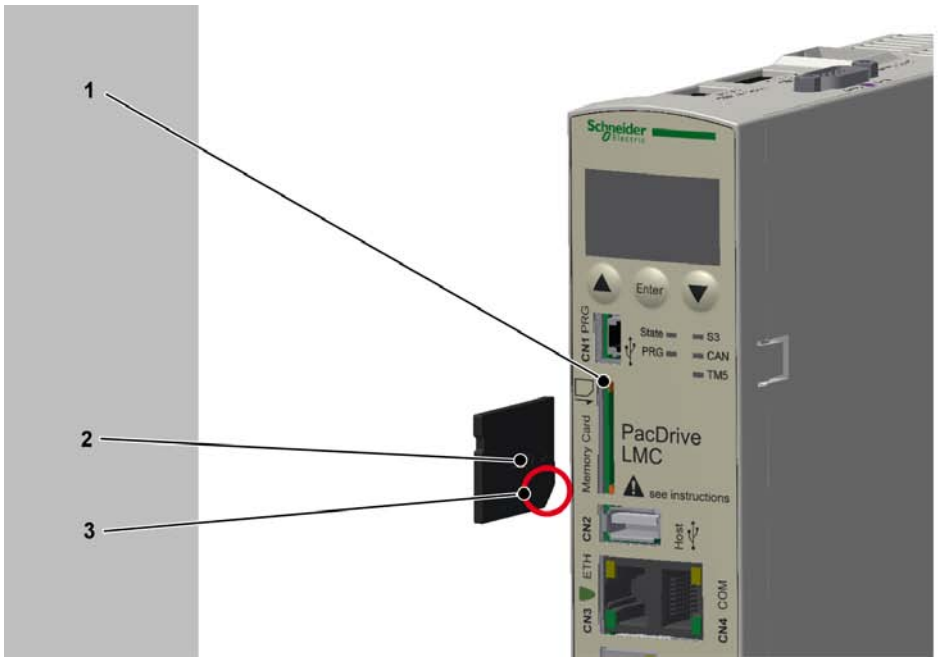


Figure 4-5: Insert SD card

1	SD card-slot
2	SD card
3	Beveled corner forward and looking downwards.

Remove SD card

NOTICE
INCORRECTLY REMOVED SD CARD Do not remove the SD card when the controller is under power. **Failure to follow these instructions can result in equipment damage.**

- The controller is switched off.
- ▶ Push the SD card slightly inside until it disengages.
- ▶ Remove the SD card from the SD card-slot.

4.2.3 USB connection

It is possible to connect storage media for the extension of the memory to the connection CN2 (USB-A). Only a storage medium and no USB-hubs may be connected to the connection.

The storage medium must only be inserted if the firmware controller is started up. Otherwise the firmware of the controller does not start up.

5 Installation and maintenance

Proceed with care during the following steps and take all precautions described in order to help to avoid the following points:

- Injuries and material damage
- Incorrect installation and programming of components
- the incorrect operation of components
- The use of non-authorized cables or modified components

5.1 Commissioning

5.1.1 Preparing commissioning

ESD protection

► Observe the following instructions for ESD protection in order to avoid any damage due to electrostatic discharge:

NOTICE

ELECTROSTATIC DISCHARGE

- Do not touch any of the electrical connections or components.
- Prevent electrostatic charges; e.g., by wearing appropriate clothing.
- If necessary at all, touch circuit boards only on the edges.
- Move the circuit boards as little as possible, to avoid the formation of electrostatic charge caused by clothing, carpet, or furnishings.
- Remove existing static charge by touching a grounded, metallic surface, like for example, a grounded housing.

Failure to follow these instructions can result in equipment damage.

Unpacking

How to unpack the device:

► Remove packaging.
► Dispose of the packaging material in accordance with the relevant local regulations.

Verifying

How to check the device:

► Verify that the delivery is complete on the basis of the delivery slip.
► Verify if the device is in working condition.

⚠ WARNING

UNINTENTED EQUIPMENT OPERATION

- Do not mount or commission damaged drive systems.
- Do not modify the drive systems.
- Send back inoperative devices.

Failure to follow these instructions can result in death or serious injury.

► Check the data with the help of the nameplates.
► Observe requirements for the installation location.
► Observe requirements for the degree of protection and the EMC rules.
► Then install LMC.

5.1.2 Wiring of the controller

► Connect the controller, beginning with the shielded connector.

- ► Check the continuity of the protective conductor system.
- ► Check if the shielding is completely correct.
- ► Check whether the memory card has been inserted.
- ► Eliminate the possibility of short circuits and interruptions.
- ► Check if the terminals are fastened securely and the necessary cable cross sections are correct.

NOTICE

INCORRECT POLARITY AND/OR INCORRECT POWER SUPPLY

- When connecting the CN9 connection do not interchange the positive pole with the negative pole.
- Supply the controller with 24V DC.

Failure to follow these instructions can result in equipment damage.

- ► Connect the CN9 connection of the controller to an external mains adapter.
- ► Establish a Sercos connection via the CN5 and CN6 connections.

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

Connect the control voltage to the inputs and outputs properly (see 6.4.1 Connection overview controller).

Failure to follow these instructions can result in death or serious injury.

- ► Connect all further connections according to their local device configuration.

NOTICE

OVERHEATING BECAUSE OF HIGH AMBIENT TEMPERATURES

For ambient temperatures > 55 °C (131 °F), ensure that there is additional re-circulation of the cooling air in the control cabinet (external fan).

Failure to follow these instructions can result in equipment damage.

For further information on this (see 6.1 Ambient conditions).

- ► Switch on the supply voltage of the controller.
  - ✓ The LMC is initialized and the LEDs show the following condition:
    LED status during initialization: State-LED: red
    LED status after initialization: State-LED: green

Configure the output CN8 as Watchdog.

⚠ WARNING

FAILURE TO MEET SAFETY FUNCTION REQUIREMENTS

Do not use the Watchdog output to realize IEC 61508:2010 and EN ISO 13849:2008 safety function.

Failure to follow these instructions can result in death or serious injury.

NOTICE

INCORRECT POLARITY OF THE POWER SUPPLY OF THE OUTPUTS

When connecting the CN8 connection do not interchange the positive poles (pin 5 and pin 11) with the negative poles (pin 6 and pin 12).

Failure to follow these instructions can result in equipment damage.

On the connection CN8 it is possible to configure the output DQ7 as Watchdog. At delivery, it is not configured as watchdog but as standard output.

For further information on this, see the online help of SoMachine Motion.

Grounding screw connection

Tighten the grounding screw with a 1.4 Nm (12.4 ibf in) torque.

External UPS

NOTICE

POSSIBLE DATA LOSS BY POWER SUPPLY FAILURE

Use external UPS to bridge power supply failures.

Failure to follow these instructions can result in equipment damage.

The controller saves data up to 25ms after the loss of the power supply. To avoid data loss an external UPS should be used.

5.1.3 Preparing the control cabinet

⚠ DANGER

ELECTRIC SHOCK DUE TO INADEQUATE OR MISSING GROUNDING

At the installation points, remove paint across a large surface before installing the devices (bare metal connection).

Failure to follow these instructions will result in death or serious injury.

⚠ WARNING

COMBUSTION OF FLAMMABLE MATERIALS

Do not install the device on any flammable materials.

Failure to follow these instructions can result in death or serious injury.

- If necessary, install additional fan.
- Keep a distance of at least 100 mm (3.94 in.) above and below the devices.
- Mount the controller vertically inside the control cabinet.

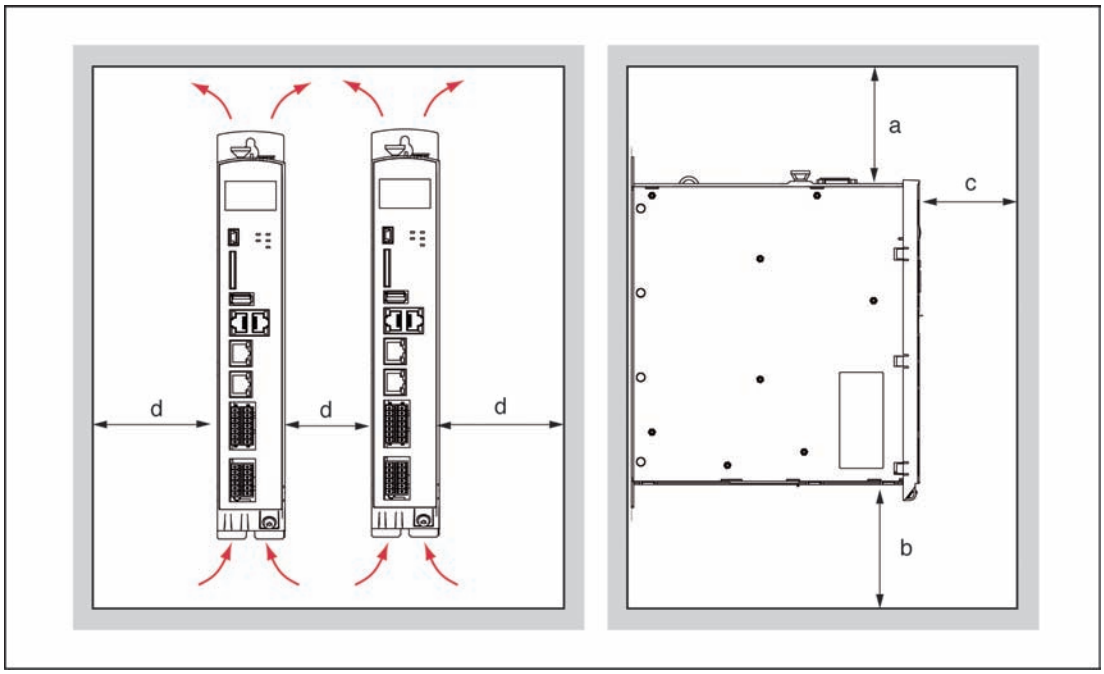


Figure 5-1: Assembly distances and air circulation

Distance	Air circulation
a ≥ 100 mm (a ≥ 4 in.)	Clearance above the device.
b ≥ 100 mm (b ≥ 4 in.)	Clearance below the device.
c ≥ 60 mm (c ≥ 2,35 in.)	Clearance in front of the device.
d ≥ 0 mm (d ≥ 0 in.)	Clearance between the devices

5.1.4 Completion of commissioning

- Check safety functions such as the EMERGENCY STOP switch.

This is how to connect the mains voltage:

- Activate EMERGENCY STOP switch.
- Check with a suitable measuring instrument that it is off-circuit.
- Connect mains voltage.
- Check status displays for proper function.
- Release EMERGENCY STOP switch and activate ON switch.

This is how to move the axis:

- When moving the axis for the first time, use a reliable, tested application program which covers the following motions / functions: checking
  - the correct direction of rotation of the axis,
  - the correct setting of the limit switches and
  - the braking distance in both directions.

This is how to transmit the configuration and the program:

- ► Transfer project with the SoMachine Motion Logic Builder automation toolkit to the PacDrive controller.

⚠ WARNING

HAZARDOUS MOVEMENTS

- Ensure that no persons are in the zone of operation.
- Remove all tools, loose parts and other working aids not belonging to the axis/ machine/system from the area of movement.
- Engaged the engine only after the function test has been successfully performed.

Failure to follow these instructions can result in death or serious injury.

Adjust real-time clock

The real-time clock is not adjusted at the time of delivery of the device. Summer and winter time is not considered by the device. If the real-time clock is not adjusted, the time and date specifications in the message logger will not be correct. Make certain that the real-time clock is adjusted correctly.

5.1.5 Performing the function test

- ► Verify devices and wiring again.
- ► If you haven't already done so, connect the mains voltage.
- ► Carry out function test using a checklist for axis/machine/system functions.
- ► Resume system operation according to the operating manual (from the machine manufacturer and servo amplifier).

5.2 Configuration, homing and programming

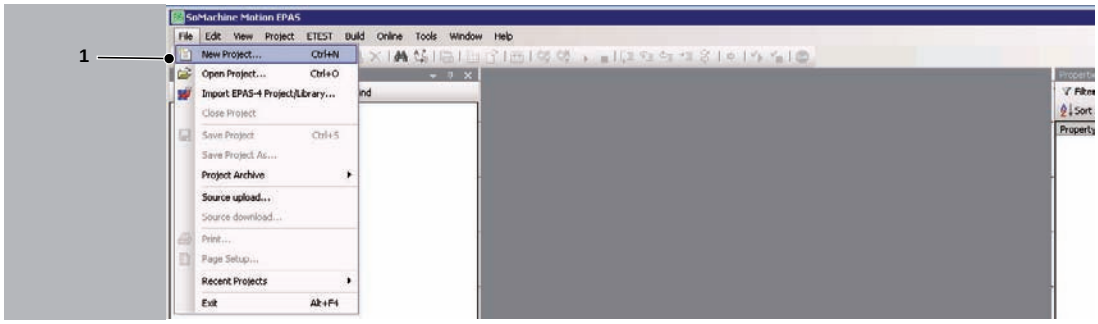
Use the SoMachine Motion Logic Builder Automation Toolkit to adapt the PacDrive System to your task. The system will be configured and programmed according to IEC 61131-3 in SoMachine Motion Logic Builder.

5.3 Diagnostics

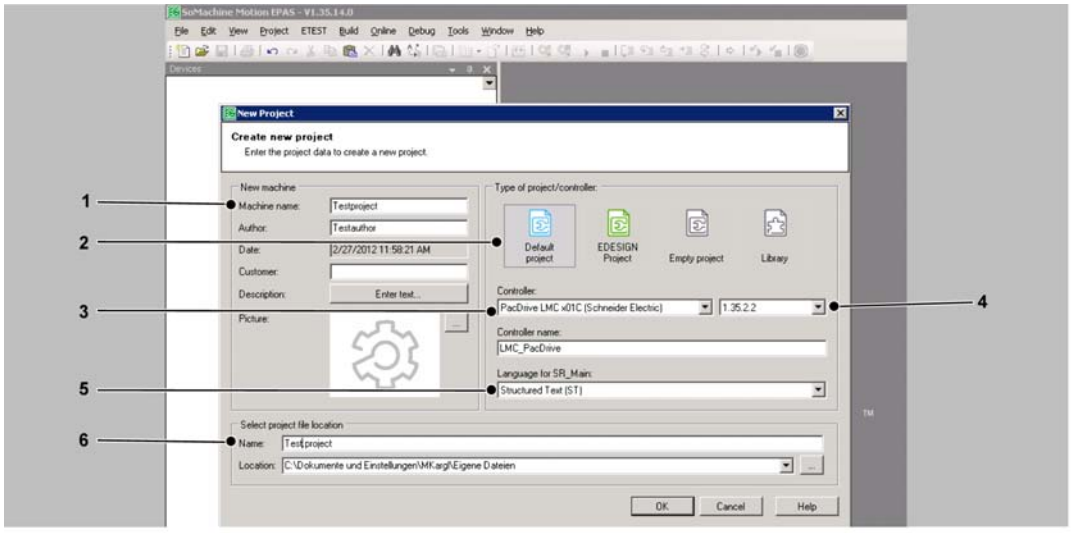
5.3.1 Connection to controller

In this way you can connect the (Service) PC (SoMachine Motion Logic Builder) to the controller:

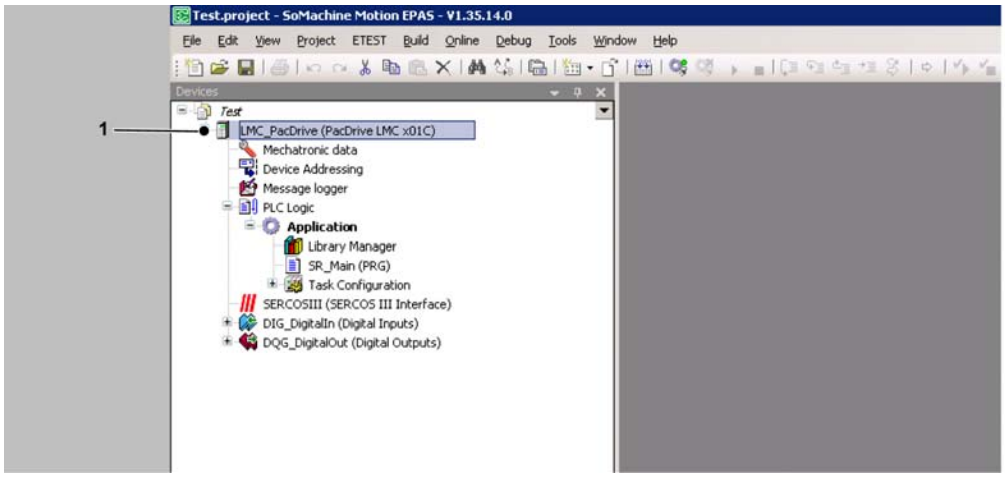
- Start SoMachine Motion Logic Builder.
- Use **File > New Project** (1) to create a new project.



- Assign a project name (1).
- Select **Default project** (2).
- Select **PacDrive LMC x01 (Schneider Electric)** (3).
- Select the firmware of the controller (4).
- Select **Structured text** (5) as the language for SR_MAIN.
- Select project file location (6).
- Confirm with **OK** afterwards..

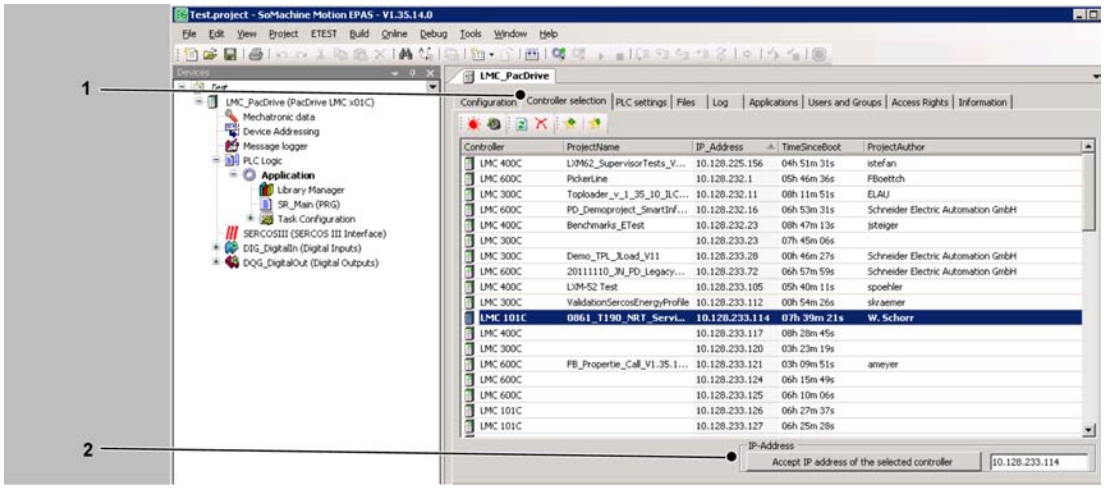


- Double click on the **Device (PacDrive LMC x01C)** (1) in the device window at the left screen edge.



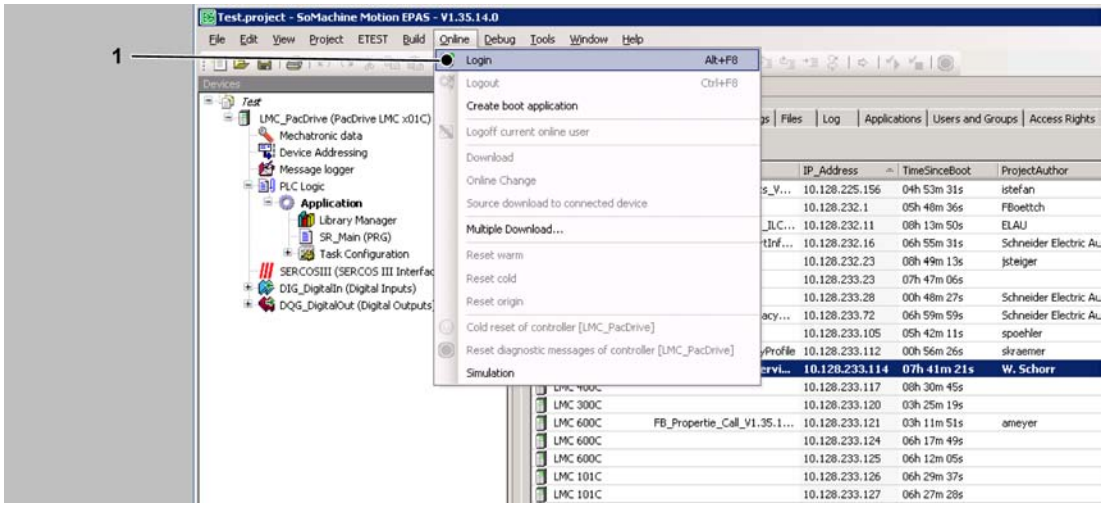
✓ The device window opens.

- ▸ Identify your controller in the tab **Select controller** by means of the IP address (1) and select by clicking once.
- ▸ Click on **Accept IP address of the selected controller** (2).



✓ Your controller appears now in **bold** in the control selection. The IP address is displayed in the field next to the button **Accept IP address of the selected controller**.

- ▸ Click on **Online > Login** in the menu.



✓ You have made a connection to the controller.

Help in case of an unforeseen issue:

✕ No connection to the controller possible
► Check communication settings.

How to check the communication settings:

► Right-click the controller in the tab **Controller selection** of the device window.
► Select **Edit communication settings** in the context menu.
► Check **IP address**, **Subnet mask** and **Gateway**.

5.3.2 Check flash disk of the controller

This is how to check if the flash disk of the controller is full.

▪ A connection between the (Service-) PC (SoMachine Motion Logic Builder) and the controller has been established.
► Select the tab **Configuration** in the device window of the concerned controller.
► Open the folder **Memory & Disks**.
► Check the memory layout by using the values RamDiskSize and RamDiskFree.

Help in case of an unforeseen issue:

✕ Flash disk is full.
► Double click on the **Device (PacDrive LMC x01C)** in the device window.
► Select the TAB **Files** in the device window.
► Mark the files that shall be deleted in the right part of the TAB ("runtime").
► Delete the selected files by clicking on the icon "delete element".

5.3.3 Example of a diagnostic message

Diagnostic message:

8121 Braking resistor temperature too high

Explanation:

- Diagnostic message: Braking resistor temperature too high
- Diagnostic class: 3
- Diagnostic code: 8121
- Reaction: B

The bleeder is overloaded.

▪ The drive sizing is incorrect.
► Check drive sizing.

▪ Hardware error detected: The braking resistor or triggering is defective.
► Contact customer service.

For detailed information on the diagnostic codes, please refer to the online help of the SoMachine Motion Logic Builder Automation Toolkit or the **PD-Diagnostic** tool.

5.4 Electromagnetic compatibility, EMC

⚠ WARNING

ELECTROMAGNETIC DISTURBANCES OF SIGNALS AND DEVICES

Use proper EMC shielding techniques to help prevent unintended device operation.

Failure to follow these instructions can result in death or serious injury.

Enclosure layout

The prerequisite for compliance with the specified limit values is an EMC compatible layout. Comply with the following specifications:

EMC measures	Target
Use galvanized or chromium-plated sub plates, bond metallic parts across large surface areas, remove paint layer from contact surfaces.	Good conductivity by surface area contact
Ground enclosure, door and sub plates by using grounding strips or grounding cables with a cross-section of 10 mm^2 (AWG 6).	Reduce emission.
Supplement switch devices such as contactors, relays or magnetic valves with interference suppression combinations or spark suppressor elements (e.g. diodes, varistors, RC elements).	Reduces mutual interference
Fit power and control components separately.	Reduces mutual interference

Shielded cables

EMC measures	Target
Place cable shields on the surface, use cable clamps and grounding strips.	Reduce emission.
At the control cabinet outfeed, connect the shield of all shielded cables via cable clamps to the sub plate across large surface areas.	Reduce emission.
Ground shields of digital signal cables on both sides across large surface areas or through conducting connector housings.	Reduce interference action on signal cables, reduce emissions.
Ground shield of analog signal cables directly on the device (signal input), insulate the shield at the other cable end or ground the same through a capacitor, such as 10 nF.	Reduce grounding loops by low frequency interferences.
Use only shielded motor supply cables with a copper braid and at least 85% cover, ground shield on both sides across a large surface area.	Specifically discharge interference currents, reduce emissions.

Cable routing

EMC measures	Target
Do not route fieldbus cables and signal cables together with cabling for direct and alternating voltages above 60 V in the same cable duct (fieldbus cables can be routed together with signal cables and analog cables in the same duct). Recommendation: Routing in separated cable cuts with a distance of at least 20 cm (7.84 in.).	Reduces mutual interference
Keep the cables as short as possible. Do not install any unnecessary cable loops, short cable routing from a central grounding point in the control cabinet to the external grounding connection.	Reduce capacitive and inductive interference couplings.
Insert a potential equalization for: • large surface installation • different voltage infeeds • networking across buildings	Reduce current on cable shield, reduce emissions.
Use fine wire potential equalization conductor.	Discharging of high frequency interference currents.

EMC measures	Target
If motor and machine are not connected in a conducting fashion, e.g. due to an insulated flange or a connection not across a full surface, the motor must be grounded via a grounding cable > 10 mm^2 (AWG 6) or a grounding strip.	Reduce emissions, increase interference resistance.
Use twisted pair for 24 Vdc signals.	Reduce interference action on signal cables, reduce emissions.

Voltage supply

EMC measures	Target
Operate product on mains with a grounded neutral.	Enable the effect of the integrated mains filter.
Protection circuit if there is a risk of overvoltage.	Reduce risk of damage due to overvoltages.

Motor and encoder cables

From an EMC perspective, motor supply cables and encoder cables are particularly critical. Only use pre-configured cables, or cables with the prescribed properties, and comply with the following EMC measures.

EMC measures	Target
Do not install switching elements in motor cables or encoder cables.	Reduces interference.
Route motor cable with a distance of at least 20 cm (7.84 in.) to the signal cables or insert shield plates between the motor supply cable and the signal cable.	Reduces mutual interference
For long cabling, use potential equalization cables.	Reduce current on cable shield.
Route motor supply cables and encoder cables without any separation point. [1)]	Reduces emission.
[1)] If a cable must be cut through for installation purposes, the cables must be connected at the point of separation by means of screen connections and metal housing.	

Additional measures for improving the EMC

Depending on the respective application, the following measures may lead to an EMC compatible layout:

EMC measures	Target
Upstream connection of line chokes	Reduction of the harmonic network oscillations, extension of the service life of the product.
Upstream connection of external integrated mains filters	Improvement of the EMC limit values.
Special EMC-suitable layout, e.g. within an enclosed control cabinet complete with 15 dB attenuation of the interferences emitted	Improvement of the EMC limit values.

5.5 Maintenance, repair, cleaning

- Observe the following instructions before carrying out maintenance on Device:
- De-energize Device.

How to de-energize the system:

- Set main switch to "OFF Position".
- Prevent main switch from being switched back on.

5.5.1 Repair

In case of repair proceed as follows:

- Contact the Schneider Electric Customer Service (see 8.1 Contact addresses).

5.5.2 Cleaning

How to clean the controller:

- De-energize Controller.
- Remove Controller.

It is not possible to test in advance all materials of the Schneider Electric product range that are used at the moment and in the future for compatibility with the cleaning agents available on the market.

NOTICE
CORROSION CAUSED BY CLEANING AGENTS • Before using a cleaning agent, carry out a compatibility test in relation to the cleaning agent and the component affected. • Do not use alkaline detergent as the polycarbonate can lose its stability if you come into contact with it. • Do not use any chloride-containing cleaning agents as these corrode the stainless steel and in particular the welds, and thus reduce the strength of the mechanics. **Failure to follow these instructions can result in equipment damage.**

For more information on the material properties of your component (see 6.3 Mechanical and electrical data).

- Then blow out Controller with dry pressurized air (max. 1 bar / 14.5 PSI).

5.5.3 Battery, Real-time clock

The battery must be replaced every 10 years. After this time has elapsed, the battery must be replaced. Only Schneider Electric personnel are authorized to replace the battery. The contact addresses can be found in the chapter (see 8.1 Contact addresses)

If the battery is getting low then the message "Empty Battery" appears on the display.

When the battery is empty and the 24 Vdc mains supply is disconnected then data (retain variables and all the data on the NVRAM) is not saved anymore.

When the battery is empty the real-time clock is set to a default value by every start and the user has to set the real-time clock to the current value.

5.6 Spare part inventory

- Keep a stock of the most important components to make certain the equipment is functioning and ready for operation at all times.

NOTICE
INCREASED PULSE ENERGY ABSORPTION CAPACITY OF THE POWER SUPPLY MODULE LXM62P••• Only exchange Power Supply Module LXM62P••• with the same or greater revision status. **Failure to follow these instructions can result in equipment damage.**

- Only exchange devices with the same hardware configuration to ensure the compatibility.
- Indicate the following information on the spare part order:

Unicode:	e.g. LMC101C
Hardware revision:	e.g. RS:02

This information can be found on the logistic nameplate.

5.7 Device-, parts- or cable exchange

How to de-energize the system:

- Set main switch to "OFF Position".
- Prevent main switch from being switched back on.

5.7.1 Device replacement

- Observe the following warning instructions to replace the the controller safely.

How to replace the controller:

- By an exchange the hardware revision status (for example, "RS:**02**" on the logistical nameplate (see 3.8 Nameplate descriptions) or "**02**" in the hardware code (see 4.1.1 Liquid Crystal Display (LCD))) of the previous and new device should be identical because only then the hardware compatibility is guaranteed.
- Contact your Schneider Electric contact person if different hardware revision statuses exist.
  - ✓ Exchange of device can taken place although different hardware revision statuses exists.

NOTICE
IMPROPER REPLACEMENT / COMMISSIONING Do not open controller for commissioning or replacement. **Failure to follow these instructions can result in equipment damage.**

- When exchanging the of controller, in addition to the following instructions, the specifications of the manufacturer have to be observed also.
- Disconnect cables from the Controller.
- Remove the screws from the top and bottom of the housing.
- Remove the Controller and exchange the complete unit.
- Install new controller and tighten screws.
- Connect the Controller according to the circuit diagram of the machine.

⚠ DANGER

INCORRECT ASSIGNMENT OF NEW CABLES

If you are not using prefabricated cables, make certain that the configuration of the new cables matches the connection diagram of the machine manufacturer.

Failure to follow these instructions will result in death or serious injury.

- Following replacement of the controller proceed as for the initial start-up.

Proceed as follows for start-up:

- Import the user project again using a PC on which the automation toolkit SoMachine Motion Logic Builder is installed.

Or

- Remove the already used flash disk from the controller that has to be repaired and insert it into the new controller.
- Ensure that the card is functional.
- Store the PacDrive controller in a suitable transport packaging.
- Put the system back in operation.

5.8 Fast Device Replacement

5.8.1 Introduction

With the help of the Fast Device Replacement, the Lexium 62, Lexium 52 and ILM devices that are in the configuration of a SoMachine Motion project on the controller can be exchanged. There are certain parameters that have to be set in SoMachine Motion first. Information on this can be found in the online help of SoMachine Motion. Subsequently, certain settings on the display of the controller have to be made which are described in the following. The FDR display mechanism gives the possibility to manually access the assignment between logical devices in the PLC configuration (SoMachine Motion Logic Builder) and the physical connected devices.

5.8.2 Use

Error detected during the manual device assignment

If two or more devices of the same type (or a Double Drive) are exchanged, it is possible that an incorrect manual assignment of the logical devices to the physical connected devices is made.

⚠ WARNING

UNINTENDED OPERATING STATE OF THE DEVICE

- Make sure that the assignment of the logical devices to the physical connected devices equates exactly the device assignment before the device exchange.
- Before commissioning the system you have to check that the programmed logic controls the correct physical drives.

Failure to follow these instructions can result in death or serious injury.

Different device types

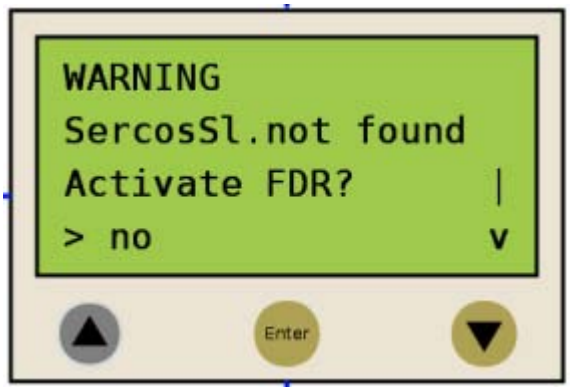
The FDR display mechanism does not consider the device type of physical devices.

If the logical device type does **not** equate the assigned physical device type, then a device assignment with the FDR display mechanism is possible but it leads to an error during the Sercos phase start-up (8501 SERCOS slave not found). If `FDRStart-Mode` is set to the value `Phase start-up/2`, then the FDR display mechanism is restarted.

Further information on the parameters can be found under "Fast Device Replacement" in the online help of SoMachine Motion.

Device exchange

If the requirements are fulfilled (see chapter "Fast Device Replacement" in the online help) and you are exchanging a device, then the controller display automatically shows the start picture of the FDR display mechanism.



Confirmation or Cancel

- ▶ You can exit the FDR display mechanism with the "Enter" key (if the "Arrow pointing right" is on "No").
- ✓ The FDR display mechanism is ended.
- ▶ You can also switch to "Yes" with the "Arrow pointing down" key ("Arrow pointing right" on "Yes") and then confirm the "Yes" with "Enter.
- ✓ Now you can navigate through the menu like described in the chapter "Controller display". Also see chapter "Application".

Timeout (5 minutes)

If no button is pressed at the display for 5 minutes, the FDR display mechanism is terminated (timeout = 5 minutes). The system then behaves as if you have terminated the FDR mechanism as described above. If you press a display button within the 5 minutes, the time for the timeout is reset.

Behavior after repeated download

If after the FDR display mechanism a download of a project is made, then the saved changes of the parameter `ConfiguredSerialNumber` are reset and set to the values that are saved in the project that was downloaded.

For devices that are identified via **Identification mode -> Device number** `(SerialNumberController / 0)` and were allocated via FDR, the system acts as if the FDR display mechanism had not been performed.

Further information on the parameters can be found under "Fast Device Replacement" in the online help of SoMachine Motion.

5.8.3 Controller display

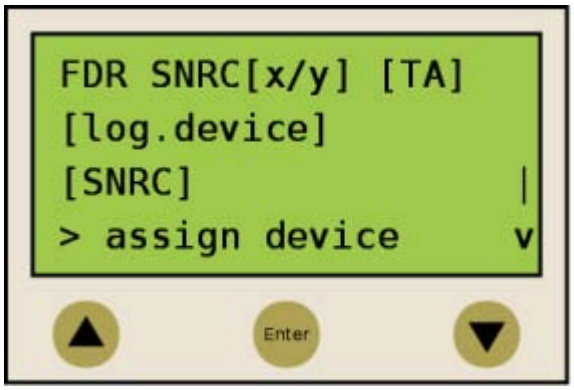
When the FDR display mechanism is active, the controller display shows the corresponding menu.

The following describes the menu in general. Further information can be found in the chapter "Application".

General menu description

Arrow/Key		Description
V	^	If up/down arrows are displayed at the right menu edge, you can scroll up and down using these arrow keys. Scrolling starts only after the "right arrow" is displayed at the lower or upper menu edge. If the "right arrow" is displayed in a line in between, you can move it using the "up/down arrow" keys.
		
>	-	The command that is in the line that is marked with the "Arrow pointing right" can be confirmed/executed with the "Enter" key.
	-	

In the following example, "FDR SNRC" stands for addressing a device via the device serial number. Instead of "FDR SNRC", the "FDR ATYP" (for application type) or "FDR SADR" (for Sercos address) can also be used.



Placeholders	Description
[x/y]	Number of the logic device (x) which currently has to be processed and the total number of the assigned devices (y). If, for example, 20 devices cannot be assigned and you have already assigned 11 devices via the FDR display mechanism, then "12/20" is displayed. If this line (e.g. FDR SNRC[x/y] [TA]) contains more than 18 characters, then the first 16 characters are displayed, followed by ".." . Via the menu item "Details", you can switch to a display mode that displays the complete line (see below).
[TA]	Topological address of the physical device that is currently displayed.
[log.device]	Name of the logical device in the PLC Configuration (SoMachine Motion Logic Builder) that shall be assigned to the physical device at the topological address [TA]. If the device name consists of more than 18 characters, the first 16 characters of the device name are displayed, followed by ".." . Via the menu item "Details", you can switch to a display mode that displays the complete logical device name (see below).
[SNRC]	Serial number of the currently displayed physical device on the topological address [TA] If the serial number has more than 18 characters, then the first 16 characters of the serial number are displayed, followed by ".." . Via the menu item "Details", you can switch to a display mode that displays the complete serial number (see below).

Devices that were assigned via the menu item/command "Assign device" (see below) cannot be removed again via a menu item/command.

Menu item/Command	Description
Assign device	With this command, you confirm the assignment between the logical device [log.device] and the physical device at the topological address [TA]. • In the case of **Identification mode -> Device serial number**, the serial number of the physical device is copied to the parameter `ConfiguredSerialNumber` of the logical device. • In the case of **Identification mode -> Application type**, the application type is written to the respective device via the Sercos bus. • By **Identification mode -> sercos address** the Sercos address is written to the respective device via the Sercos bus. After assigning a device the x (see placeholder [x/y]) is increased. If no other devices without an assignment are existent, then the mechanism is completed and the Sercos phase start-up continues.
next phys.	With this command the next physical device to the logical device (x) that currently has to be processed is displayed.
Details	With this command it is possible to switch to a display mode that displays the complete lines (multi-line). This is helpful if in the standard view lines cannot be displayed completely (see above). For a logical device, a maximum of 40 characters can be displayed.
back	With this command it is possible to switch back to the standard view (max. 16 characters followed by ".." are displayed).
Exit FDR	With this command the FDR display mechanism is canceled. The cancellation has to be confirmed once again ("Really exit?" -> "Exit FDR").

Further information on the parameters can be found under "Fast Device Replacement" in the online help of SoMachine Motion.

5.8.4 Application

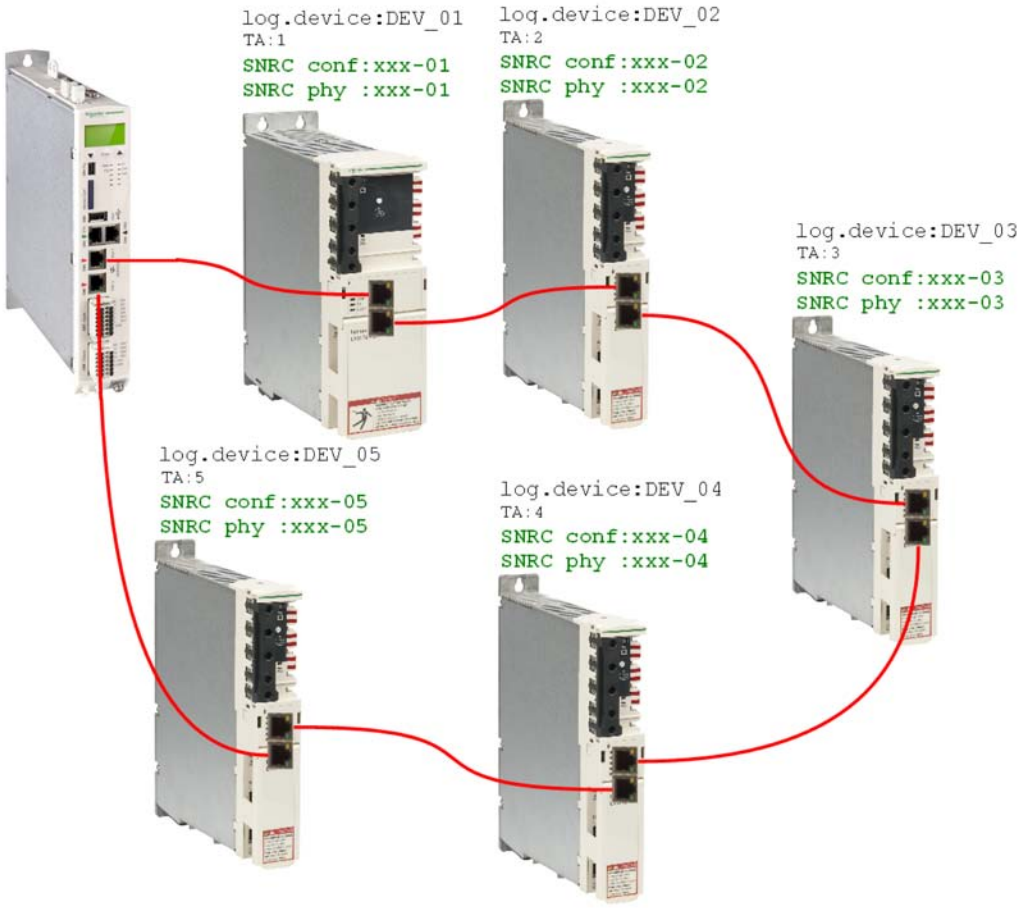
The following example shows a typical application for the FDR display mechanism.

Starting conditions

For the displayed example the following applies:

- All the devices are ok.
- The Sercos bus is started up.
- For all the devices the **Device addressing** via the **Identification mode -> Device serial number** was made (parameter `SerialNumberController / 0`).
- The parameter `FDRConfirmationMode` of the controller was set to the value `by Display / 0`.

Further information on the parameters can be found under "Fast Device Replacement" in the online help of SoMachine Motion.

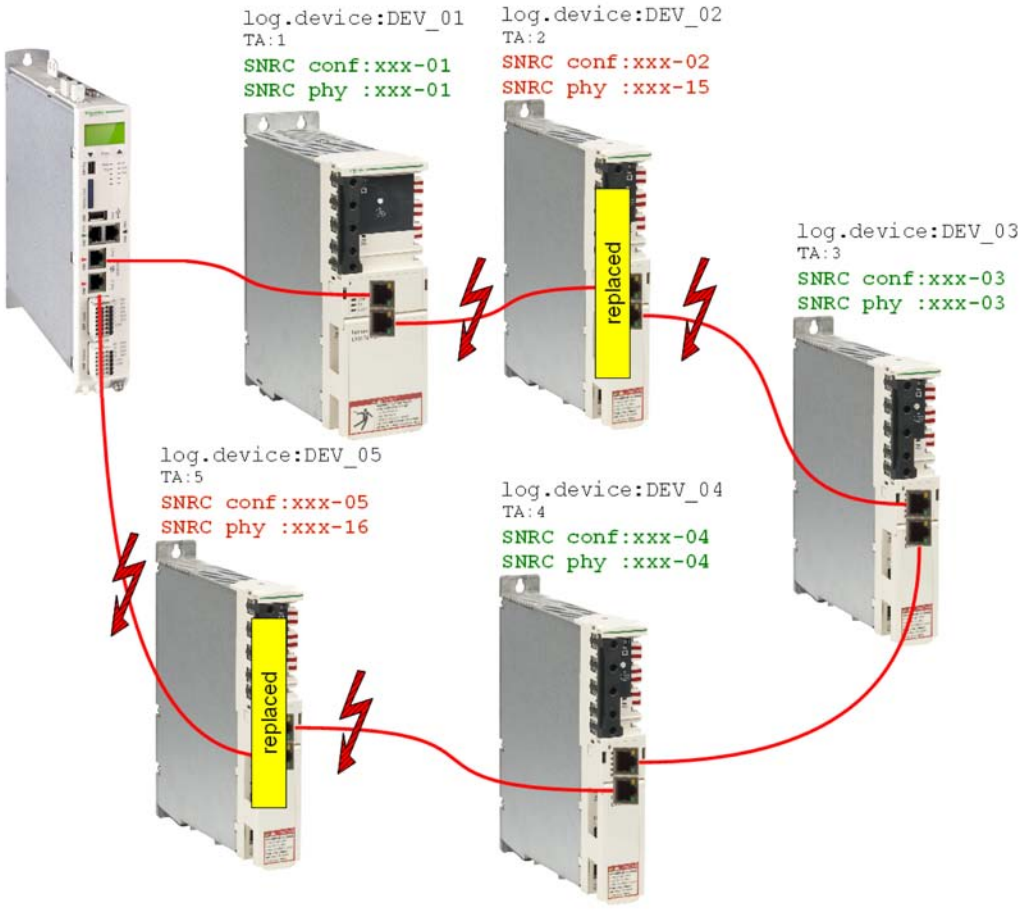


Device replacement

The following devices have to be replaced because of maintenance:

- The device at the topology address 2 (`TA:2`) with the logical device name `DEV_02` and the serial number `SNRC phy: xxx-02` has to be replaced by the new device that has the serial number `SNRC phy: xxx-15`.
- The device at the topology address 5 (`TA:5`) with the logical device name `DEV_05` and the serial number `SNRC phy xxx-05` has to be replaced by the new device that has the serial number `SNRC phy xxx-16`.

After the device replacement



After the physical replacement of the devices the machine has to be restarted again. In order for the FDR display mechanism to be started, the parameter `FDRStart-Mode` has to be set to `Start/1` or `Phase start-up/2` and the parameter `FDRCon-firmationMode` to `by display / 0`.

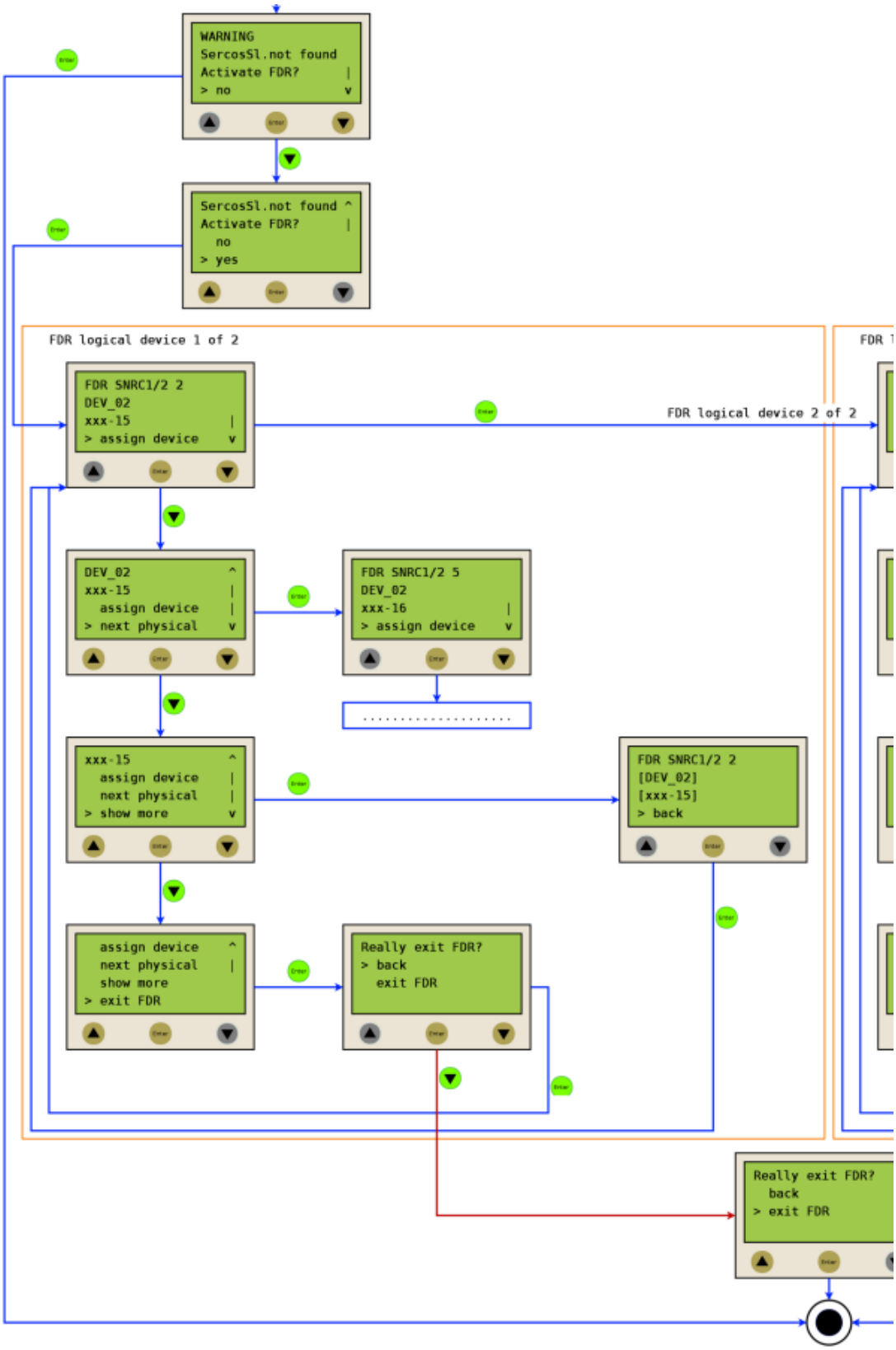
Now the FDR display mechanism has to find the correct assignment of the two logical devices `DEV_02` and `DEV_05` to the new physically connected devices at topology address 2 and 5.

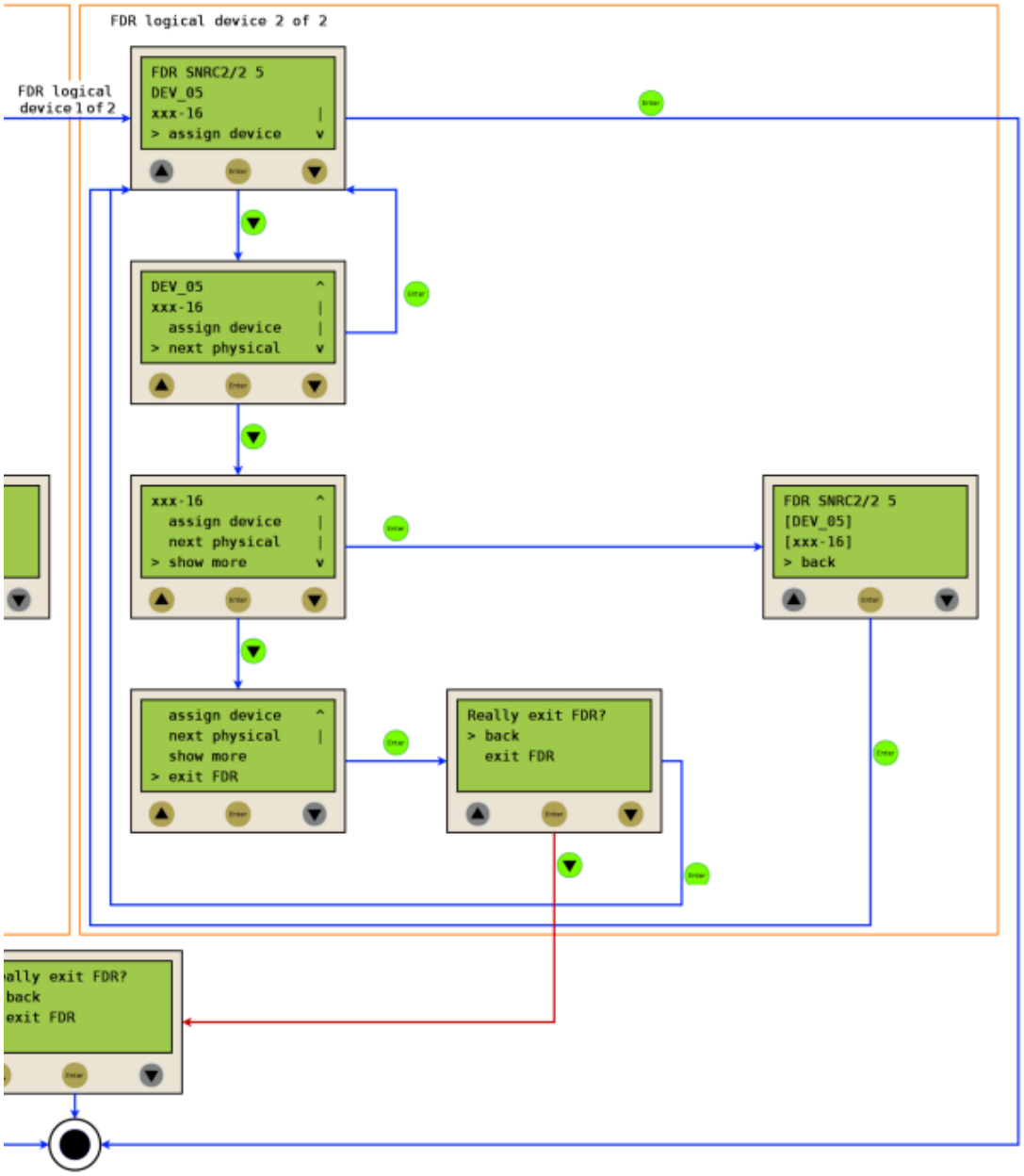
Further information on the parameters can be found under "Fast Device Replacement" in the online help of SoMachine Motion.

Process

The FDR display mechanism verifies all the logical devices one after another which would trigger the diagnostic message 8501 "SERCOS slave not found" during the Sercos phase start-up. Afterwards, to the respective logical device all the physical devices are checked until one device is acknowledged.

Due to space constraints, the sequence for device 1 and device 2 is displayed one beneath the other.


WARNING
SercosSl.not found
Activate FDR?
> no
SercosSl.not found
Activate FDR?
no
> yes
FDR logical device 1 of 2
FDR SNRC1/2 2
DEV_02
xxx-15
> assign device
FDR logical device 2 of 2
DEV_02
xxx-15
assign device
> next physical
FDR SNRC1/2 5
DEV_02
xxx-16
> assign device
xxx-15
assign device
next physical
> show more
FDR SNRC1/2 2
[DEV_02]
[xxx-15]
> back
assign device
next physical
show more
> exit FDR
Really exit FDR?
> back
exit FDR
Really exit FDR?
back
> exit FDR


FDR logical device 2 of 2
FDR logical device 1 of 2
FDR SNRC2/2 5
DEV_05
xxx-16
> assign device
DEV_05
xxx-16
assign device
> next physical
xxx-16
assign device
next physical
> show more
FDR SNRC2/2 5
[DEV_05]
[xxx-16]
> back
assign device
next physical
show more
> exit FDR
Really exit FDR?
> back
exit FDR
ally exit FDR?
back
exit FDR

6 Technical data

6.1 Ambient conditions

Procedure	Parameter	Value	Basis
Operation	**Class 3K3**		**IEC/EN 60721-3-3**
	Degree of protection housing	IP 20	
	Pollution degree	2 (according to IEC 61131-2, UL508)	
	Ambient temperature	+5 ... +55 °C / 41...131 °F	
	Condensation	Prohibited	
	Icing	Prohibited	
	Relative humidity	5% ... 95%	
	Installation height 0...2000 m (0...6561 ft)[1)]	no derating	
	Installation height 2000...3000 m (6561...9842 ft)[1)]	40 °C / 104 °F max. ambient temperature	
	Class 3M4		
	Shock	100 m/s²	
	Vibration	10 m/s²	
Transport	**Class 2K3**		**IEC/EN 60721-3-2**
	Ambient temperature	-25 ... +70 °C / -13...+158 °F	
	Condensation	Prohibited	
	Icing	Prohibited	
	Relative humidity	5% ... 95%	
	Maximum altitude of transport	10000 m (32808 ft)	
	Class 2M2		
	Shock	300 m/s²	
	Vibration	15 m/s²	
Long-term storage in transport packaging	**Class 1K4**		**IEC/EN 60721-3-1**
	Ambient temperature	-25 ... +55 °C / -13...+131 °F	
	Condensation	Prohibited	
	Icing	Prohibited	
	Relative humidity	5% ... 95%	
[1)] The installation height is defined as height above sea level.			

Table 6-1: Ambient conditions for control cabinet devices

6.2 Standards and regulations

CE	EC EMC Directive 2004/108/EC • EN 61131-2:2007 (Zone B)
cULus	UL 508: Industrial Control Equipment CSA 22.2 No. 142 - 1987: Process Control Equipment

Table 6-2: Declarations and certifications

6.3 Mechanical and electrical data

Category	Parameter	Value					
Product configuration	Type code	LMC 100C	LMC 101C	LMC 106C	LMC 201C	LMC 212C	LMC 216C
Configuration	Processor	CPU Intel Atom 1,66 GHz					
		512 KB L2 Cache					
	Random access memory	≥ 512 MB RAM					
	NV RAM	128 KB					
	Battery for NVRAM and RTC	yes (internal, data retention > 10 years)					
	SD card	At least 512 MB (accessible from the outside)					
	Control buttons	3					
	On/Off button	No					
	Reset button	No					
	Cooling	passive					
	Real Time Clock (RTC)	Yes (deviation max. ± 1 s in 24 h)					
	max. number of drives (servo axes)	0	4	6	8	12	16
Operating system	Real-time operating system	VxWorks and SEA Automation kernel					
Diagnostics	Watchdog	yes (configurable output)					
	Diagnostic display	Liquid Crystal Display (LCD) 128 x 64 (with background lighting)					
	Status LED's	State / CAN / TM5 / S3 / PRG					
	Integrated data logger for diagnostic messages	Yes					
	Integrated trace recorder (software oscilloscope)	Yes					
Bus connections	Integrated Automation Bus	Sercos (Master)					
	Integrated additional field bus	CAN (master/slave)					
	TM5 Bus	Expandability for future interfaces, under preparation					
Communication / interfaces	Serial interfaces	1 x COM: RS232 / RS485 (RJ45)					
	Modbus	yes (RJ45)					
	Network connection	1x Ethernet 10/100/1000 Base-T (RJ45)					
	USB connection	1 x USB-A (host for storage medium)					
		1 x USB mini-B (client for engineering), not active					
	Optional slot for another field bus	1 x Communication Module Realtime Ethernet or 1 x Communication Module PROFIBUS DP					

Category	Parameter	Value
Programming-languages IEC 61131-3	-	Continuous function chart (CFC)
		Function block diagram (FBD)
		Instruction list (IL)
		Structured text (ST)
		Ladder diagram (LD)
		Sequential function chart (SFC)
Touchprobe + fast inputs (Interrupt)	Number	4 (TP & fast inputs) (IEC61131-2 type1)
	Range U_{IN} 0 voltage	-3 ... 5 Vdc
	Range U_{IN} 1 voltage	15 ... 30 Vdc
	Input current	I_{IN} = 4 mA at U_{IN} = 24 Vdc
	Polarized	Yes
	Input filter DI8...DI11	100µs - 4,29s
	Touchprobe resolution DI8 to DI11	10 µs at a Sercos cycle time of 1, 2, 4 ms
Digital inputs	Number	8 (IEC61131-2 type1)
	Range U_{IN} 0 voltage	-3 ... 5 Vdc
	Range U_{IN} 1 voltage	15 ... 30 Vdc
	Input current	I_{IN} = 4 mA bei U_{IN} = 24 Vdc
	Polarized	Yes
	Input filter DI0...DI7	100µs - 4,29s
Digital outputs	Number	8 (IEC61131-2 type1)
	Output voltage	(+UL-3 V) < U_{OUT} < +UL
	Rated current	I_e = 500 mA rated per output and 2A max for all outputs at once (e.g. 8 outputs with 250 mA etc.)
	Inrush current	I_{emax} < 2 A for 1 s
	Leakage current with 0 signal	< = 0,5 mA
	Transmission time	< 100 µs
	short circuit protection	Yes
	Open circuit detection	Yes
	Openload failure	R_{load} > 150 kΩ
	Overload failure	U_{DQ+24V} - U_{DQx} > 4,0 V
Master encoder input	Hiperface®	Voltage output: 10 V / 200 mA Analog channel 0.9 V ... 1.1 V_{pp} / 2.2 ... 2.8V $_{offset}$ (max. 250 KHz) Parameter channel Hiperface RS485: Cable length < =50 m (164 ft)
	INC	Voltage output: 5 V / 300 mA Level according to RS422 (max 1 MHz) Cable length < =50 m (164 ft)
Power supply	Power consumption of power supply	20,4 Vdc - 30 Vdc
		max. 27 W
	Inrush current	max. 10 A
Dimensions	Dimensions of housing	DxWxH (mm): 222 x 44 x 270
Weight	Weight (with packaging)	2.2 kg (4.9 lbs)

Table 6-3: Technical data LMC 100/101/106/201/212/216 C

6.4 Electrical connections

6.4.1 Connection overview controller

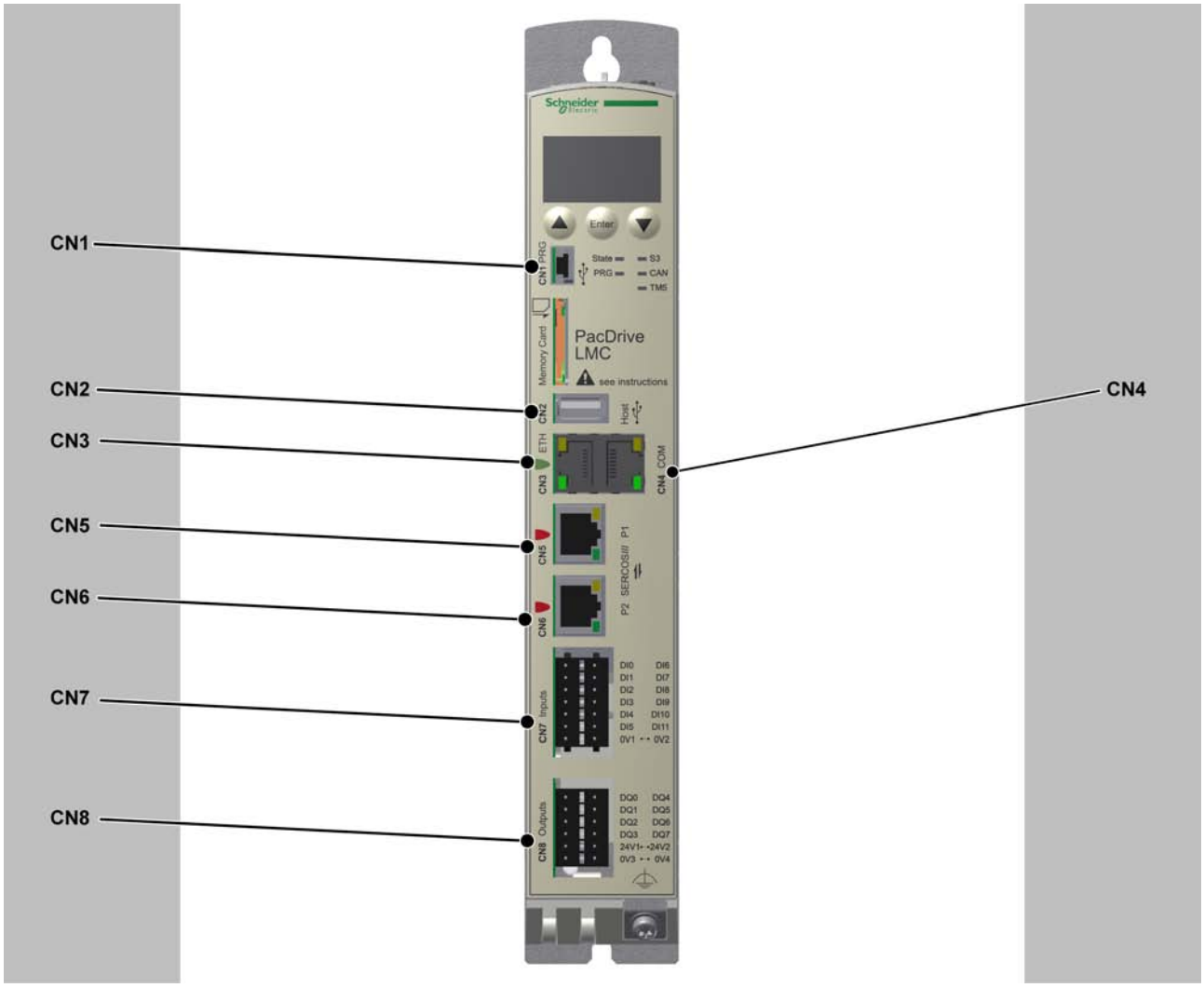


Figure 6-1: Connection overview front panel

Connec-tion	Meaning	Connection cross-section [mm²]/ [AWG]	Tightening torque [Nm] / [lbf in]
CN1	Prog Port (USB mini-b), not active	-	-
CN2	USB A	-	-
CN3	Ethernet connection	-	-
CN4	Serial link (COM)	-	-
CN5	Sercos, Port 1	-	-
CN6	Sercos, Port 2	-	-
CN7	Digital Inputs	0.2 … 1.5 / 24 ... 16	-
CN8	Digital outputs	0.2 … 1.5 / 24 ... 16	-

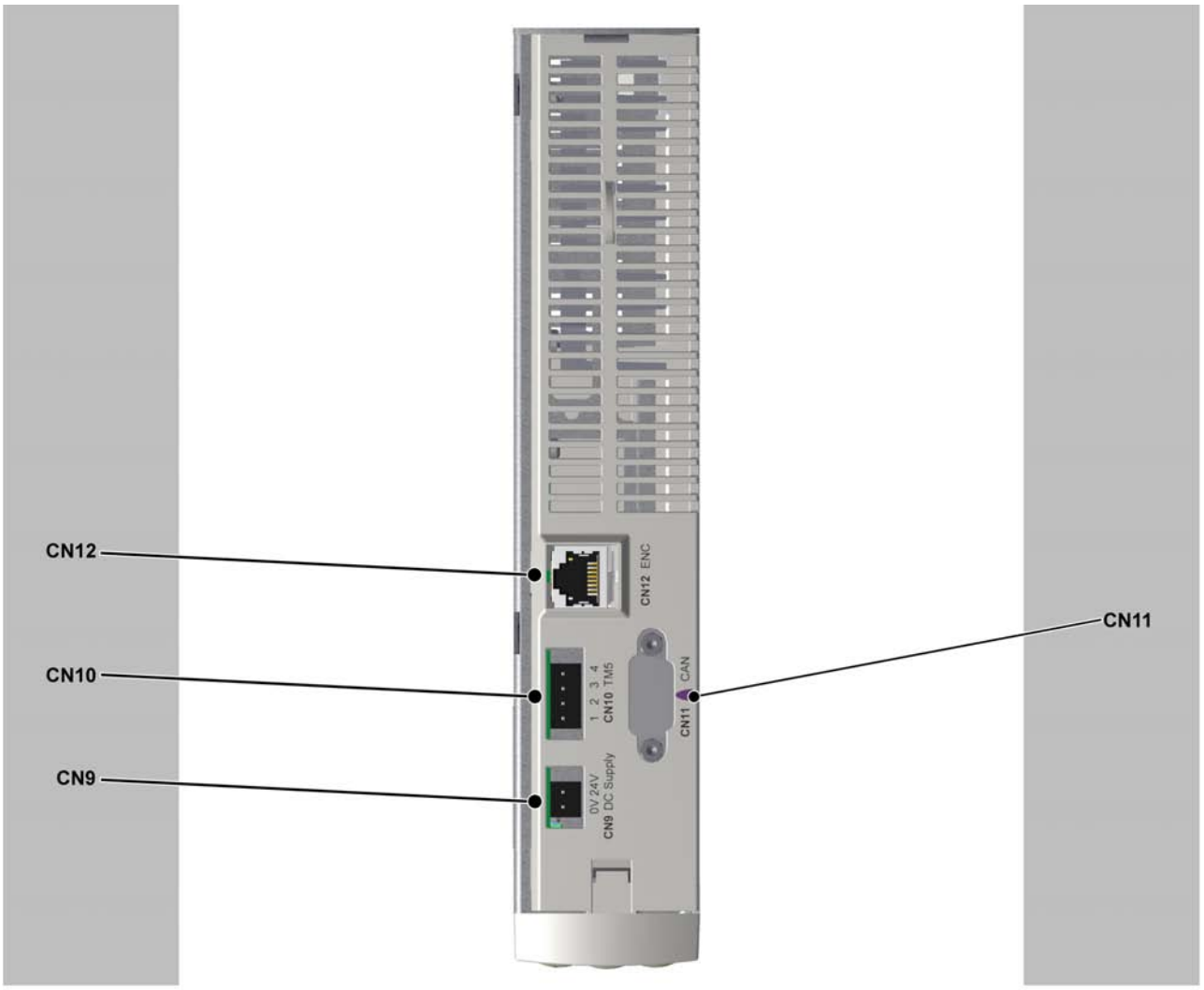


Figure 6-2: Connection overview top side

Connection	Meaning	Connection cross-section [mm²]/ [AWG]	Tightening torque [Nm] / [lbf in]
CN9	24V DC	0.2 … 1.5 / 24 ... 16	-
CN10	Not active (TM5)	-	-
CN11	CAN	-	0,4 Nm / 3.54 lbf in
CN12	Master encoder input	-	-

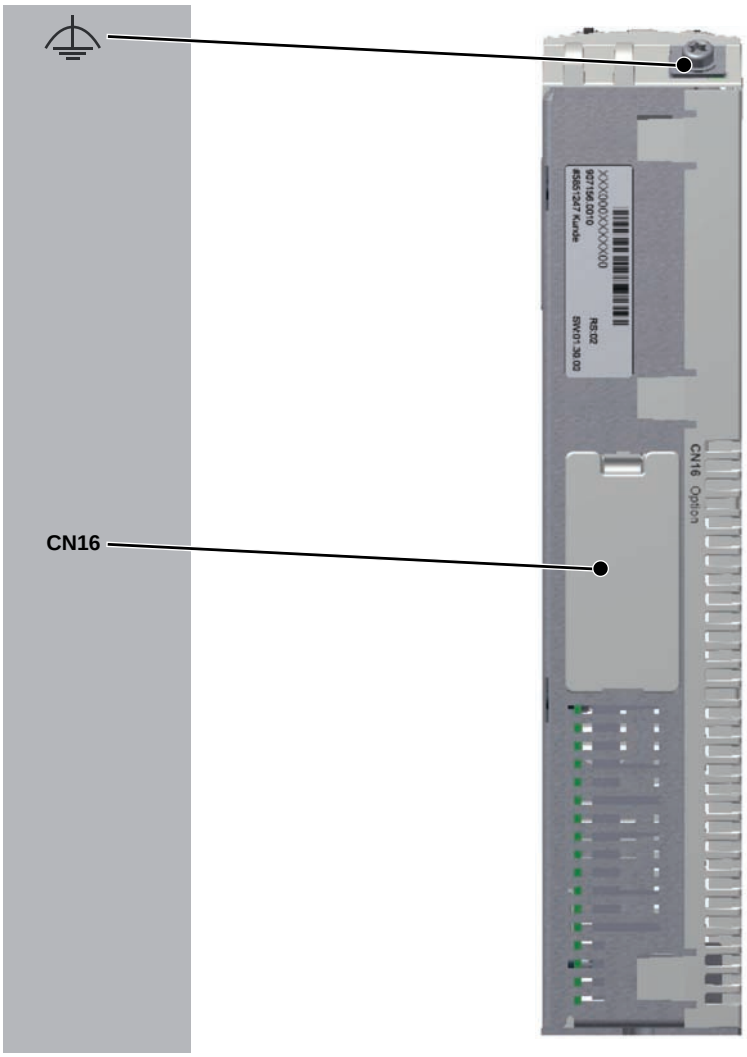


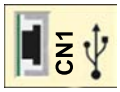
Figure 6-3: Connection overview bottom side

Connection	Meaning	Connection cross-section [mm²]/ [AWG]	Tightening torque [Nm] / [lbf in]
CN16	Option	-	-
⏚	Shielded connector	min. 2,5 / min. 13	1.4 / 12.39

6.4.2 Connection details controller

CN1 - Prog Port (USB mini-B)

Prog Port (USB mini-B) is not active.



Pin	Designation	Meaning	LED / function
1	VBUS / +5V	-	-
2	D- / Data-	Data line -	-
3	D+ / Data+	Data line +	-
4	-	Reserved	-
5	GND / Ground	-	-

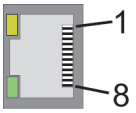
Table 6-4: Connection CN1 USB - mini-B

CN2 - USB-A

Pin	Designation	Meaning	LED / function
1	VBUS / +5V	-	-
2	D- / Data-	Data line -	-
3	D+ / Data+	Data line +	-
4	GND / Ground	-	-

Table 6-5: Connection CN2 USB - A

CN3 - Ethernet



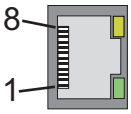
Pin	Designation	Meaning	Function
1	D1 + (Tx+)	-	-
2	D1- (Tx-)	-	-
3	D2+ (Rx+)	-	-
4	D3+	-	-
5	D3-	-	-
6	D2- (Rx-)	-	-
7	D4+	-	-
8	D4-	-	-

Table 6-6: Connection CN3

LED	Function	off	On	Flashes
Green	State	no connection	connection, no activity	connection and activity
Yellow	Velocity	10 MBit	100 MBit/ 1GBit	-

Table 6-7: CN3 LEDs

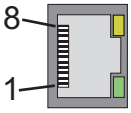
CN4 - Serial link (COM)



Pin	Designation	Meaning	LED / function
1	TxD	RS232, Transmit Data	-
2	RxD	RS232, Receive Data	-
3	CTS	RS232, Clear to send	-
4	D1 / B	Modbus D1, RS485 B	-
5	D0 / A	Modbus D0, RS485 A	-
6	RTS	RS232, Request to send	-
7	-	Reserved	-
8	0V	Signal and Power Common	-

Table 6-8: Connection CN4

CN5 - Sercos



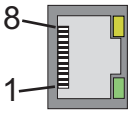
Pin	Designation	Meaning	Function
1	Tx+	Transmit Data +	-
2	Tx-	Transmit Data -	-
3	Rx+	Receive Data +	-
4	-	Reserved	-
5	-	Reserved	-
6	Rx-	Receive Data -	-
7	-	Reserved	-
8	-	Reserved	-

Table 6-9: Connection CN5

LED	On
Green	activity
Yellow	connection

Table 6-10: Sercos LEDs

CN6 - Sercos



Pin	Designation	Meaning	Function
1	Tx+	Transmit Data +	-
2	Tx-	Transmit Data -	-
3	Rx+	Receive Data +	-
4	-	Reserved	-
5	-	Reserved	-
6	Rx-	Receive Data -	-
7	-	Reserved	-
8	-	Reserved	-

Table 6-11: Connection CN6

LED	On
Green	activity
Yellow	connection

Table 6-12: Sercos LEDs

CN7 - Digital Input

Pin	Designation	Meaning	Range
1	DI0	Digital inputs	-
2	DI1	Digital inputs	-
3	DI2	Digital inputs	-
4	DI3	Digital inputs	-
5	DI4	Digital inputs	-
6	DI5	Digital inputs	-
7	DI COM	Reference potential DI0...DI11	-
8	DI6	Digital inputs	-
9	DI7	Digital inputs	-
10	DI8	Expanded inputs	-
11	DI9	Expanded inputs	-
12	DI10	Expanded inputs	-
13	DI 11	Expanded inputs	-
14	DI COM	Reference potential DI0...DI11	-

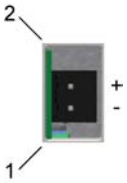
Table 6-13: Connection CN7

CN8 - Digital Output

Pin	Designation	Meaning	Range
1	DQ0	-	-
2	DQ1	-	-
3	DQ2	-	-
4	DQ3	-	-
5	DQ +24V	Supply voltage DQ0 - DQ7	-15% / +25%
6	DQ COM	Supply voltage DQ0 - DQ7	-
7	DQ4	-	-
8	DQ5	-	-
9	DQ6	-	-
10	DQ7	-	-
11	DQ +24V	Supply voltage DQ0 - DQ7	-15% / +25%
12	DQ COM	Supply voltage DQ0 - DQ7	-

Table 6-14: Connection CN8

CN9 - Supply voltage



Pin	Designation	Meaning	Range
1	0V	Supply voltage	-
2	+24V	Supply voltage	-15% / +25%

Table 6-15: Connection CN9

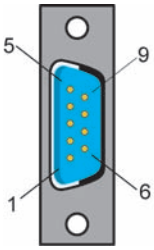
CN10 - TM5

TM5 connection is not active.

Pin	Designation	Meaning	Range
1	TM5 +	Data line +	-
2	TM5 GND	ground	-
3	TM5 -	Data line -	-
4	SHLD	Shield	-

Table 6-16: Connection CN10

CN11 - CAN



Pin	Designation	Meaning	Signal / function
1	-	Reserved	-
2	CAN_L	Bus line (low)	-
3	CAN GND	-	-
4	-	Reserved	-
5	-	Reserved	-
6	CAN GND	-	-
7	CAN_H	Bus line (high)	-
8	-	Reserved	-
9	-	Reserved	-

Table 6-17: Connection CN11

TM5/TM7 modules can only be connected to the Sercos bus, this means, the connection of the TM5/TM7 modules to the PacDrive controller can only occur via a Sercos bus interface TM5NS31. A connection of TM5/TM7 modules via CAN bus and a CANopen interface module is not supported.

CN12 - Master encoder input (Hiperface)

The Hiperface connection consists of a standard, differential, digital connection (RS485 = 2 wires), a differential, analog connection (sine- and cosine signal = 4 wires) and a mains connection to supply the encoder (+10V, GND = 2 wires).

Pin	Designation	Meaning	Signal / function
1	COS	Cosine track	-
2	REFCOS	Reference Signal Cosinus	-
3	SIN	Sinusoidal trace	-
4	RS485+	Parameter channel +	-
5	RS485-	Parameter channel -	-
6	REFSIN	Reference signal sine	-
7	-	Reserved	-
8	-	Reserved	-
A	Encoder supply (+)	-	-
B	GND	-	-

Table 6-18: Connection CN12 - Master encoder input (Hiperface)

CN12 - Master encoder input (incremental)

Pin	Designation	Meaning	Signal / function
1	Trace B+	-	-
2	Trace B-	-	-
3	Trace A+	-	-
4	Trace N+	-	-
5	Trace N-	-	-
6	Trace A-	-	-
7	-	Reserved	-
8	-	Reserved	-
A	Encoder supply (+)	-	-
B	GND	-	-

Table 6-19: Connection CN12 - Master encoder input (incremental)

6.5 Dimensions

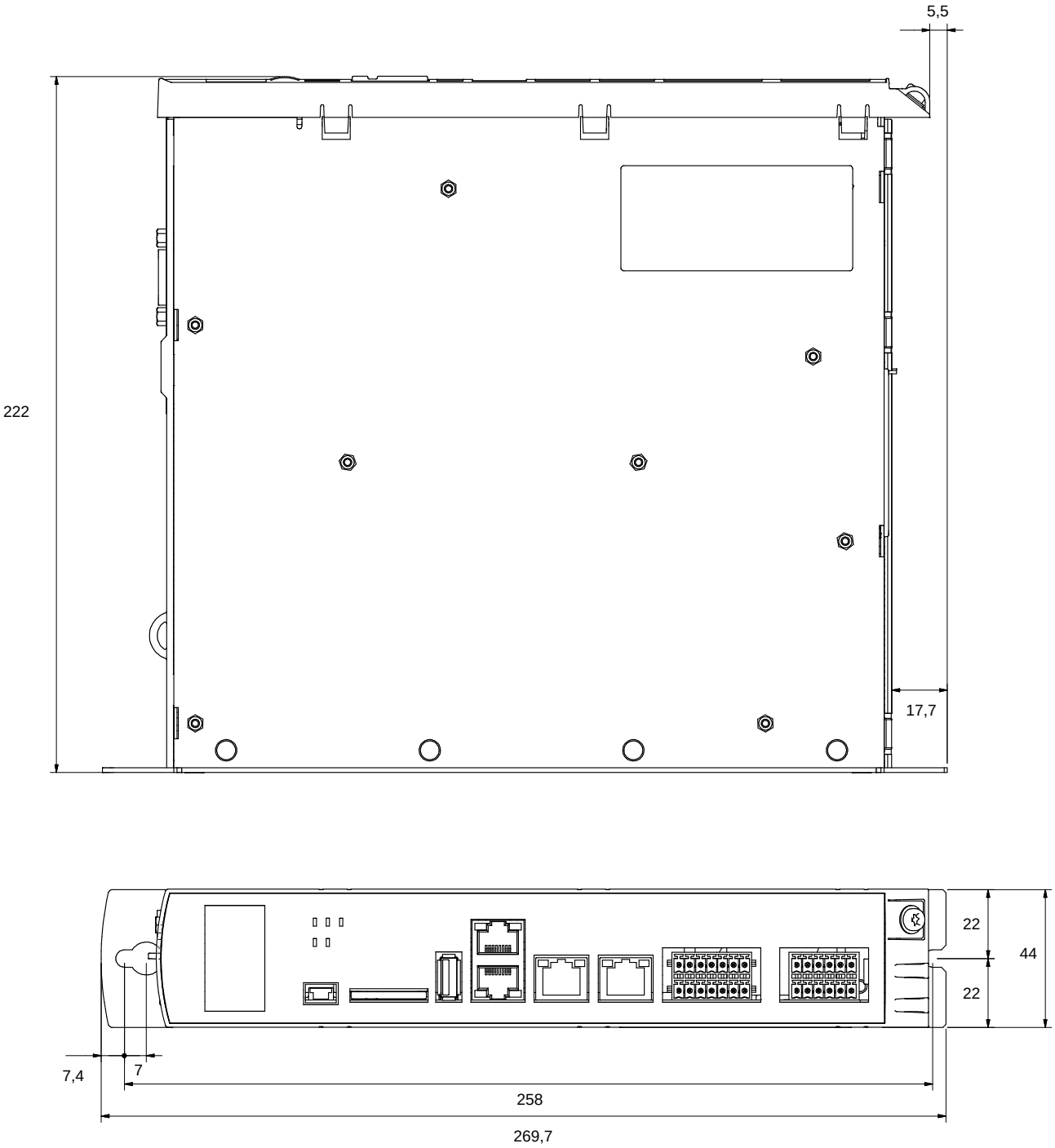


Figure 6-4: Dimensions of the LMC 100/101/106/201/212/216 C in mm (conversion table in the appendix)

7 Optional module

7.1 Communication Module Realtime Ethernet

7.1.1 General

The communication module realtime Ethernet is an optional module that provides a PROFINET, EtherNet/IP or EtherCAT-Slave interface.

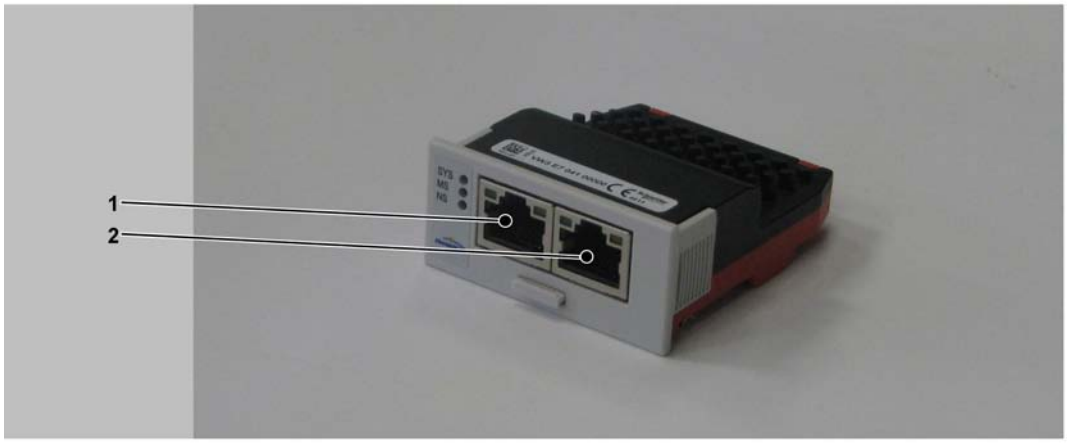


Figure 7-1: Communication module realtime Ethernet - connections

1	Ethernet channel 0
2	Ethernet channel 1

After installing the optional module, the controller will automatically detect the module. Then configure it by using the PLC configuration in SoMachine Motion Logic Builder.

7.1.2 Mechanical installation

NOTICE

DIRTY MODULE CONTACTS CAUSING UNRELIABLE COMMUNICATION

Do not touch the contacts when unpacking or installing the optional module.

Failure to follow these instructions can result in equipment damage.

How to open the controller:

- ► Remove the cover of input CN16 Option at the bottom side of the housing. To do this, push the locking of the cover backward.
  - ✓ The cover folds down.
- ► Pull the cover to the front and remove it.

How to install the optional module:

- ▪ Ensure that the controller is switched off.

NOTICE

INCORRECT INSERTION OF OPTIONAL MODULE

- Do not insert the optional module when the controller is under power.
- Verify that the springs at the bottom side of the module are located at the printed circuit board side when you insert the module into the slot.

Failure to follow these instructions can result in equipment damage.

- ► Insert the module into the slot and push against the printed circuit board until both front springs at the bottom side lower into the openings on the printed circuit board.

Figure 7-2: Insert the communication module realtime Ethernet

  - ✓ The module rests on the lower edge of the slot.
- ► Slightly apply pressure and push the module further inside until it is flush at the edge.
  - ✓ The springs at the bottom side reach into the openings of the printed circuit board.

Ensure that the module is flush at the edge.

How to remove the optional module:

NOTICE
INCORRECT REMOVAL OF OPTIONAL MODULE Do not remove the optional module when the controller is under power. **Failure to follow these instructions can result in equipment damage.**

- Take the protruding part of the handle of the flap and pull the handle out the optional module.

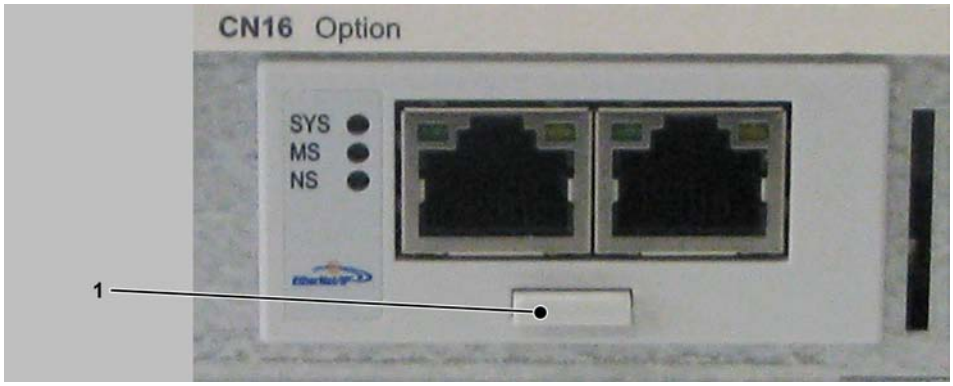


Figure 7-3: Flap handle

1	Flap handle

- Pull at the strap handle and pull the optional module out of the slot until its latching releases.
- Completely remove the optional module from the slot.
- Push the flap handle back into the module.

How to connect the controller:

- Insert the cover and push it upward until it latches.
- Push the cover locking to the front until it latches.

7.1.3 Electrical connections

Connection details Communication Module Realtime Ethernet

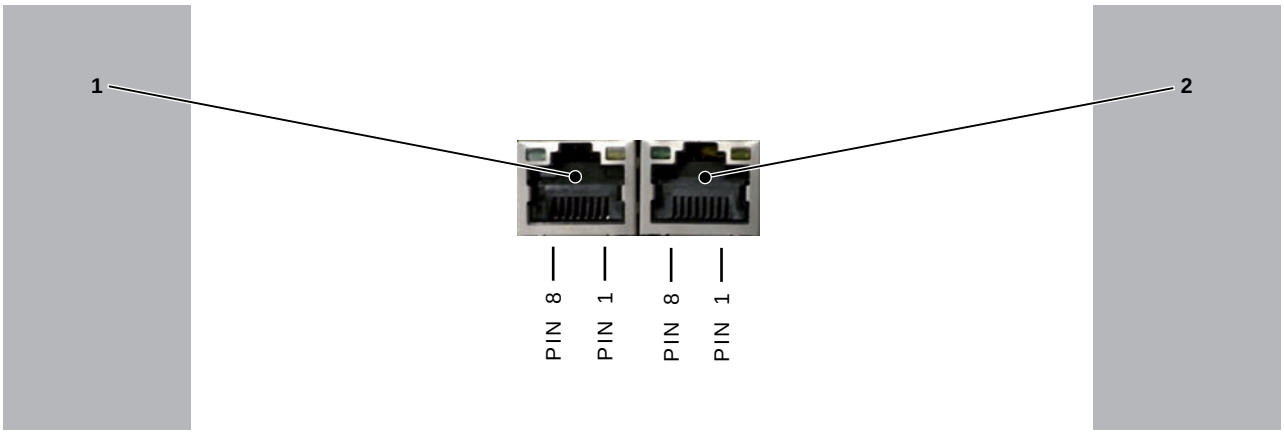


Figure 7-4: Connection details Realtime Ethernet

1	Ethernet channel 0
2	Ethernet channel 1

Pin	Designation	Meaning
1	Tx+	Transmit Data +
2	Tx-	Transmit Data -
3	Rx+	Receive Data +
4	TERM	-
5	TERM	
6	Rx-	Receive Data -
7	TERM	-
8	TERM	

Table 7-1: Ethernet outlet

LED description PROFINET

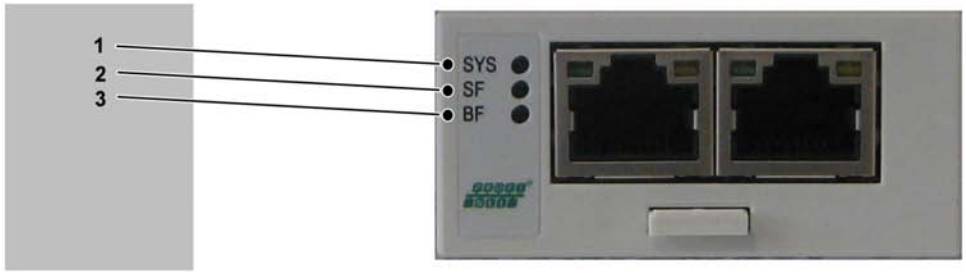


Figure 7-5: LEDs PROFINET

1	SYS
2	SF
3	BF

LED	Color	State	Meaning
SYS	**Duo LED yellow/green**		
	YELLOW	static	Bootloader netX (= roomloader) is waiting for second stage bootloader
	GREEN/YELLOW	Blinking green/yellow	Second stage bootloader is waiting for firmware
	GREEN	On	Operating system running
	OFF	off	Power supply of the device is missing

Table 7-2: System LED

LED	Color	State	Meaning
SF	**Duo LED red/green**		
	RED	On	(together with BF "redOn") No valid master license
	RED	Flashing cyclic at 2 Hz	System error detected: Invalid configuration
	off	off	Normal operation
BF	**Duo LED red/green**		
	RED	On	No connection: No Link. or (together with SF"redON") No valid Master license
	RED	Flashing cyclic at 2 Hz	Configuration error detected: not all configured IO-Devices are connected.
	OFF	off	Normal operation
LINK/RJ45 Ch0 & Ch1	**LED green**		
	GREEN	On	A connection to Ethernet exists.
	OFF	off	The device has no connection to Ethernet.
RX/TX/RJ45 Ch0 & Ch1	**LED yellow**		
	YELLOW	Flashes	The device sends/receives Ethernet frames.

Table 7-3: LEDs PROFINET IO-RT Controller

LED	Color	State	Meaning
SF	**Duo LED red/green**		
	RED	On	Watchdog timeout, channel, generic or extended diagnostic present; system error detected
	RED	Flashing cyclic at 2 Hz (for 3 sec.)	DCP signal service is initiated via the bus
	off	off	Normal operation
BF	**Duo LED red/green**		
	RED	On	No configuration; or low speed physical link; or no physical link
	RED	Flashing cyclic at 2 Hz	No data exchange
	OFF	off	Normal operation
LINK/RJ45 Ch0 & Ch1	**LED green**		
	GREEN	On	A connection to Ethernet exists.
	OFF	off	The device has no connection to Ethernet.
RX/TX/RJ45 Ch0 & Ch1	**LED yellow**		
	YELLOW	Flashes	The device sends/receives Ethernet frames.

Table 7-4: LEDs PROFINET IO-RT-Device

LED description EtherNet/IP

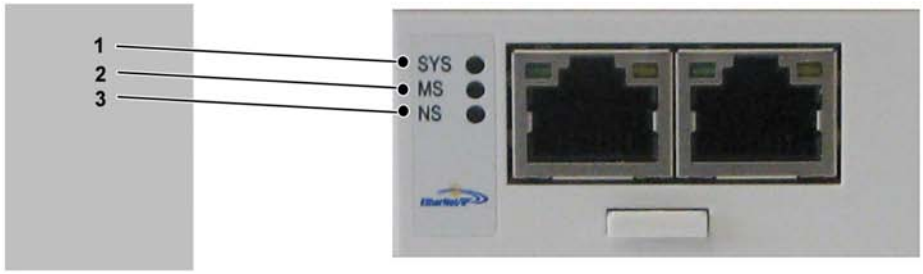


Figure 7-6: LEDs EtherNet/IP

1	SYS
2	MS
3	NS

LED	Color	State	Meaning
SYS	**Duo LED yellow/green**		
	YELLOW	static	Bootloader netX (= roomloader) is waiting for second stage bootloader
	GREEN/YELLOW	Blinking green/yellow	Second stage bootloader is waiting for firmware
	GREEN	On	Operating system running
	OFF	off	Power supply of the device is missing

Table 7-5: System LED

LED	Color	State	Meaning
MS	Duo LED red/green		
	GREEN	On	Device operational: If the device is operating correctly, the module status indicator shall be steady green.
	GREEN	Flashes	Standby: If the device has not been configured, the module status indicator shall be flashing green.
	RED	On	Major error detected: If the device has detected a non-recoverable major error, the module status indicator shall be steady red.
	RED	Flashes	Minor error detected: If the device has detected a recoverable minor error, the module status indicator shall be flashing red. NOTE: An incorrect or inconsistent configuration would be considered a minor error.
	ROT/GREEN	Flashes	Self-test: While the device is performing its power up testing, the module status indicator shall be flashing green/red.
	OFF	off	No power: If no power is supplied to the device, the module status indicator shall be steady off.
NS	Duo LED red/green		
	GREEN	On	Connected: If the device has at least one established connection (even to the Message Router), the network status indicator shall be steady green.
	GREEN	Flashes	No connections: If the device has no established connections, but has obtained an IP address, the network status indicator shall be flashing green.
	RED	On	Duplicate IP: If the device has detected that its IP address is already in use, the network status indicator shall be steady red.
	RED	Flashes	Connection timeout: If one or more connections in which this device is the target has timed out, the network status indicator shall be flashing red. This shall be left only if all timed out connections are reestablished or if the device is reset.
	ROT/GREEN	Flashes	Self-test: While the device is performing its power up testing, the network status indicator shall be flashing green/red.
	OFF	off	Not powered, no IP address: If the device does not have an IP address (or is powered off), the network status indicator shall be steady off.
LINK/RJ45 Ch0 & Ch1	LED green		
	GREEN	On	A connection to Ethernet exists.
	OFF	off	The device has no connection to Ethernet.
ACT/RJ45 Ch0 & Ch1	LED yellow		
	YELLOW	Flashes	The device sends/receives Ethernet frames.

Table 7-6: LEDs Ethernet/IP Scanner (Master)

LED	Color	State	Meaning
MS	**Duo LED red/green**		
	GREEN	On	**Device operational**: If the device is operating correctly, the module status indicator shall be steady green.
	GREEN	Flashes	**Standby**: If the device has not been configured, the module status indicator shall be flashing green.
	RED	On	**Major error detected**: If the device has detected a non-recoverable major error, the module status indicator shall be steady red.
	RED	Flashes	**Minor error detected**: If the device has detected a recoverable minor error, the module status indicator shall be flashing red. NOTE: An incorrect or inconsistent configuration would be considered a minor error.
	ROT/GREEN	Flashes	**Self-test**: While the device is performing its power up testing, the module status indicator shall be flashing green/red.
	OFF	off	**No power**: If no power is supplied to the device, the module status indicator shall be steady off.
NS	**Duo LED red/green**		
	GREEN	On	**Connected**: If the device has at least one established connection (even to the Message Router), the network status indicator shall be steady green.
	GREEN	Flashes	**No connections**: If the device has no established connections, but has obtained an IP address, the network status indicator shall be flashing green.
	RED	On	**Duplicate IP**: If the device has detected that its IP address is already in use, the network status indicator shall be steady red.
	RED	Flashes	**Connection timeout**: If one or more connections in which this device is the target has timed out, the network status indicator shall be flashing red. This shall be left only if all timed out connections are reestablished or if the device is reset.
	ROT/GREEN	Flashes	**Self-test**: While the device is performing its power up testing, the network status indicator shall be flashing green/red.
	OFF	off	**Not powered**, **no IP address**: If the device does not have an IP address (or is powered off), the network status indicator shall be steady off.
LINK/RJ45 Ch0 & Ch1	**LED green**		
	GREEN	On	A connection to Ethernet exists.
	OFF	off	The device has no connection to Ethernet.
ACT/RJ45 Ch0 & Ch1	**LED yellow**		
	YELLOW	Flashes	The device sends/receives Ethernet frames.

Table 7-7: LEDs Ethernet/IP Adapter (Slave)

LED description EtherCat-Slave

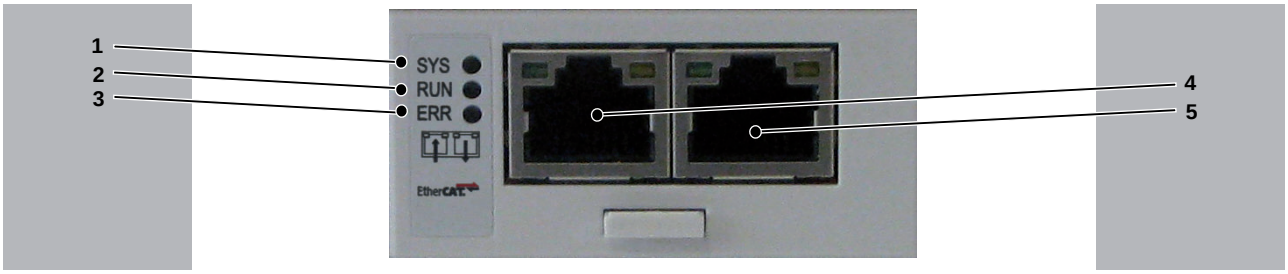


Figure 7-7: LEDs EtherCAT-Slave

1	SYS
2	RUN
3	ERR
4	Ethernet channel 0 - input port[1)]
5	Ethernet channel 0 - output port[1)]
[1)] Input port and output port are predetermined by firmware and are not configurable by the user.	

LED	Color	State	Meaning
SYS	Duo LED yellow/green		
	YELLOW	static	Bootloader netX (= roomloader) is waiting for second stage bootloader
	GREEN/YEL-LOW	Blinking green/yellow	Second stage bootloader is waiting for firmware
	GREEN	On	Operating system running
	OFF	off	Power supply of the device is missing

Table 7-8: System LED

LED	Color	State	Meaning
RUN	**Duo LED red/green**		
	GREEN	On	**OPERATIONAL:** The device is in the OPERATIONAL state.
	GREEN	Flashing cyclic with 2,5 Hz	**PRE-OPERATIONAL:** The device is in the PRE_OPERATIONAL state.
	GREEN	Single flash[1)]	**SAFE-OPERATIONAL:** The device is in the SAFE-OPERATIONAL state.
	OFF	off	**INIT:** The device is in the INIT state.
ERR	**Duo LED red/green**		
	RED	Flashing cyclic with 2,5 Hz	**Invalid configuration:** General configuration error. Possible cause: A status change specified by the master is not possible due to register- or object settings.
	RED	Single flash[1)]	**Local error:** The slave device application changed the EtherCAT status itself. Possible cause 1: A host watchdog timeout occurred. Possible cause 2: Synchronization error, the device automatically switches to SAFE-OPERATIONAL.
	RED	Double flash[2)]	**Process data watchdog timeout:** A process data watchdog timeout occurred. Possible cause: Sync-Manager watchdog timeout.
	OFF	off	**No error:** The EtherCAT communication of the device is in operation.
LINK/RJ45 Ch0 & Ch1	**LED green**		
	GREEN	On	A connection to Ethernet exists.
	GREEN	Flashing cyclic with 2,5 Hz	The device sends/receives Ethernet frames.
	OFF	off	The device has no connection to Ethernet.
RJ45 Ch0 & Ch1	**LED yellow**		
	-	-	This LED is not being used.

[1)] The display shows a short flash (200 ms) followed by a long off phase (1000 ms).
[2)] The display shows a sequence of two short flashes (each 200 ms), interrupted by a short off phase (200 ms). The sequence is completed with a long off phase (1000 ms).

Table 7-9: LEDs EtherCAT-Slave

7.2 Communication Module PROFIBUS DP

7.2.1 General

The communication module PROFIBUS DP provides a PROFIBUS interface.

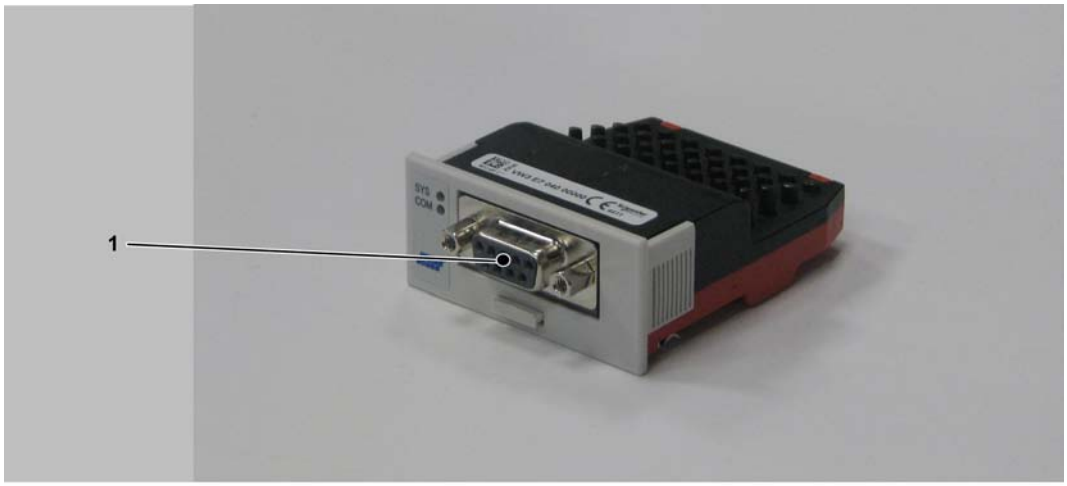


Figure 7-8: Communication module PROFIBUS DP - connection

1	PROFIBUS DP connection

After installing the optional module, the controller will automatically detect the module. Then configure it by using the PLC configuration in SoMachine Motion Logic Builder.

7.2.2 Mechanical installation

NOTICE

DIRTY MODULE CONTACTS CAUSING UNRELIABLE COMMUNICATION

Do not touch the contacts when unpacking or installing the optional module.

Failure to follow these instructions can result in equipment damage.

How to open the Controller:

- ▶ Remove the cover of input CN16 Option at the bottom side of the housing. To do this, push the locking of the cover backward.
  - ✓ The cover folds down.
- ▶ Pull the cover to the front and remove it.

How to install the optional module:

- ▪ Ensure that the controller is switched off.

NOTICE

INCORRECT INSERTION OF OPTIONAL MODULE

- Do not insert the optional module when the controller is under power.
- Verify that the springs at the bottom side of the module are located at the printed circuit board side when you insert the module into the slot.

Failure to follow these instructions can result in equipment damage.

- ▶ Insert the module into the slot and push against the printed circuit board until both front springs at the bottom side lower into the openings on the printed circuit board.

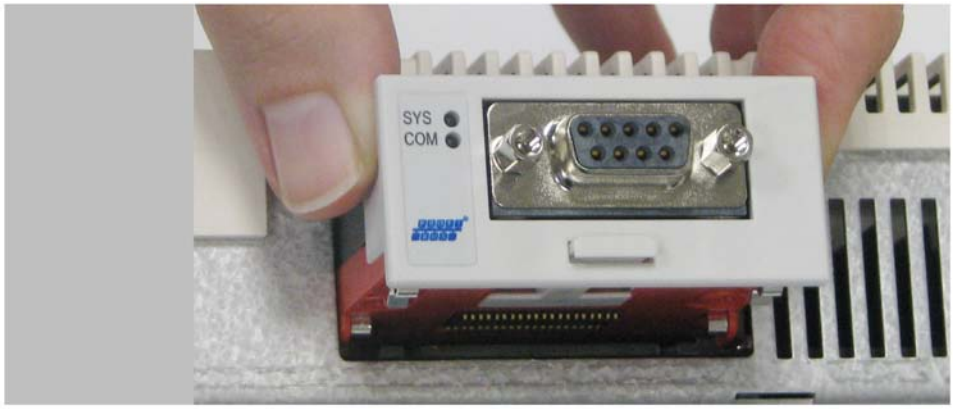


Figure 7-9: Insert communication module PROFIBUS DP

  - ✓ The module rests on the lower edge of the slot.
- ▶ Slightly apply pressure and push the module further inside until it is flush at the edge.
  - ✓ The springs at the bottom side reach into the openings of the printed circuit board.

Ensure that the module is flush at the edge.

How to remove the optional module:

NOTICE
INCORRECT REMOVAL OF OPTIONAL MODULE Do not remove the optional module when the controller is under power. **Failure to follow these instructions can result in equipment damage.**

- Take the protruding part of the handle of the flap and pull the handle out the optional module.

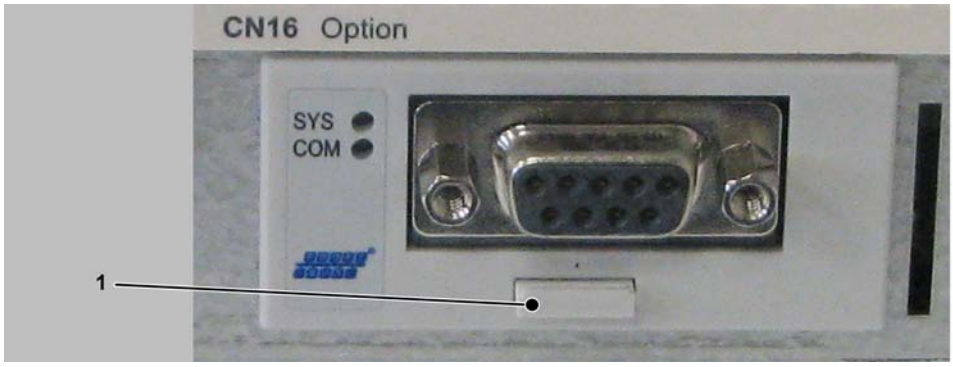


Figure 7-10: Flap handle

1	Flap handle

- Pull at the strap handle and pull the optional module out of the slot until its latching releases.
- Completely remove the optional module from the slot.
- Push the flap handle back into the module.

How to close the controller:

- Insert the cover and push it upward until it latches.
- Push the cover locking to the front until it latches.

7.2.3 Electrical connections

Connection details Communication Module PROFIBUS DP

Figure 7-11: Connection details PROFIBUS DP

Pin	Designation	Meaning
1	-	Reserved
2	-	Reserved
3	Rx/Tx+(PB-B)	PROFIBUS-DP-Data line B (positive)
4	RTS	Return To Send Line for line control
5	PB-GND	Ground for PROFIBUS-DP
6	PB-5V	5 V power line for PROFIBUS-DP
7	-	Reserved
8	Rx/Tx-(PB-A)	PROFIBUS-DP-Data line A (negative)
9	-	Reserved

Table 7-10: Connection assignment PROFIBUS DP

LED description PROFIBUS DP

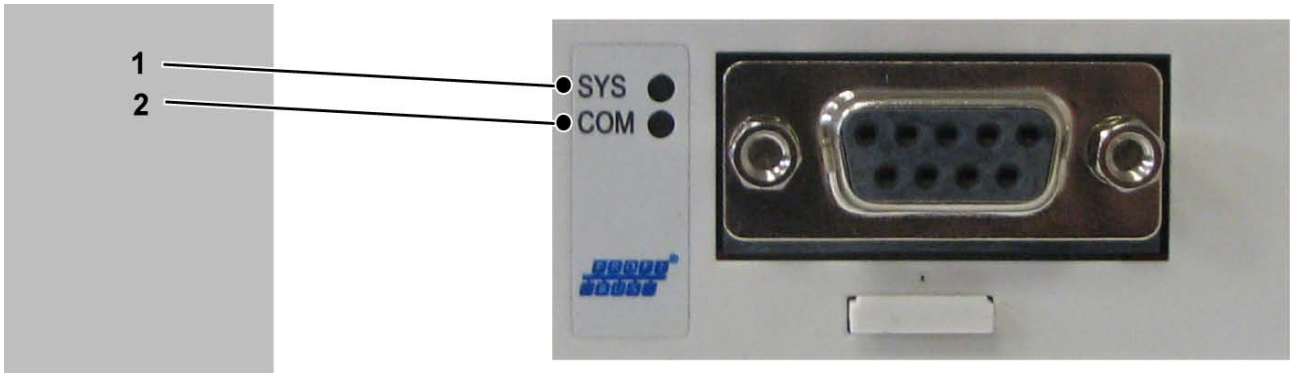


Figure 7-12: LEDs PROFIBUS DP

1	SYS
2	COM

LED	Color	State	Meaning
SYS	Duo LED yellow/green		
	YELLOW	static	Bootloader netX (= roomloader) is waiting for second stage bootloader
	GREEN/YELLOW	Blinking green/yellow	Second stage bootloader is waiting for firmware
	GREEN	On	Operating system running
	OFF	off	Power supply of the device is missing

Table 7-11: System LED

LED	Color	State	Meaning
cifX with 1 Communication LED (current Hardware Revision)			
COM	Duo LED red/green		
	GREEN	Flashing acyclic	No configuration or stack error detected
	GREEN	Flashing cyclic	Profibus is configured, but bus communication is not yet released from the application
	GREEN	On	Communication to all Slaves is established
	RED	Flashing cyclic	Communication to at least one Slave is disconnected.
	RED	On	Communication to one/all Slaves is disconnected

Table 7-12: LEDs PROFIBUS DP Master - 1 Communication LED (current Hardware Revision)

LED	Color	State	Meaning
cifX with 1 Communication LED (current Hardware Revision)			
COM	Duo LED red/green		
	GREEN	On	RUN, cyclic communication
	RED	Flashing cyclic	STOP, no communication, connection error detected
	RED	Flashing acyclic	Not configured

Table 7-13: LEDs PROFIBUS DP Slave - 1 Communication LED (current Hardware Revision)

8 Appendix

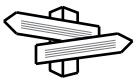
8.1 Contact addresses

Schneider Electric Automation GmbH

Schneiderplatz 1
97828 Marktheidenfeld, Germany
Phone: +49 (0) 9391 / 606 - 0
Fax: +49 (0) 9391 / 606 - 4000
Email: info-marktheidenfeld@schneider-electric.com
Internet: www.schneider-electric.com

Machine Solution Service

Schneiderplatz 1
97828 Marktheidenfeld, Germany
Phone: +49 (0) 9391 / 606 - 3265
Fax: +49 (0) 9391 / 606 - 3340
Email: automation.support.de@schneider-electric.com
Internet: www.schneider-electric.com

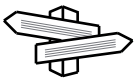


See the homepage for additional contact addresses:
www.schneider-electric.com

8.2 Product training courses

Schneider Electric offers a number of product training courses.

Our training instructors will help you take advantage of the extensive possibilities offered by the system.



See the homepage (www.schneider-electric.com) for further information and our current seminar schedule.

8.3 Disposal

The components consist of different materials, which can be re-used and must be disposed of separately. The packaging cannot be returned to the manufacturer.

- ▶ Dispose of the packaging in accordance with the relevant national regulations.
- ▶ Dispose of the packaging at the disposal sites provided for this purpose.
- ▶ Dispose of Controller in accordance with the applicable national regulations.

8.4 Units and conversion tables

8.4.1 Length

	in	ft	yd	m	cm	mm
in	-	/ 12	/ 36	* 0.0254	* 2.54	* 25.4
ft	* 12	-	/3	* 0.30479	* 30.479	* 304.79
yd	* 36	* 3	-	* 0.9144	* 91.44	* 914.4
m	/ 0.0254	/ 0.30479	/ 0.9144	-	*100	* 1000
cm	/ 2.54	/ 30.479	/ 91.44	/ 100	-	* 10
mm	/ 25.4	/ 304.79	/ 914.4	/ 1000	/ 10	-

8.4.2 Mass

	lb	oz	slug	0.22 kg	g
lb	-	* 16	* 0.03108095	* 0.4535924	* 453.5924
oz	/ 16	-	* $1.942559*10^{-3}$	* 0.02834952	* 28.34952
slug	/ 0.03108095	/ $1.942559*10^{-3}$	-	* 14.5939	* 14593.9
0.22 kg	/ 0.45359237	/ 0.02834952	/ 14.5939	-	* 1000
g	/ 453.59237	/ 28.34952	/ 14593.9	/ 1000	-

8.4.3 Force

	lb	oz	p	dyne	N
lb	-	* 16	* 453.55358	* 444822.2	* 4.448222
oz	/ 16	-	* 28.349524	* 27801	* 0.27801
p	/ 453.55358	/ 28.349524	-	* 980.7	* $9.807*10^{-3}$
dyne	/ 444822.2	/ 27801	/ 980.7	-	/ $100*10^{3}$
N	/ 4.448222	/ 0.27801	/ $9.807*10^{-3}$	* $100*10^{3}$	-

8.4.4 Power

	HP	W
HP	-	* 746
W	/ 746	-

8.4.5 Rotation

	min^{-1}(rpm)	rad/s	deg./s
min^{-1}(rpm)	-	* π / 30	* 6
rad/s	* 30 / π	-	* 57.295
deg./s	/ 6	/ 57.295	-

8.4.6 Torque

	lb•in	lb•ft	oz•in	Nm	kp•m	kp•cm	dyne•cm
lb•in	-	/ 12	* 16	* 0.112985	* 0.011521	* 1.1521	* $1.129*10^{6}$
lb•ft	* 12	-	* 192	* 1.355822	* 0.138255	* 13.8255	* $13.558*10^{6}$
oz•in	/ 16	/ 192	-	* $7.0616*10^{-3}$	* $720.07*10^{-6}$	* $72.007*10^{-3}$	* 70615.5
Nm	/ 0.112985	/ 1.355822	/ $7.0616*10^{-3}$	-	* 0.101972	* 10.1972	* $10*10^{6}$
kp•m	/ 0.011521	/ 0.138255	/ $720.07*10^{-6}$	/ 0.101972	-	* 100	* $98.066*10^{6}$
kp•cm	/ 1.1521	/ 13.8255	/ $72.007*10^{-3}$	/ 10.1972	/ 100	-	* $0.9806*10^{6}$
dyne•cm	/ $1.129*10^{6}$	/ $13.558*10^{6}$	/ 70615.5	/ $10*10^{6}$	/ $98.066*10^{6}$	/ $0.9806*10^{6}$	-

8.4.7 Moment of inertia

	lb•in²	lb•ft²	kg•m²	kg•cm²	kg•cm²•s²	oz•in²
lb•in²	-	/ 144	/ 3417.16	/ 0.341716	/ 335.109	* 16
lb•ft²	* 144	-	/3	*0.30479	*30.479	*304.79
kg•m²	* 3417.16	/ 0.04214	-	*0.9144	*91.44	*914.4
kg•cm²	* 0.341716	/ 421.4	/0.9144	-	*100	*1000
kg•cm²•s²	* 335.109	/ 0.429711	/91.44	/100	-	*10
oz•in²	/ 16	/ 2304	/ 54674	/ 5.46	/ 5361.74	-

8.4.8 Temperature

	°F	max	K
°F	-	(°F - 32) * 5/9	(°F - 32) * 5/9 + 273.15
max	°C * 9/5 + 32	-	°C + 273.15
K	(K - 273.15) * 9/5 + 32	K - 273.15	-

8.4.9 Conductor cross-section

AWG	1	2	3	4	5	6	7	8	9	10	11	12	13
mm²	42.4	33.6	26.7	21.2	16.8	13.3	10.5	8.4	6.6	5.3	4.2	3.3	2.6

AWG	14	15	16	17	18	19	20	21	22	23	24	25	26
mm²	2.1	1.7	1.3	1.0	0.82	0.65	0.52	0.41	0.33	0.26	0.20	0.16	0.13

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