Visualisation; Diagnostics

Easy to Configure

Programming IEC 61131-3

Rapid Installation

PMCprimo C2

PILZ

THE SPIRIT OF SAFETY

▸ Control systems

1 Introduction

1.1 Validity of the documentation

This documentation is valid for the product PMCprimo C2. It is valid until new documentation is published.

This operating manual explains the function and operation, describes the installation and provides guidelines on how to connect the product PMCprimo C2.

Please also refer to the following documents from the motion control range:

▶ The online help for the PASmotion commissioning software describes how to set the parameters for the servo amplifiers from the PMC product area.

▶ Guidelines regarding installation and environmental conditions can be found in the operating manual for the servo amplifier PMCprotego D.

▶ The configuration and programming software for motion control devices (e.g. CODESYS, PASmotion) can be found on the Internet at www.pilz.com.

▶ The manuals for Pilz products from the PMC product area are available on the supplied DVD "Drive technology PMC – Operating manuals".

You will need to be conversant with the information in these documents in order to fully understand this operating manual.

1.1.1 Retaining the documentation

This documentation is intended for instruction and should be retained for future reference.

1.2 Definition of symbols

Information that is particularly important is identified as follows:

DANGER!

This warning must be heeded! It warns of a hazardous situation that poses an immediate threat of serious injury and death and indicates preventive measures that can be taken.

WARNING!

This warning must be heeded! It warns of a hazardous situation that could lead to serious injury and death and indicates preventive measures that can be taken.

CAUTION!

This refers to a hazard that can lead to a less serious or minor injury plus material damage, and also provides information on preventive measures that can be taken.

NOTICE

This describes a situation in which the product or devices could be damaged and also provides information on preventive measures that can be taken. It also highlights areas within the text that are of particular importance.

INFORMATION

This gives advice on applications and provides information on special features.

2 Overview

2.1 Unit features

PMCprimo C2 is a motion controller used to automate multi-axis motion sequences. The device contains a PLC with the functionality of a logic and motion controller.

▶ Logic controller universally programmable in accordance with IEC 61131-3

▶ Motion controller
- – Speed axes
- – Positioning axes
- – Synchronisation axes (electrical cam disk)
- – Path axes (interpolation)
- – Technology functions

▶ Digital inputs and outputs
- – 8 digital inputs, I1:1 … I1:6 can be used as quick reference inputs
- – 8 single-pole digital outputs

▶ Encoder
- – Incremental encoder with TTL signal
- – Absolute encoder with SSI interface

▶ Interfaces
- – Ethernet TCP/IP
- – Modbus TCP
- – EtherCAT
- – 2 CANopen interfaces or 1 CANopen/1 PROFIBUS DP interface (can be configured via the software)

▶ Supply voltages for
- – Device plus digital outputs
- – Encoder

▶ Memory for
- – Operating system
- – Data
- – Device project with user program

▶ USB interface

▶ Reset button
- – To change between operating states
- – For a hardware reset (cold start)
- – For importing project data when devices are exchanged

▶ LED display for device's operating status

2.2 Front view
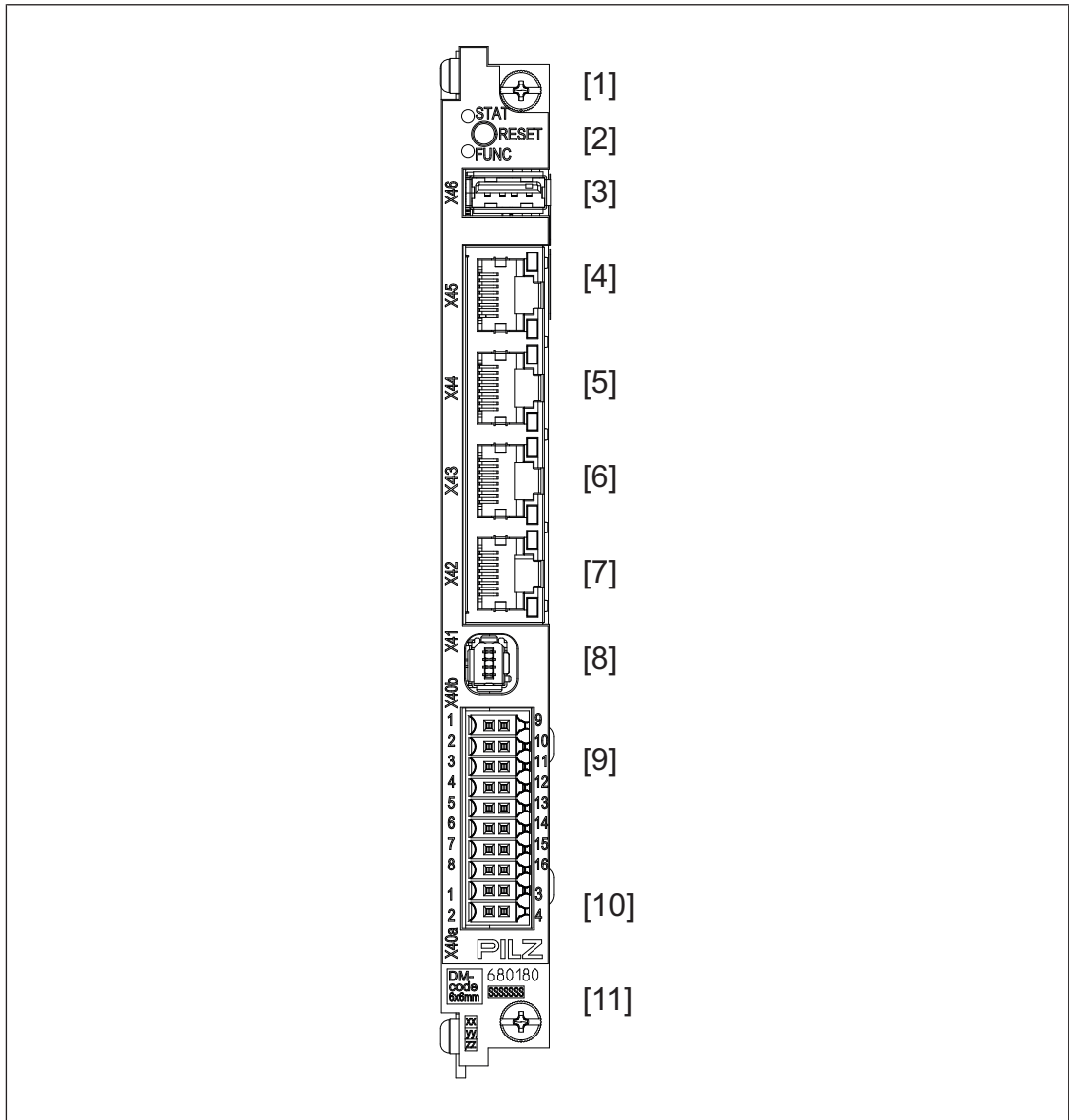
Fig.: Front view PMCprimo C2

Legend

[1]	Screw for attachment to the servo amplifier
[2]	Reset button and LEDs to display operating states
[3]	X46, USB interface
[4]	X45, unused
[5]	X44, EtherCAT interface
[6]	X43, Ethernet TCP/IP interface
[7]	X42, CANopen/PROFIBUS interface
[8]	X41, connection for encoder 1
[9]	X40b, digital inputs and outputs

[10]   X40a, supply voltage for device, digital outputs X40b and interfaces X42 …
        X45

[11]   Labelling strip

        –   Order number

        –   Serial number

        –   Number of device version

2.3   Type code

Always state when ordering	Type
Order number	PMCprimo C2 . 0 / _ / _ / _

CPU	C
1.3 GHz	

Hardware	C
Configurable CAN/PROFIBUS	

Software	2	3	4	5	6	7
Without	■					
Dynamic curve calculation		■		■		■
IEC 61131-3 programming			■	■	■	■
Path interpolation					■	■
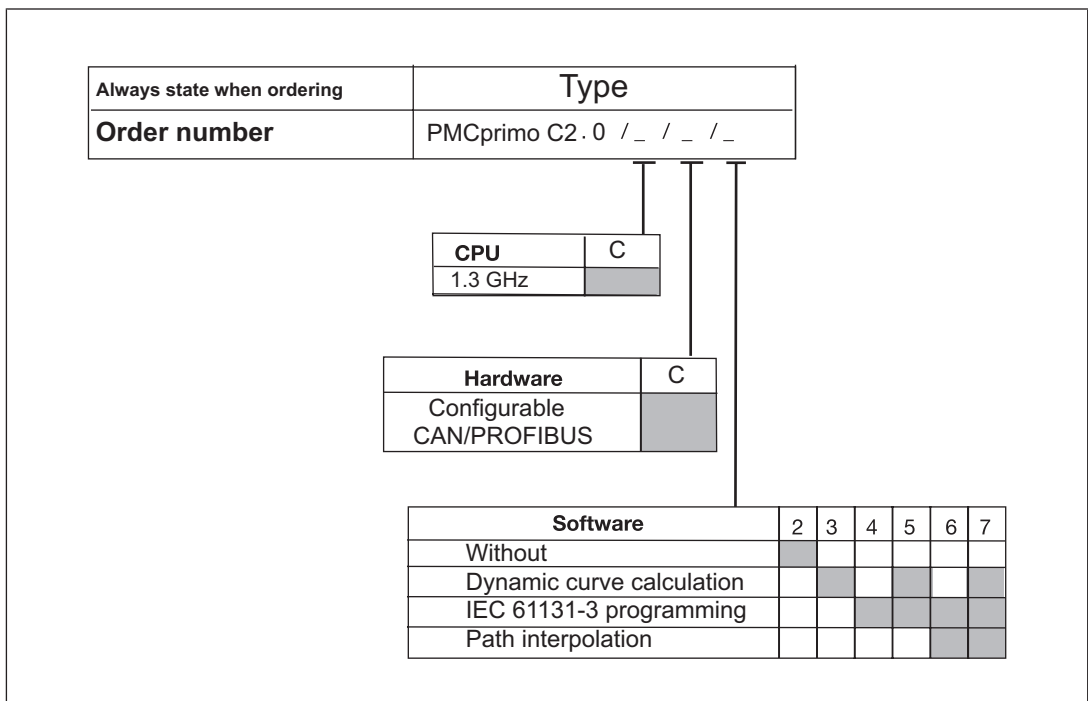
Fig.: Type code for PMCprimo C2

Legend

Explanation of type code

Software

2   Software option **not** enabled

3,5,7   **Dynamic curve calculation** enabled

The dynamic curve calculation is a calculation program for allocation tables. The allocation table is defined through variables and scaling. The dynamic curve calculation reads in the variable and calculates an allocation table.

4-7   **IEC 61131-3 programming** enabled

PLC functionality is programmed with CODESYS

6.7 **Path interpolation** enabled

PLC functionality and path interpolation

2.4 Scope of supply

Order reference	Description	Order number
PMCprimo C2	Expansion card for motion controller (for function range see "Type code")	See "Type code"
DVD "Drive technology PMC – Operating manuals"	Operating manual PMCprimo C2, Manuals for Pilz products from the PMC product area	---

3   Security

3.1   Intended use

The motion controller PMCprimo C2 is suitable for use in logic and motion control applications.

Examples of typical application areas for the product are

▶   Clocked production machinery

▶   Continuous manufacturing processes (winding, flying saw, cross cutter)

▶   Machine tools

▶   Packaging machines

▶   Pick and place applications

The motion controller is installed in the servo amplifier PMCprotego D. Once installed, the environmental conditions of the servo amplifier PMCprotego D apply, e.g. the lower storage temperature (see "Technical Details" in the operating manual for the servo amplifier).

Please note that the PMCprimo C2 has no internal electrical connection to the servo amplifier PMCprotego D. When installing and operating the device, you must refer to the operating manuals for the servo amplifiers, in particular the safety guidelines.

The following is deemed improper use in particular

▶   Any component, technical or electrical modification to the product,

▶   Use of the product outside the areas described in this manual,

▶   Use of the product outside the technical details (see Technical details).

> **NOTICE**
>
> **EMC-compliant electrical installation**
>
> The product is designed for use in an industrial environment. The product may cause interference if installed in other environments. If installed in other environments, measures should be taken to comply with the applicable standards and directives for the respective installation site with regard to interference.

3.2   Safety regulations

3.2.1   Use of qualified personnel

The products may only be assembled, installed, programmed, commissioned, operated, maintained and decommissioned by competent persons.

A competent person is a qualified and knowledgeable person who, because of their training, experience and current professional activity, has the specialist knowledge required. To be able to inspect, assess and operate devices, systems and machines, the person has to be informed of the state of the art and the applicable national, European and international laws, directives and standards.

It is the company's responsibility only to employ personnel who

▸ Are familiar with the basic regulations concerning health and safety / accident prevention,

▸ Have read and understood the information provided in the section entitled Safety

▸ Have a good knowledge of the generic and specialist standards applicable to the specific application.

3.2.2 Warranty and liability

All claims to warranty and liability will be rendered invalid if

▸ The product was used contrary to the purpose for which it is intended,

▸ Damage can be attributed to not having followed the guidelines in the manual,

▸ Operating personnel are not suitably qualified,

▸ Any type of modification has been made (e.g. exchanging components on the PCB boards, soldering work etc.).

3.2.3 Disposal

▸ When decommissioning, please comply with local regulations regarding the disposal of electronic devices (e.g. Electrical and Electronic Equipment Act).

3.3 Standards

To use the device correctly you will need to have a good knowledge of the relevant standards and directives. The following standards are relevant:

▸ EN 61131-1: Programmable controllers – Part 1: General information

▸ EN 61131-2: Programmable controllers – Part 2: Equipment requirements and tests

▸ EN 61131-3: Programmable controllers – Part 3: Programming languages

Please note this is not an exhaustive list of safety standards and directives.

Where standards are undated, the 2014-06 latest editions shall apply.

4 Function description

4.1 Device properties

4.1.1 Controller

The PMCprimo C2 is a drive-integrated programmable logic controller with motion control functionalities. The controller has volatile and non-volatile memory for the operating system, the data and the device project with the user program.

It can be used for logic and motion control of intelligent drives.

User programs can be programmed in the main IEC 61131-3 languages. The software CODESYS is used to program the PLC functionality. The controller runs as an independent task.

The motion controller has 8 digital inputs and 8 single-pole digital outputs. The inputs and outputs are read cyclically. The cycle times are ≤ 1ms. It can also access inputs and outputs on networked servo amplifiers from the PMC product area.

The motion controller has fieldbus interfaces for communication with the periphery.

An additional encoder can be connected (incremental encoder with TTL signal or absolute encoder with SSI interface).

Two LEDs provide information on the operating states of the controller and indicate any errors.
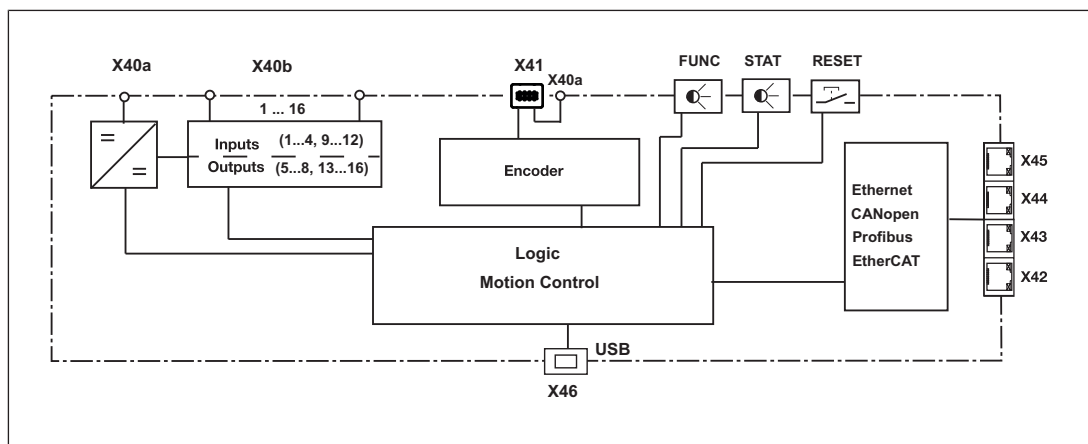
Fig.: Block diagram PMCprimo C2

The motion controller PMCprimo C2 (1) is installed in a servo amplifier PMCprotego D (3). A fieldbus junction box PMCprotego D.CAN-CANbus Adapter or PMCprotego D.CAN-PROFIBUS Adapter (2) is used for networking (CANopen, PROFIBUS DP).
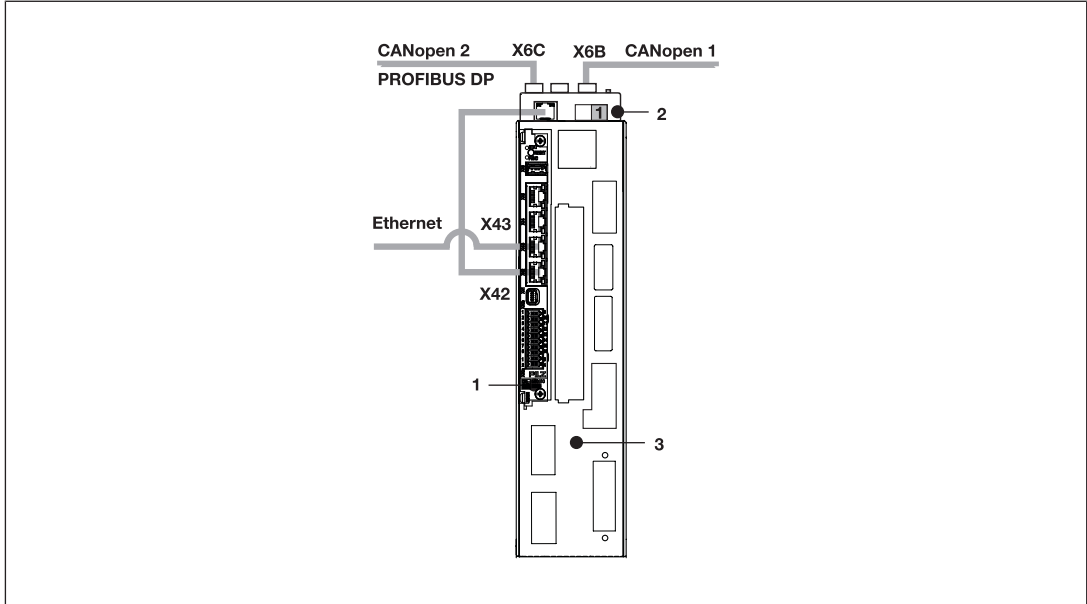

Fig.: Installation of the motion controller in a servo amplifier PMCprotego D

The motion controller PMCprimo C2 (1) is installed in a servo amplifier PMCprotego D (2). Networking can be via EtherCAT.
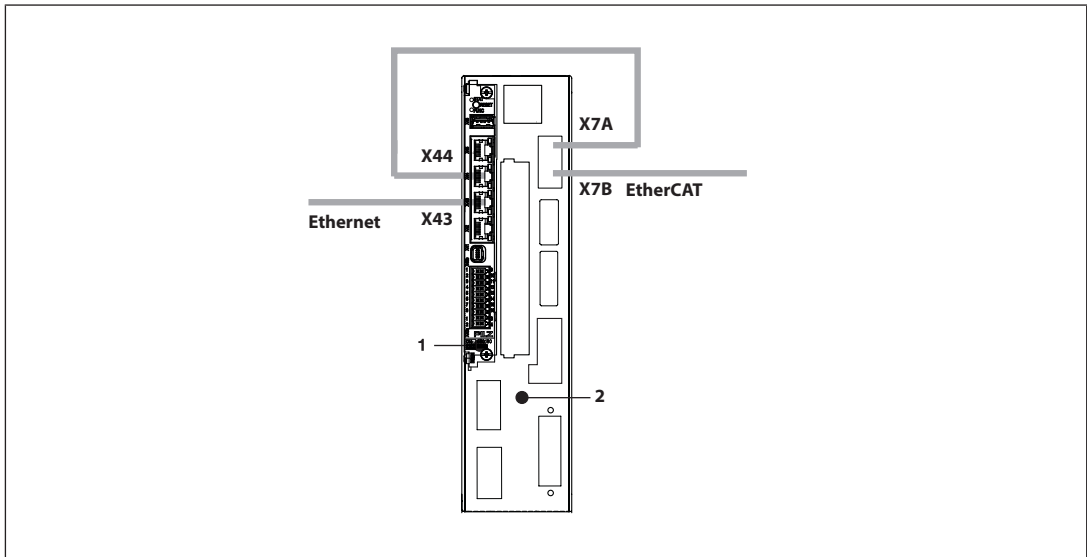
Fig.: Installation of the motion controller in a servo amplifier PMCprotego D

4.1.2 Supply voltage

The PMCprimo C2 has two supply voltages:

▸ X40a/1,3

Supply voltage for the device and the digital outputs (24 VDC)

▸ X40a/2,4

Supply voltage for the encoder (5 V, 24 VDC)

The voltage is connected directly to the Mini-I/O connector X41/1,2.

Internally the two supply voltages are galvanically isolated. The two earths can be connected externally.

4.1.3 Digital inputs

The device has 8 digital inputs.

The inputs are compatible with EN 61131-2, Type 1.

The time behaviour of the digital inputs depends on the method of use:

▸ With normal use, the inputs have a filter time of ≤ 600 µs.

▸ If the inputs are used as reference inputs, the reaction time to 0/1 or 1/0 pulse edges is < 5µs.

  The inputs can be used as reference inputs, to poll the position of the encoder for example.

4.1.4 Digital outputs

The device has 8 single-pole digital outputs.

Signals at the output

▸ "0" signal (0 V) at the output:

  – Output is high impedance

  – No current to the load

▸ "1" signal (+24 V) at the output:

  – Output is low impedance

  – Current is supplied to the load

  – The maximum current strength per output is 0.5 A.

All digital outputs are protected against short circuit and overload.

The outputs can be used to connect relays, valves or inputs from another controller, for example.

4.1.5 Interfaces

4.1.5.1 Overview

The motion controller PMCprimo C2 has various fieldbuses for communication with the periphery. These are available on four RJ45 sockets on the front of the device. The interfaces are suitable for the following applications:

▶ **CANopen as a drive bus**

– Real-time capable networking between CAN devices and the motion controller

– Suitable for applications

– Configuration: Two CANopen interfaces
with ≤ 49 subscribers, 32 can be servo amplifiers

– Configuration: One CANopen interface
with ≤ 32 subscribers, 32 can be servo amplifiers

– with cycle time of ≥ 1 ms

– Connection to the servo amplifier PMCprotego D via the fieldbus junction box PMC-protego D.CAN-CANbus Adapter (supplied with the device)

▶ **PROFIBUS DP Slave**

– Networking between the motion controller and a PROFIBUS Master.

– Suitable for data exchange with a third party controller.

– Connection to the servo amplifier PMCprotego D via the fieldbus junction box PMC-protego D.CAN-PROFIBUS Adapter (supplied with the device)

▶ **Ethernet**

– **Ethernet TCP/IP**

– Communication between the programming device and the motion controller

– Suitable for configuration, programming, commissioning

– **Modbus/TCP**

– Communications protocol based on Industrial Ethernet (TCP/IP over Ethernet).

– Suitable for networking between the motion controller and a visualisation device or a PSS 4000, for example.

▶ **EtherCAT as a drive bus**

– EtherCAT is an Ethernet-based master bus system suitable for industrial use. It is suitable for real-time capable networking between the motion controller PMCprimo C2 and the servo amplifier PMCprotego D.

– The PMCprimo C2 acts as Master

– Suitable for applications

– with ≤ 32 subscribers

– with cycle time of 1 ms

▶ **USB**

– For data exchange, see section entitled USB [20]

4.1.5.2 CANopen

The CANopen interface is suitable for networking drive components at field level. It meets the requirements defined in the communications protocol DS-301.

The following device classes with CANopen device profiles are supported:

▶ I/O modules DS-401

▸ Electrical drives DS-402

▸ Encoder DS-406

The CAN network is designed as a linear structure. The CANopen communication protocol is based on CAN.

▸ CAN networking with the motion controller is suitable for applications with a maximum subscriber number of ≤ 49 and a cycle time ≥ 1 ms.

▸ Only CAN devices that are known to the controller or support a corresponding device profile can be operated in the motion controller's CAN network.

▸ CAN devices detected by the motion controller are ready for operation immediately after the initial network run-up. No complex configuration of the CAN devices is required.

▸ The overall cable length and the length of the stub lines depend on the transmission rate.

▸ Process data objects (PDO) are defined for each CAN device type and cannot be customised by the user.

▸ For servo amplifiers, the "FS" command can be used to set which process data is to be exchanged between the motion controller and the servo amplifier (see "PMCprimo Programming Manual").

▸ The signal lines must be terminated with resistors (120 Ohm) on the first and last subscriber. The resistors are generally integrated within the connected devices and can be activated there. For a PMCprimo C2, a terminating resistor can be activated in the fieldbus junction box PMCprotego D.CAN-CANbus Adapter or PMCprotego D.CAN-PFOFIBUS Adapter.

The PROFIBUS DP and CANopen interface are on the same socket (X42) and are assigned to two CANopen interfaces or a combined CANopen/PROFIBUS interface, depending on the basic configuration (PASmotion).

4.1.5.3   PROFIBUS DP

PROFIBUS is an open fieldbus standard. Communication is defined in IEC 61158 and IEC 61784. Further provisions have been defined in specifications published by the PROFIBUS User Group. These specifications are available from PROFIBUS International.

The PROFIBUS interface is activated in the basic configuration (PASmotion) and is available together with a CANopen interface on an RJ45 socket (X7).

The operating parameters of the motion controller and PROFIBUS are set using CODESYS.

Maximum data length of the PROFIBUS interface:

▸ Input 244 Byte

▸ Output 244 Byte

INFORMATION

The GSD file is available in the download area www.pilz.de. The name of the description file can be found in the chapter Technical details.

INFORMATION

Please also refer to the installation guidelines published by the PROFIBUS User Group.

4.1.5.4 Ethernet

The Gigabit Ethernet interface (X43) connects the PMCprimo C2 to a programming device for configuration, programming and commissioning. The interface can also be used to connect a visualisation device.

The Gigabit Ethernet interface is compatible with 1000Base-T (Standard Gigabit Ethernet). Data exchange is possible via Modbus/TCP.

4.1.5.5 EtherCAT

EtherCAT uses the Ethernet Standard (IEEE 802.3) without modifications.

The PMCprimo C2 does not require a setting (CD command) to use the EtherCAT master as a drive bus.

To do this, however, a CODESYS V3 project must be active (Boot project), where all the EtherCAT devices are configured.

Before the CODESYS project starts, all the devices must be operational so that they are detected by the EtherCAT master.

The address assignment of the network subscribers is performed automatically in the sequence of the physical arrangement. The sequence of the inserted devices in the device tree must match the physical arrangement.

Please note the following during operation:

▶   The device sequence may no longer be modified.
▶   It is not permitted to add or remove devices.

The PMCprimo C2 is an EtherCAT master, which is the only subscriber in the segment that can actively send an EtherCAT frame; all the other subscribers only forward the frames. This prevents unforeseeable delays and it guarantees real-time capability.

Bit errors in the transmission are reliably detected in the evaluation of CRC check sums. Rare interferences can be detected and localised with EtherCAT even if the interference does not influence the functionality of the machine.

4.1.5.6   USB

> **INFORMATION**
>
> Use a USB stick with FAT32 formatting.

▸ The USB interface is used for data exchange.

▸ The data can contain a new firmware with a complete project.

▸ **Save data from a controller to a USB stick:**

– Save data on a USB stick into the following directory: "\PILZ\primoBACKUP\"

▸ To save, execute the SP11 command.

▸ **Save data for device exchange via reset button to USB stick:**

– Make sure that the directory "primoBACKUP" does not exist on the USB stick.
  (avoid overwriting accidentally)

– Insert USB stick

– Press the RESET button during the boot process until the LEDs flash blue.

▸ **Copy data stored on a USB stick to the controller:**

– Insert USB stick

▸ Activate the hardware reset (cold start) by pressing the "RESET" button, see Functions of the reset button.

4.1.6   Encoder

An encoder can be connected to the Mini I/O socket X41.

The following encoders are supported:

▸ Incremental encoder with TTL signal

▸ Absolute encoder with SSI interface

The encoder's supply voltage is connected to separate terminals on the device (X40a/2,4). The size of the voltage depends on the encoder (e.g. 5 V, 10 - 30 VDC).

> **INFORMATION**
>
> Refer to the chapter entitled Wiring [📖 26] for details of how to connect the supply voltage.

4.1.7   Reset button

The "RESET" button is mounted in a recess on the front of the unit. It can only be accessed using an appropriate tool (e.g. a pin).

The following actions can be triggered by pressing the "RESET" pushbutton:

▸ Change from "Startup" operating status to "Boot Menu"

▸ Hardware reset (cold start): Change from operating states "RUN" or "STOP" to "Startup" (if a USB stick is inserted, any device data present will be copied, see Functions of the reset button [📖 53].)

▸ Change from "RUN" operating status to "STOP"

▸ Change from "STOP" operating status to "RUN"

> **INFORMATION**
>
> For further information on the reset button see the chapter entitled Operation [📖 47].

4.2 Software

Various tools are available for planning, configuration, programming and commissioning. They are used to create a project:

▸ PASmotion

PASmotion is used to parameterise and commission the motion controller and the servo amplifier PMCprotego D.

– Terminal program: The terminal can be used to transfer commands directly to the hardware. It can also be used for firmware updates and for basic configuration of the motion controller.

– Oscilloscope function: PScope is a PC-based oscilloscope with up to 4 channels. It can be used to record and visualise signals from controllers and servo amplifiers.

– Elliptical curve tool: PMotion is a tool for constructing elliptical curves.

▸ Development environment in accordance with IEC 61131-3

CODESYS is a development environment for programming controllers in accordance with IEC 61131-3. Additional commands for motion sequences have been added. In addition to the core CODESYS packages the "PMC Programming Tool" also contains the target support packages and the PMCprimo base project.

The software tools are available on the Internet at www.pilz.com.

5 Installation

5.1 General requirements

Please also refer to the operating manual for the servo amplifier.

! **NOTICE**

Damage due to electrostatic discharge!

Electrostatic discharge can damage components. Ensure against discharge before touching the product, e.g. by touching an earthed, conductive surface or by wearing an earthed armband.

! **NOTICE**

The motion controller is installed in the servo amplifier PMCprotego D. Once installed, the environmental conditions of the servo amplifier PMCprotego D apply (see "Technical Details" in the operating manual for the servo amplifier).

5.2 Dimensions
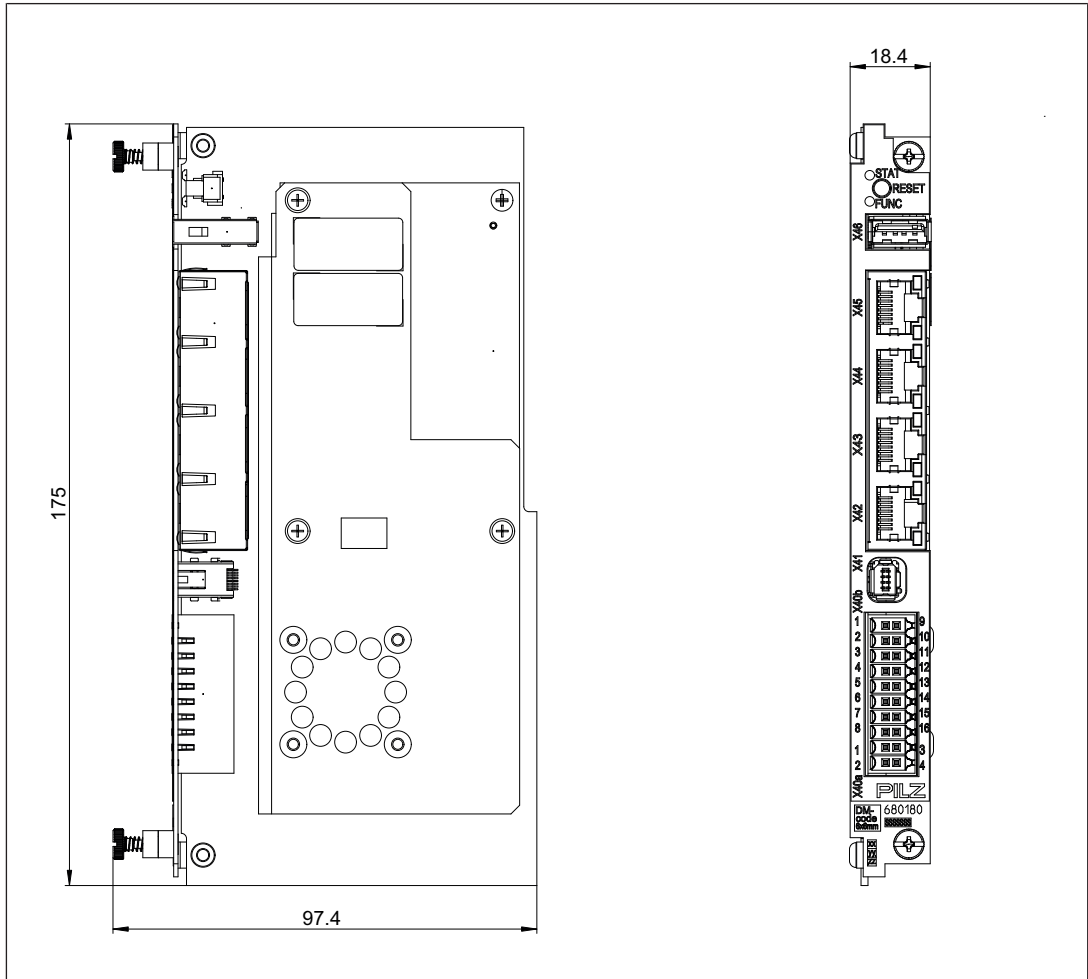
Fig.: Dimensions, stated in mm

5.3   Installing the unit

The PMCprimo C2 is installed in slots 1 and 2 of the servo amplifier PMCprotego D. When installing, please note the guidelines given under "Installation" in the operating manual for the servo amplifier.
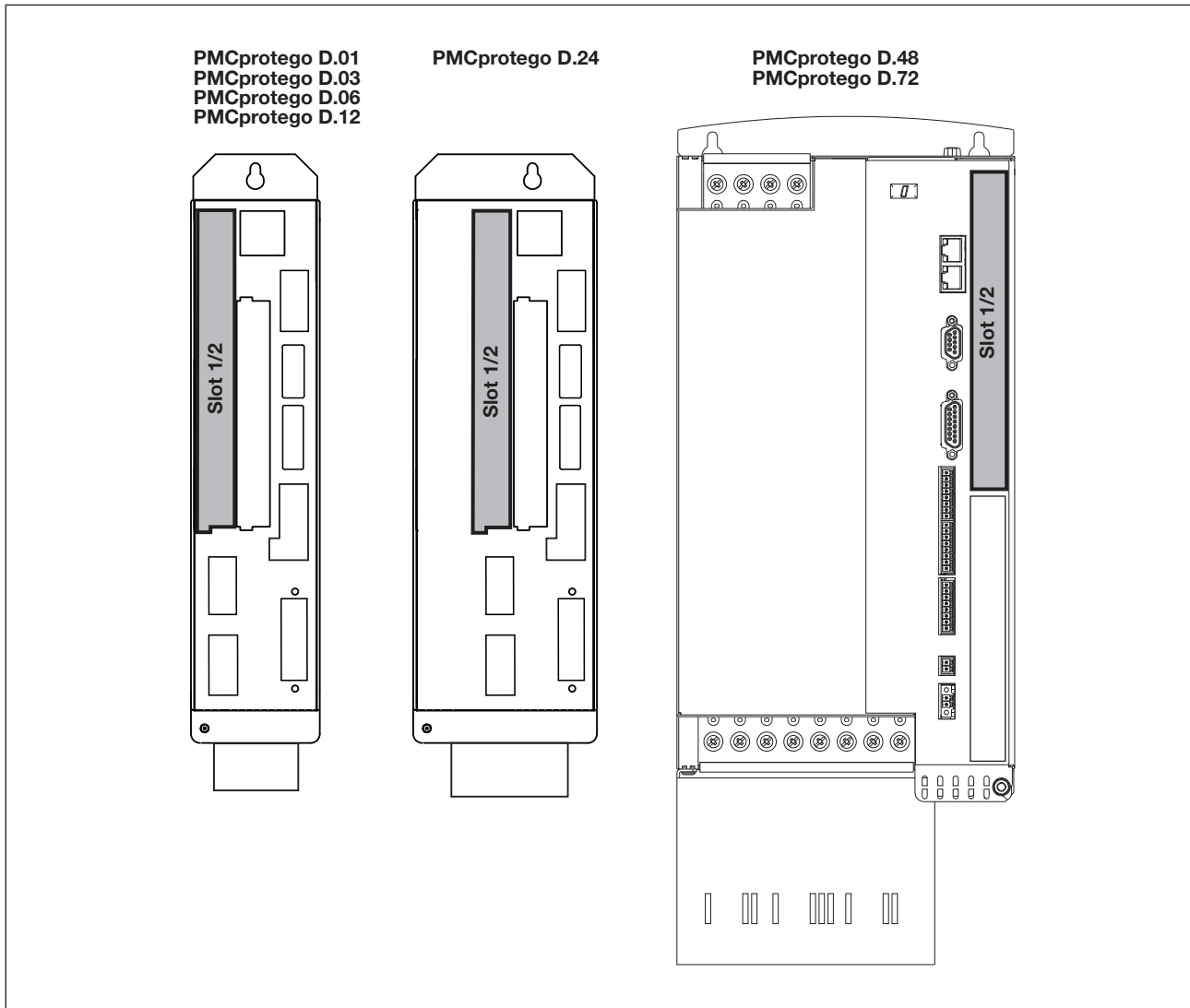
Fig.: Slots 1 and 2 for installing the PMCprimo C2

5.4   Installing the fieldbus junction box

To network a PMCprimo C2 via CANopen, PROFIBUS DP you need a fieldbus junction
box. This is available as an accessory. The fieldbus junction box is plugged into the servo
amplifier.

> **INFORMATION**
>
> Pin assignment, wiring and assembly are described in the operating manual
> for the fieldbus junction box.

To install the fieldbus junction box, follow the instructions below:

▸ Switch off the mains voltages and 24 V supply.

▸ Connect the 9-pin female D-Sub connector X6D to the male connector X6 on the servo
  amplifier.

▸ Turn the screws into the thread on the housing.
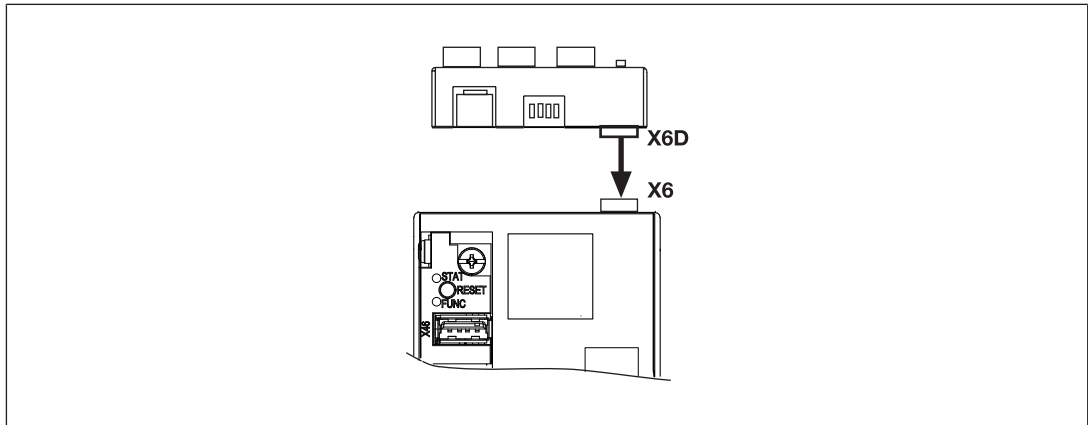
Fig.: Installing the fieldbus junction box on a servo amplifier

6 Wiring

6.1 Wiring guidelines

Please note:

▸ Cable cross sections for field connection terminals in mm^2:

 – Digital inputs/outputs, supply voltage: 0.5 (AWG20) ... 1.0 (AWG18), AEH without plastic collar, in accordance with DIN 46228/1

Inputs

▸ Appropriate wiring must be used to exclude short circuits between the inputs or to a supply line.

▸ Cables must be shielded if the signals are used as reference inputs. Other signal lines do not need to be shielded.
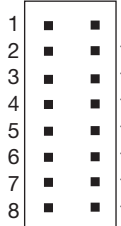
Outputs

▸ If short circuits occur between the cable from the output to the load and a supply line, it will no longer be possible to switch off the load.

 Possible remedy: Use separate multicore cable for supply voltages.

▸ Use appropriate wiring to exclude short circuits between the outputs.

▸ The actuators may be connected using unshielded cables.

▸ The outputs do not need suppression for inductive loads.

Cable material

▸ Use copper wiring.

6.2 Connector pin assignment X40b

Connector X40b	Pin	Designation	Description
1 ■ ■ 9 2 ■ ■ 10 3 ■ ■ 11 4 ■ ■ 12 5 ■ ■ 13 6 ■ ■ 14 7 ■ ■ 15 8 ■ ■ 16	1	I1:1	Digital, fast input 1
	2	I1:2	Digital, fast input 2
	3	I1:3	Digital, fast input 3
	4	I1:4	Digital, fast input 4
	5	O1:1	Digital output 1
	6	O1:2	Digital output 2
	7	O1:3	Digital output 3
	8	O1:4	Digital output 4
	9	I1:5	Digital, fast input 5
	10	I1:6	Digital, fast input 6
	11	I1:7	Digital input 7
	12	I1:8	Digital input 8
	13	O1:5	Digital output 5
	14	O1:6	Digital output 6
	15	O1:7	Digital output 7
	16	O1:8	Digital output 8

6.3 Supply voltage

The digital outputs and the unit need a 24 VDC supply.

▸ When selecting the power supply, please refer to the requirements stated under "Technical Details".

▸ The power supply must be able to bridge a power outage of 20 ms.

> **WARNING!**
> **Electric shock!**
> Safe electrical isolation must be ensured for the external power supply that generates the supply voltage. Failure to do so could result in electric shock. The power supplies must comply with EN 60950-1, 05/2006, EN 61558-2-6, 11/1997.

Connector X40a	Pin	Designation	Description
1 ■ ■ 3 2 ■ ■ 4	1	+24 V	Supply voltage +24 VDC
	3	0 V supply	Earth for supply voltage
	Supply voltage for: the device, digital outputs X40b, interfaces X42 to X45		

Supply voltage 24 V	
X40a +24 V 1 0 V Supply 3	24 V connection isolated from external power supply, e.g. with isolating transformer *If the link is removed, earth fault monitoring must be used in accordance with EN 60204 / VDE 0113.
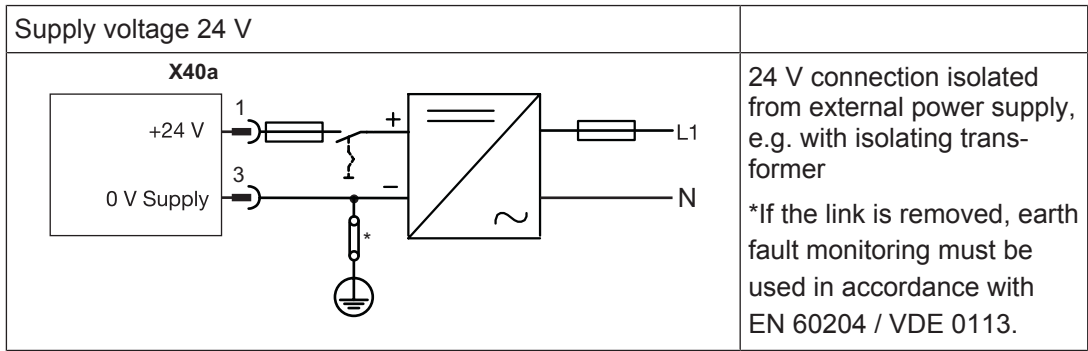
6.4 Digital inputs

Connector X40a, X40b	Pin	Designation	Description
1 9 X40b 2 10 3 11 4 12 5 13 6 14 7 15 8 16 1 3 X40a 2 4	**X40b**		
	1	I1:1	Digital, fast input 1
	2	I1:2	Digital, fast input 2
	3	I1:3	Digital, fast input 3
	4	I1:4	Digital, fast input 4
	9	I1:5	Digital, fast input 5
	10	I1:6	Digital, fast input 6
	11	I1:7	Digital input 7
	12	I1:8	Digital input 8
	X40a		
	3	0 V	Reference earth for digital inputs

Input circuit	Digital input
X40b I1:1 1 I1:2 2 I1:3 3 I1:4 4 I1:5 9 I1:6 10 I1.7 11 I1.8 12 **X40a** 0V 3 Shield	24 VDC, referenced to earth (X40a/3) Cables must be shielded if the signals are used as reference inputs. Example: Reference inputs I1:1 and I1:2 (Pin 1, 2)
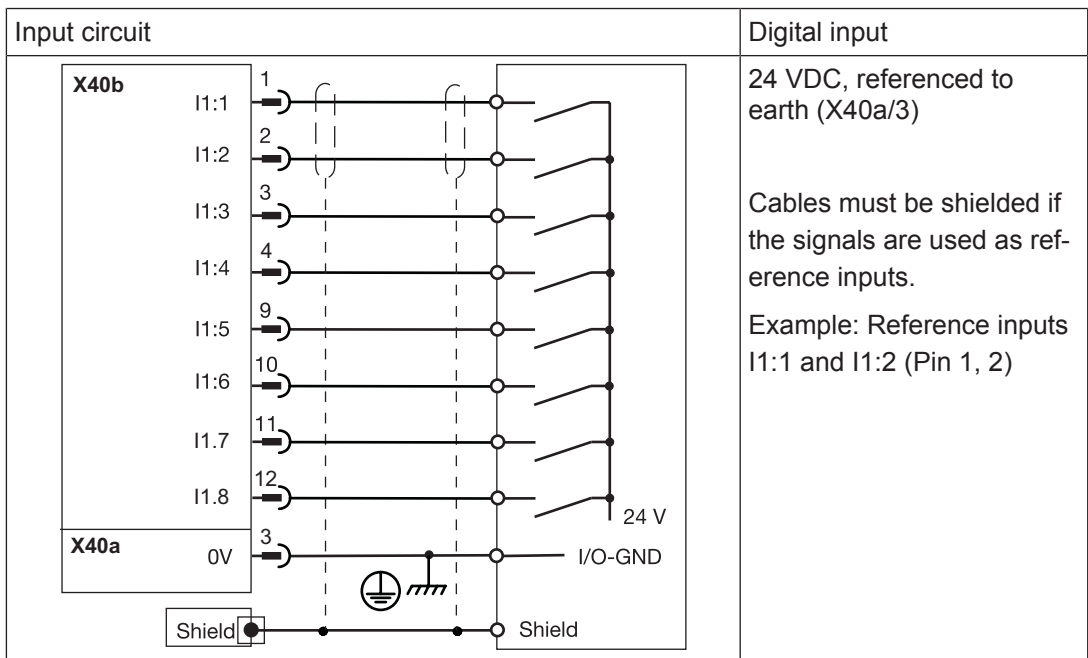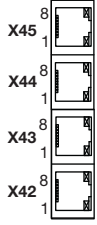
6.5 Digital outputs

Connector X40a, X40b	Pin	Designation	Description
	X40b		
	5	O1:1	Digital output 1
	6	O1:2	Digital output 2
	7	O1:3	Digital output 3
	8	O1:4	Digital output 4
	13	O1:5	Digital output 5
	14	O1:6	Digital output 6
	15	O1:7	Digital output 7
	16	O1:8	Digital output 8
	X40a		
	1	+24 V	Supply voltage for digital outputs
	3	0 V supply	Reference earth for digital outputs

Output circuit	Digital output
X40b O1:1 ... O1:8, **X40a** +24 V, 0 V	24 VDC, referenced to earth (X40a/3)
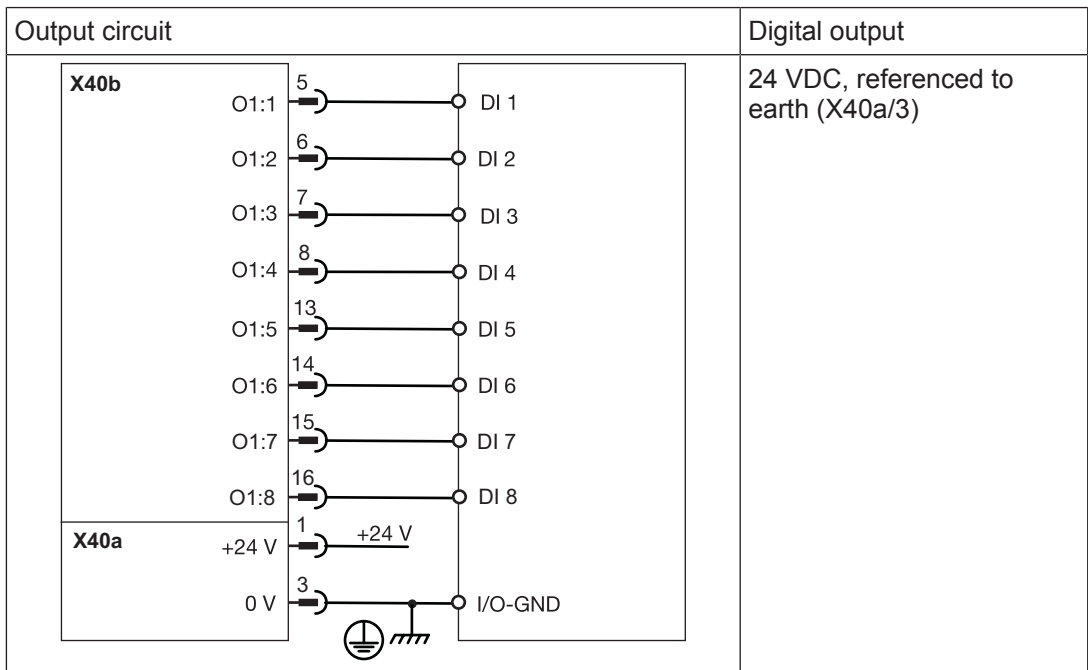
6.6 Interfaces

6.6.1 Overview

Four RJ45 sockets with interfaces are available on the front.

Socket X42-X45	Connector	Description
X45 X44 X43 X42	X45	Unused
	X44	EtherCAT interface
	X43	Ethernet interface
	X42	Configurable: - 2 CANopen interfaces, or - 1 CANopen/1 PROFIBUS DP interface (connection via fieldbus junction box on the servo amplifier PMCprotego D, see section entitled Device properties)

Socket assignment

6.6.2 CANopen, PROFIBUS DP

The PROFIBUS DP and CANopen interface is on the same socket. Depending on the basic configuration (PASmotion), socket X42 is assigned to

▸ A combined CANopen/PROFIBUS DP interface

▸ Two CANopen interfaces

6.6.2.1 Wiring guidelines for the CANopen interface

The CAN network is designed in a linear structure.

▸ The overall line length and the length of the stub lines depend on the transmission rate and on the cable properties (cable resistance and cable capacitance).

▸ The signal lines must be terminated with resistors on the first and last subscriber.

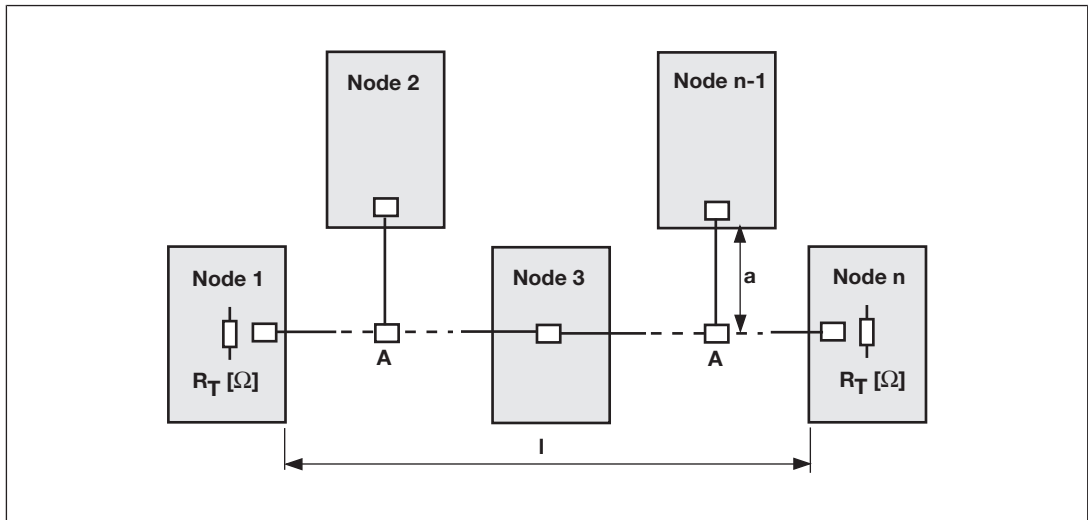▸ A characteristic impedance of 120 Ohm is acceptable for bus lengths up to 40 m.

Fig.: Overall length and length of the stub lines on a CAN network.

Legend:

▶ Node: CANopen subscriber

▶ a: Length of stub line

▶ A: Branch

▶ R_T: Terminating resistor

Relationship between transmission rate, bus length and length of stub lines:

Transmission rate [kBit/s]	Bus length l [m]	Length of stub line a [m]	Overall length of all stub lines [m]
1000	10	1.5	7.5
500	70	5.5	27.5
250	115	11	55

The following table provides an approximate overview of the size of the terminating resistor R_T with different cable lengths. In each specific case, details of the characteristic impedance can be found in the cable specification.

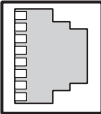| Bus length l [m]	Terminating resistor R_T [Ohm]
0 - 40	120
40 - 300	150 - 300
300 - 500	150 - 300

INFORMATION

Please also refer to the installation guidelines published by the CANopen User Group.
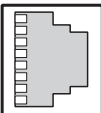
6.6.2.2 Two CANopen interfaces

There are two CANopen interfaces on the same socket. The two CANopen interfaces use the same operating earth (GND).

Socket X42	Pin	Designation	Description
8 ... 1	1	n. c.	
	2	n. c.	
	3	GND	Ground
	4	CAN2_H	CAN2 high signal
	5	CAN2_L	CAN2 low signal
	6	GND	Ground
	7	CAN_H	CAN1 high signal
	8	CAN_L	CAN1 low signal
	n.c. = not connected		
	Basic configuration: 2 CANopen interfaces		
	Connection via fieldbus junction box on the servo amplifier PMC-protego D		

6.6.2.3 CANopen/PROFIBUS DP interface
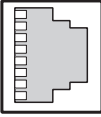
The PROFIBUS and CANopen interface are on the same socket. The PROFIBUS and CANopen interface use the same operating earth (GND).

Socket X42	Pin	Designation	Description
8 ... 1	1	CNTR-P (RTS)	PROFIBUS RTS
	2	n. c.	n. c.
	3	GND	Ground
	4	RxD/TxD-N	PROFIBUS A cable
	5	RxD/TxD-P	PROFIBUS B cable
	6	GND	Ground
	7	CAN_H	CAN high signal
	8	CAN_L	CAN low signal
	n.c. = not connected		
	Basic configuration:		
	1 CANopen/ 1 PROFIBUS DP interface		
	Connection via fieldbus junction box on the servo amplifier PMC-protego D		

Socket assignment

> **INFORMATION**
>
> Please also refer to the installation guidelines published by the PROFIBUS User Group.
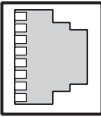
6.6.3 Ethernet

Socket X43	Pin	Designation	Description
8 ... 1	1	D1+	TX D1+
	2	D1-	TX D1-
	3	D2+	RX D2+
	4	D3+	BI D3+
	5	D3-	BI D3-
	6	D2-	RX D2-
	7	D4+	BI D4+
	8	D4-	BI D4-

The Ethernet interface is compatible with 1000Base-T (Standard Gigabit Ethernet)

Recommended cable: Cat5e SF/UTP

6.6.4 EtherCAT

Socket X44	Pin	Designation	Description
8 ... 1	1	TD+	Transmit +
	2	TD-	Transmit -
	3	RD+	Receive +
	4	n. c.	
	5	n. c.	
	6	RD-	Receive -
	7	n. c.	
	8	n. c.	
	n. c. = not connected		

Recommended cable: Cat5e SF/UTP

6.7 Encoder

6.7.1 Supply voltage

<table>
<tr><td>⚠</td><td>WARNING!
Electric shock!
Safe electrical isolation must be ensured for the external power supply that generates the supply voltage. Failure to do so could result in electric shock. The power supplies must comply with EN 60950-1, 05/2006, EN 61558-2-6, 11/1997.</td></tr>
</table>
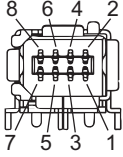
Connector X40a	Pin	Designation	Description
1 ■ ■ 3 **X40a** 2 ■ ■ 4	2	Encoder Supply	Supply voltage for external encoder
	4	0 V Encoder Supply	Supply voltage for external encoder (0 V)
	Supply voltage for encoder at X41		

Supply voltage	
	X40a/2 is linked internally to X41/4 and X40a/1 to X41/2 *If the link is removed, earth fault monitoring must be used in accordance with EN 60204 / VDE 0113.
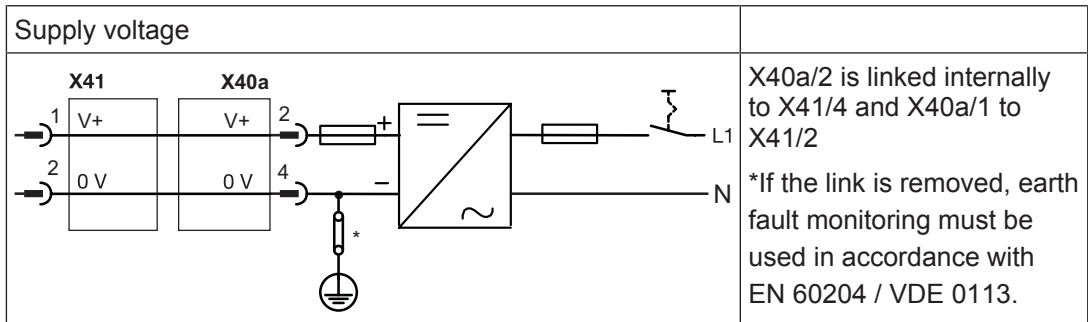
6.7.2   Incremental encoder with TTL signal

If the cable length is > 50 m, please speak to our Customer Support.

Mini-I/O socket X41,	Pin	Designation	Description
	1	V+	Supply voltage
	2	0 V	Supply voltage 0 V
	3	Z	Reference pulse Z
	4	A	Channel A
	5	A\	Channel A inverted
	6	Z\	Reference pulse Z inverted
	7	B	Channel B
	8	B\	Channel B inverted
	---	Shield	Shield
	n. c. = not connected		

Input circuit	Incremental encoder
	Twisted pair, shielded Shield connection in the housing
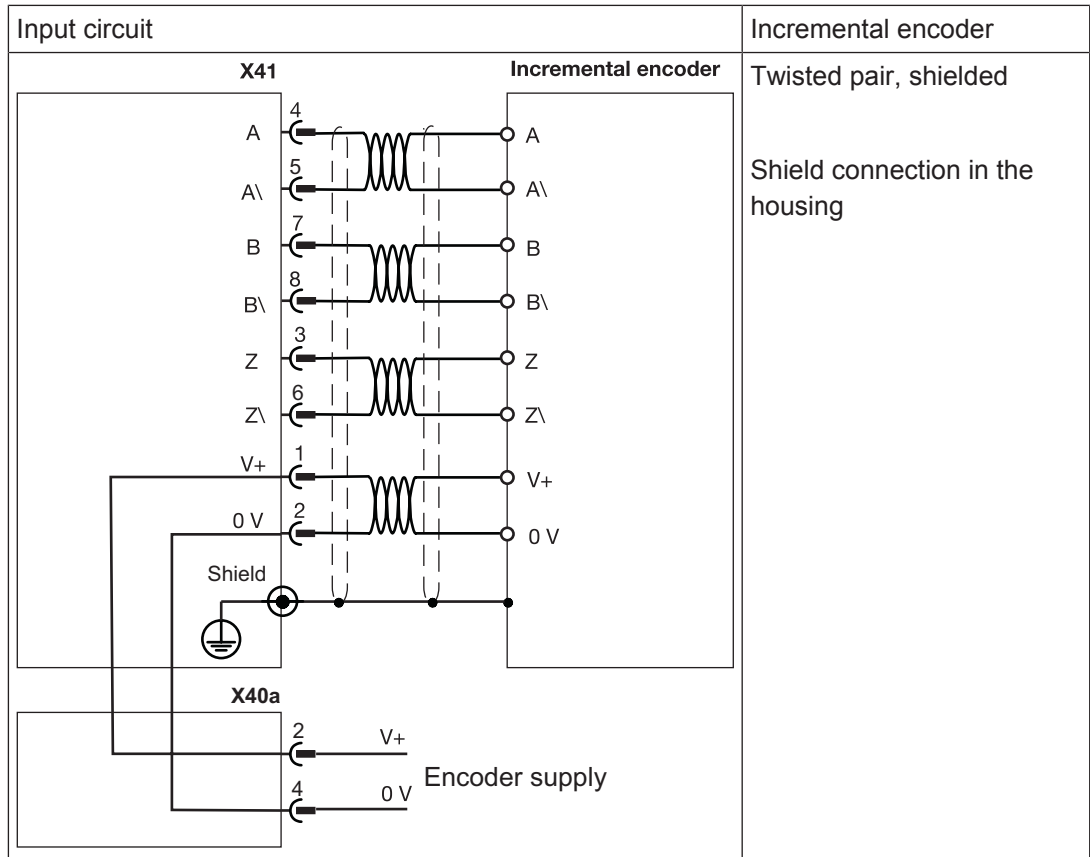
6.7.3 Absolute encoder with SSI interface
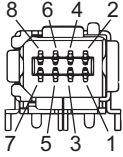
If the cable length is > 50 m, please speak to our Customer Support.

Mini-I/O socket X41,	Pin	Designation	Description
	1	V+	Supply voltage
	2	0 V	Supply voltage 0 V
	3	n. c.	---
	4	CLOCK	Pulse signal
	5	CLOCK	Pulse signal inverted
	6	n. c.	---
	7	DATA	Data
	8	DATA\	Data inverted
	---	Shield	Shield
	n. c. = not connected		

Input circuit	Absolute encoder with SSI interface
	Shielded Shield connection in the housing
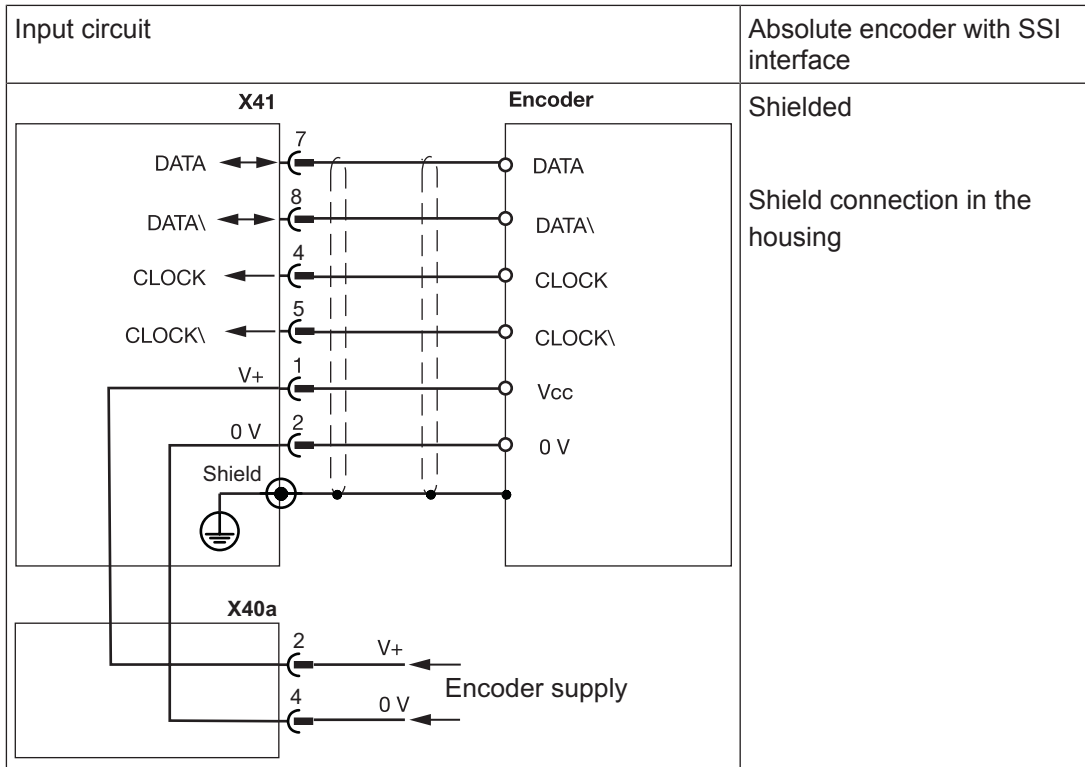
7   Commissioning

7.1   Safety guidelines

This chapter describes the communication between a PMCprimo C2 and a servo amplifier PMCprotego D during initial commissioning.

Further information on commissioning the servo amplifier can be found in the operating manual.

Please note the following safety guidelines during commissioning:

▶ When commissioning, you must ensure that the control systems do not present a risk to persons, plant or machinery. Appropriate protection and precautionary measures must be put in place.

▶ To avoid personal injury and material damage, only qualified, trained personnel should work on the devices. Qualified technical staff are those who are familiar with the transport, installation, commissioning, maintenance and operation of the device. They will be familiar with the relevant standards and regulations.

▶ Prior to commissioning the machine manufacturer must produce a hazard analysis for the machine and take appropriate measures to ensure that unexpected movements do not cause injury to people or damage to equipment.

▶ Only specialist staff with extensive knowledge of drive technology and control engineering should be permitted to program a running drive online.

▶ Data stored on data media is not protected from unintended changes by third parties. Data must be checked for accuracy before it is downloaded to the control system.

▶ Prior to installation and commissioning, information in this operating manual, and in particular the safety guidelines, must be carefully read and considered (see Chapter entitled "Safety"). Personal injury and material damage may result if devices are handled incorrectly.

▶ It is essential to comply with the technical details and specifications (type label and documentation).

▶ Life-threatening voltages up to 900 V are present. Check that all live connections are safely protected against contact.

▶ The heat sink and front plate temperature on the amplifier may reach 80 °C during operation. Check (measure) the temperature of the heat sink. Wait until the heat sink has cooled to 40 °C before touching it.

7.2   Commissioning the PMCprimo C2

7.2.1   Preparing for commissioning

PASmotion

Install the commissioning software PASmotion. The software is available on www.pilz.com.

Example 1 via CANopen/PROFIBUS DP interface: Connect PMCprimo C2 and PMC-protego D

Fig.: Connect PMCprimo C2 and PMCprotego D, example 1 via CANopen/PROFIBUS interface

Prerequisites:

▶ The motion controller PMCprimo C2 must be installed in a servo amplifier.

▶ A fieldbus junction box PMCprotego D.CAN-CANbus Adapter or PMCprotego D.CAN-PROFIBUS Adapter must be inserted.

Establish the following connections:

▶ Connect X42 on the motion controller to X6E on the fieldbus junction box using the supplied RJ45 cable.

▶ Connect the Ethernet interface X43 on the motion controller to the PC.

Example 2 via EtherCAT interface: Connect PMCprimo C2 and PMCprotego D.
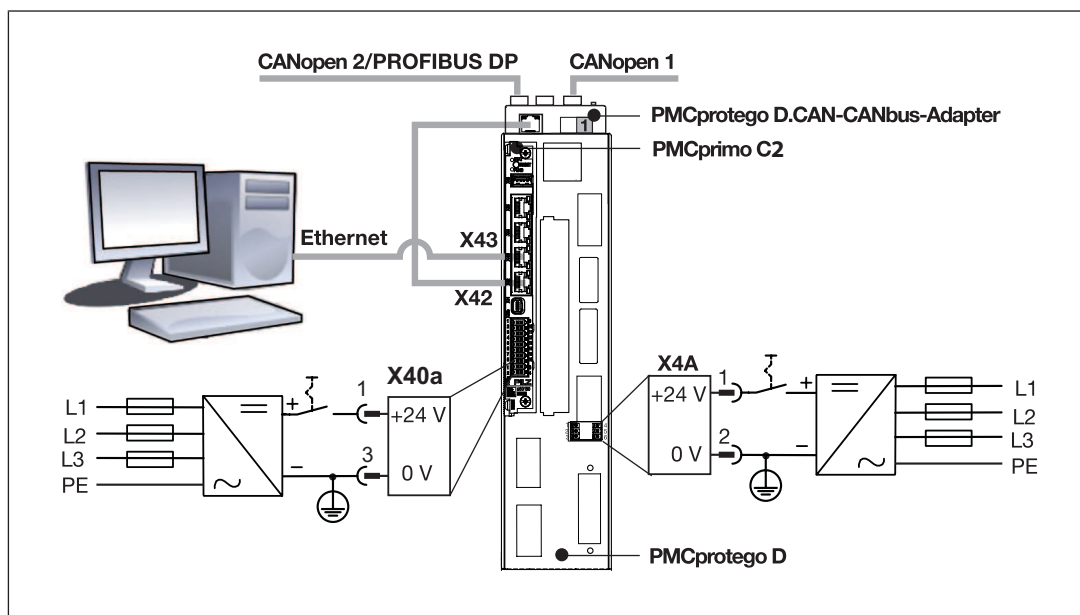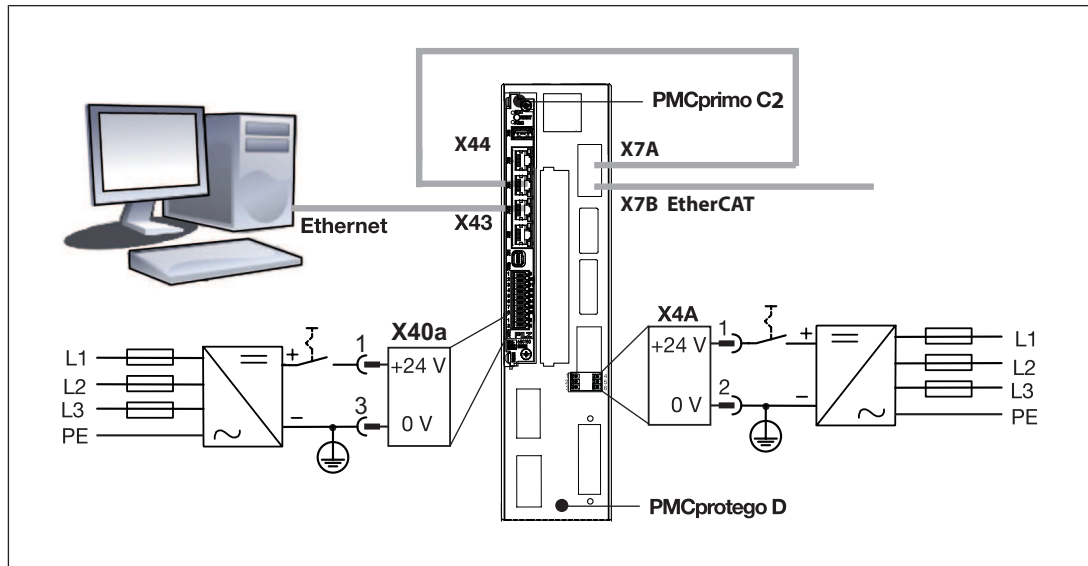

Fig.: Connect PMCprimo C2 and PMCprotego D, example 2 via EtherCAT interface

Prerequisites:

▸ The motion controller PMCprimo C2 must be installed in a servo amplifier.

Establish the following connections:

▸ Connect X44 on the motion controller to X7A on the PMCprotego D servo amplifier.

▸ Connect the Ethernet interface X43 on the motion controller to the PC.

Connect the supply voltages

▸ Servo amplifier:

– PMCprotego D.01 … D.24

X4A/1: 24 V

X4A/2: 0 V

– PMCprotego D.48 or PMCprotego D.72

X4/1: 24 V

X4/3: 0 V

▸ PMCprimo C2:

– X40a/1: 24 V

– X40a/3: 0 V

Apply the supply voltages

▸ Switch on the supply voltages for the motion controller and the servo amplifier's control element.

The devices start. The motion controller PMCprimo C2 scans the network for subscribers.

Logical axes are automatically assigned to the servo amplifiers in the motion controller if

▸ No configuration is stored on the motion controller.

▶   New servo amplifiers are detected in the existing configuration.

7.2.2 Establish communication between PMCprimo C2 and PC

The following steps describe how to establish a connection between the PC and motion controller via the Ethernet interface.

Prerequisite:

▶   The motion controller PMCprimo C2 must be installed in a servo amplifier PMCprotego D.

▶   The commissioning software PASmotion is installed on the PC.

▶   The supply voltages (24 VDC) must be present on the servo amplifier and PMCprimo C2.

▶   The configuration PC must be connected to the Ethernet interface X43 on the PMCprimo C2.

Establish connection

1. Start the commissioning software PASmotion.

2. Select the *Terminal* window.

3. Click on the icon   - *Create New Connection*.

    The *Connection Settings* window opens.

You can now connect to a known network subscriber. If you do not know the IP address, you can browse the network for subscribers.

Alternative 1: The IP settings are known

▶   Prerequisite: The PMCprimo C2 and PC must be in the same network or be accessible via a Router.

1. Select *Ethernet*.

    The *New Connection* window opens.

2. Enter the *IP address* in the connection settings and select *Finish*.

    The connection to the PMCprimo C2 is established.

Alternative 2: The IP settings are unknown

▶   Prerequisite: The PMCprimo C2 and the PC are in the same broadcast domain.

1. Select *Ethernet*.

2. From the list, select the subscriber to which you wish to connect.

    Note: Click on *Ping* to identify the device's hardware.

3. Select *Configuration…* The *Device Configuration* window opens.

4. Enter the IP settings and then select *Use this IP address*. The *Connection Wizard* window opens.

5. Select *Finish*.

    The network subscriber is connected.

The motion controller reports on the configuration, once the Ethernet connection has been established.

```
0.1:        Hw1
0.1:
```

```
SOFTWARE
            Firmware:           03.04.00.08, Mar 19 2018, 12:01:18
            Motion:             INSTALLED
            IEC PLC:            INSTALLED
            Interpolation:      NOT INSTALLED
```

```
ETHERNET
            IP ad-              192.168.0.11
            dress
            Netmask             255.255.255.0
            Gateway             0.0.0.0
```

```
CHANNELS
            Number              1...10
```

```
HARDWARE
            Type:     PMCprimo C2 1300MHz CAN/Profibus
            Item No.:           680180
            Ser. No.:           111111
            Pr. Ver.:           1.0
            Encoder             1
            Inputs:             8
            Outputs:            8
            Virtual inputs:     56
            Virtual outputs:    56
            Analogue inputs:    0
            Analogue outputs:   0
DEVICES in CAN Network:
            PMCprotego D (S703) at CAN1 ADDR 1 found (DS402)
                  Inputs:       5
                  Outputs:      1
                  Virtual in-   17
                  puts:
                  Virtual out-  19
                  puts:
                  Analogue in-  2           Inputs linked to
                  puts:                     channel from 0.1
                                            to 0.2
```

```
DEVICES in EtherCAT Network:
No EtherCAT device found (919)
0.1:


0.1: hw2
0.1:
No EtherCAT device found (919)
STATE OF DEVICES:
          Device      Network    Addr CH   FS VN          State


--------------------------------------------------------------------------------
          Device
          PMCprimo C2 ---        --- ---   3.2.0          ACTIVE
          PMCprot-     CAN1          1     --- 6.12        ACTIVE
          ego D
0.1:
```

The motion controller is ready for operation. It reports with the command prompt 0.1:. Key:

Charac-ter	Meaning	Details		
0	Address of the controller (always 0 on PM-Cprimo C2)			
.	Decimal point			
1	Number of current axis			
:	Status indicator of current axis	>	Control loop closed	
		:	Control loop open	
		A	Axis executes alignment movement	
		C	Axis executes coupling process	
		I	Initialisation running	
		M	Axis executes positioning	
		S	Axis executes stop command	
		V	Axis is in speed control	
		W	Axis is in standby	
		X	Position assignment is active on the axis	

7.2.3   Adapt basic configuration of PMCprimo

The basic configuration of the motion controller can be amended in the terminal program using the "CD" command.

```
0.1: cd
```

```
0.1:
A C T U A L C O N F I G U R A T I O N:
Operate Mode:           STANDALONE
(24) Cycle Time:         1000 µs
( 4) Actual IP address:  192.168.0.11
( 4) Actual Netmask:     255.255.255.0
( 4) Actual Gateway:     0.0.0.0
(12) Number of Channels: 10
(27) Channel for en-     1
coder:
( 9) CAN node address:   50
( 3) CAN1 baudrate:      1000 KBit
( 8) CAN1 cycle time:    4 ms
(16) Startup delay:      0 s
(22) CAN-mode:           CAN1: Master
(26) PMCprotego with SD- 1000
Card:
(34) PROFIBUS/CAN:       PROFIBUS
(35) Codesys:            Version 3
(36) No CAN reserved for
Codesys
---- Configuration PROFIBUS is not valid for SoftSPS! ----
(11) PROFIBUS Address:   5
( 5) PROFIBUS IN/OUT     10 (Words)
Length:
( 6) PROFIBUS Offset:    0
(28) Modbus Client       not active
*****************************************

0:   Exit menu
2:   Delete application data
3:   Change CAN1 baudrate
4:   Change Ethernet
5:   Change in/out length for Profibus
6:   Change offset for Profibus
8:   Set CAN1 Cycle time
9:   Set CAN address
11:  Change Profibus address
12:  Change number of channels
16   Change startup delay
22:  Enable slave mode for CAN
23:  Set CAN2 cycle time
```

```
24:  Change cycle time of system
26:  Set address for PMCprotego with SD-Card
27:  Change channel for encoder
28:  Set number of ModbusClient
29:  Change ModbusClient Parameter
34:  Activate PROFIBUS/CAN
35:  Set Codesys Version
36:  Reserve CAN for Codesys
Choice [Return; ESC exits menu]:
```

Once you exit the menu the basic configuration is active and saved, if changes have been made. It may be necessary to reboot the motion control system for the changes to take effect.

7.2.4 Configure servo amplifier

Parameters for the servo amplifiers available in the network can be set using the commissioning software PASmotion.

Please note the following prerequisites:

▶ The servo amplifier must not be enabled (ENABLE = 0).

▶ The mains voltage for the servo amplifier's power element must be switched off.

▶ The 24 VDC supply voltage for the servo amplifier's control element must be present.

▶ The CANopen network must be configured for the motion control system and servo amplifier

Further information is available in the operating instructions for the servo amplifier.

7.2.5 Operate PMCprimo C2

You can operate the motion controller in the commissioning software terminal by issuing commands in the command language.

HW1 - Show Hardware

```
0.1: hw1
0.1:
SOFTWARE
    Firmware:      3.2.0, Dec 16 2014, 13:20:52
    Motion:        INSTALLED
    IEC PLC:       INSTALLED
    Interpolation: INSTALLED

ETHERNET
    IP address    192.168.0.11
    Netmask       255.255.255.0
```

```
    Gateway          192.168.0.1

CHANNELS
    Number           1...32

HARDWARE
    Type:            PMCprimo C2 600MHz CAN/CAN
    Item No.:        680055
    Ser. No.:        111
    Pr. Ver.:        1.0
    Encoder:         1
    Inputs:          6
    Outputs:         6
    Virtual in-      56
    puts:
    Virtual out-     56
    puts:
    Analogue in-     0
    puts:
    Analogue out-    0
    puts:

DEVICES in CAN Network:
    PNOZmulti (DS401) at CAN1 ADDR 14 found.
    Inputs:          24
    Outputs:         24

    CAN-I/O (DS401) at CAN1 ADDR 23 found: PSSuniversal
    Inputs:          32
    Outputs:         32
    Analogue in-     2 inputs linked to channel from 0.1 to 0.2
    puts:
    Analogue out-    2 outputs linked to channel from 0.1 to 0.2
    puts:

    PMCtendo DD4 (SD01) at CAN1 ADDR 13 found (DS402)
    Inputs:          2
    Outputs:         0
```

HW2 - Show Hardware State

```
0.1: HW2
0.1:
STATE OF DEVICES:
    Device                Network   Addr   CH    FS    VN      State
    --------------------------------------------------------------------------
    PMCprimo C2           ---       ---    ---   ---   3.2.0   ACTIVE
    PNOZmulti             CAN1      14     ---   ---   ---     ACTIVE
    CAN-I/O               CAN1      23     ---   ---   ---     FAULT
    PMCtendo DD4          CAN1      13     2     27    5.180   FAULT
```

7.3 Install CODESYS

The development environment for programming in accordance with IEC 61131-3 CODESYS can be found in the software package "PMC Programming Tool". The software package is available on the Internet at www.pilz.de.

After downloading

⇨ Unpack the Zip file,

⇨ Start the installation program.

The PMCprimo Target Package is installed.

8   Operation

8.1   Operating states and changes in operating status

8.1.1   Status graph

The following status graph shows the operating states and changes in operating status. The priority of a transition is indicated by a number in a small square in the middle of the transition arrow. The operating states and changes in operating status are described in detail below.
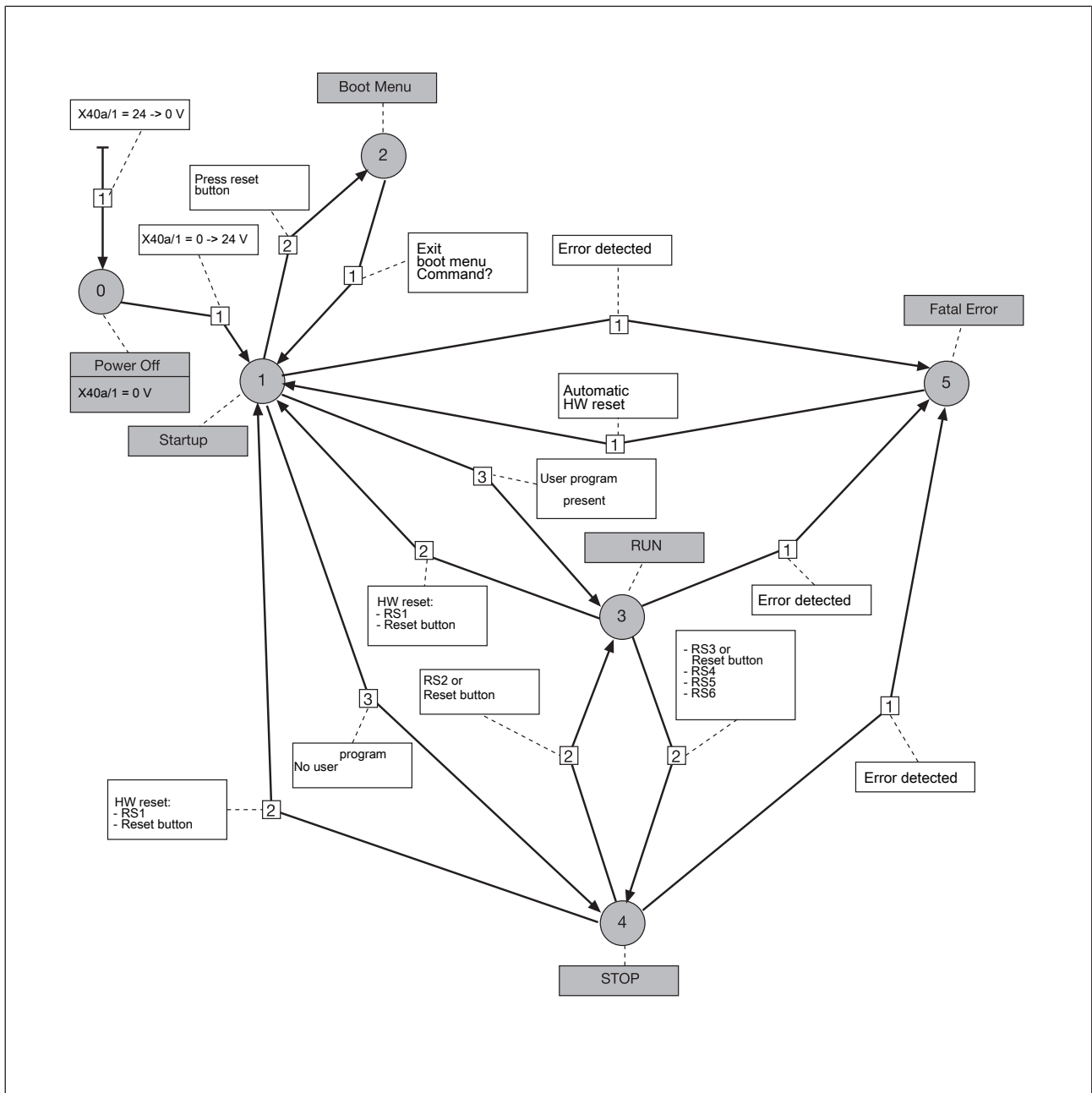
Fig.: Operating states and changes in operating status of the motion controller

8.1.2 Operating states

8.1.2.1 "Power Off" operating status

In the "Power Off" operating status, the motion controller PMCprimo C2 is voltage-free. By switching on the supply voltage, the system changes to the "Startup" operating status.

8.1.2.2 "Startup" operating status

The following steps are performed in the "Startup" operating status:

▶ Initialise hardware

▶ Initialise fieldbus interfaces

▶ Load operating system

▶ Load user program

If no errors are detected during "Startup", the controller changes to

▶ "RUN" status, if a user program has been loaded.

▶ "STOP" status, if **no** user program has been loaded.

Status of LEDs:

▶ "STAT" LED flashes yellow, "FUNC" LED off: "Startup" operating status active

▶ "STAT" LED flashes green for 4 s when startup has been run. During this time it's possible to change to "Boot Menu" operating status.

Change to "Boot Menu":

▶ Press the reset button while the "STAT" LED flashes green.

8.1.2.3 "Boot Menu" operating status

In the "Boot Menu" operating status, the operating parameters for the motion controller can be configured in the command language in the terminal program using the CD command, e.g.

▶ Configuration of the interfaces

▶ Deletion of the user program

Prerequisite:

▶ The PC and motion controller must be connected via the Ethernet interface.

Status of LEDs:

▶ "STAT" LED: Flashes green

▶ "FUNC" LED: Lights up yellow

8.1.2.4 "RUN" operating status

In "RUN" operating status

▶ All system sections are in a RUN condition and are operating without error.

▶ A PLC user program is run as part of each cycle.

▶ It is possible to communicate with the motion controller in the terminal program via the command language.

Status of LEDs:

▶ The "STAT" and "FUNC" LEDs light up green.

8.1.2.5 "STOP" operating status

In "STOP" operating status

▶ No user program is run.

▶ The system is operating without error.

▶ It is possible to communicate with the motion controller in the terminal program via the command language.

Status of LEDs:

▶ "STAT" LED: Lights up green

▶ "FUNC" LED: Off

8.1.2.6 "Fatal Error" operating status

"Fatal Error" operating status is reached when an error occurs.

▶ The function is disrupted long-term The operating status is adopted temporarily.

▶ The motion controller automatically changes back to "Startup" operating status.

▶ The error is entered in the error stack.

Status of LEDs:

▶ The "STAT" and "FUNC" LEDs light up red.

8.1.3 Change in operating status

--> (0) **All operating states change to "Power Off"**

The system changes to "Power Off" operating status when the 24 VDC supply voltage has been switched off.

(0) --> (1) **Change from "Power Off" to "Startup"**

The system changes to "Startup" operating status when the 24 VDC supply voltage has been switched on.

(1) --> (2) **Change from "Startup" to "Boot Menu"**

The "STAT" LED flashes green for 4 s, if the "Startup" operating status has been run without error.

▶ Press the reset button during this time to change to "Boot Menu" operating status.

(1) --> (3) **Change from "Startup" to "RUN"**

"Startup" operating status has been run without error. The system changes to "RUN" status if a user program was loaded in "Startup" status.

(1) --> (4) **Change from "Startup" to "STOP"**

"Startup" operating status has been run without error. The system changes to "STOP" status if **no** user program was loaded in "Startup" status.

(1) --> (5) **Change from "Startup" to "Fatal Error"**

The system changes to "Fatal Error" status if an error occurred in "Startup" status.

(2) --> (1) **Change from "Boot Menu" to "Startup"**

The system changes to "Startup" status if the "Boot Menu" in the terminal program is exited using the command O or ESC.

(3) --> (1) **Change from "RUN" to "Startup"**

The system performs a hardware reset after

▸   Running the command RS1 in the terminal program (cold start).

▸   Holding down the reset button for a long period (> 4 s) (alternative to RS1 command).

(3) --> (4) **Change from "RUN" to "STOP"**

The system performs this status change after

▸   Running the following commands in the terminal program:

    –   RS3 (change to "STOP")

    –   RS4 (warm reset), stops the user program

    –   RS5 (cold reset), stops the user program

    –   RS5 (original reset), deletes the user program

▸   Running commands in the IEC 61131 development environment.

▸   Holding down the reset button for a short period (< 4 s) (alternative to RS3 command, change to "STOP").

(3) --> (5) **Change from "RUN" to "Fatal Error"**

The system changes to "Fatal Error" status if an error occurred in "RUN" status.

Remedy

▸   Delete user program

▸   Firmware update

(4) --> (1) **Change from "STOP" to "Startup"**

The system performs a hardware reset after

▸   Running the command RS1 in the terminal program (cold start).

▸   Holding down the reset button for a long period (> 4 s) (alternative to RS1 command (cold start)).

(4) --> (3) **Change from "STOP" to "RUN"**

The system performs this status change after

- ▸ Running the command RS2 in the terminal program (change to "RUN").
- ▸ Running commands in the IEC 61131 development environment:
- ▸ Holding down the reset button for a short period (< 4 s) (alternative to RS2 command (change to "RUN")).

④ --> ⑤ **Change from "STOP" to "Fatal Error"**

The system changes to "Fatal Error" status if an error occurred in "STOP" status.

Remedy

- ▸ Delete user program
- ▸ Firmware update

⑤ --> ① **Change from "Fatal Error" to "Startup"**

"Fatal Error" operating status is only adopted temporarily after an error has occurred. The motion controller automatically changes to "Startup" operating status.

The error is entered in the error stack.

8.2 Reset, restart, start and stop options

8.2.1 Overview

Various options are available to specifically stop or start the motion controller, for operation or commissioning for example. The implications of intervening depend on the specific command that is used.

Options	Action	Command language	IEC 61131 programming
Cold start motion controller	Cold start (HW reset)	RS1 (alternative: Hold down reset button for long period (> 4 s))	
Stop user program	Stop	RS3 (alternative: Hold down reset button for short period (< 4 s))	Online --> Stop
Start user program	Start	RS2 (alternative: Hold down reset button for short period (< 4 s))	Online --> Start
Reset motion controller	Cold reset	RS5	Online --> Reset (cold)
	Warm reset	RS4	Online --> Reset
	Original reset	RS6	Online --> Reset (original)

The following table provides an overview of the impact of a reset, start or stop on a variable.

Action	Variable with attribute RETAIN	Variable with attribute PERSISTENT	Variable with attribute RETAIN PERSISTENT
Warm reset	x	-	x
Cold reset	-	-	-
Original reset	-	-	-

x = Value is retained, - = Value is re-initialised

8.2.2 Cold start, "Startup"

A reset via the "Power Off" operating status performs a system cold start with "Startup".

▸ Switch the 24 VDC supply voltage to the motion controller off and then on again.

▸ The motion controller changes to "Startup" operating status.

8.2.3 Reset commands

8.2.3.1 Warm reset

This command

▸ Stops the user program.

▸ Resets all variables to the value with which they were initialised (exception: variable with attribute RETAIN).

▸ Resets all variables that have not been explicitly initialised to a default initialisation value.

Commands:

▸ Command language: RS4

▸ IEC 61131 programming: Menu *Online -> Reset*

8.2.3.2 Cold reset

This command

▸ Stops the user program.

▸ Resets all variables to the value with which they were initialised.

Commands:

▸ Command language: RS5

▸ IEC 61131 programming: Menu *Online -> Reset (cold)*

8.2.3.3 Original Reset

This command

▸ Deletes the user program.

▸ Resets all variables to the value with which they were initialised (including remanent variables with attribute RETAIN and PERSISTENT).

▸ Resets the motion controller to its original condition (factory defeault settings).

Commands:

▸ Command language: RS6

▸ IEC 61131 programming: Menu *Online -> Reset (original)*

8.2.4 Start and stop commands

The user program can be started and stopped via commands in command language or in the IEC 61131 development environment. Start and stop commands are used to change between the operating states "RUN" and "STOP".

Stopping the user program

The stop command

▸ Changes the controller's operating status from "RUN" to "STOP".

▸ Stops the user program.

Commands:

▸ Command language: RS3

▸ IEC 61131 programming: Menu **Online -> Stop**

▸ Hold down reset pushbutton for short period (< 4 s)

Starting the user program

The start command

▸ Changes the controller's operating status from "STOP" to "RUN".

▸ Starts the user program.

Commands:

▸ Command language: RS2

▸ IEC 61131 programming: Menu **Online -> Start**

▸ Hold down reset pushbutton for short period (< 4 s)

8.3 Functions of the reset button

The "RESET" button is mounted in a recess on the front of the unit. It can only be accessed using an appropriate tool (e.g. a pin).

The following actions can be triggered by pressing the "RESET" button:

▸ Change from "Startup" operating status to "Boot Menu"

▸ Hardware reset (cold start): Change from "RUN" or "STOP" operating status to "Startup"

▸ Change from "RUN" operating status to "STOP"

▸ Change from "STOP" operating status to "RUN"

▸ A USB stick must be inserted: the data stored on the USB stick is copied to the controller. The data can contain a new firmware with a complete project.

Change from "Startup" operating status to "Boot Menu"

After cold starting the motion controller you can change to the "Boot Menu" in order to set the operating parameters.

Proceed as follows:

▸ The controller is in "Startup" operating status. LED flashes rapidly.

‣ The LED lights for 4 s continuously after "Startup" has been run. During this time it's possible to change to "Boot Menu" operating status.

‣ Press the reset button while the LED is lit continuously.

‣ The controller changes to "Boot Menu".

Hardware reset (cold start)

A hardware reset can be triggered in "RUN" or "STOP" operating status. The controller changes to "Startup" operating status.

Proceed as follows:

‣ The controller is in "STOP" or "RUN" operating status.

‣ Hold the reset button down for at least 4 s.

‣ The controller changes to "Startup".

Changing between the operating states "RUN" and "STOP"

You can change between the operating states "RUN" and "STOP".

‣ Briefly press the reset button to change from "RUN" to "STOP" or from "STOP" to "RUN".

8.4   Messages

The motion controller provides many options for diagnostics, fault detection and communication with other controllers.

Diagnostics can be performed via

‣ The LEDs on the front of the device.

‣ The error stack.

‣ PVIS expanded diagnostics.

‣ Display commands.

‣ Recording of process data.

LEDs

LEDs on the front of the device provide information on the operating status (see section on "Display elements" in this chapter).

Error stack

The error stack contains the last 100 error messages. It can be read in the operating status "RUN" and "STOP".

‣ Select the LE1 command in the terminal program.

PVIS

Errors, messages and the corresponding remedies are displayed in the expanded diagnostics system PVIS.

Display commands

Display commands for recording process data are axis-related. They are used to display motion control data, e.g. position, speed, tracking distance. Display commands can be executed in the operating status "RUN" and "STOP".

‣ To start display mode, select the DM command in the terminal program.

‣ To end display mode, select the DO command in the terminal program.

Process data

Process data can be recorded in the operating status "RUN" and "STOP" via the

▶ Motion controller

▶ Terminal program.

▶ Oscilloscope function PScope.
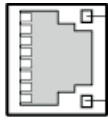
8.5 Display elements
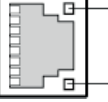
The motion controller has two multi-coloured "STAT" and "FUNC" LEDs for displaying the operating status.

STAT	FUNC	Description
Yellow	Yellow	Firmware update is running
Yellow	●	"Startup" operating status active
Green	●	Reset button can be pressed in order to perform an action (4 s duration)
Green	Yellow	Controller is in "Boot Menu" operating status
Green	Green	Controller is in "Startup" operating status
Red	Red	Fatal error, "Fatal Error" operating status
Green	Green	Controller is in "RUN" operating status
Green	●	System is in "STOP" operating status
Green	Blue	Identification (Ping)
Blue	Blue	Data storage for device exchange (see USB)

▶ Legend

☀	LED on
●	LED off
◖	LED flashes

LED		Meaning		
X42 CAN1 CAN2	CAN1	☀Green	Network connection	
		●	No network connection	
	CAN2	☀Yellow	Network connection	
		●	No network connection	

LED		Meaning		
LINK TRAFFIC X43, X44, X45	LINK	☀Green	Network connection	
		●	No network connection	
	TRAFFIC	☀Yellow	Data traffic	
		●	No data traffic	

9   Technical details

General	
Approvals	**CE**
Application range	**Standard**
Electrical data	
Supply voltage	
for	**Supply**
Voltage	**24 V**
Kind	**DC**
Voltage tolerance	**-15 %/+20 %**
Output of external power supply (DC) at no load	**10 W**
Max. power dissipation of module	**10 W**
Permitted loads	**inductive, capacitive, resistive**
CPU	
Memory for applications	**256 MB**
Processor clock speed	**1,3 GHz**
Typ. processing time/1000 instructions	**2 µs**
Working memory (RAM)	**512 MB**
Non-volatile ST memory	**32 KB**
Absolute encoder input	
Number of counter inputs	**1**
Type of counter inputs	**SSI encoder**
Connection type	**Mini-IO female connector, 8-pin**
Supply voltage for absolute encoder	**10 ... 30 VDC**
Output signal (clock)	**Differential signal (RS-422/TTL)**
Max. number of bits on the counter input	**12 - 32 Bit**
Transmission rate	**300 kHz**
Coding of the input signal	**Binary, Gray**
Signal at the data input	**Differential signal (RS-422/TTL)**
Potential isolation	**yes**
Incremental encoder input	
Number of inputs	**1**
Connection type	**Mini-IO female connector, 8-pin**
Supply voltage for incremental encoders	**10 ... 30 VDC, 4,75 ... 5,25 VDC**
Phase position for the differential signals A, /A and B,/B	**90° ±30°**
Maximum cutoff frequency	**0,5 MHz**
Inputs	
Number	**8**
Input filter depending on parameter settings	**5 µs, 600 µs**
Signal level at "0"	**-3 - +5 V DC**
Signal level at "1"	**15 - 30 V DC**
Input voltage in accordance with EN 61131-2 Type 1	**24 V DC**

Inputs	
Input current range	**3,5 - 10,8 mA**
Potential isolation	**yes**
Semiconductor outputs	
Number of positive-switching single-pole semiconductor outputs	**8**
External supply voltage	**24 V**
Voltage tolerance	**-15 %/+20 %**
Typ. output current at "1" signal and rated voltage of semiconductor output	**0,5 A**
Permitted current range	**0,5 A**
Potential isolation	**yes**
Short circuit-proof	**yes**
PROFIBUS-DP interface	
Number	**1**
Device type	**Slave**
Station address	**0 ... 126d**
Station address selectable via	**Software**
Maximum data length of PROFIBUS interface	
Input device	**244 Byte**
Output	**244 Byte**
Diagnostics	**80 Byte**
Connection	**RJ45**
Log	**DPV0**
Operating modes	**AutoBaud**
Description file	**Pilz0DCC.gsd**
Manufacturer's ID	**0DCCh**
CANopen interface	
Number	**1, 2**
Connection type	**RJ45**
Device type	**Master, Slave**
Cycle times	**1 ms, 2 ms, 4 ms**
Transmission rates	**1000 kBit/s, 250 kBit/s, 500 kBit/s**
Potential isolation	**yes**
Ethernet interface	
Number	**1**
IP address, factory setting	**192.168.0.11**
Connection type	**RJ45**
Transmission rate	**1 Gbit/s**
Potential isolation	**yes**
EtherCAT interface	
Quantity	**1**
Connection	**RJ45**
Transmission rates	**100 MBit/s**
Potential isolation	**yes**

Environmental data	
Climatic suitability	**EN 60068-2-1, EN 60068-2-14, EN 60068-2-2, EN 60068-2-78**
Ambient temperature	
In accordance with the standard	**EN 60068-2-14**
Temperature range	**0 - 40 °C**
Storage temperature	
In accordance with the standard	**EN 60068-2-1/-2**
Temperature range	**-40 - 70 °C**
Climatic suitability	
In accordance with the standard	**EN 60068-2-78**
Humidity	**93 % r. h. at 40 °C**
Condensation during operation	**Not permitted**
Max. operating height above sea level	**2000 m**
EMC	**EN 61131-2**
Vibration	
In accordance with the standard	**EN 60068-2-6**
Frequency	**5 - 8,4 Hz**
Amplitude	**3,5 mm**
Acceleration	**10 m/s²**
Shock stress	
In accordance with the standard	**EN 60068-2-27**
Acceleration	**150 m/s²**
Duration	**11 ms**
Cooling	**Built-in fan**
Airgap creepage	
In accordance with the standard	**EN 61131-2**
Overvoltage category	**II**
Pollution degree	**2**
Protection type	
In accordance with the standard	**EN 60529**
Housing	**IP20**
Terminals	**IP20**
Mounting area (e.g. control cabinet)	**IP54**
Potential isolation	
Potential isolation between	**Encoder and system voltage**
Type of potential isolation	**Basic insulation**
Rated surge voltage	**500 V**
Potential isolation between	**Ethernet and system voltage**
Type of potential isolation	**Basic insulation**
Rated surge voltage	**500 V**
Potential isolation between	**EtherCAT and system voltage**
Type of potential isolation	**Basic insulation**
Rated surge voltage	**500 V**
Potential isolation between	**SC output and system voltage**
Type of potential isolation	**Basic insulation**

Potential isolation	
Rated surge voltage	**500 V**
Potential isolation between	**Input and system voltage**
Type of potential isolation	**Basic insulation**
Rated surge voltage	**500 V**
Potential isolation between	**CANopen and system voltage**
Type of potential isolation	**Basic insulation**
Rated surge voltage	**500 V**
Mechanical data	
Material	
Front	**Steel 1.4016**
Top	**Polyester film**
Mounting type	**plug-in**
Conductor cross section with screw terminals	
Rigid single-core, flexible multi-core or multi-core with crimp connector	**0,75 mm²**
Dimensions	
Height	**173 mm**
Width	**18,5 mm**
Depth	**97 mm**
Weight	**200 g**

Where standards are undated, the 2014-06 latest editions shall apply.

10 Order reference

10.1 Product

Only the basic versions are listed. Please refer to the Type code for expansion details.

Product type	Features	Order no.
PMCprimo C2.0/C/C/2	Motion controller with configurable CANopen/PROFIBUS interface, 1.3 GHz, no software option	680 180
PMCprimo C2.0/C/C/3	Motion controller with configurable CANopen/PROFIBUS interface, 1.3 GHz, dynamic curve calculation	680 181
PMCprimo C2.0/C/C/4	Motion controller with configurable CANopen/PROFIBUS interface, 1.3 GHz, IEC 61131-3 programming	680 182
PMCprimo C2.0/C/C/5	Motion controller with configurable CANopen/PROFIBUS interface, 1.3 GHz, dynamic curve calculation and IEC 61131-3 programming	680 183
PMCprimo C2.0/C/C/6	Motion controller with configurable CANopen/PROFIBUS interface, 1.3 GHz, IEC 61131-3 programming and path interpolation	680 184
PMCprimo C2.0/C/C/7	Motion controller with configurable CANopen/PROFIBUS interface, 1.3 GHz, dynamic curve calculation, IEC 61131-3 programming and path interpolation	680 185

10.2 Accessories

Product type	Features	Order no.
PMCprotego D.CAN-CANbus Adapter 01-24A incl. RJ45 connection cable	Fieldbus junction box with two CANopen interfaces for PMCprotego D.01 … D.24	680040
PMCprotego D.CAN-CANbus Adapter 48-72A incl. RJ45 connection cable	Fieldbus junction box with two CANopen interfaces for PMCprotego D.48/D.72	680042
PMCprotego D.CAN-PROFIBUS Adapter 01-24A incl. RJ45 connection cable	Fieldbus juction box with one CANopen interface and one PROFIBUS interface for PMCprotego D.01 … D.24	680041
PMCprotego D.CAN-PROFIBUS Adapter 48-72A incl. RJ45 connection cable	Fieldbus juction box with one CANopen interface and one PROFIBUS interface for PMCprotego D.48/D.72	680043

Product type	Features	Order no.
Cable PMCprimo mini-I/O>enc. SubD9 0.75m	Adapter cable 0.75 m Mini-I/O connector - Sub-D socket, 9-pin (for encoder)	680044