Motion Control PMC

pilz
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safe automation

PMCprimo Drive2

Installation Manual – Item No. 21 486-02

1 General conditions

1.1 Copyright

1.2 Notes

Pilz GmbH & Co. KG reserves the right to make amendments to this document at any time.

The examples given serve only as illustrations. No guarantee is given for their suitability in particular applications. Although the utmost care has been taken in the production of this document, no liability can be accepted for any mistakes that it may contain. We welcome any suggestions for the improvement of our products, or documentation.

We reserve the right to make technical changes, which lead to the improvement of the product!

1.3 Previous editions

Edition	Comments
V1	Initial release
V2	Revision

2 Table of contents

3 Type key

To be included when ordering, please state	Type	Voltage
Order number	PMCprimo Drive2 . _ _ / _ _ / _	230-480 VAC

Current	Size
1,5A	01
3A	03
6A	06
10A	10
14A	14
20A	20

	2	3	4	5	6	7
without	■					
Motion		■		■		■
Software SPS			■	■	■	■
Interpolation					■	■

	11	16	21	22	23	24	25	26
without	■							
switching relay AS		■		■		■		■
expansion board (1)			■	■			■	■
Profibus-DP/S Small (2)					■	■	■	■

Bus systems standard: CANopen, Modbus

(1) Expansion board with:
Compactflash
Ethernet
Second CAN-Bus
Realtime clock
Battery backed RAM

(2) In case of an activated Profibus-DP-IC the Modbus is without function

4 Safety instructions

- **Only properly qualified personnel are permitted to perform activities such as transport, installation, commissioning and maintenance. Properly qualified persons are those who are familiar with the transport, assembly, installation, commissioning and operation of the product, and who have the appropriate qualifications for their job. The qualified personnel must know and observe:**
  IEC 364 and CENELEC HD 384 or DIN VDE 0100
  IEC-Report 664 or DIN VDE 0110
  National Accident Prevention Regulations or BGV A2

- **Read this documentation before carrying out installation and commissioning. Incorrect handling of the PMCprimo Drive can lead to personal injury or material damage. It is vital that you keep to the technical data and information on connection requirements (on the nameplate and in the documentation).**

- **The PMCprimo Drive2 contains electrostatically sensitive components which may be damaged by incorrect handling. Discharge your body before touching the PMCprimo Drive2. Avoid contact with highly insulating materials (synthetic fibre, plastic film etc.). Place the PMCprimo Drive2 on a conductive surface.**

- **Do not open the units. Keep all covers and switchgear cabinet doors closed during operation. Otherwise there are deadly hazards, with the possibility of severe danger to health or material damage.**

- **During operation, PMCprimo Drives, according to their degree of enclosure protection, may have uncovered live components. Control and power connections may be live, even if the motor is not rotating.**

- **PMCprimo Drives may have hot surfaces during operation. Since the front panel is used for cooling, it can reach temperatures above 80°C.**

- **Never undo the electrical connections to the PMCprimo Drive2 while it is live. There is a danger of electric arcing with damage to contacts and danger to persons.**

- **Wait at least five minutes after disconnecting the PMCprimo Drive2 from the mains supply voltage before touching live sections of the equipment (e.g. contacts) or undoing connections. Capacitors can still have dangerous voltages present up to five minutes after switching off the supply voltages. To be sure, measure the voltage in the DC-link circuit and wait until it has fallen below 40V.**

- **Based on the guideline 94/9/EC (ATEX guideline) this product is not suitable for the application in potential explosive areas without evaluation of the conformity.**

5 European directives and standards

Servo amplifiers are components that are intended to be incorporated into electrical plant and machines forindustrial use. When the servoamplifiers are built into machines or plant, the intended operation of the amplifier is forbidden until it has been established that the machine or plant fulfills the requirements of the EC Machinery Directive 98/37/EG and the EC Directive on EMC (89/336/EEC).

To fulfill the EC Machinery directive (98/37/EG), the following standards have to be applied: EN 60204-1 (Safety and electrical equipment of machines) EN 292 (Safety of machines)

The manufacturer of the machine must produce a hazard analysis for the machine and take appropriate measures to ensure that unforeseen movements do not result in personal injury or material damage.

To fulfill the Low Voltage Directive 73/23/EEC, the following standards have to be applied:

EN 60204-1	(Safety and electrical equipment of machines)
EN 50178	(Equipment of high voltage plant with electronic devices)
EN 60439-1	(Low-voltage switchgear and controlgear assemblies)

To fulfill the EC EMC regulations (89/336/EEC), the following standards have to be applied:

EN 61000-6-1 or EN 61000-6-2 (noise immunity within the domestic range/industrial range)

EN 61000-6-3 or EN 61000-6-4 (noise emission within the domestic range/industrial range)

The manufacturer of the machine or plant is responsible for ensuring that they meet the limits required by the EMC regulations. Advice on the correct installation for EMC – such as shielding, grounding, arrangement ofconnectors and cable routing – can be found in this documentation.

The machine / plant manufacturer must examine whether with its machine / plant still further or other standards or EEC guidelines are to be used.

ce- conformance

Conformity with the EC Directive on EMC 89/336/EEC and the Low Voltage Directive 73/23/EEC is mandatory for servoamplifiers supplied within the European Union. To fulfill the EMC directive, the standard EN 61800-3 is applied.

In the reference to noise immunity and noise emission the servoamplifier fulfills the requirement to the category second environment (industrial environment).

The servo amplifiers have been tested by an authorized testing laboratory in a defined configuration with the system components which are described in this documentation. Any divergence from the configuration and installation described in this documentation means that you will be responsible for carrying out new measurements to ensure that the regulatory requirements are fulfilled.

To fulfill the Low Voltage Directive, the standard EN 50178 has to be applied.

UL and cUL- Conformance

UL (cUL)-certified servo amplifiers (Underwriters Laboratories Inc.) fulfil the relevant U.S. and Canadian standard (in this case UL 840 and UL 508C).

This standard describes the fulfillment by design of minimum requirements for electrically operated power conversion equipment, such as frequency converters and servo amplifiers, which is intended to eliminate the risk of fire, electric shock, or injury to persons, being caused by such equipment.

The technical conformance with the U.S. and Canadian standard is determined by an independent UL (cUL) fire inspector through the type testing and regular check-ups.

Apart from the notes on installation and safety in the documentation, the customer does not have to observe any other points in direct connection with the UL (cUL)-certification of the equipment.

UL 508C

UL 508C describes the fulfillment by design of minimum requirements for electrically operated power conversion equipment, such as frequency converters and servo amplifiers, which is intended to eliminate the risk of fire being caused by such equipment.

UL 840

UL 840 describes the fulfillment by design of air and insulation creepage spacings for electrical equipment and printed circuit boards.

6 Abbreviations and symbols

The abbreviations used in this manual are explained in the table below.

Abbrev.	Meaning
AGND	Analog ground
BTB/RTO	Ready to operate
CAN	Controller area network- Bus system
CE	Communité Europeenne
CLK	Clock
COM	Serial interface of a PC-AT
DGND	Digital ground
DIN	Deutsches Institut für Normung
Drive	Servo amplifier
EGND	Ground for PMCprimo Drive2, RS232 and encoder
EMC	Electromagnetic compatibility
EN	Europäische Norm
ESD	Electrostatic discharge
IEC	International Electrotechnical Commission
IGBT	Insulated Gate Bipolar Transistor
ISO	International Standardization Organization
MODBUS	Serial protocol for operator manuals
NI	Zero pulse
RBallast	Regen resistor
RBext	External regen resistor
RBint	Internal regen resistor
RES	Revolver
PLC	Programmable logic controller
SRAM	Static RAM
SSI	Synchronous serial interface
TN/TT-Netz	Mains standard DIN 57100 T310
UL	Underwriter Laboratories
V AC	AC voltage
V DC	DC voltage
VDE	Verein deutscher Elektrotechniker
VGA	Grafical display with min. 640x480 pixels
XGND	Ground for the 24V supply

	Meaning/Description
	This symbol indicates the possibility of a danger, risk to life and/or health. Ignorance may seriously affect health and cause dangerous injuries.
	This symbol indicates the possibility of a danger, risk to life and/or health from electricity and its effects.
	This symbol indicates important instructions regarding the correct use of the product. Ignorance may affect the performance of the machinery and/or the connected system.
	This symbol indicates special user tips and/or important useful information. These will support optimum use of the product and functions.
●	Emphasis
⇒	see page (or cross reference)

7 General

7.1 About this manual

This manual describes the digital control system PMCprimo Drive2.

Here you can find information about:

The programming of the PMCprimo-motion control-systems is described explicitely in the PMCprimo programming manual.

Useful hints about linking controls and CANopen devices via CAN bus can be found in the manual „PMCprimo CAN network“.

Both manuals are part on the CD-ROM PMCprimo Motion Control Tools.

7.2 Requirements

Transport:	**only by personnel with knowledge in handling electrostatically sensitive components.**
Installation:	**only by electrically qualified personnel**
Commissioning:	**only by personnel with extensive knowledge of electrical engineering technology**

7.3 Prescribed use (Use as directed) of the control

The servo amplifiers are components which are built into electrical equipment or machines, and can only be used as integral components of such equipment.

The manufacturer of the machine must generate a hazard analysis for the machine, and take appropriate measures to ensure that unforeseen movements cannot cause injury or damage to any person or property.

The PMCprimo Drive2 family of servo amplifiers can be connected directly to symmetrically earthed (grounded) three-phase industrial mains supply networks [TN-system, TT-system with earthed (grounded) neutral point, not more than 5000 rms symmetrical amperes, 480 VAC maximum].

The servo amplifiers must not be operated directly on power supply networks >230 V without an earth (ground) or with an asymmetrical earth (ground).

Connection to different mains supply networks (with additional isolating transformer) (page 16).

Periodic overvoltages between outer conductor (L1, L2, L3) and housing of the servo amplifier may not exceed 1000 V (peak value).

Transient overvoltages (< 50µs) between the outer conductors may not exceed 1000 V.

Transient overvoltages (< 50µs) between outer conductors and housing may not exceed 2000 V.

If the servo amplifiers are used in residential areas, or in business or commercial premises, then additional filter measures must be implemented by the user.

The PMCprimo Drive2 family of servo amplifiers is intended to drive specific brushless synchronous servomotors, with closed-loop control of torque, speed and/or position. Asynchronous and linear motors can also be used. The rated voltage of the motors must be at least as high as the DC-link voltage of the servo amplifier.

The servo amplifiers may only be operated in a closed switchgear cabinet, taking into account the ambient conditions defined on page 21 and the dimensions shown on page 34. Ventilation or cooling may be necessary to prevent enclosure ambient from exceeding 45 °C (113 °F).

Use only copper wire. Wire size may be determined from EN 60204 (or table 310-16 of the NEC

60 °C or 75 °C column for AWG size).

We only guarantee the conformance of the servo amplifiers with the standards for industrial areas, if the components (motors, cables, amplifiers etc) are delivered by Pilz GmbH & Co. KG.

7.4 Instrument description

7.4.1 Scope of delivery

When you order a PMCprimo Drive2 from us, you will receive:

- PMCprimo Drive2 - size 01..20
- Mating connectors X3, X4, X0A, X0B, X7, X8

The mating motor connector X9 is not part of the package!

- Assembly, installation- and commissioning instructions
- Setup software package PMCprimo Motion Control Tools on CD-ROM
- Software manual **PDrive** and PMCprimo programming manual on CD-ROM

7.4.2 Accessories

- Servo motor PMCtendo AC1 or PMCtendo AC2
- Motor cable (pre-assembled), or both motor connectors separately with motor cable as cut-off length
- Feedback cable (pre-assembled) or both feedback connectors separately with feedback cable as cut-off length
- External regen resistor
- Communication cable to the PC for parameterisation (Null modem cable)
- MODBUS panel and communication cable; Panel (2 line till Touch screen)
- CAN cables
- Software keys for Motion Generator or Soft-PLC
- Ethernet cables
- Adapter cable Modbus/Profibus
- Expansion card (page 88)
- CompactFlash Cards
- Profibus DPS-small IC
- Master encoder
- Expansion board (page 88)

7.4.3 The PMCprimo Drive2 family

7.4.3.1 Performance data

- Position controller with 1 ms cycle time
- Digital current controller (space vector, pulse-width modulation, 62,5 µs)
- Evaluation of the resolver signals or sine-cosine signals of a HIPERFACE encoder
- 9 axes in system: 1 Motor direct, as well as 8 other axes channels for controlling further axes
- Each axis can operate in virtual motor mode
- Software gearbox
- Software differential and clutch
- Internal map generator (*motion generator*) as an option
- Product referencing
- Tension control
- Up to 8 cam
- Soft positioning („s-curves“)

7.4.3.2 Fieldbus Interface

- CAN-Bus with 500 kBit/s or 1 MBit/s (CANopen) – linking up to 60 PMCprimo-motion control-systems
- Modbus interface - devices like panels
- Option: Profibus DP (small) – easy communication with SoftPLC
- Option: Ethernet 10/100 Mbit/s
- Option: second CAN interface

7.4.3.3 Soft-PLC CoDeSys®

- Soft-PLC CoDeSys® as an option
- Fully PLC functionality specified in IEC 61131-3
- PLC and PMCprimo - combined in one system

7.4.3.4 Interfaces

- 12 digital inputs, 24 V, electrically isolated
- 8 digital outputs, 24 V, short circuit protected and electrically isolated
- 2 analog outputs with ± 10 V output range
- 2 analog inputs with ± 10 V input range
- 1 input for master encoder (incremental / SSI)

7.4.3.5 Power supplies

- 24 V power supply
- Common power supply for all master encoders

7.4.3.6 Power section

- Power supply: B6 rectifier bridge, directly off 3-phase earthed supply system, integral power input filter and inrush circuit
- All shielding connections directly on the amplifier
- Output stage: IGBT- module with isolated current measurement
- Regen circuit: with dynamic distribution of the regen power between several amplifiers on the same DC-link circuit. Internal regen resistor as standard, external regen resistors if required
- DC-link voltage 260 — 900 V DC, can be paralleled

7.4.3.7 Electrical supply

- Directly off grounded 3 phase system,
  230V-10% ... 480V +10% ,50 Hz,
  208V-10% ... 480V +10% ,60 Hz
  TN-system or TT-system with grounded neutral point, not more than 5000 rms symmetrical amperes
- 6 current ratings (1.5 A , 3 A , 6 A , 10 A , 14 A, 20 A)
- single-phase supply (e.g. for commissioning or setting-up) is possible

7.4.3.8 Power input filter

- Interference suppression filter for the supply input (to Class A) is integrated)
- Interference suppression filter for the 24V aux. supply (to Class A) is integrated

7.4.3.9 Operation and programming

- Comfortable programming with the software package PMCprimo Motion Control Tools under Windows 98/NT/2000/XP.
- Fully programmable with any ASCII-Terminal

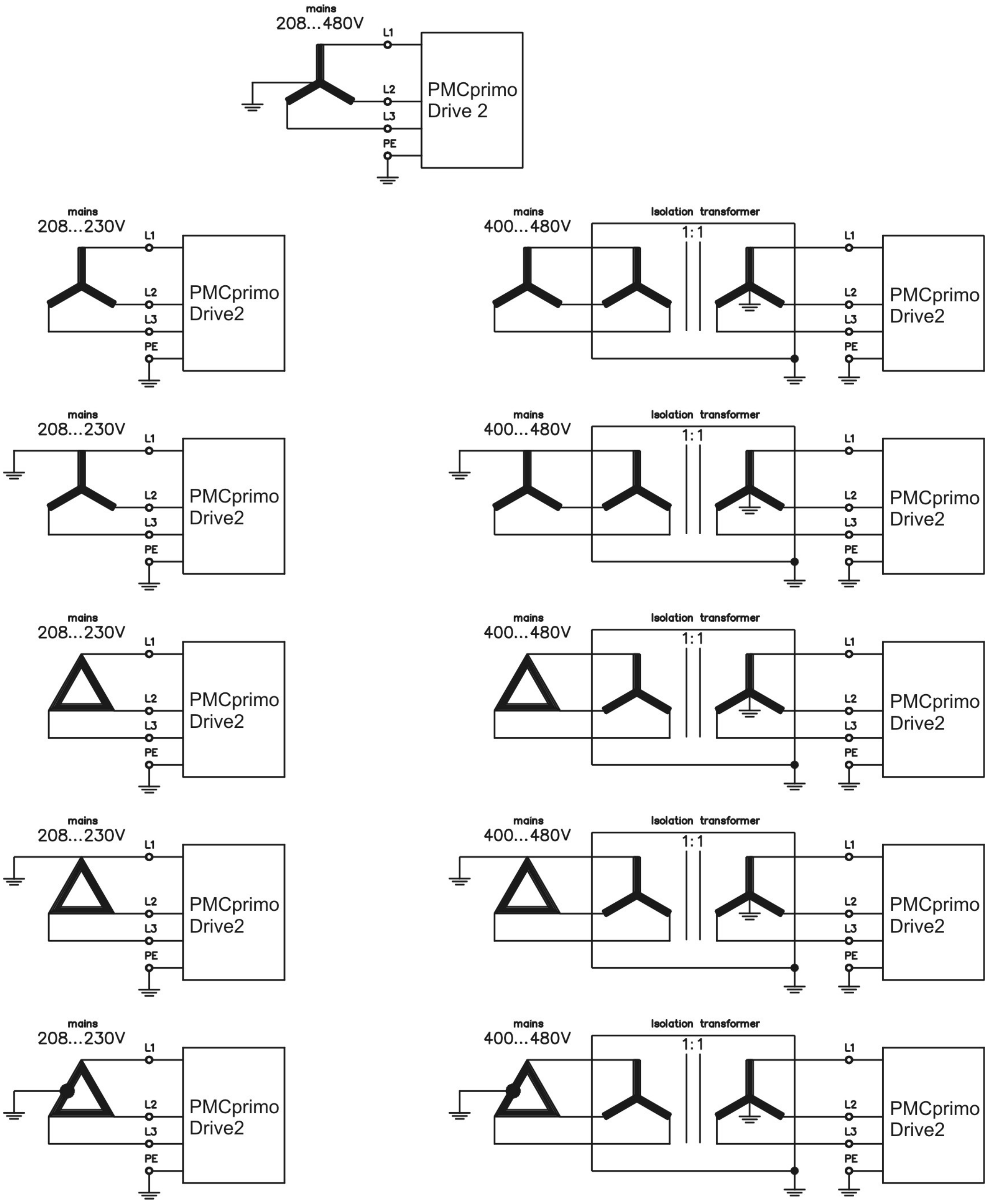
7.4.3.10 Integrated safety

- Safe electrical separation to EN 50178 between the power input / motor connections and the signal electronics, provided by appropriate insulation/creepage distances and complete electrical isolation
- Softstart, overvoltage recognition, short-circuit protection, phase-failure monitoring
- Temperature monitoring of PMCprimo Drive2 and motor (when using motors from the PMCtendo AC series with our pre-assembled cables)
- -AS- built-in safety relay (personnel-safety starting lock-out).

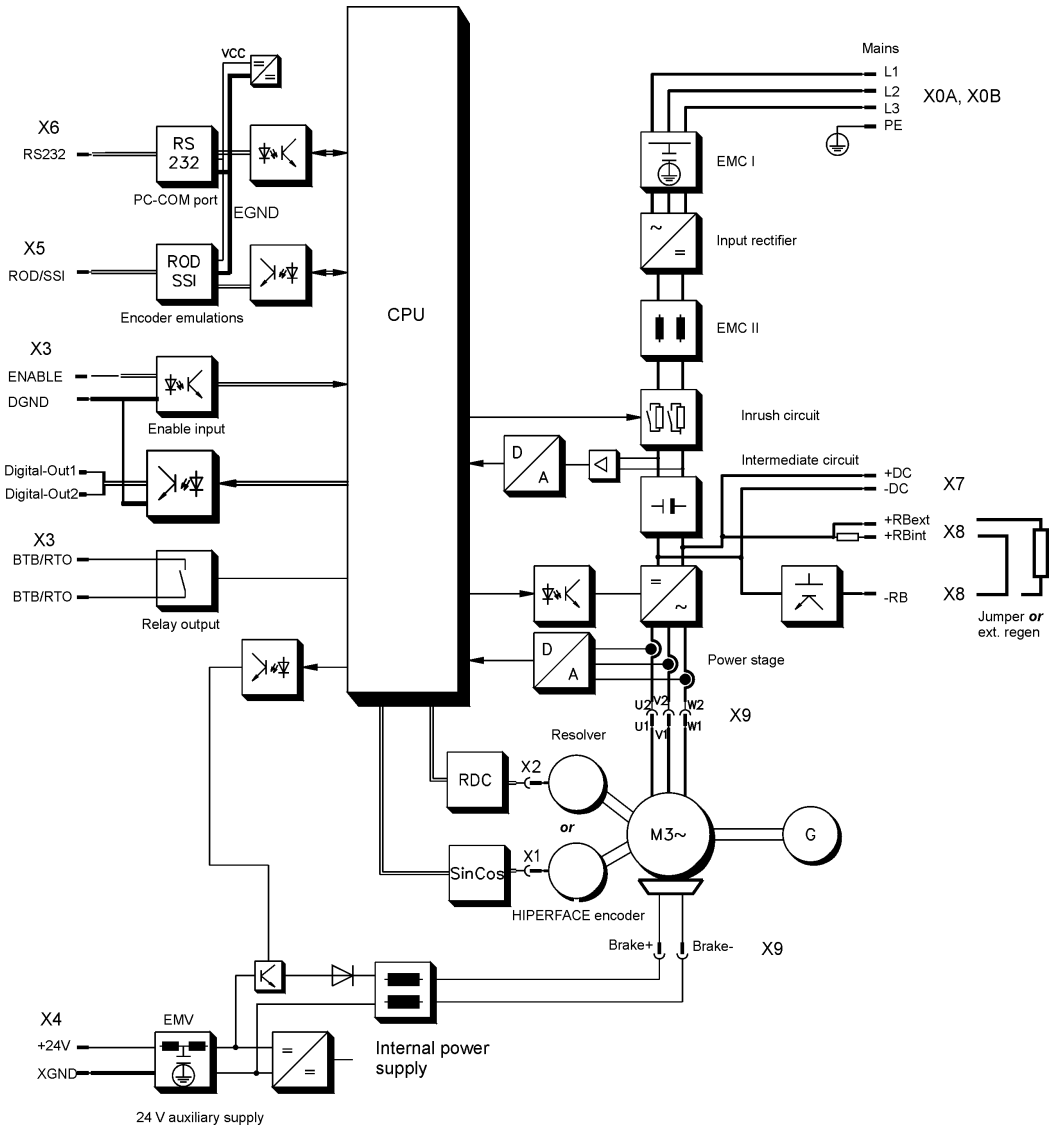
7.5 Connection to different mains supply networks

On this page you'll find all possible connection variations to different mains supply networks.

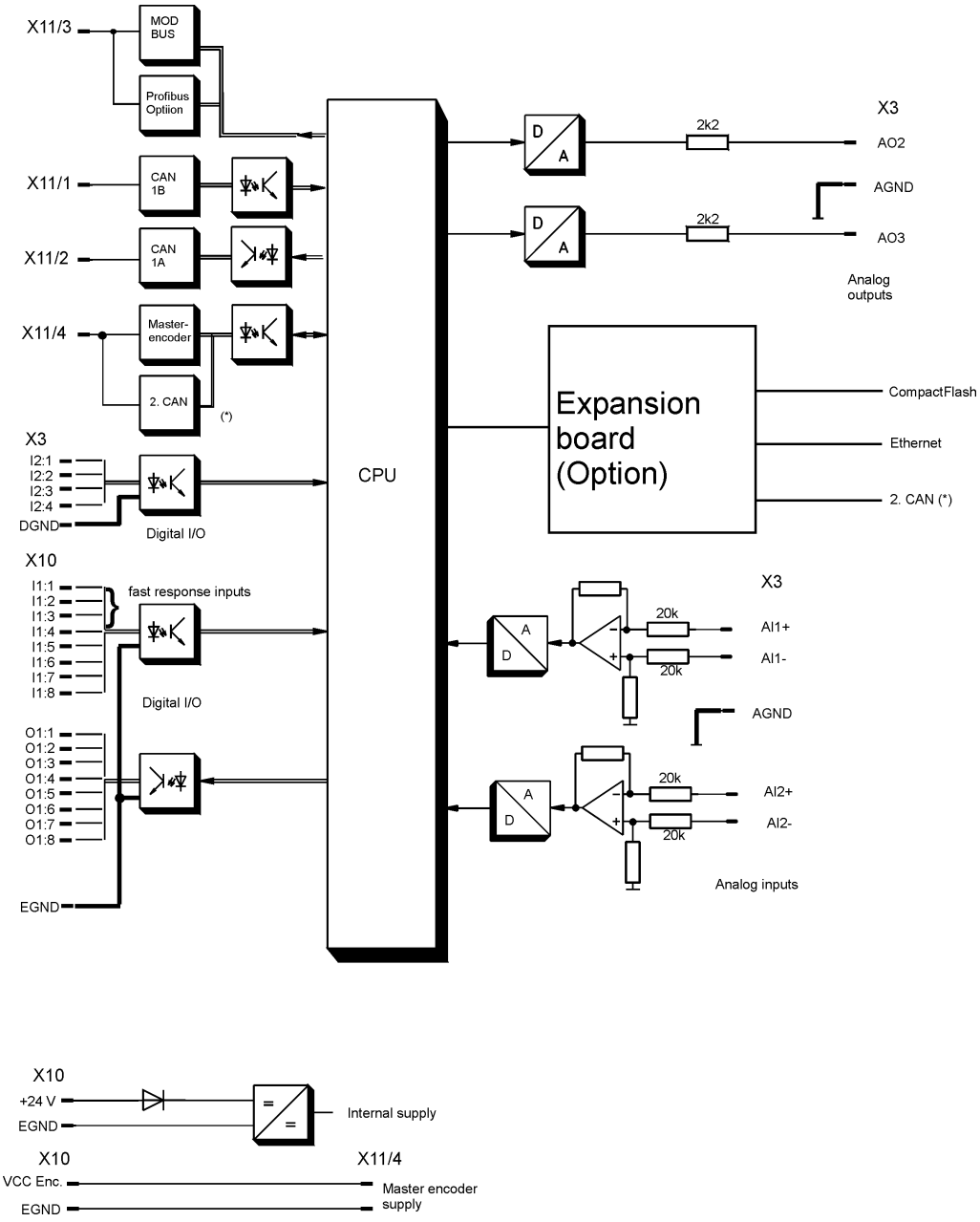
An isolating transformer is always required for 400...480V mains networks without earth(ground) and for networks with asymmetrical earth(ground).



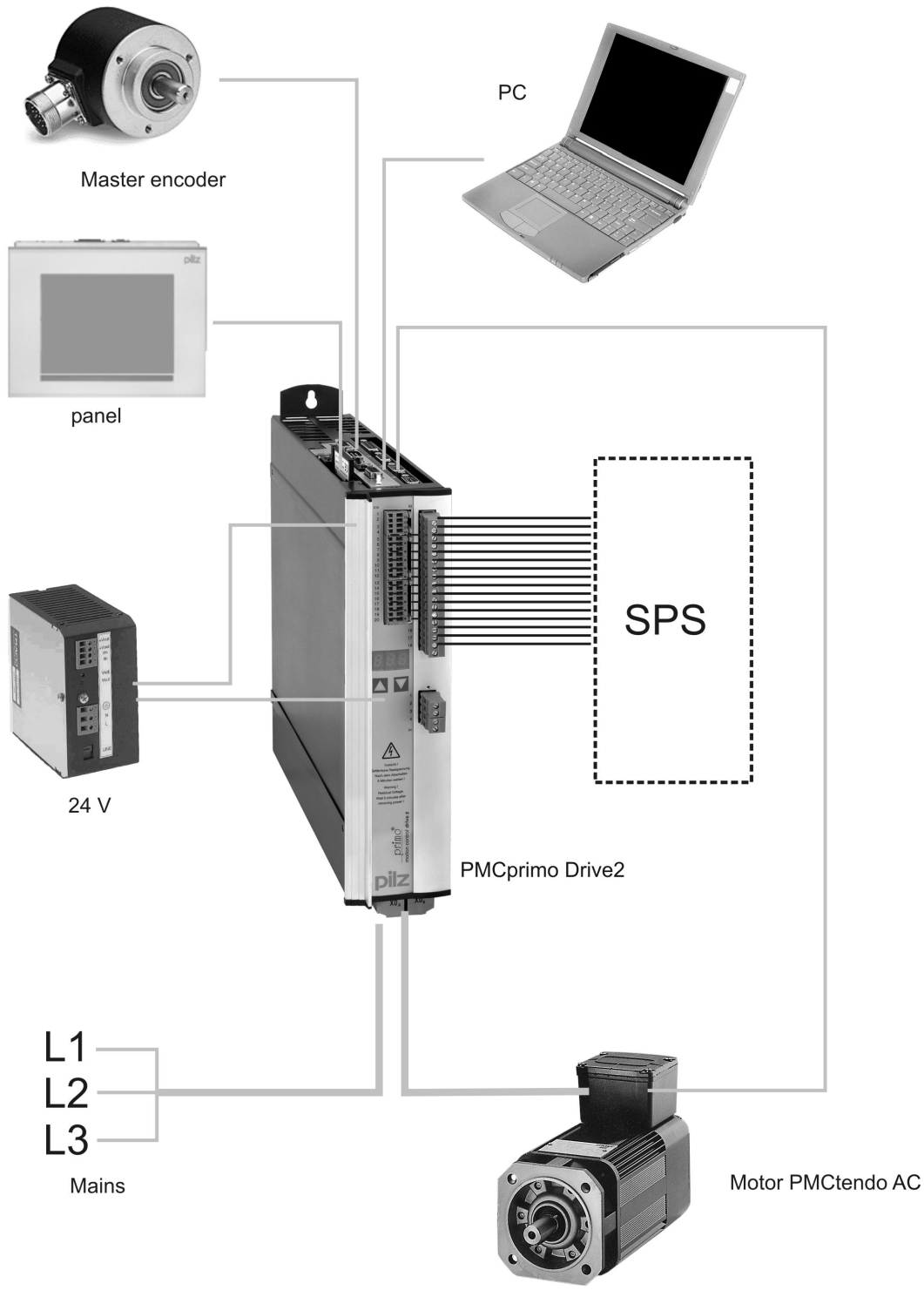
7.6 Block diagram – part 1



7.7 Block diagram – part 2



7.8 Components of a servo system



7.9 Technical data

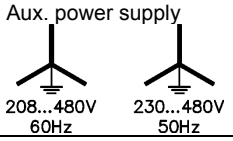
		PMCprimo Drive2					
Rated data	**DIM**	**01**	**03**	**06**	**10**	**14**	**20**
Rated supply voltage	V~	3 x 230V-10% ... 480V+10%, 50 ... 60 Hz					
Rated installed load for S1 operation	kVA	1	2	4	7	10	14
Rated DC-link voltage	V=	310 - 675					
Rated output current (rms value, ± 3%)	Arms	1,5	3	6	10	14	20
Peak output current (max. ca. 5s, ± 3%)	Arms	3	6	12	20	28	40
Clock frequency of the output stage	kHz	8					
Technical data for regen circuit	—	⇒ S. 24					
Overvoltage protection threshold	V	450...900					
Form factor of the output current (at rated data and min. load inductance)	—	1.01					
Bandwidth of subordinate current controller	kHz	> 1,2					
Residual voltage drop at rated current	V	5					
Quiescent dissipation, output stage disabled	W	15					
Dissipation at rated current (incl. power supply losses, without regen dissipation)	W	30	40	60	90	160	200
Internal fusing (external fusing ⇒ page 21)							
Auxiliary supply 24V	—	internal 3.15 AT					
Regen resistor	—	internal electronic					
Inputs							
Analog inputs (X3), resolution 14bit (AI1) and 12bit (AI2)	V	±10					
Common-mode voltage max.	V	±10					
Input resistance	kΩ	20					
Digital inputs (X3)		according to IEC 1131					
Digital inputs (X10)		according to IEC 1131					
Outputs							
Output current digital outputs (X10), each channel	mA	max. 100 (overload protection)					
Output current digital outputs (X3)	mA	max 10 (open collector)					
Voltage range analog outputs (X3) , resolution 10 Bit	V	± 10					
Output resistance	kΩ	2.2					
Max. output current, brake	A	2					
Master encoder PMCprimo Drive2							
Input resistance	Ω	200					
Transfer rate	MHz	1					
Pulse width (Z-track incremental encoder)	ns	mind. 200					
Power dissipation							
24 V supply supply, electrically isolated	V	24 (-0% +15%)					
without brake, no load	mA	1000					
24 V supply supply, electrically isolated	V	24 (-0% +15%)					
with brake, no load	mA	3000					
Encoder supply	-	5-24 V, see datasheet encoder					
12V supply CAN	mA	10 each client					

		PMCprimo Drive2					
Connections	**DIM**	**01**	**03**	**06**	**10**	**14**	**20**
Control signals (X3)	—	Combicon 5.08 / 18pole , 2,5mm²					
24 V supply (X4)	—	Combicon 5.08 / 4 pole , 2,5mm²					
24 V supply (X10)	—	Combicon 3.5 / 11 pole , 1mm²					
Encoder supply (X10)	—	Combicon 3.5 / 11 pole , 1mm²					
Digital inputs (X10)	—	Combicon 3.5 / 11 pole , 1mm²					
Digital outputs (X10)	—	Combicon 3.5 / 8 pole , 1mm²					
Power signals (X0,X7,X8,X9)	—	Power Combicon 7.62 / 4x4 + 1x6-pole, 4mm²					
Resolver input (X2)	—	SUB-D 9pol. (plug)					
HIPERFACE input (X1)	—	SUB-D 15pol. (plug)					
PC interface (X6)	—	SUB-D 9pol. (socket)					
Encoder emulation, ROD/SSI (X5)	—	SUB-D 9pole (plug)					
Master encoder (X11/4) / CAN2 (Option)	—	SUB-D 9pole (socket)					
MODBUS (X11/3) / Profibus (Option)	—	RJ45					
CAN-1A (X11/2)	—	SUB-D 9pole (plug)					
CAN-1B (X11/1)	—	SUB-D 9pole (socket)					
Mechanical							
Weight	kg	4				5	7,5
Height without connectors	mm	275					
Width	mm	70				100	120
Depth without connectors	mm	265					

7.9.1 External fusing

Fusible cutouts or similay		**PMCprimo Drive2 01 / 03**	**PMCprimo Drive2 06 / 10**	**PMCprimo Drive2 14 / 20**
AC supply	FN1/2/3	6 AT	10 AT	20 AT
24V supply	FH1/2	max. 16 AF		
Regen resistor	FB1/2	4 AF	6 AF	6 AF

7.9.2 Permissible ambient conditions ventilation, mounting position

Storage temperature/humidity,duration	⇒ S. 93
Transport temperature / humidity	⇒ S. 93
Supply voltage tolerances Input power Aux. power supply  	min 3x230V$^{-10\%}$ AC / max 3x 480V$^{+10\%,}$ 50 ... 60 Hz 24 V DC (-0% +15%)
Ambient temperature in operation	0...+45°C at rated data
Humidity in operation	rel. humidity 85%, no condensation
Site altitude	up to 1000m a.m.s.l. without restriction 1000...2500m a.m.s.l. with power derating 1.5%/100m
Pollution level	Pollution level 2 to EN60204/EN50178
Enclosure protection	IP 20
Mounting position	generally vertical. ⇒S. 33
Ventilation	built-in fan
Vibration	Vibration: 1g sinuid according to 60068-2-Fc Shock: 15g, 11ms, 60068-27-Ea

Make sure that there is sufficient forced ventilation within the switchgear cabinet!

7.9.3 Conductor cross-sections

Following EN 60204 (for AWG: table 310-16 of the NEC 60°C or 75°C column), we recommend:

AC connection	PMCprimo Drive2 sz. 01-10 : 1,5 mm² PMCprimo Drive2 sz. 14/20 : 4 mm²	600V, 105°C, twisted
DC-link	PMCprimo Drive2 sz. 01-10 : 1,5 mm² PMCprimo Drive2 sz 14/20 : 4 mm²	shielded for length > 20 cm
Motor cables up to 25 m length	PMCprimo Drive2 sz. 01-10 : 1 - 1,5mm² PMCprimo Drive2 sz. 14/20 : 2,5 mm²	shielded, capacitance<150pF/m
Motor cables 25 to 100 m length	PMCprimo Drive2 sz. 01-10 : 1 mm² PMCprimo Drive2 sz. 14/20 : 2,5 mm²	shielded with motor choke MD400
Resolver, thermostat-motor	8x0.25 mm² twisted pairs, shielded, max.100m, capacitance <120pF/m	
HIPERFACE Encoder, thermostat-motor	10x0.14 mm² twisted pairs, shielded, max.100m, capacitance <120pF/m	
Analog In- and outputs, AGND	0.25 mm² , twisted pairs, shielded	
Control signals, BTB, DGND	0.5 mm²	
Holding brake (Motor)	min. 0.75 mm², shielded, check voltage drop	
+24 V / XGND	max. 2.5 mm², check voltage drop	
24 V (X10) EGND / VCC Enc.	Max. 1 mm^2, check voltage drop	

7.9.4 LED-Display

A 3-character LED displays the servo amplifiers firmware version after switching on the 24V supply for two seconds (e.g. “2.46”).
Afterwards the status of up to 10 axes is shown (or just “run”).

When an error occurs the error number is displayed (⇒ S. 83).

7.10 Grounding system

AGND	ground for analog inputs and outputs, internal analog ground
DGND	ground for digital inputs and outputs (X3), optically isolated
XGND	ground for 24V aux. supply (X4)
EGND	ground for encoder-emulation, RS232, digital In-and outputs (X10); power supply PMCprimo Drive2 and master encoder, optically and inductively isolated

The potential isolation is shown in the block diagram (⇒ S. 17/18).

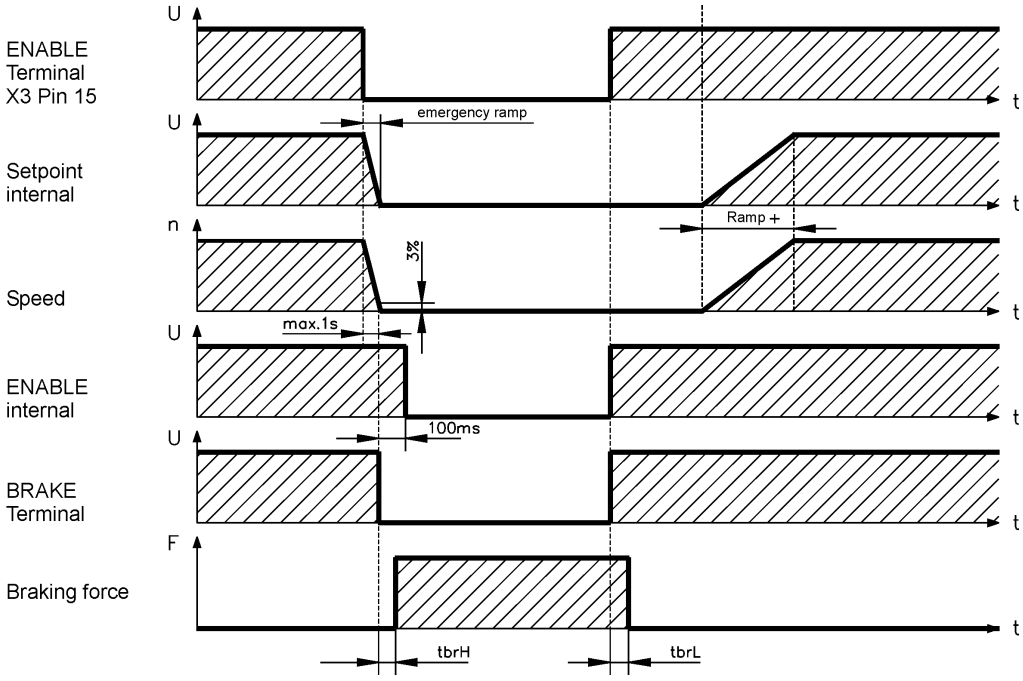
7.11 Control for motor-holding brake

A 24V / max. 2A holding brake in the motor can be controlled directly by the PMCprimo Drive2.

This function does not ensure personnel safety! (s. Option –AS- page 28)

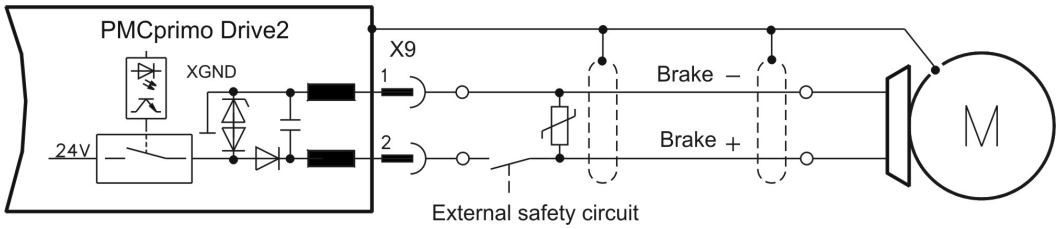
The brake function must be enabled through the setup software **PDRIVE** with the parameter „brake“.

In the diagram below you can see the time and functional relationships between the ENABLE signal, speed setpoint, speed and braking force.



During the internal ENABLE delay time of 100ms the speed setpoint of the PMCprimo Drive2 is internally driven down a 10ms ramp to 0V. The brake output is switched on when 3% of the final speed is reached. The rise (fbrH) and fall (fbrL) times of the holding brake which is built into the motors are different for the various types of motor (see motor manual). A description of the interface can be found on page 49.

A safe (for personnel) operation of the holding brake requires an additional “make” (n.o.) contact in the brake circuit and a suppressor device (varistor) for the recommended brake circuit diagram



7.12 Regen circuit

During braking with the aid of the motor, energy is fed back to the PMCprimo Drive2. This energy is converted into heat in the regen resistor. The regen circuit (thresholds) are adjusted to the supply voltage with the help of the setup software **PDRIVE.**

Our applications department can help you with the calculation of the regen power which is required. A description of the interface can be found on page 50 .

Internal regen resistor:	PMCprimo Drive2 sz. 01/03	66 Ohm
	PMCprimo Drive2 sz. 06-20	33 Ohm
External regen resistor:	PMCprimo Drive2 sz. 01-20	33 Ohm

Functional description:

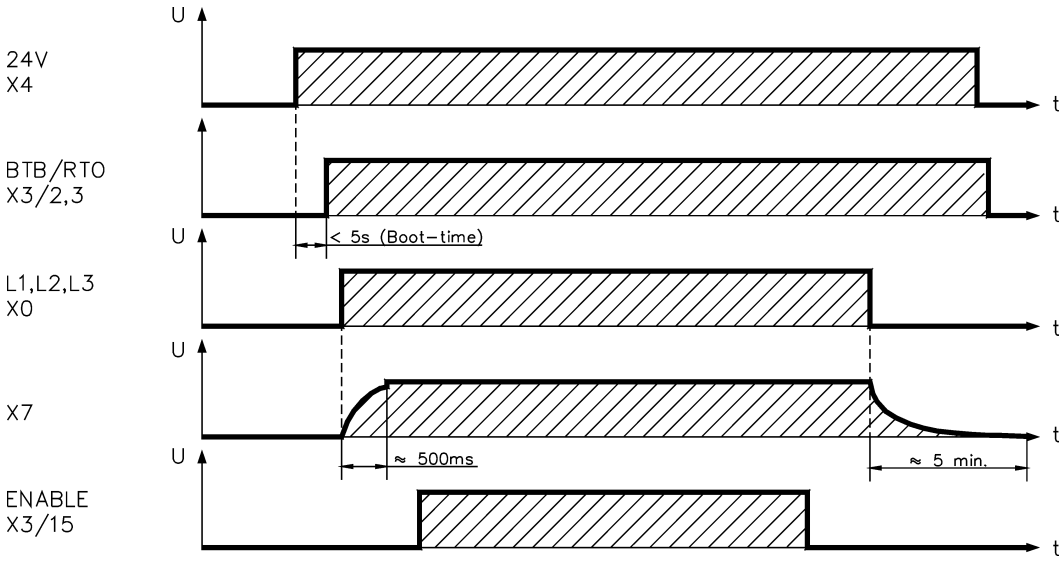
1. Individual amplifiers, **not coupled** through the DC-link (DC+, DC-)
The circuit starts to respond at a DC-link voltage of 400V, 720V or 840V (depending on the supply voltage). If the energy which is fed back from the motor, as an average over time or as a peak value, is higher than the preset regen power, then the PMCprimo Drive2 will output the status “regen power exceeded” and the regen circuit will be switched off. At the next internal check of the DC-link voltage (after a few ms) an overvoltage will be detected and the PMCprimo Drive2 will be switched off with the error message “Overvoltage” (⇒ page 82).
BTB/RTO contact (terminal X3, Pin2+3) will be opened at the same time (⇒page 64)

2. Several servo amplifiers **coupled** through the DC-link circuit (DC+, DC-)
Thanks to the built-in regen circuit with its patented w-characteristic, several amplifiers (even with different current ratings) can be operated off a common DC-link, if they have a common supply voltage. This is achieved by an automatic adjustment of the regen thresholds (which vary, because of tolerances). The regen energy is distributed equally among all the amplifiers. The combined power of all the amplifiers is always available, as continuous or peak power. The switch-off takes place as described under 1. (above) for the PMCprimo Drive2 with the lowest switch-off threshold (resulting from tolerances). The RTO (BTB) contact of this amplifier (terminals X3, Pin2+3) will be opened at the same time (⇒ S. 64).

Regen circuit: technical data			**PMCprimo Drive2**	
Supply voltage	**Rated data**	**DIM**	**01 - 03**	**06 - 20**
3 x 230 V	Upper switch-on level of regen circuit	V	400 – 430	
	Switch-off level of regen circuit	V	380 – 410	
	Continuous power of regen circuit (RBint)	W	80	200
	Continuous power of regen circuit (RBext) max.	kW	0,25	0,75
	Pulse power, internal (RBint max. 1s)	kW	2,5	5
	Pulse power, external (RBext max. 1s)	kW	5	
3 x 400 V	Upper switch-on level of regen circuit	V	720 – 750	
	Switch-off level of regen circuit	V	680 – 710	
	Continuous power of regen circuit (RBint)	W	80	200
	Continuous power of regen circuit (RBext) max.	kW	0,4	1,2
	Pulse power, internal (RBint max. 1s)	kW	8	16
	Pulse power, external (RBext max. 1s)	kW	16	
3 x 480 V	Upper switch-on level of regen circuit	V	840 – 870	
	Switch-off level of regen circuit	V	800 – 830	
	Continuous power of regen circuit (RBint)	W	80	200
	Continuous power of regen circuit (RBext) max.	kW	0,5	1,5
	Pulse power, internal (RBint max. 1s)	kW	10,5	21
	Pulse power, external (RBext max. 1s)	kW	21	

7.13 Switch-on and switch-off behaviour

The diagram below illustrates the correct functional sequence for switching the PMCprimo Drive2 on and off.



7.13.1 Stop function to EN 60204 (VDE 0113)

If a fault occurs (⇒ S. 81)) the output stage of the PMCprimo Drive2 is switched off and the BTB/RTO contact is opened. Instruments which are equipped with a selected “Brake” function use a special sequence for switching off the output stage (⇒ S. 49).

The -AS- option can be used to switch off the drive via a positive-action (BG-approved) safety relay, so that personnel safety is ensured at the drive shaft.

The stop functions are defined in EN 60204 (VDE 0113), Para. 9.2.2, 9.2.5.3.

There are three categories of stop functions:

Category 0: Shut down by immediately switching off the supply of energy to the drive machinery (i.e. an uncontrolled shut-down);

Category 1: A controlled shut-down, during which the supply of energy to the drive machinery is maintained to perform the shut-down, and where the energy supply is only interrupted when the shut-down has been completed;

Category 2: A controlled shut-down, where the supply of energy to the drive machinery is maintained.

Every machine must be equipped with a stop function to Category 0. Stop functions to Categories 1 and/or 2 must be provided if the safety or functional requirements of the machine make this necessary.

7.13.2 Emergency Stop strategies

The Emergency Stop function is defined in EN 60204 (VDE 0113), Para. 9.2.5.4.

You can find wiring recommendations in our application note “Stop and Emergency Stop functions with PMCtendo DD4”.

7.13.2.1 Category 0

The controller is switched to “disable”, the electrical supply (400VAC) is disconnected. The drive must be held by an electromagnetic holding device (brake).

In multiaxis systems with connected DC-link bus (intermediate circuit) the motor leads have to be disconnected by a changeover switch (contactor, e.g. Siemens 3RT1516-1BB40) and shortcircuited by resistors connected in a star configuration

7.13.2.2 Category 1

If hazardous conditions can result from an emergency stop switch-off with an unbraked rundown, then the drive can be switched off by a controlled shut-down.

Stop Category 1 permits electromotive braking with a switch-off when zero speed has been reached.

Safe shutdown can be achieved, when the loss of the mains supply is not rated as a fault and the control takes over the disabling of the PMCprimo Drive2.

In the normal situation, only the supply power is switched off in a safe manner.

The 24V auxiliary supply remains switched on.

7.14 Option -AS

7.14.1 General

A frequently required application task is the protection of personnel against the restarting of drives. This can not be achieved by an electronic inhibit, but must be implemented with mechanical elements (positively driven relay contacts).

To get round this problem, up to now either the main contactor in the mains supply line was switched off, or another contactor was used to disconnect the motor from the PMCprimo Drive2.

The disadvantages of this method are:

- the DC-link has to be charged up again at restart
- wear on the contacts of the contactors, caused by switching under load
- extensive wiring required, with additional switching components

The -AS- option avoids these disadvantages. A safety relay in the servo amplifier is activated either by the PLC or manually. Positively driven contacts provide a safe disconnection of the PMCprimo Drive2, the setpoint input of the PMCprimo Drive2 is inhibited, and a signal is sent to the safety.

The advantages of the Option -AS-:

- the DC-link remains charged up, since the mains supply line remains active
- only low voltages are switched, so there is no contact wear
- very little wiring is required
- the functionality and the personnel safety when using the circuit recommendations in this documentation have been approved by the trade liability association

7.14.2 Prescribed use

The -AS- restart lock is **exclusively** intended to provide safety for personnel, by preventing the restart of a system.

To achieve this personnel safety, the wiring of the safety circuits must meet the safety requirements of EN60204, EN292 and VDI 2853.

The -AS- restart lock must **only** be activated,

- when the motor is no longer rotating (speed = 0 rpm).
  Drives with a suspended load must have an additional safe mechanical blocking (e.g. by a motor-holding brake).
- when the monitoring contacts (KSO1/2 and BTB/RTO) for all PMCprimo Drives are wired into the control signal loop (to recognize a cable break).

The -AS- restart lock may **only** be controlled by a CNC if the control of the internal safety relay is arranged for redundant monitoring

The -AS- restart lock must **not** be used if the drive is to be made inactive for the following reasons:

1. - cleaning, maintenance and repair operations
   - long inoperative periods
   In such cases, the entire system should be disconnected from the supply by the personnel, and secured (main switch).)
2. - emergency-stop situations
   In an emergency-stop situation, the main contactor is switched off (by the emergency-stop button or the BTB-contact in the safety circuit).)

7.14.3 Functional description

An additional connector (X12) is mounted on the front panel of the PMCprimo Drive2. The coil connections and a make (n.o.) contact of a safety relay are made available through 4 terminals on this connector.

The 24V DC safety relay in the servo amplifier (TÜV approved) is controlled externally. All the relay contacts have positive action.

Two contacts switch off the driver supply of the output stage in the PMCprimo Drive2, and short the internal setpoint signal to AGND (0 V).

The make (n.o.) contact used for monitoring is looped into the control circuit.

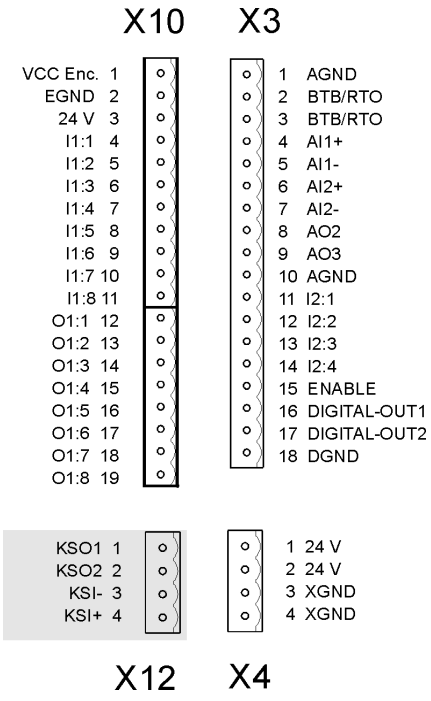
If the safety relay is not energized, then the monitoring contact is open and the PMCprimo Drive2 is ready for operation.

If the drive is electronically braked, the PMCprimo Drive2 is disabled and the motor-holding brake is on, then the safety relay is energized (manually or by the controls).

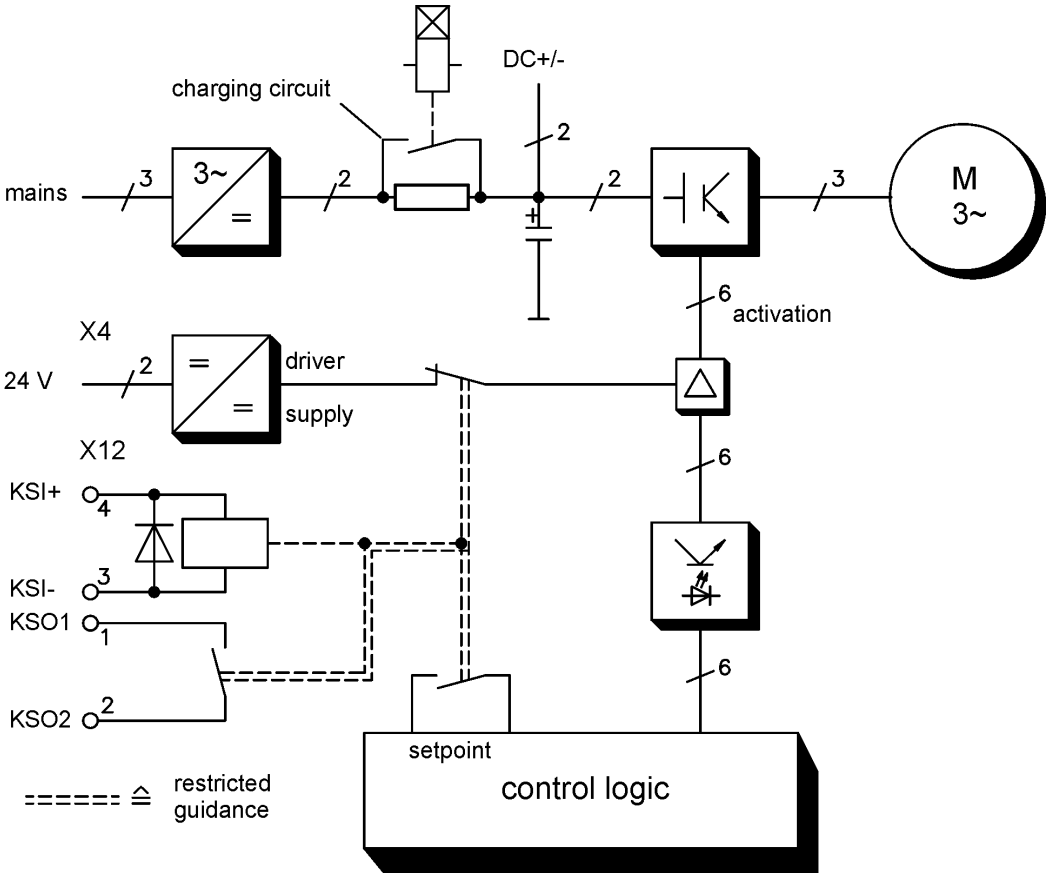
The supply voltage for the driver circuit of the output stage is switched off in a safe manner, the internal setpoint is shorted to 0V, and the monitoring contact bridges the safety logic in the control circuit of the system (monitoring of protective doors etc.)

Even if the output stage or driver is destroyed, it is impossible to start the motor.

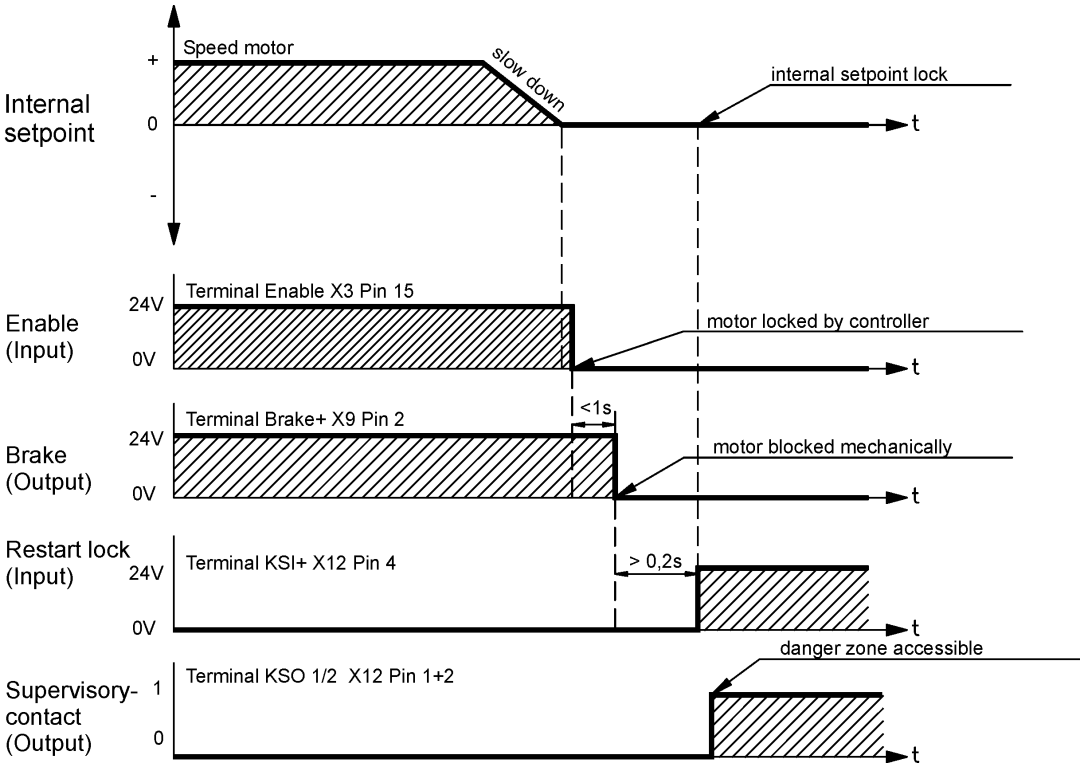
If the safety relay itself is faulty, then the monitoring contact cannot bridge the safety logic of the system. Opening the protective devices will then switch off the system.



7.14.4 Block diagram



7.14.5 Signal diagram



7.14.6 Installation and Commissioning

7.14.6.1 Safety instructions

- Observe "Use as directed" on page 11.
- The monitoring contacts (KSO1/2) for each PMCprimo Drive2 with an -AS- option must be looped into the control circuit. This is vital, so that a malfunction of the internal safety relay or a cable break can be recognized.
- If the -AS- option is automatically activiated by a control system (KSI1/2), then make sure that the output of the control is monitored for possible malfunction. This can be used to prevent a faulty output from activating the -AS- option while the motor is running.

7.14.6.2 Application example

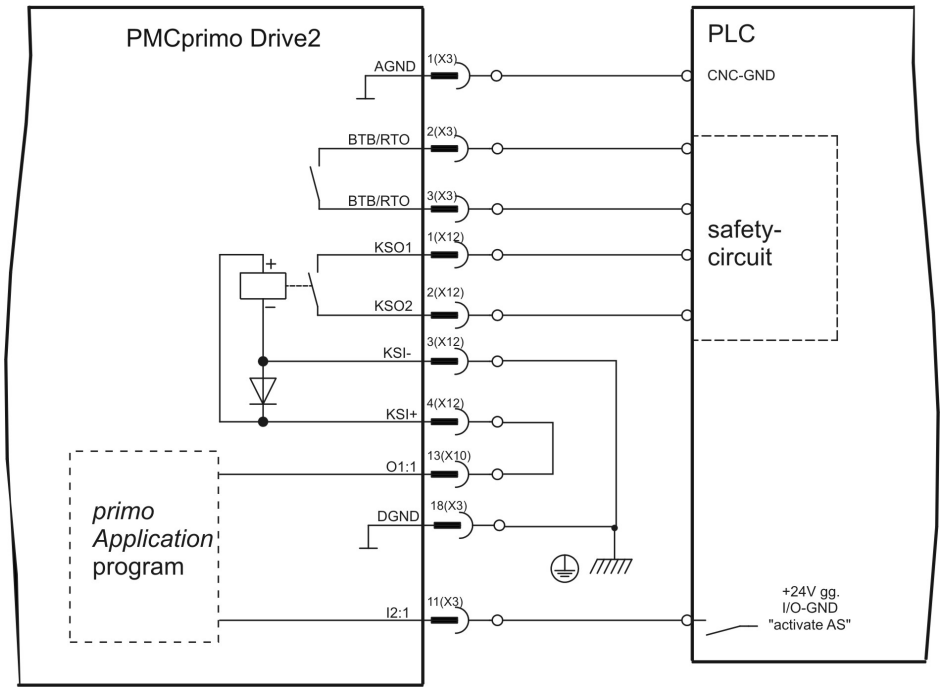
The following application example describes the function of the –AS- option. A PLC is controlling the function:

1. The PLC sets the signal „activate AS“ with a digital output to a digital input of the PMCprimo Drive2
2. The PMCprimo Drive2 triggers a program which stops the motor and goes in the motor-off state (**MO**).
3. The ENABLE-signal (X3/pin 15) has to go low (0V).
4. The motor brake is activated from the PMCprimo Drive2
5. Now another PMCprimo Drive2 program sets an output and activates the option –AS
6. The PLC will get the message „AS activated“ via the monitoring contacts KSO1/2

If the PLC doesn’t gets the message „AS activated“ after setting „activate –AS“ to PMCprimo Drive2 there is a malfunction in the system.

The master contactor should be opened in this case.

7.14.6.3 Connection diagram



8 Installation

8.1 Important instructions

- Protect the PMCprimo Drive2 from impermissible stresses. In particular, do not let any components become bent or any insulation distances altered during transport and handling. Avoid contact with electronic components and contacts.
- Check the combination of PMCprimo Drive2 and motor. Compare the rated voltage and current of the units. Carry out the wiring according to the connection diagram on page 31.
- Make sure that the maximum permissible rated voltage at the terminals L1, L2, L3 or +DC, –DC is not exceeded by more than 10% even in the most unfavourable case (see EN 60204-1 Section 4.3.1). An excessive voltage on these terminals can lead to destruction of the regen circuit and the PMCprimo Drive2.
  Use the PMCprimo Drive2 only on an earthed 3-phased supply system, to drive a synchronous servomotor of the PMCtendo AC1 or PMCtendo AC2 series.
- The fusing of the AC supply input and the 24V supply is installed by the user (⇒ page 21).
- Take care that the PMCprimo Drive2 and motor are earthed properly. Do not use painted (non-conductive) mounting plates.
- Route power and control cables separately. We recommend a separation of at least 20 cm. This improves the interference immunity required by EMC regulations. If a motor power cable is used which includes cores for brake control, **the brake control cores must be separately shielded**. Earth the shielding at both ends (⇒ page 49).

- Install all heavy-current cables with an adequate cross-section, as per EN 60204.
- Wire the BTB/RTO contact in series into the safety circuit of the installation. Only in this way is the monitoring of the PMCprimo Drive2 assured.
- Install all shielding with large areas (low impedance), with metallized connector housings or shield connection clamps where possible.
- Ensure that there is an adequate flow of cool, filtered air into the bottom of the switchgear cabinet. See page 21.
- It is permissible to alter the PMCprimo Drive2 settings by using the setup software.
  Any other alterations will invalidate the warranty.

Caution

Never disconnect the electrical connections to the PMCprimo Drive2 while it is live. In unfavourable circumstances this could result in destruction of the electronics.

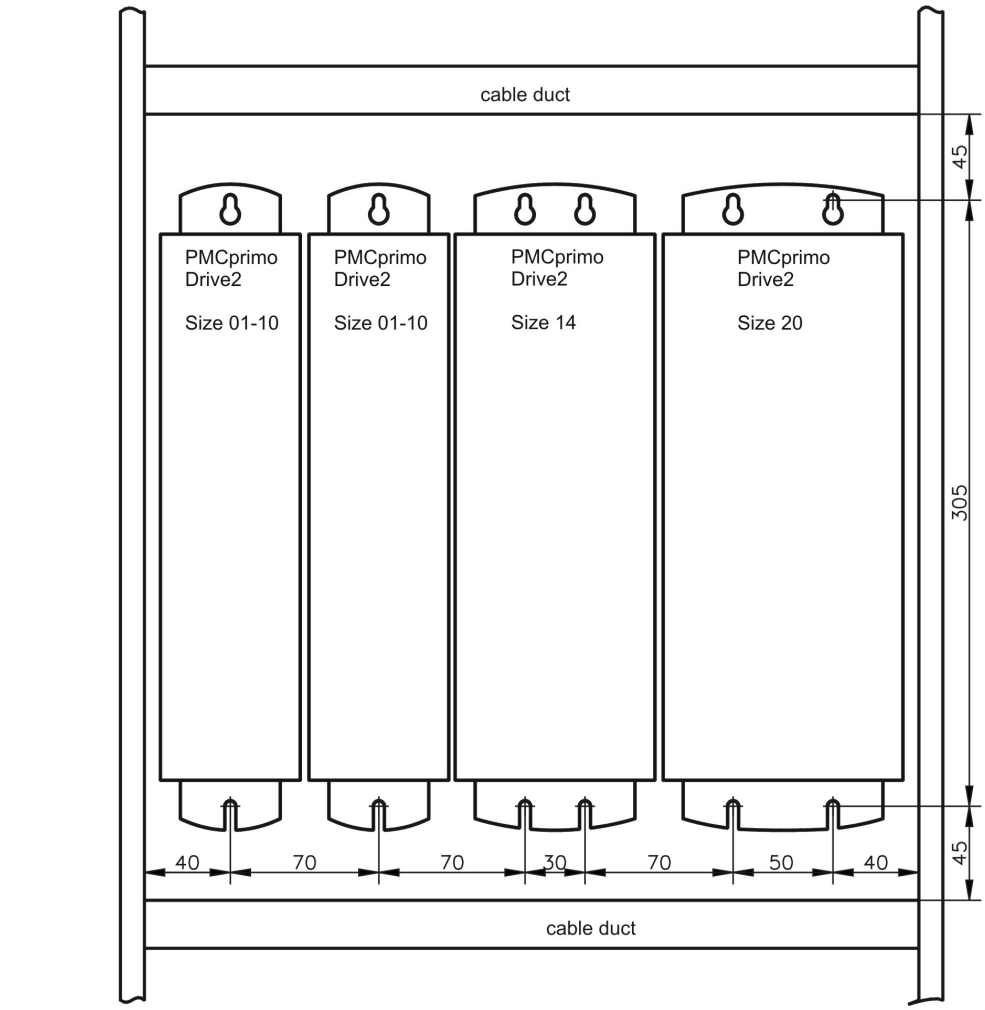
Residual charges in the capacitors can have dangerous levels up to 300 seconds after switching off the mains supply voltage. Measure the bus voltage at the DC-link pins (+DC/-DC), and wait until the voltage has fallen below 40V.

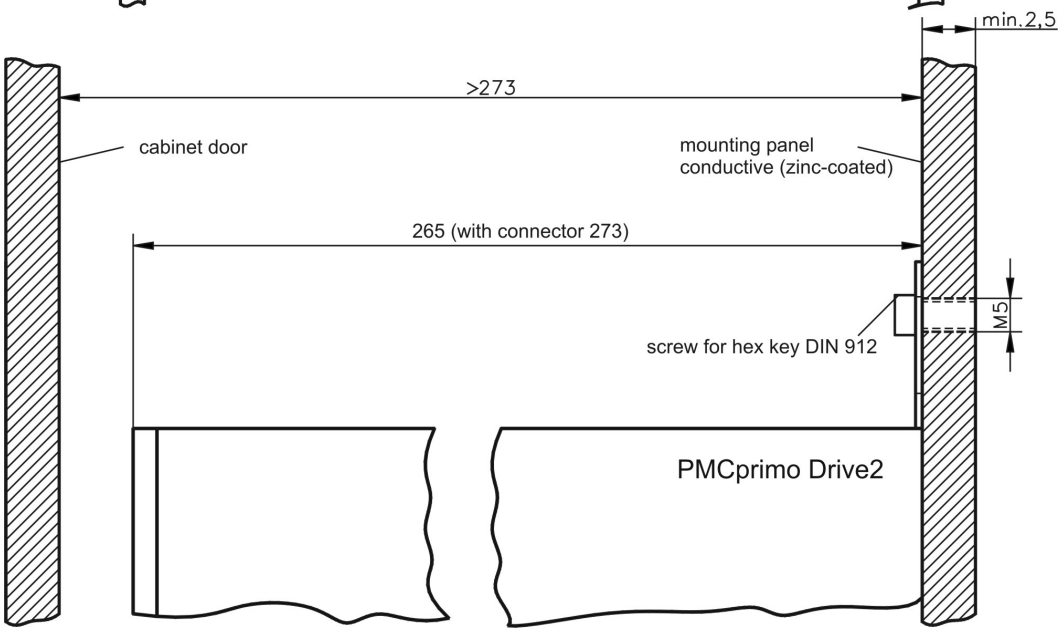
Control and power connections can still be live, even when the motor is not rotating.

8.2 Assembly

Material: 2 or 4 hexagon socket screws to DIN 912, M5

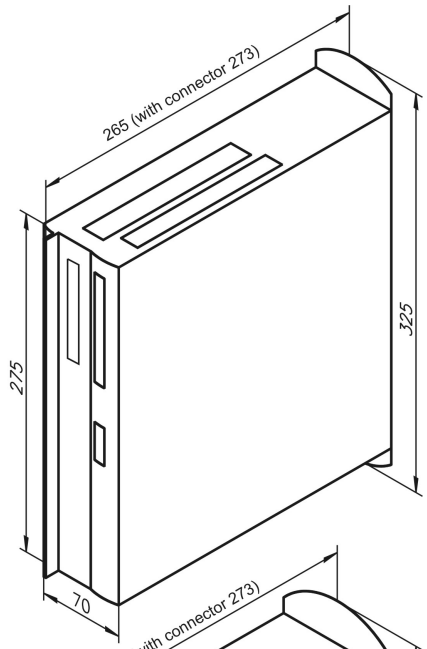
Tool required: 4 mm Allen key



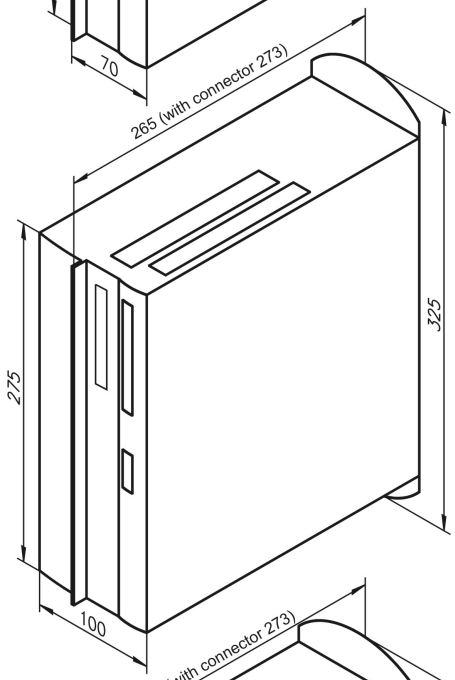


8.3 Dimensions

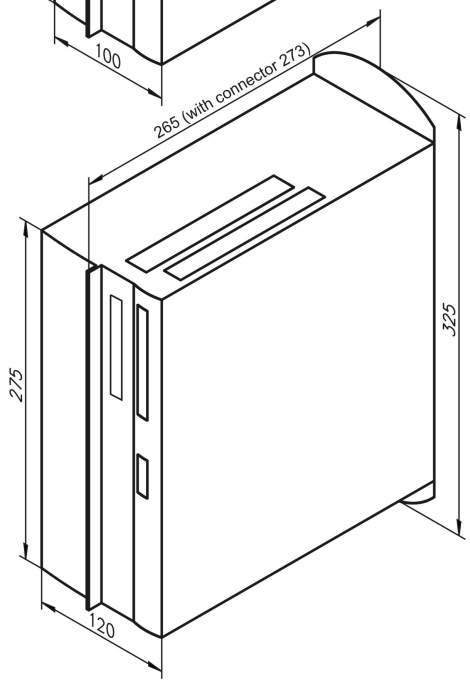
PMCprimo Drive2
Size 01/03/06/10



PMCprimo Drive2
Size 14



PMCprimo Drive2
Size 20



8.4 Wiring

Only professional staff who are qualified in electrical engineering are allowed to install the PMCprimo Drive2.

The installation procedure is described as an example. A different procedure may be sensible or necessary, depending on the application of the equipment.

Caution !

Only install and wire up the equipment when it is not live, i.e. when neither the mains power supply nor the 24 V auxiliary voltage nor the operating voltages of any other connected equipment is switched on.

Take care that the cabinet is safely disconnected (with a lock-out, warning signs etc.).

The individual voltages will be switched on for the first time during commissioning.

Note !

The ground symbol ⏚, which you will find in all the wiring diagrams, indicates that you must take care to provide an electrically conductive connection with the largest possible area between the unit indicated and the mounting plate in the switchgear cabinet. This connection is for the effective grounding of HF interference, and must not be confused with the PE- symbol ⏚ (a protective measure to EN 60204).

Use the following connection diagrams:

The following notes should assist you to carry out the installation in a sensible sequence, without overlooking anything important.

Site

In a closed switchgear cabinet. Observe page 21 .
The site must be free from conductive or corrosive materials.
For the mounting position in the cabinet ⇒ page 33

Ventilation

Check that the ventilation of the PMCprimo Drive2 is unimpeded and keep within the permitted ambient temperature ventilation ⇒ page 21.
Keep the required space clear above and below the PMCprimo Drive2 ⇒ page 33.

Assembly

Assemble the PMCprimo Drive2 and power supply close together on the conductive, **earthed** mounting plate in the cabinet.

Cable selection

Select cables according to EN 60204 ⇒ page 22.

Grounding Shielding

EMC-compliant shielding and grounding (⇒ page 86).
Earth the mounting plate, motor housing and CNC-GND of the controls.

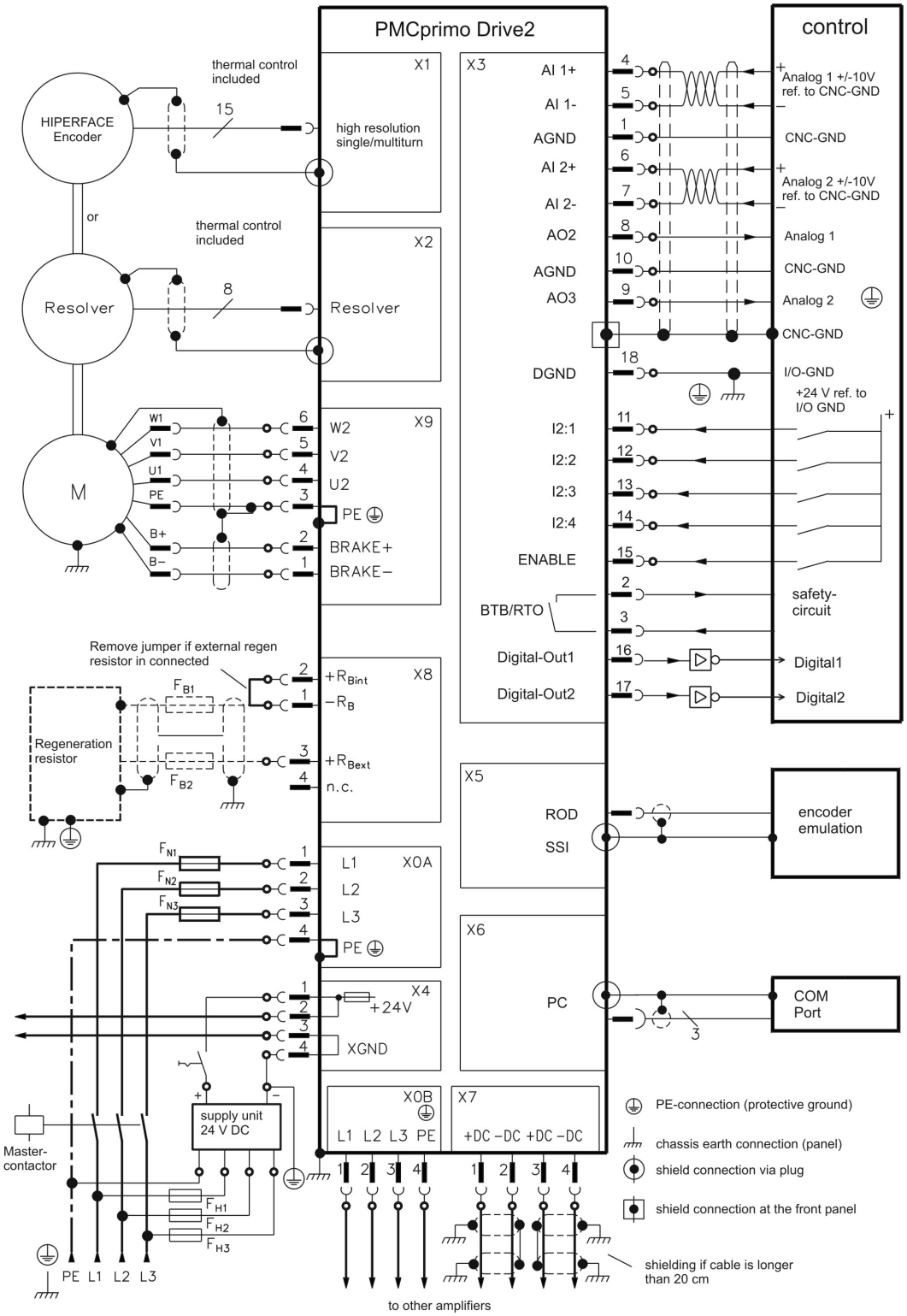
Wiring

- **Route power leads and control cables separately.**
- **Wire the BTB/RTO contact in series into the safety loop of the installation.**
- Connect the digital control inputs to the PMCprimo Drive2.
- Connect up AGND.
- Connect the analog signals, if required.
- Connect up the feedback unit (resolver or HIPERFACE encoder).
- Connect the input and output signals.
- Connect the motor leads.
  Connect shielding to EMC connectors at both ends
  Use motor choke on length >25m (MD400)
- Connect motor-holding brake, connect shielding to EMC connectors at both ends.
- If required, connect the external regen resistor (with fusing.
- Connect aux. supply (24 V).
  (for max. permissible voltage values⇒ page 20)
- Connect main power supply.
  (for max. permissible voltage values⇒ page 20)
- Connect PC (⇒ page 80).

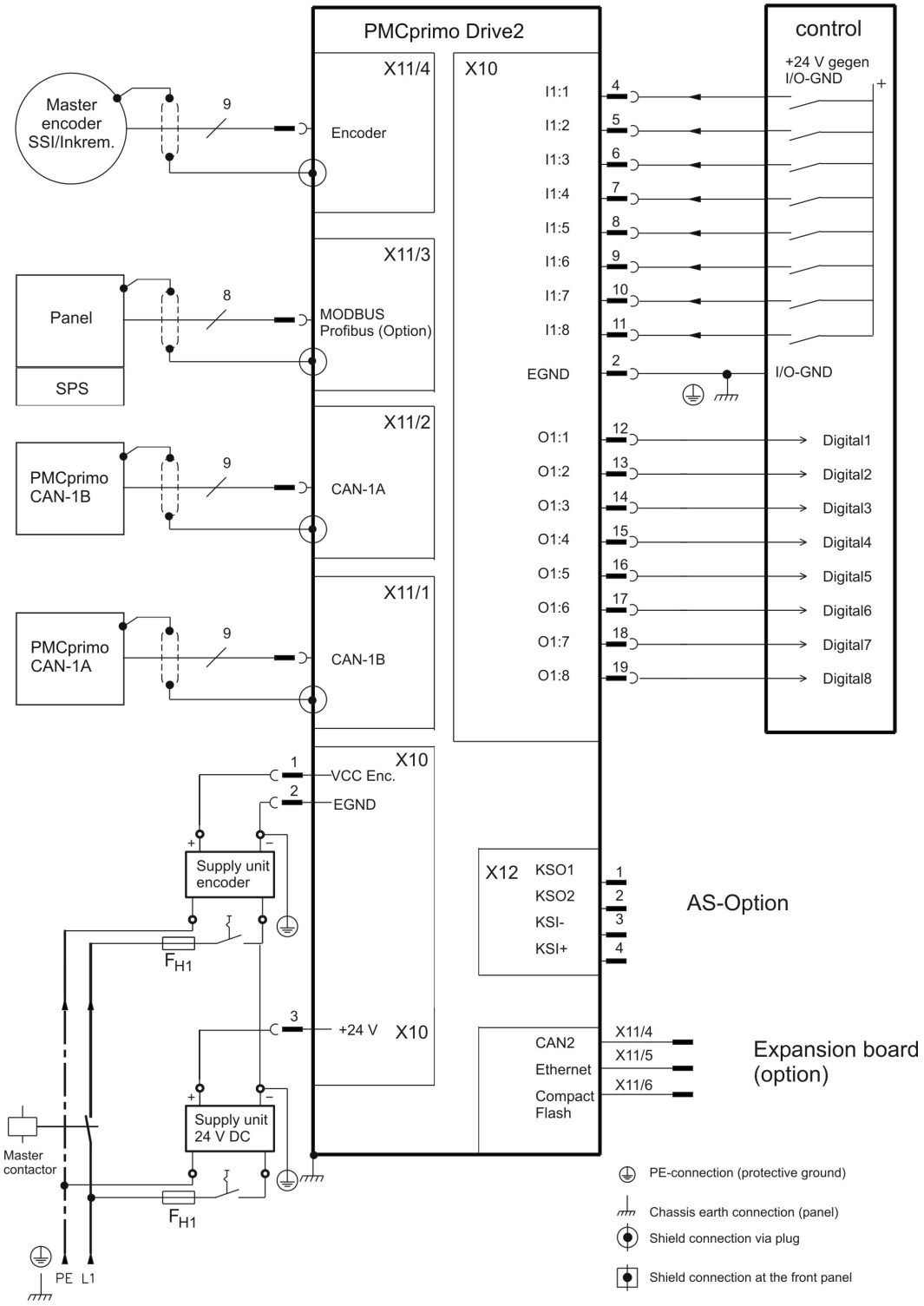
Final check

- Final check of the implementation of the wiring, according to the wiring diagrams which have been used.

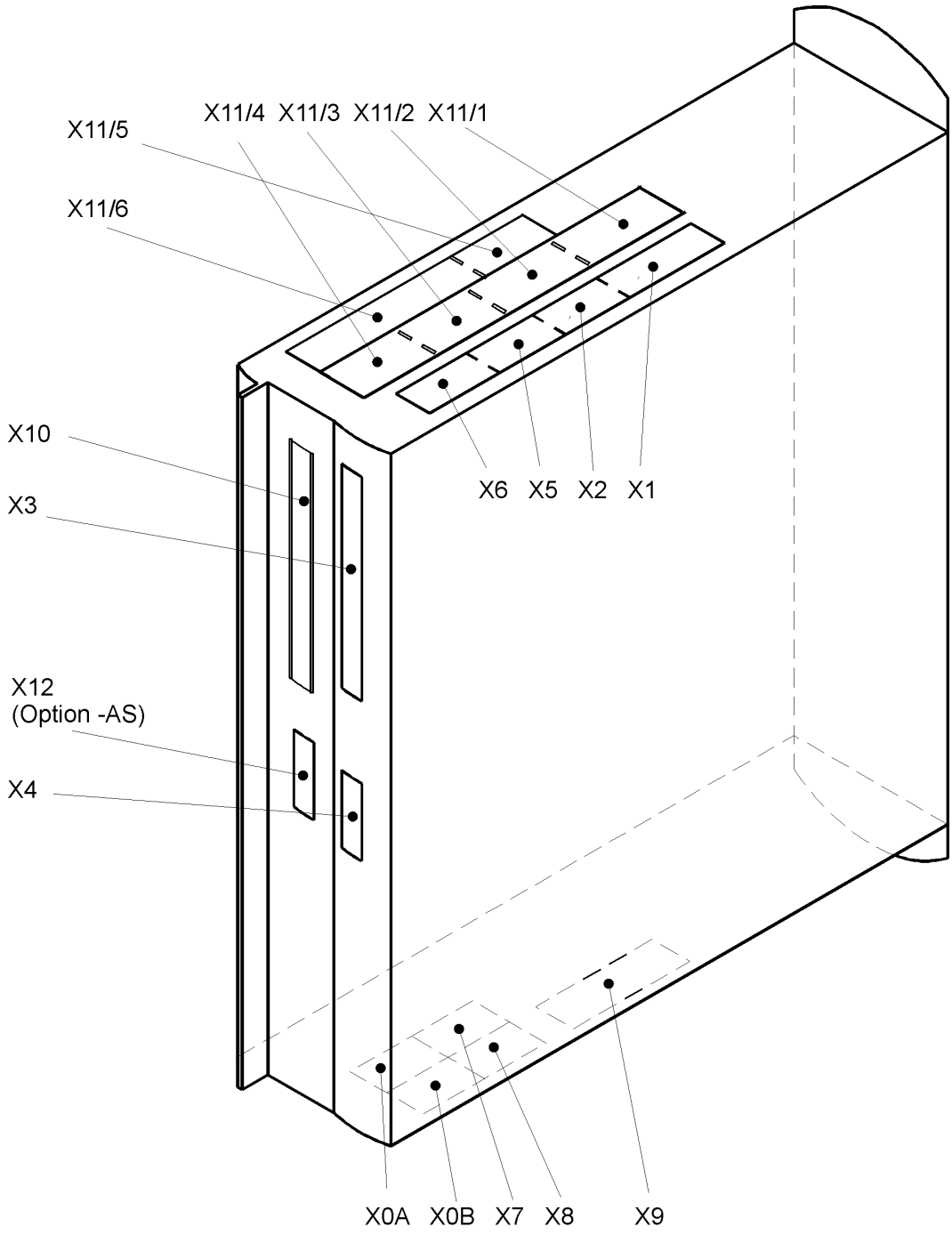
8.4.1 Connection diagram PMCprimo Drive2 - part 1



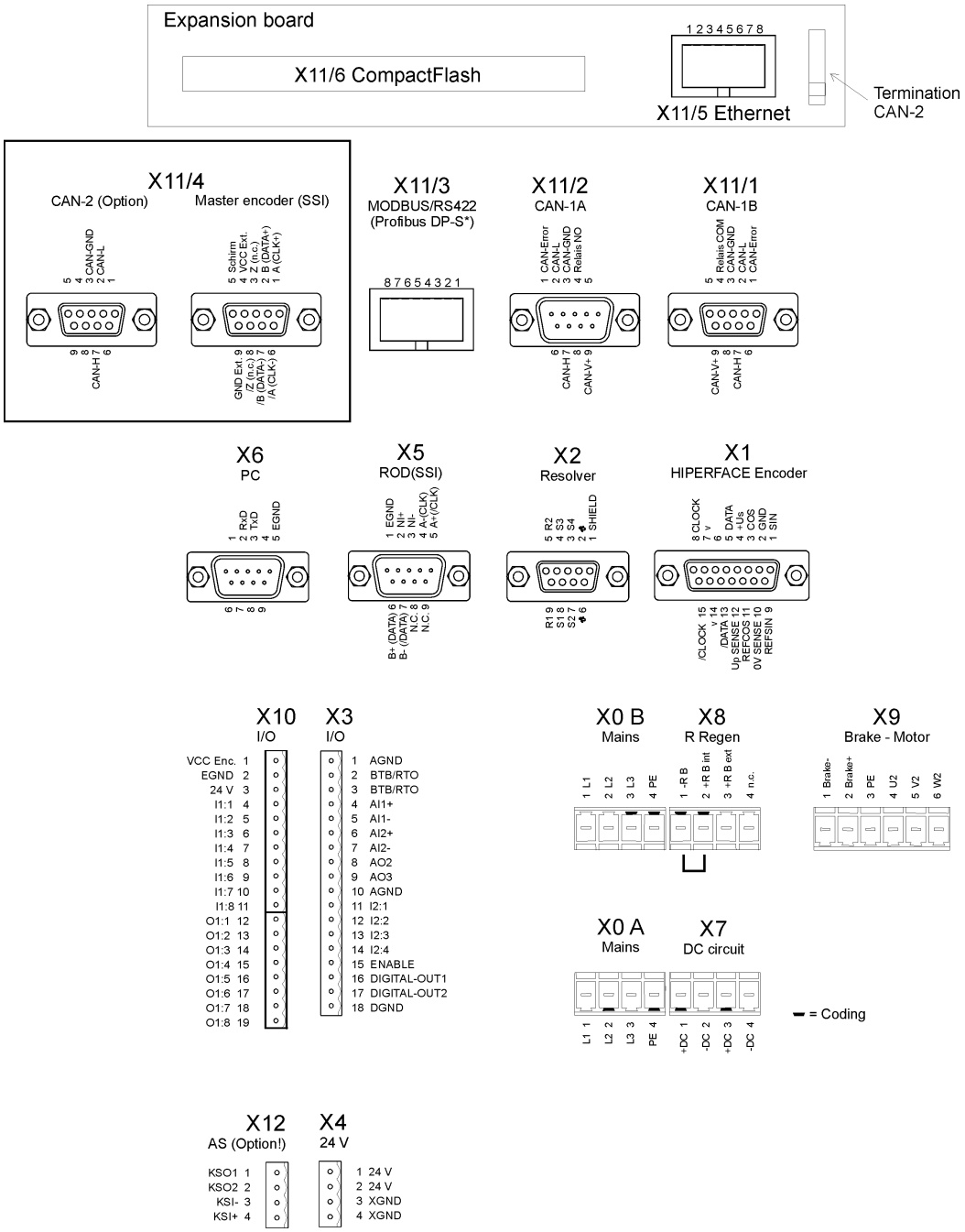
8.4.2 Connection diagram PMCprimo Drive2- part 2



8.4.3 Pin assignments overview



8.4.4 Pin assignments - details

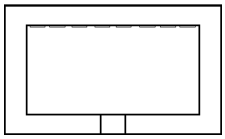


8.4.5 Pin assignments Modbus/Profibus

Note: It is not possible to use Modbus and Profibus the same time. For usage an adapter cable is needed.

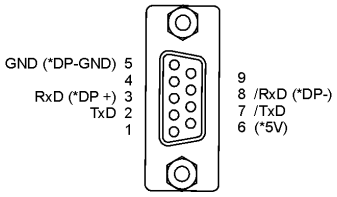
RJ 45

1 2 3 4 5 6 7 8



RJ 45	Signal Modbus	Signal Profibus	D-Sub9
1	GND	DP-GND	5
2			9
3			4
4	/RxD	DP-	8
5	RxD	DP+	3
6	/TxD		7
7	TxD		2
8		5V/100mA	6
-			1

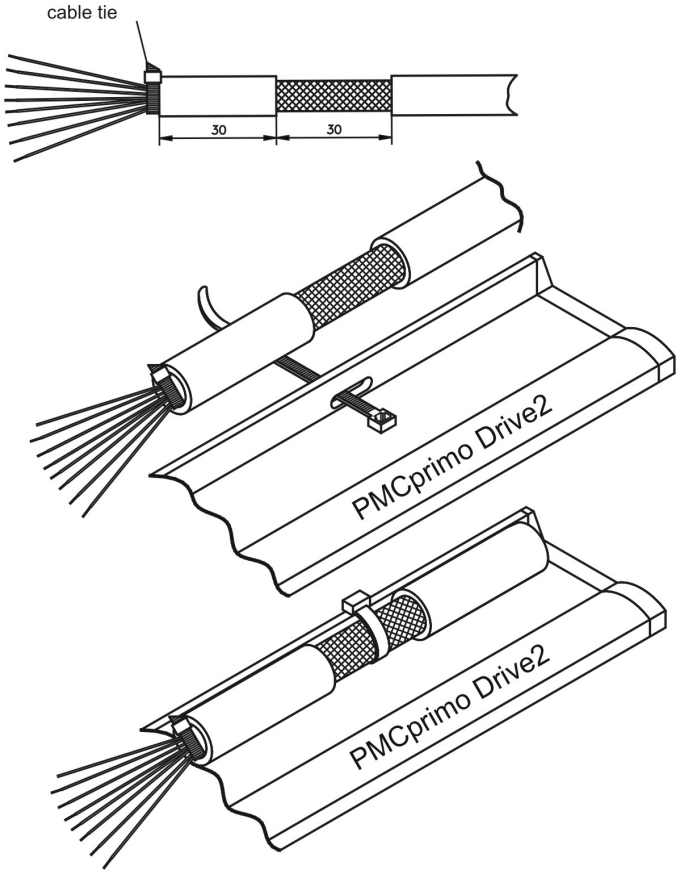
MODBUS/RS422 (Profibus DP-S*)



Note: Adapter cable RJ45 ←→ D-Sub9 is available.

8.4.6 Notes on connection techniques

Shielding connection to the front panel:



Remove the outer covering of the cable and the shielding braid from the cores for the required length. Secure the cores with a cable tie. Remove the outer covering of the cable over a length of about 30mm, without damaging the shielding braid.

Pull a cable tie through the slot in the shielding rail (front panel) of the PMCprimo Drive2.

Use the cable tie to clamp the shielding braid of the cable firmly to the shielding rail.

8.5 Key operation for parameter setting

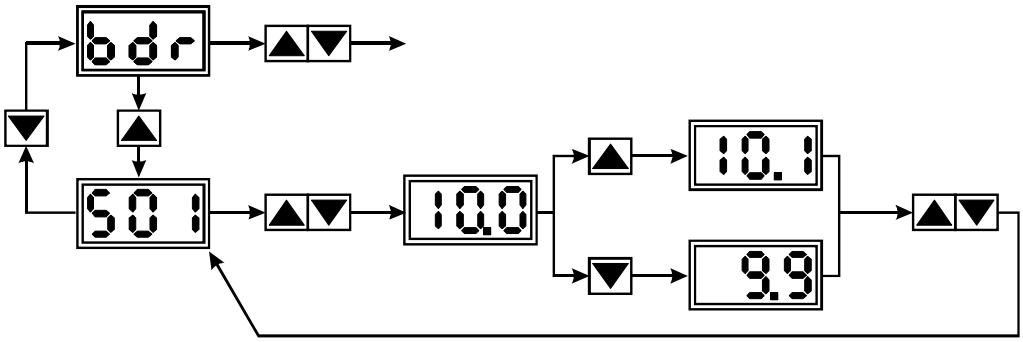
8.5.1 Comparison to the key operation with PMCtendo DD4

The key operation for PMCprimo Drive2 is like the key operation for PMCtendo DD4 (see installation manual for PMCtendo DD4). This means that the two keys are used in the same way and also the menus are named similarly.

8.5.2 Basic key operation

The two keys can be used to perform the following functions:

Key symbol	Functions
▲	press once: go up one menu item, increase number by one press twice in rapid succession: increase number by ten
▼	press once: go down one menu item, decrease number by one press twice in rapid succession: decrease number by ten
▲▼	Press and hold right key, then press left key as well: enter a number, return function name



8.5.3 Menu operation

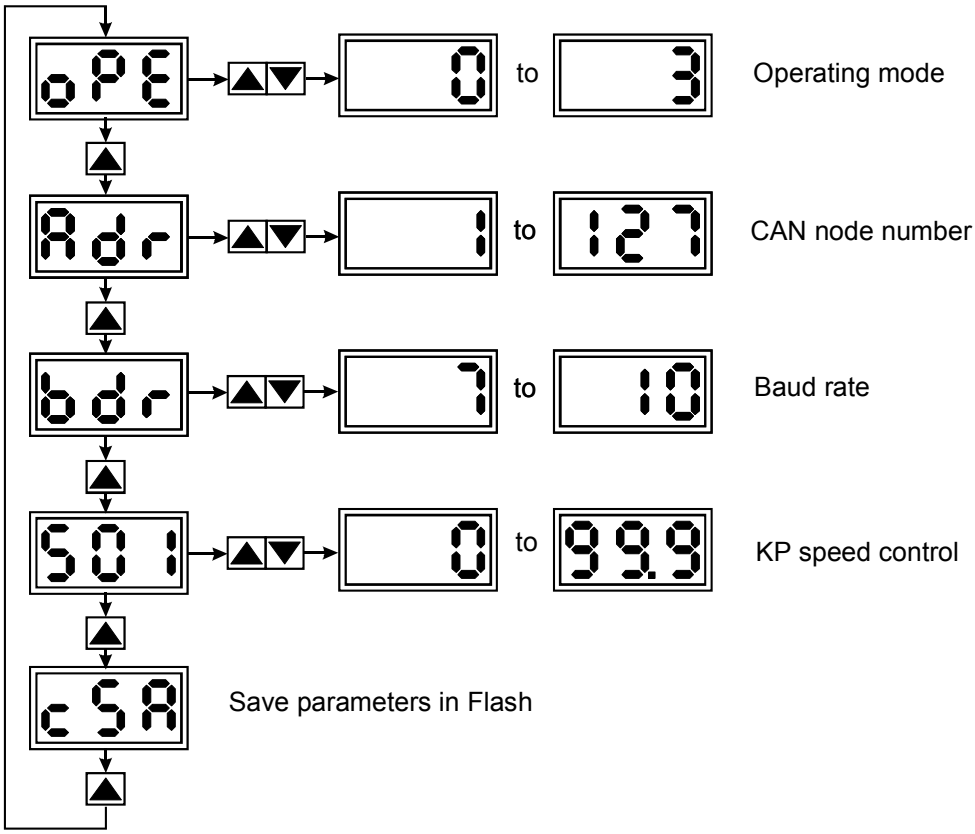
For accessing the menu press the **right key while switching on the 24 V power supply**. Then this parameters can be set with the menu:

- **The operating mode**
  (0: Standalone, 2 Node and 3 Host+Node)
  When changing the operate mode between 2 and 3 then the application program in the flash memory is not erased. The memory is even not erased if mode 0 is selected by a mistake.
- The **CAN node number** depending from the operating mode:
  Standalone: from 1 to 127
  Node: from 1 to 60
  Host+Node: Not available because node number is fixed
- The **CAN baud rate**. For similar settings as for the PMCtendo DD4 only two settings are supported: 7 (500Kbit/s) and 10 (1Mbit/s). The other baud rates as for the PMCtendo DD4 (0 to 6 and 8 to 9) are not available
- The **proportional Gain Kp** (GV command) for the velocity loop of the drive.
- Save parameters.

After changing the parameter and returning from the function the changed parameter have to be saved with the menu for saving. Then the system has to be switched off and on to enable the changed settings.

8.5.4 LED Display

The LED display will show the menu for changing the parameters:



8.5.5 Automatic detection in PMCprimo

For automatic detection of a new drive no special change in the firmware is necessary. Inside the autostart sequence it is determined if a new drive is in the cabinet.

This can be done for example with reading the serial number of the drive.

Example:

```
AS AUTOSTART
ES AUTOSTART
CH0.1
$SER1="SERIALNO"
IF($SER1!=$SER1ACTUAL);XS DRIVE_0;$SER1ACTUAL=$SER1;SP2
NS
```

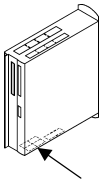
The sequence gets the actual serial number and compares it with the last saved number. If there is a difference then it calls the drive sequence which adjusts all parameters. Then it stores the new serial number. Therefore the drive parameters are stored only once.

9 Interfaces

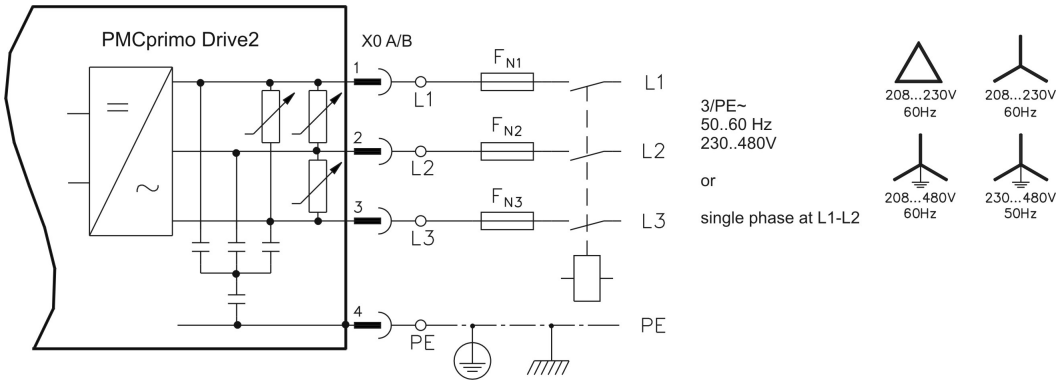
All important interfaces of the PMCprimo Drive2 are shown in this chapter. The precise location of the connectors and terminals can be seen on page 39.

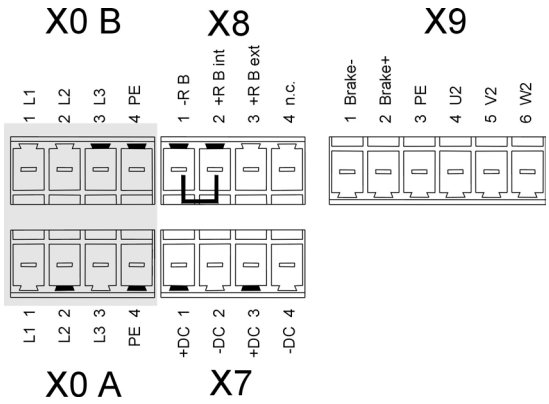
9.1 Power supply

9.1.1 Mains supply (X0)

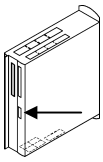


- Direct to earthed 3~ supply, 230V$^{-10\%}$ ... 480V$^{+10\%,}$ 50 ... 60 Hz, integrated filter
- Fusing (e.g. fusible cut-outs) provided by the user ⇒ page 21
- **For single phase operation use L1 and L2!**

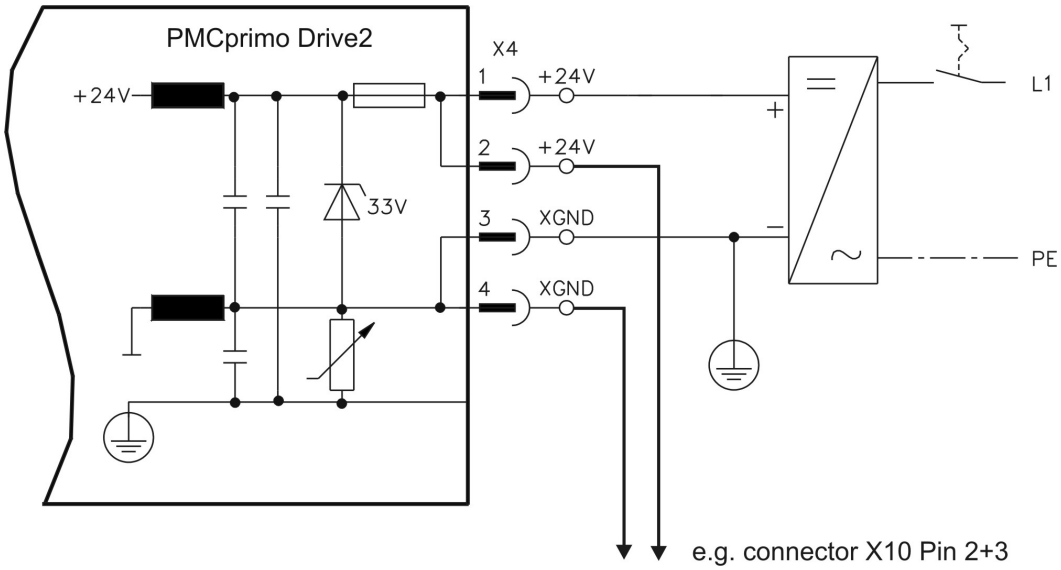


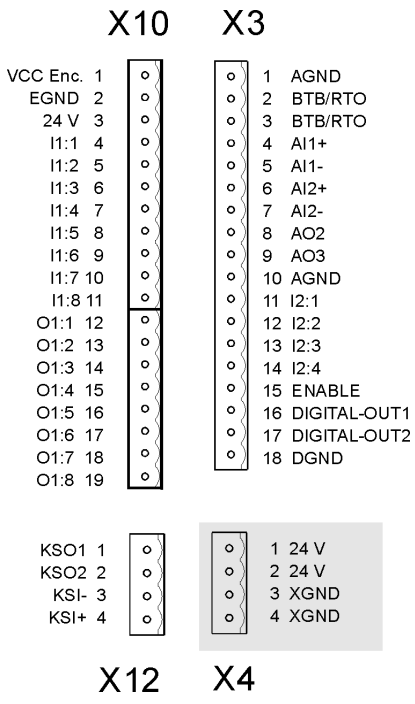


9.1.2 24V-auxiliary supply (X4)

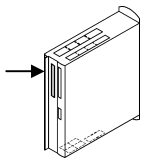


- Electrically isolated, external 24V DC supply, e.g. with insulating transformer
- Required current rating⇒ page 20
- Integrated EMC filter for the 24V auxiliary supply
- **See important notes to commissioning** ⇒ page 78

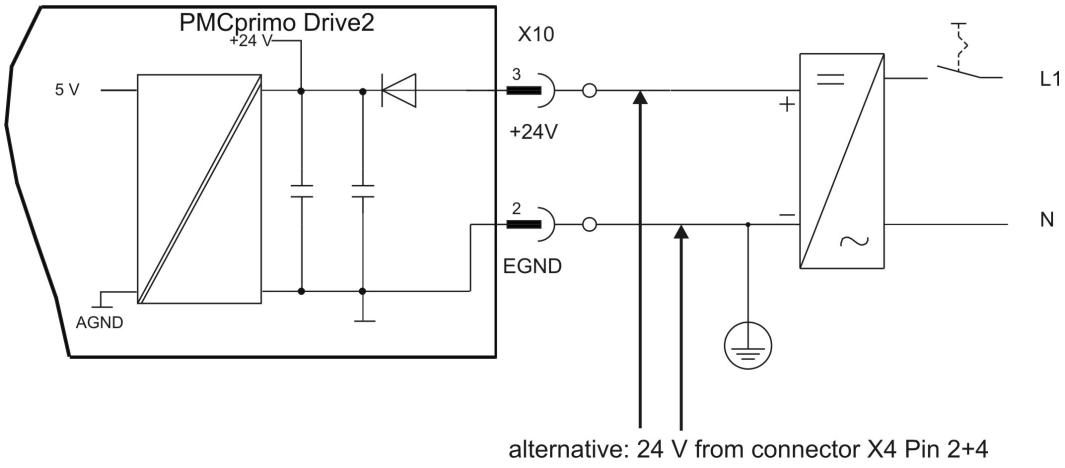


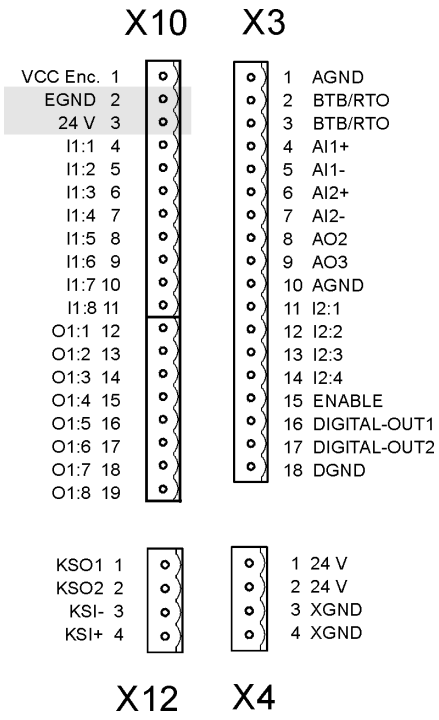


9.1.3 24V-Supply (X10)

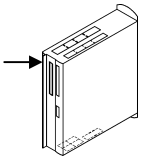


- Electrically isolated, external 24V DC supply, e.g. with insulating transformer
- You can take 24 V from terminal X4
- Required current rating ⇒ page 20
- **See important notes to commissioning** ⇒ page 78

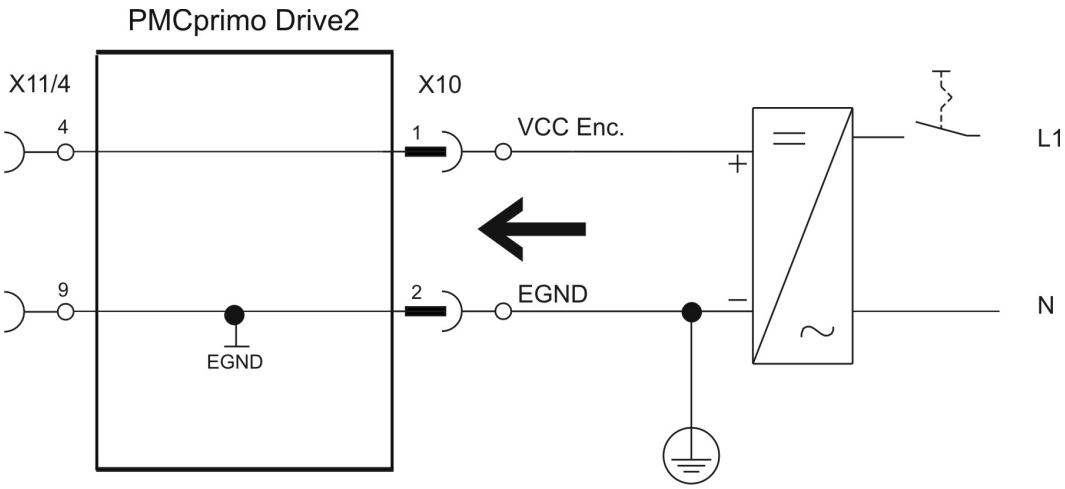




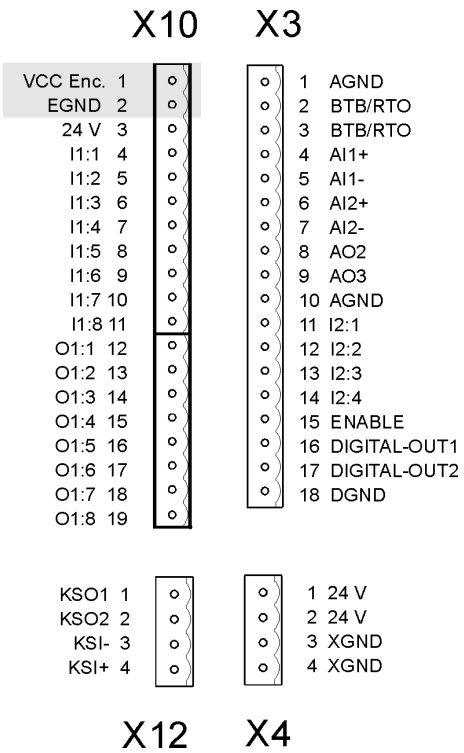
9.1.4 Master encoder supply (X10)



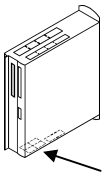
- Common power supply for all connected encoders
- Voltage range: See encoder datasheet
- Reference ground is EGND
- External fusing provided by the user



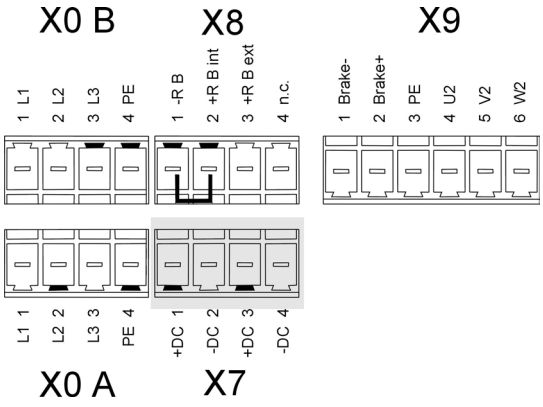
VCC Enc: see encoder data sheet



9.1.5 DC-link (X7)

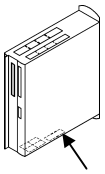


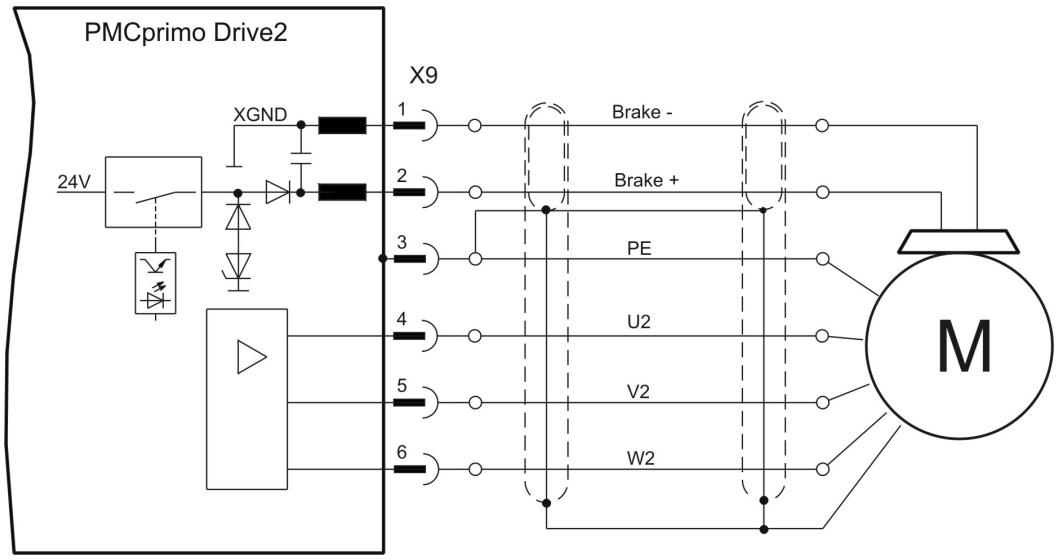
Can be connected in parallel. A patented circuit distributes the regen power among all the amplifiers connected to the same DC-link circuit

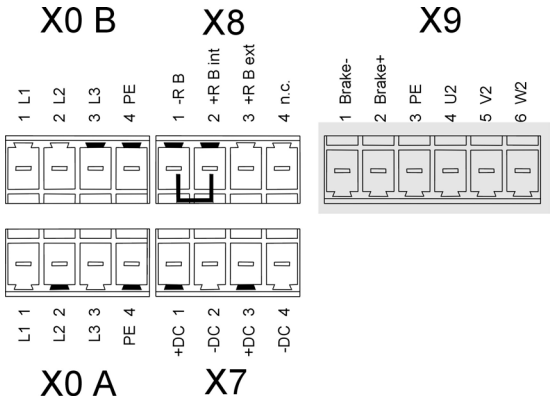


9.2 Motor connection with brake (X9)

9.2.1 Lead length < 25m

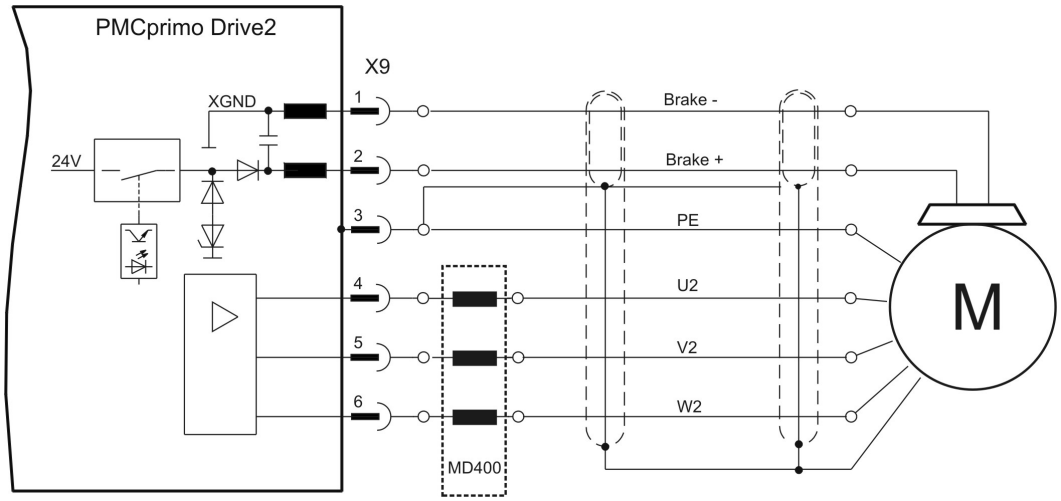


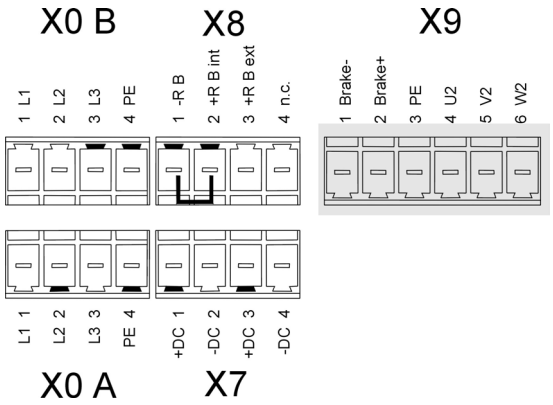




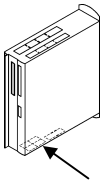
9.2.2 Lead length > 25m

For lead lengths above 25m the choke box MD400 must be wired into the motor lead, close to the PMCprimo Drive2.

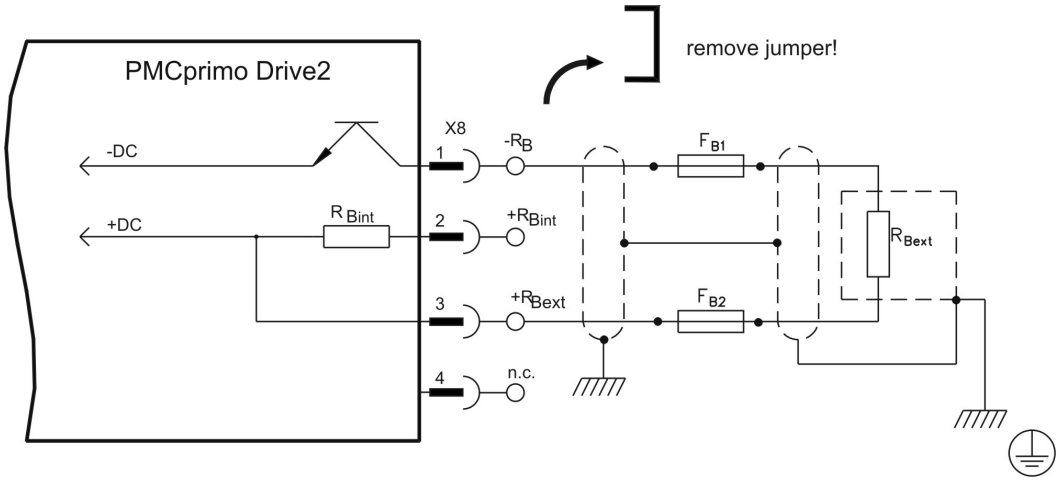


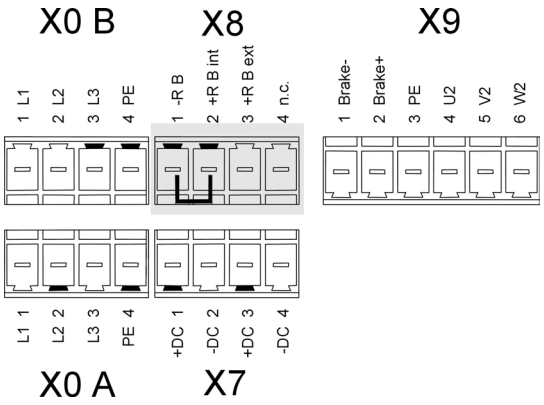


9.3 External regen resistor (X8)



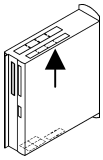
Remove the plug-in link between the terminals X8, Pin 1 (-RB) and X8, Pin 2 (+Rbint).





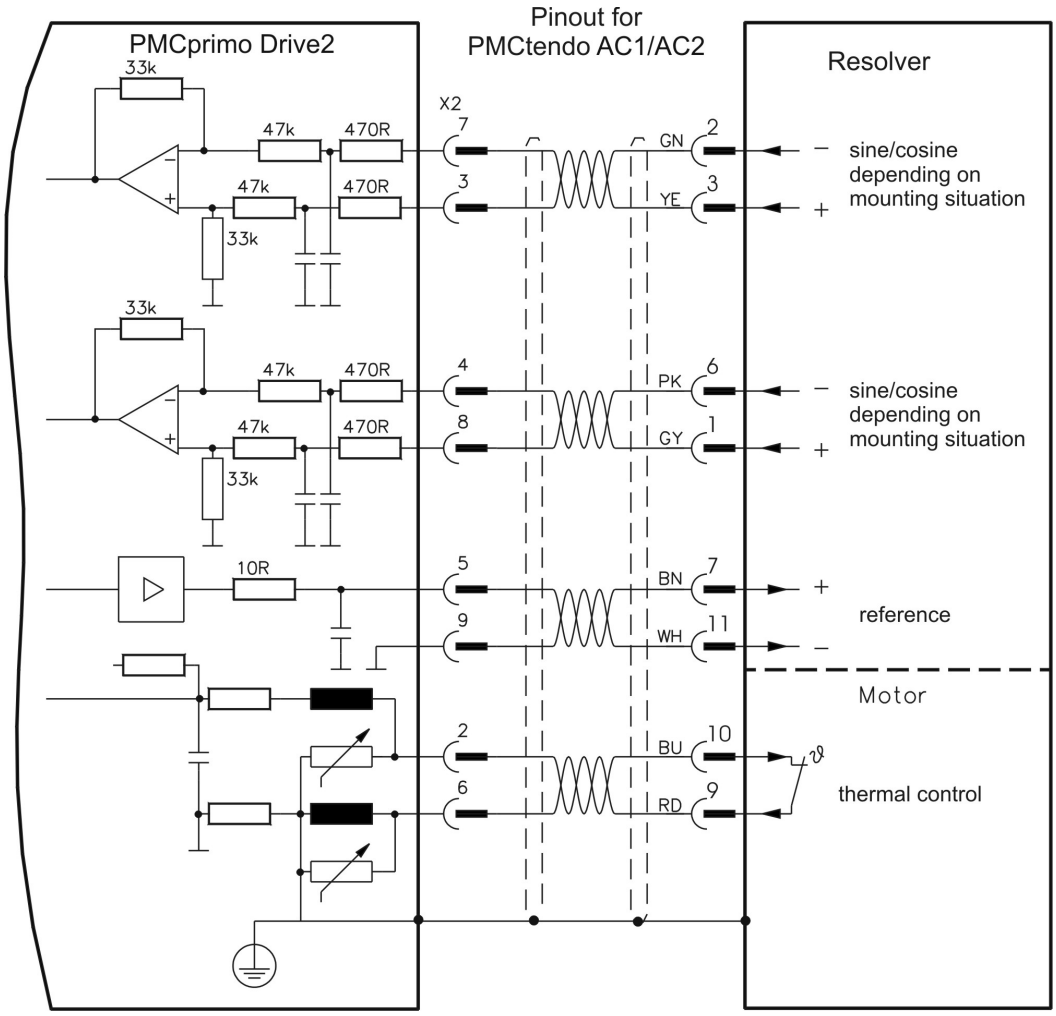
9.4 Feedback

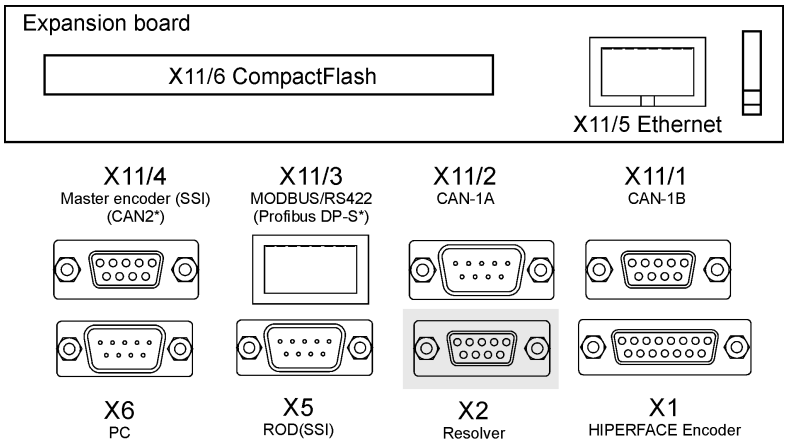
9.4.1 Resolver connection (X2)



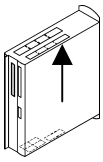
The motors of the PMCtendo AC1 and PMCtendo AC2 series have 2-pole hollow-shaft resolvers built in as a standard. It is possible to connect 2...36-pole resolvers to the PMCprimo Drive2.

If lead lengths of more than 100m are planned, please contact our application department. The thermostat contact in the motor is connected via the resolver cable to the PMCprimo Drive2 and evaluated there.





9.4.2 HIPERFACE Encoder (X1)

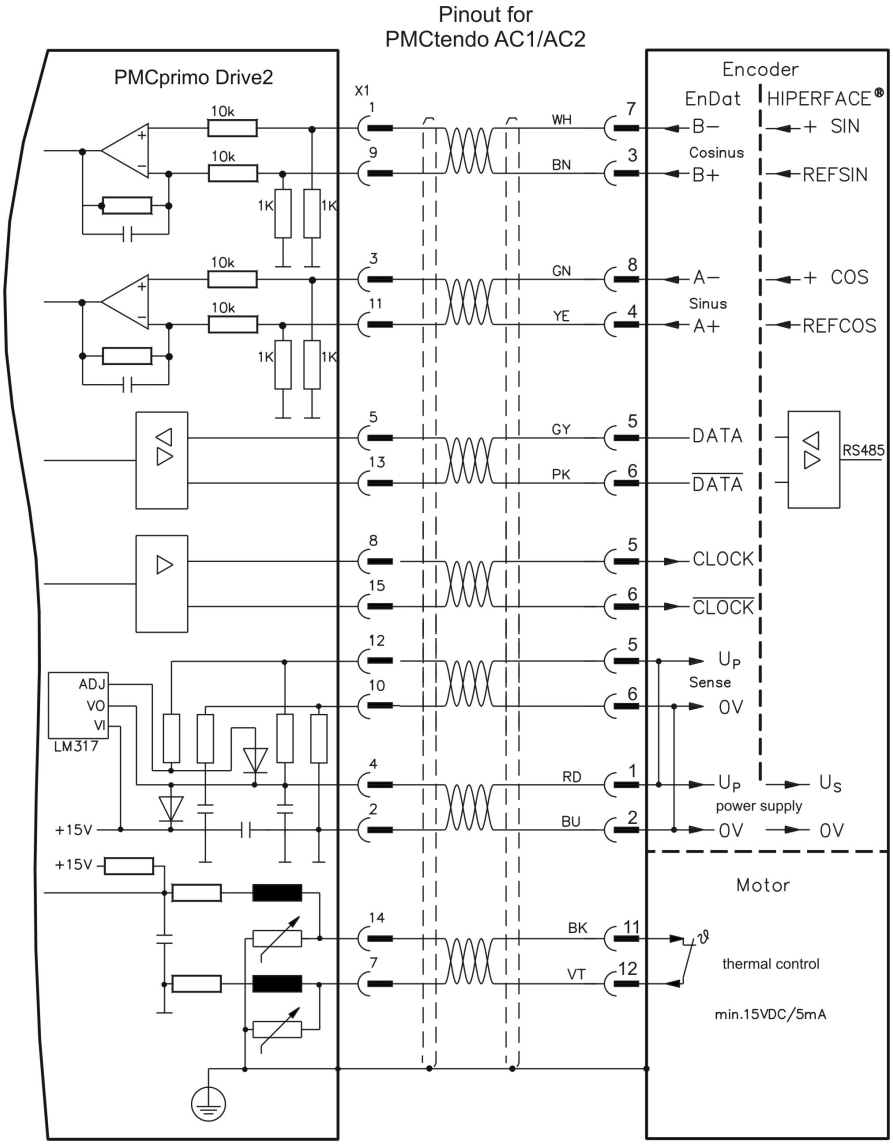


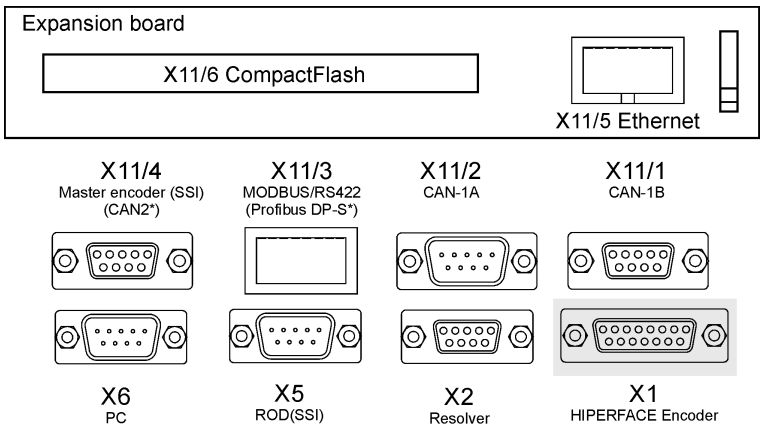
As an option, the motors can be fitted with a single-turn or multiturn sine-cosine encoder (HIPERFACE).

This encoder is used by the PMCprimo Drive2 as a feedback device for drive tasks which require highly precise positioning or extremely smooth running.

If lead lengths of more than 50m are planned, please consult our applications department.

The thermostat contact in the motor is connected via the encoder cable to the PMCprimo Drive2 and evaluated there.

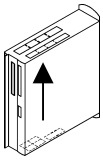




9.5 Encoder emulations

The encoder emulations are normally not used. Nevertheless there are applications which use this emulations (e.g. linking the actual position to another PMCprimo Drive2 on channel 2.

9.5.1 Incremental encoder emulation ROD (X5)



The incremental-encoder interface is part of the package supplied. In the PMCprimo Drive2, the position of the motor shaft is calculated from the cyclic-absolute signals of the resolver or HIPERFACE encoder.

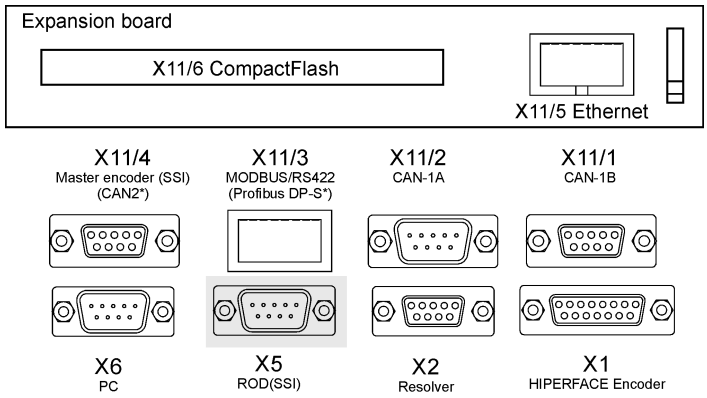
Incremental-encoder compatible pulses are generated from this information.

You can change the resolution with the parameter „Resolution“ (s. setup software **PDRIVE,** window „Encoder“):

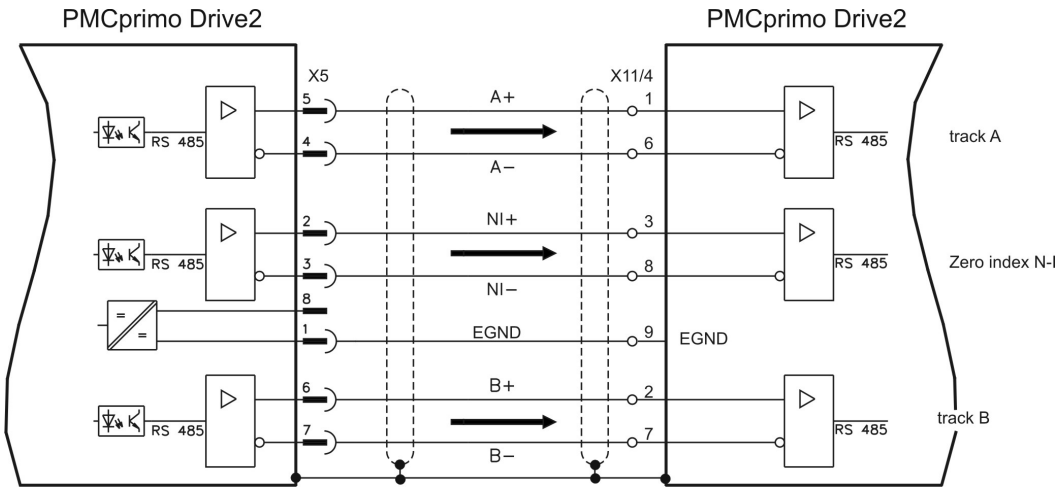
Resolution encoder	Feddback system
256/512/1024	Resolver
2048/4096	HIPERFACE
8192	HIPERFACE up to 3000 rpm
16384	HIPERFACE up to 1500 rpm

You can also adjust and store the position of the zero pulse within one mechanical turn (parameter „NI-Offset“, window „Encoder“ in **PDRIVE**). Because of the compatibility with normal commercial pulse encoders, you can only set the zero pulse when A=B=1.

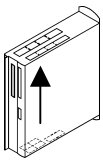
The drivers are supplied from an internal supply voltage.



9.5.2 Application example



9.5.3 SSI emulation (X5)



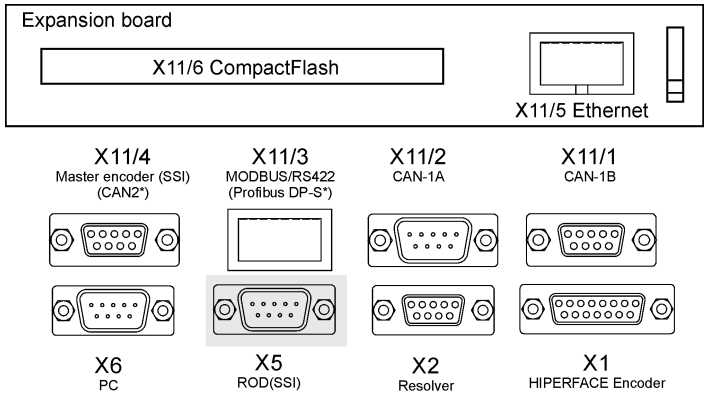
The SSI interface (synchronous serial absolute-encoder emulation) is part of the delivered package, too.

In the PMCprimo Drive2, the position of the motor shaft is calculated from the cyclic-absolute signals of the resolver or HIPERFACE encoder. A position output is generated from this information, compatible with the data format of normal commercial SSI absolute encoders. This synchronous, serial, cyclic-absolute 12-bit (singleturn) or 24-bit (multiturn) information is output on the SUB-D-Connector X5.

The signal sequence can be output in Gray code (standard) or in binary code (Parameter „SSI-Code“, window „Encoder“ in **PDRIVE**).

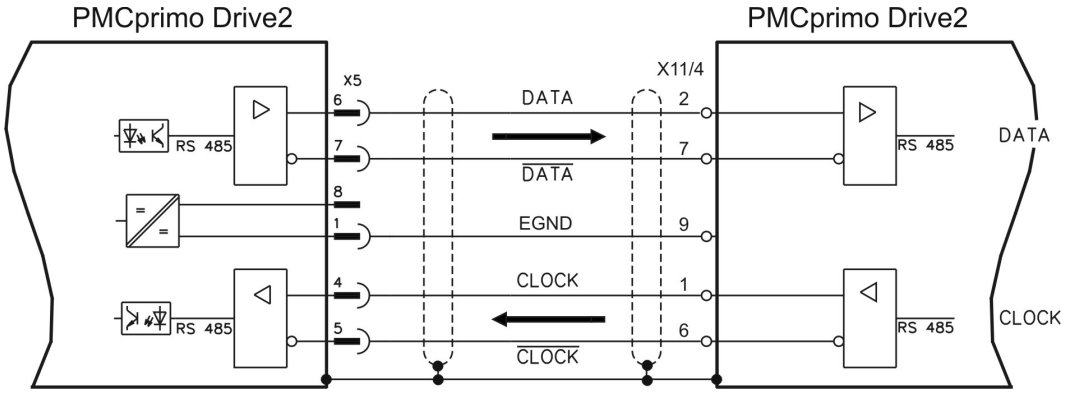
A serial signal is read out from the control, with a synchronous clock frequency of max. 1.5 MHz. The servo amplifier can be adjusted to the clock frequency of your SSI-evaluation with the SSI-CLOCK parameter (200 kHz or 1.5MHz and inverted).

The drivers are supplied from an internal supply voltage.



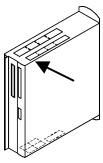
9.5.4 Application example

The count direction for the SSI interface is upwards when the motor shaft is rotating clockwise (looking at the shaft end).



9.6 RS232 interface, PC interface (X6)

9.6.1 General

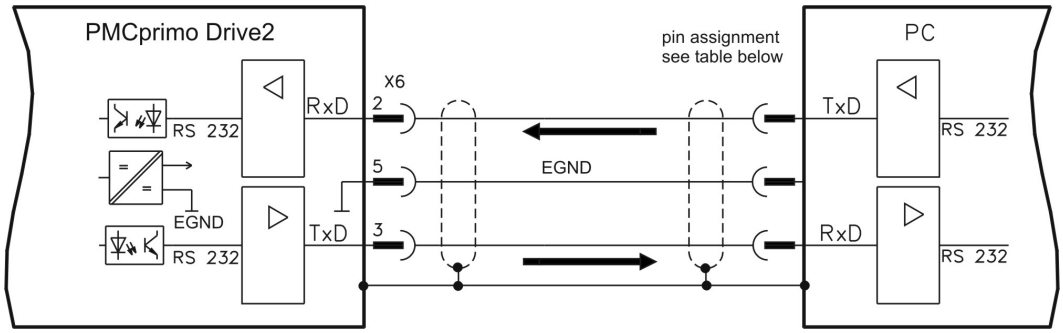


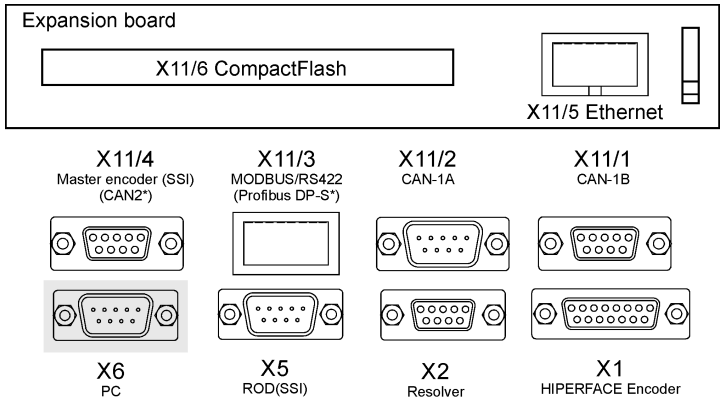
The programming of the PMCprimo Drive2 is very easy with the setup software PMCprimo Motion Control Tools on a Personal Computer (PC).

PDrive and **PTerm** are part of the PMCprimo Motion Control Tools on the supplied CD-ROM.

Connect the PC interface (X6) of the servo amplifier via a normal commercial 3-core null-modem cable to a serial interface on the PC. You can select the port (COM1 or COM2) with the setup software.
Further details can be found in the software manual for **PDrive** and **PTerm**.

The interface is electrically isolated through an optocoupler.

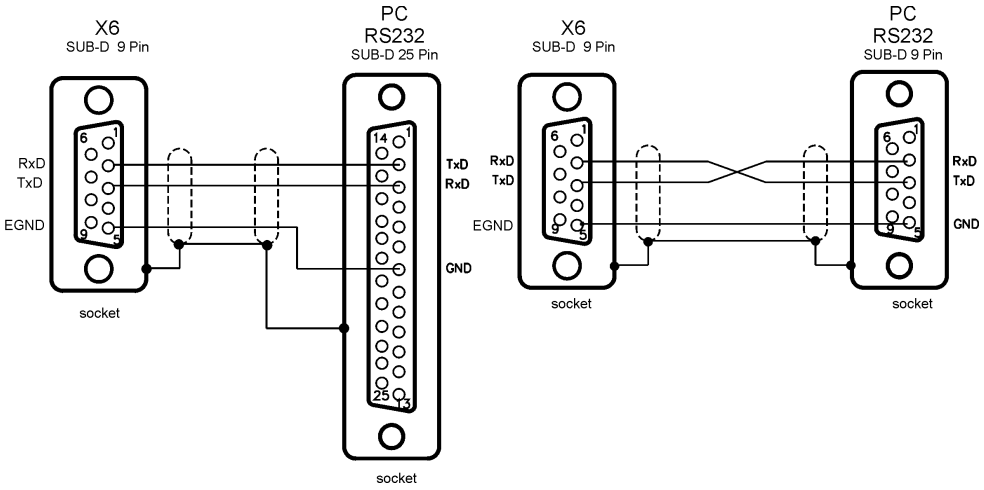




9.6.2 Pin assignment of the null-modem cable

View:

Looking at the face of the built-in SUB-D connectors, this corresponds to the solder side of the SUB-D sockets on the cable.



Caution!

Do not connect more cores than shown: X6 (Pin 2,3,5)!

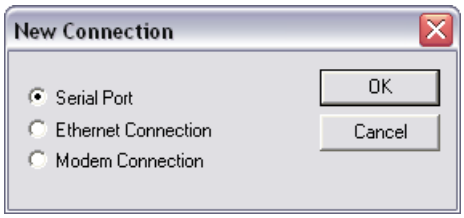
The interface may be damaged!

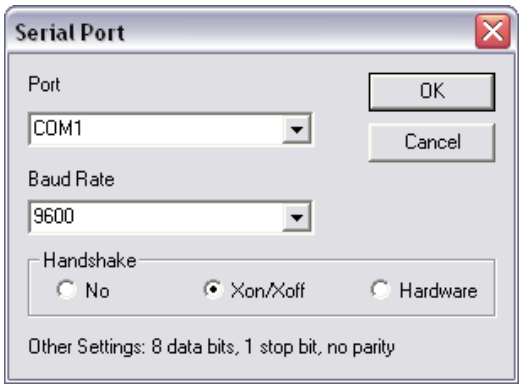
Connection via RS232
The following parameters are used (standard):

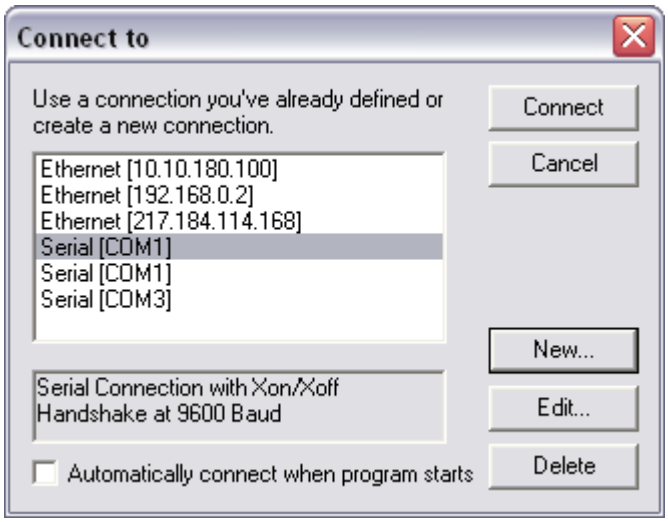
- 9600 Baud
- 8 data bits
- 1 stop bit
- No parity
- XOn/XOff-Software-Handshake

With the command **BD** the communication rate can be changed (see PMCprimo programming manual).

Set these parameters with **PTerm** (see **PTerm** programming manual):





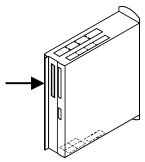


After clicking on 

the connection will be made and programming can be started.

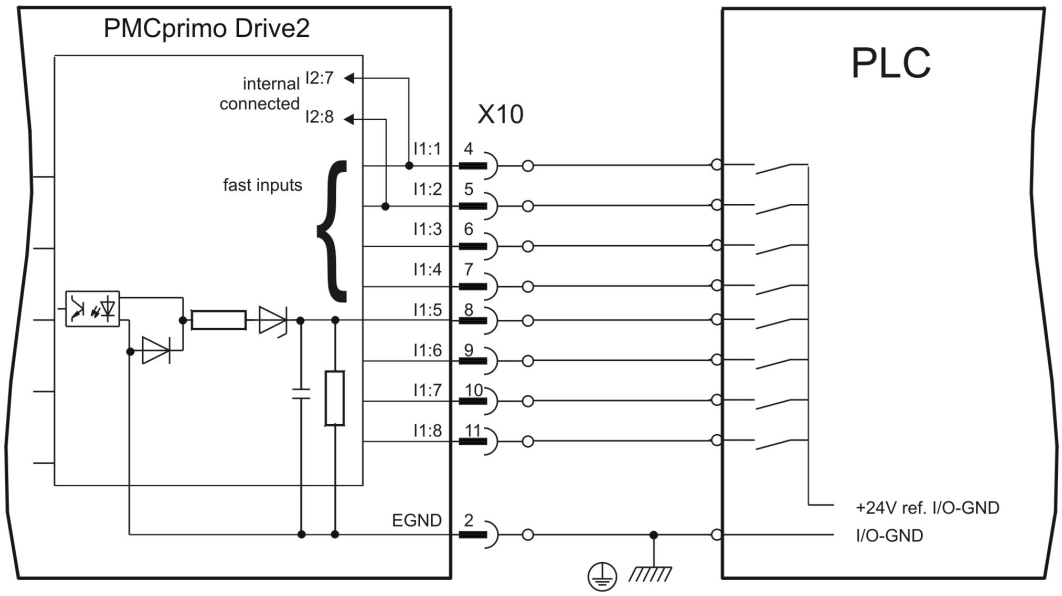
9.7 Digital signals

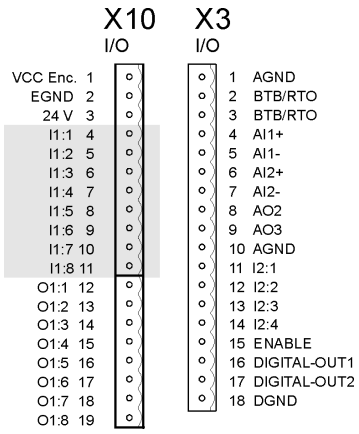
9.7.1 Digital inputs I1:1 - I1:8 (X10)

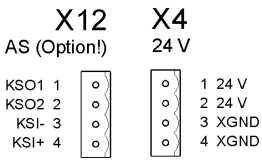


All digital inputs are electrically isolated through optocouplers

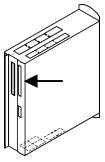
- Reference ground is EGND (terminal X10, Pin 2)
- Logic is **PLC compatible**
- H-level: +11..24V / 10 mA
- L-level: 0 V .. 11 V/ 0 mA
- The inputs I1:1 to I1:4 are „fast“ inputs (< 1 us) for e.g. product referencing
- I1:1 and I1:2 will be additionally mapped to both inputs E2:7 and E2:8





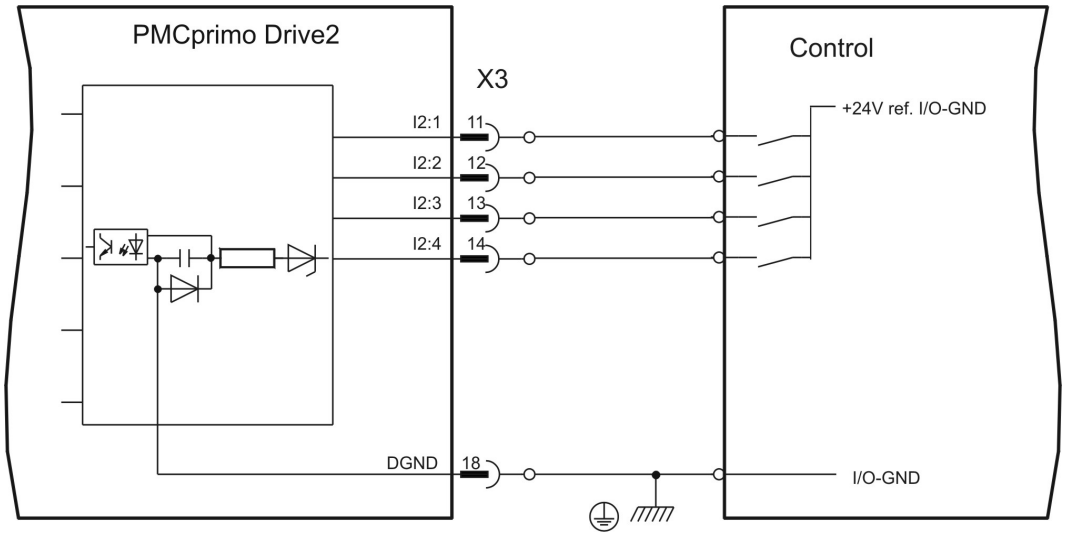


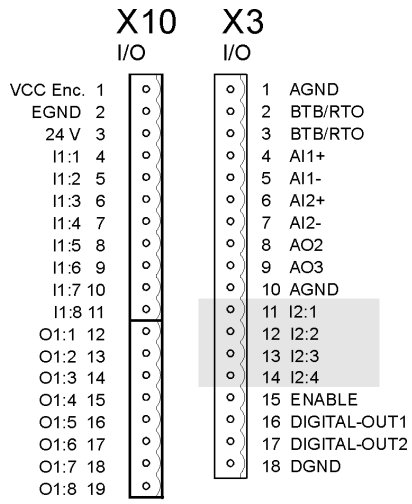
9.7.2 Digital inputs I2:1 - I2:4 (X3)

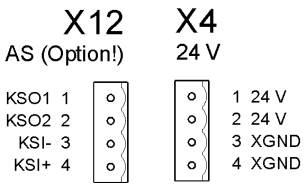


All digital inputs are electrically isolated through optocouplers

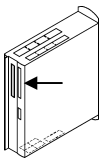
- Reference ground is DGND (terminal X3, Pin 18)
- Logic is **PLC compatible**
- H-level: +12 … 30V / 7mA
- L-level: 0 … 7V / 0 mA







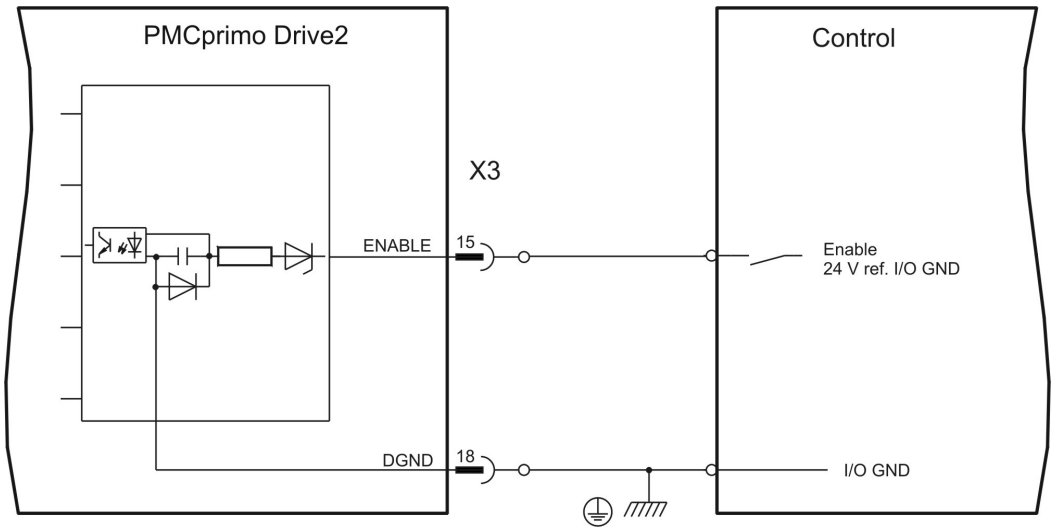
9.7.3 Digital ENABLE input (X3)

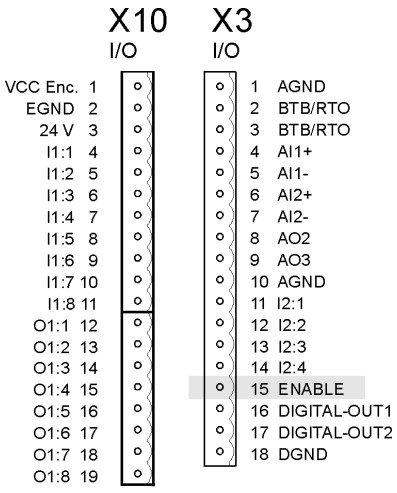


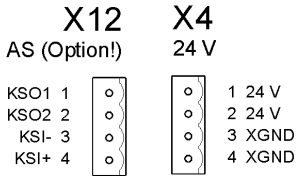
The output stage of the PMCprimo Drive2 is activated by the enable signal (terminal X3, Pin 15, input 24V, **active high**).

In the inhibited state (low signal) the motor which is attached does not have any torque.

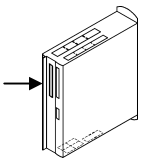
- Reference ground is **digital**-GND (DGND, terminal X3, Pin 18)
- Logic is **PLC compatible**
- H-level: +12 … 30V / 7 mA
- L-level: 0 … 7V / 0 mA
- The digital input is electrically isolated through optocoupler



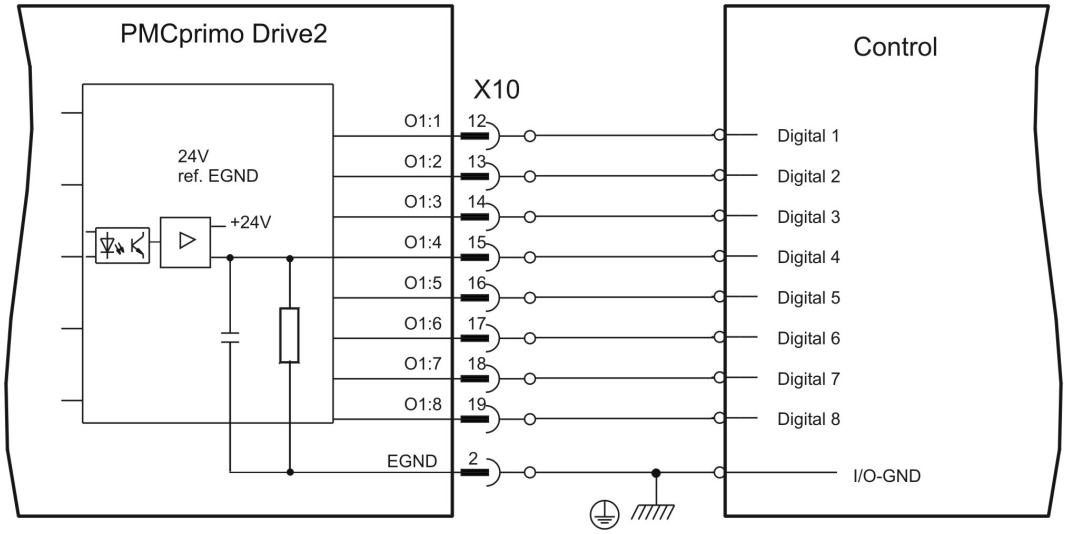


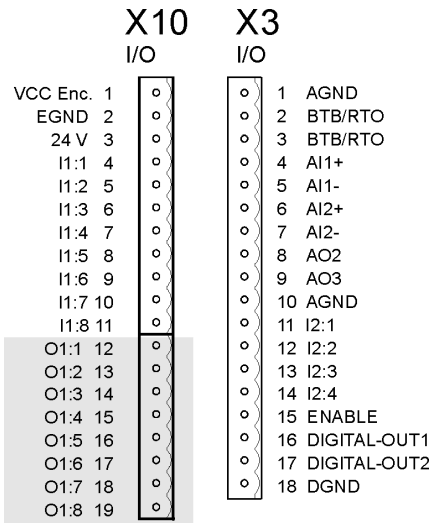


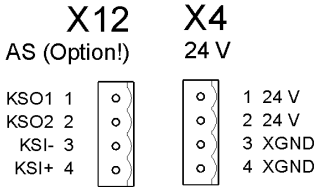
9.7.4 Digital outputs O1:1 - O1:8 (X10)



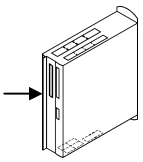
- Reference ground is EGND (terminal X10, Pin 3)
- All digital outputs are electrically isolated and shortcircuit protected
- „high-side“-outputs: 24V /0,1 A each output





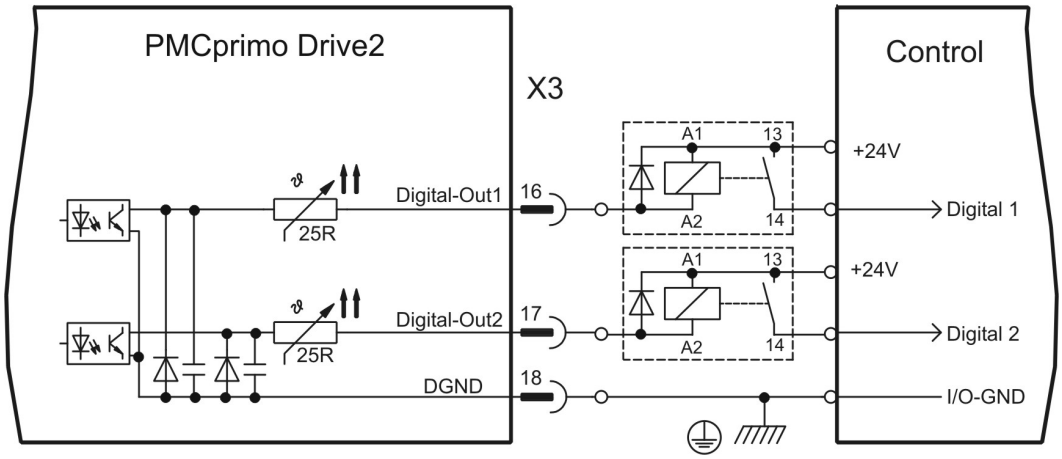


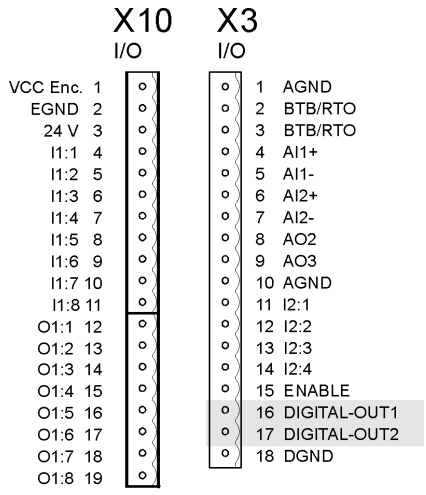
9.7.5 Digital outputs Digital-Out 1+2 (X3)

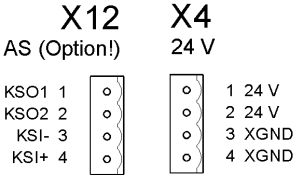


- Reference ground is DGND (terminal X3, Pin 18)
- All digital outputs are electrically isolated
- „Open-Collector“-outputs: 24V /10 mA each output

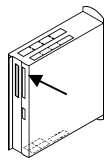
The both digital outputs DIGITAL-OUT 1+2 can not be used with the PMCprimo programming language.
But you can select with PDrive, screen window “I/O Digital“, a predefined output function , e.g. „regen resistor threshold exceeded“.
More information can be found in the PDrive user manual.



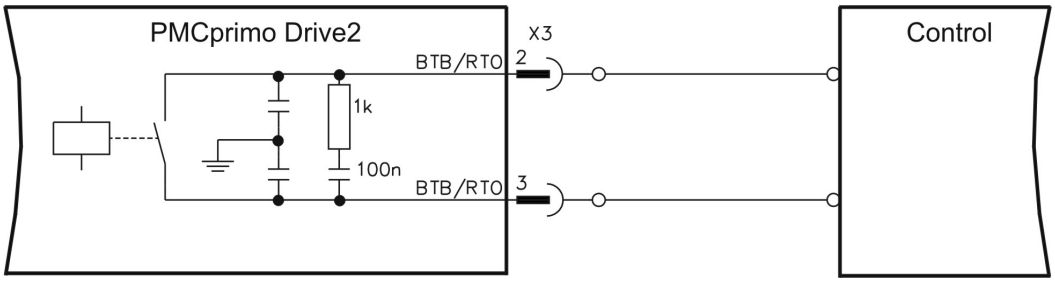




9.7.6 Relay output (X3)



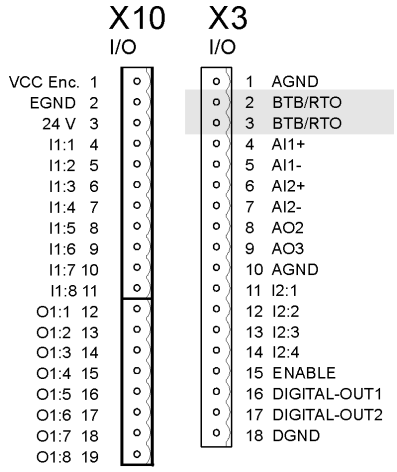
- BTB/RTO: Relay output, max. 30V DC or 42V AC, 0.5A
- Ready-to-operate contact NO (Terminal X3, Pin 2 and X3, Pin 3)

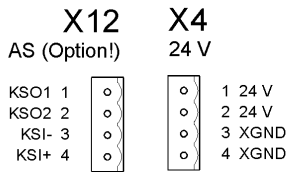


Operational readiness (terminals X3, Pin 2 and X3, Pin 3) is signalled by a floating relay contact. The contact is closed when the servo amplifier is ready for operation, the signal is not influenced by the enable signal, the I²t- limit, or the regen threshold.

Faults with error number xF20 or higher cause the BTB/RTO contact to open and the switch off of the output stage.

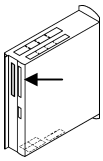
A list of the error messages can be found on page 81.



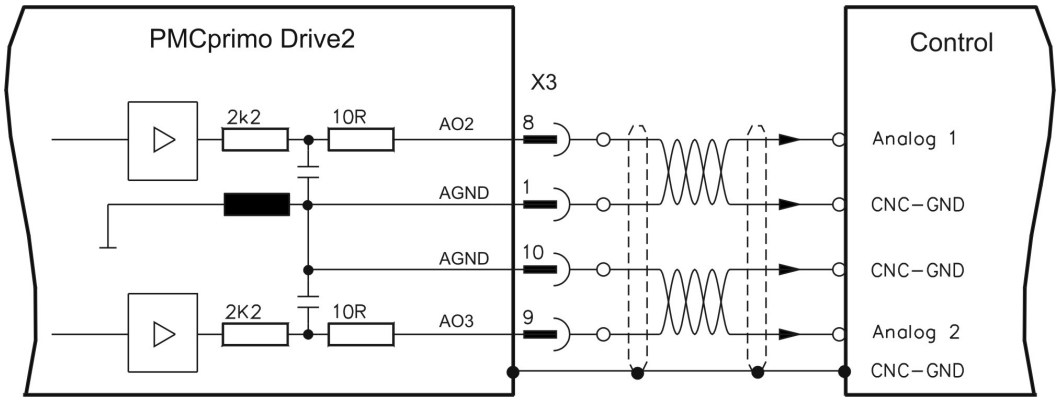


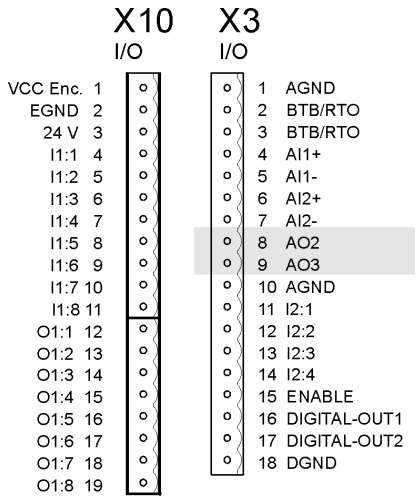
9.8 Analog signals

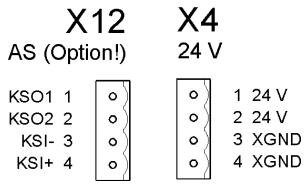
9.8.1 Analog outputs AO2 and AO3 (X3)



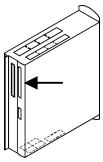
- Reference ground is AGND (Terminal X3 Pin1 and X3 Pin10)
- Output resistance: 2,2 kΩ
- Output voltage range: ± 10 V
- Resolution: 10 Bit



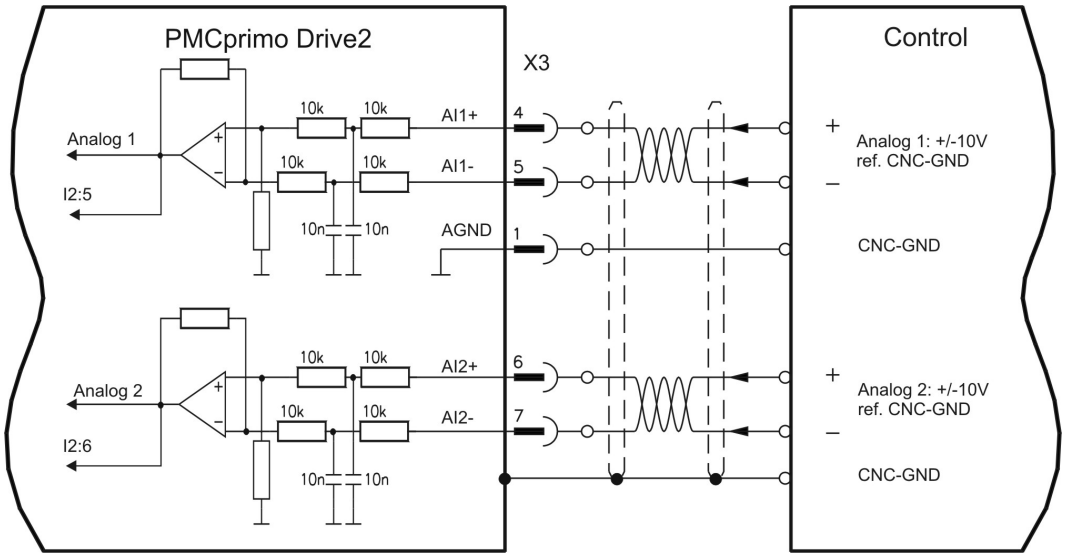




9.8.2 Analog inputs AI1 and AI2 (X3)

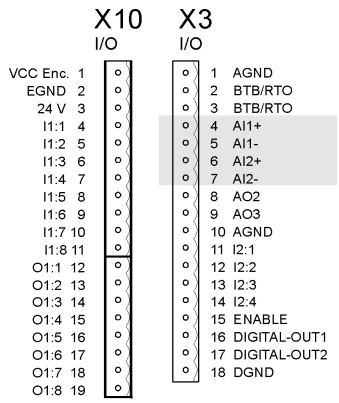


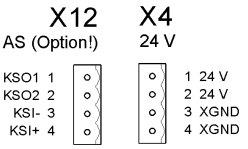
- Reference ground is AGND (Terminal X3 Pin1 and X3 Pin10)
- Input resistance: 20 kΩ
- Differential-input voltage max: ± 10 V
- Resolution AI1: 14 Bit
- Resolution AI2: 12 Bit



The analog inputs AI1 and AI2 are internal additionally mapped on the digital inputs E2:5 and E2:6. If the value of the applied voltage is beyond 7,5 V, it will be regarded as HIGH-Signal. By this means, there are two more digital inputs available, if needed.

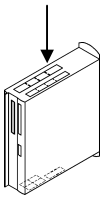
Attention: The maximum permitted input voltage range may not be exceeded (±10V). See page 20). The inputs are not divided gavalnic!





9.9 CAN bus interface (X11/2 and X11/1)

9.9.1 General

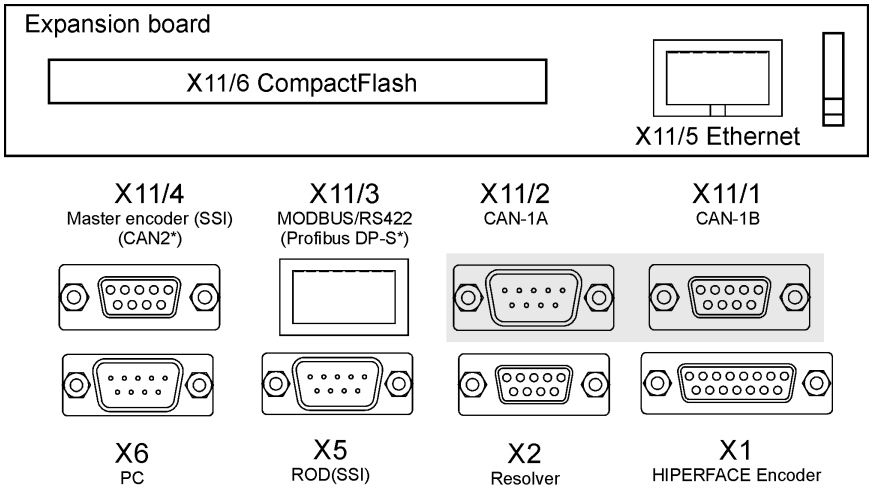


With the CAN bus interfaces CAN-1B (X11/1) and CAN-1A (X11/2) multible PMCprimo-motion control-systems can be connected together.

The bus speed is 500kBaud or 1Mbit/s.

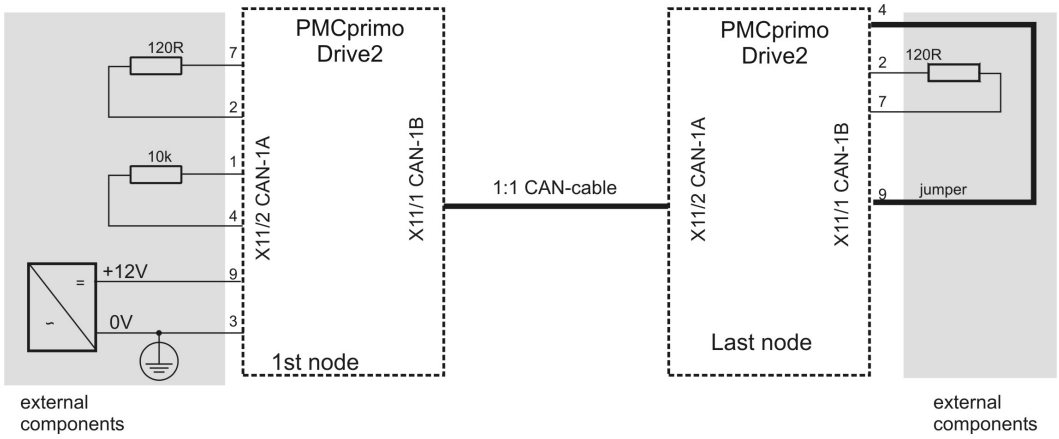
Additional safety signals provide fault detection.

Much more details about connection systems via CAN are included in the manual „PMCprimo CAN network“. The manual is part of the enclosed CD-ROM „PMCprimo Motion Control Tools“.



9.9.2 Connecting PMCprimo Drive2 systems

On each system CAN-1A (X11/2) and CAN-1B (X11/1) of the next system are joined together in the way as shown below.



9.9.3 CAN bus cable

The interface cable is a 1:1 connection (9-pole SUB-D socket to 9-pole SUB-D plug).

- Characteristic impedance: 120 Ω
- Cable capacitance : max. 60 nF/km
- Lead resistance (loop):: 159,8 Ω/km
- Max. cable length : 70 m (1st to last node)

For EMC reasons, the SUB-D connector housing must fulfill the following conditions:

- metal or metallized housing provision for cable shielding connection in housing,
- large-area connection.

You have to terminate the first and the last node (120 Ω).

9.9.4 Speciality 1st node

- The 1st node is supplied at CAN-1A (X11/2, Pin 9) with +12V , at Pin 3 CAN-GND (0V).
- Minimum power dissipation of the power supply unit: 1 VA each node.
- An additional resistor 10 kΩ (250 mW, metal 1%) between Pin 1 and Pin 4 is necessary.

9.9.5 Speciality last node

- The last node needs a jumper bridge (0 Ω) at CAN-1B between Pin 4 and Pin 9.

You can order pre-assembled cables with the following Art.No.:

Position	Art.No
CAN bus cable (1:1) 250 mm	1803136
CAN bus cable (1:1) 700 mm	1803117
CAN feedlead	0802951
CAN termination	0802950
Power supply 12 V	4803002

9.9.6 Fault detection

The following faults will be detected:

- Missing or defect +12V-CAN power supply
- Malfunction of a bus node
- Break of the CAN bus cable

9.9.7 Connecting external CANopen bus devices

It is possible to connect external CANopen devices with PMCprimo-motion control-systems.

With e.g. a CAN-I/O module you can increase the number of inputs and outputs in the system.

A CANopen encoder or CANopen panel can also be used.

Much more examples and hints can be found on the manual „PMCprimo CAN network“ on the enclosed CD-ROM.

9.10 Master encoder interface / CAN2 (X11/4)

The PMCprimo Drive2 is designed for use with incremental or SSI encoders. The encoder type can easily be changed with the **FS** command**.**

With SSI encoders the number of data bits can be set with **NB**.

The logical sense of each encoder input can be changed with the command **CW**. Setting the direction bit reverses the direction of the encoder without wiring.

If a reference signal occurs, the actual encoder position is stored (see reference inputs page 59). This is useful for product referencing. For further details see PMCprimo programming manual.

A master encoder is normally connected at the encoder input of channel 2. But with the **FC** command the encoder signals can be redirected.

All encoders have a common power supply with connector X10 (Pin 1+2). See also page 48.

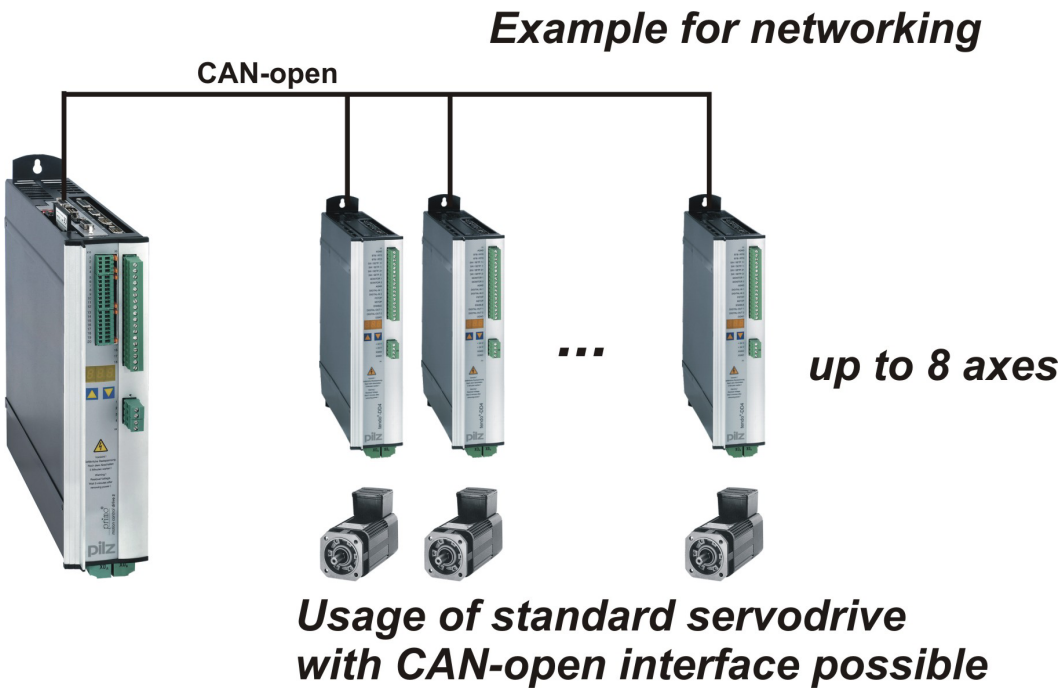
If encoders with different supply voltages should be connected, the encoder cables have to be modified. The two wires for supply voltage are connected with an external power supply (X11/4: Pin 4+9).

The input configuration is designed for 5 V logic level. Exceeding this range will damage the input logic.

9.10.1 CAN 2 interface

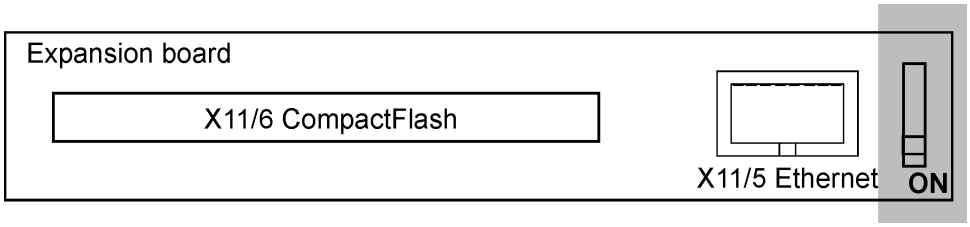
The interface X11/4 can be used, with the expansion board (page 88), as second CAN interface (CAN-2).

With the used CANopen protocol, other CAN-Bus devices can be integrated in the network. You can increase the number of inputs and outputs, with a CAN-I/O module. CANopen encoders or a CANopen panel can be included also.



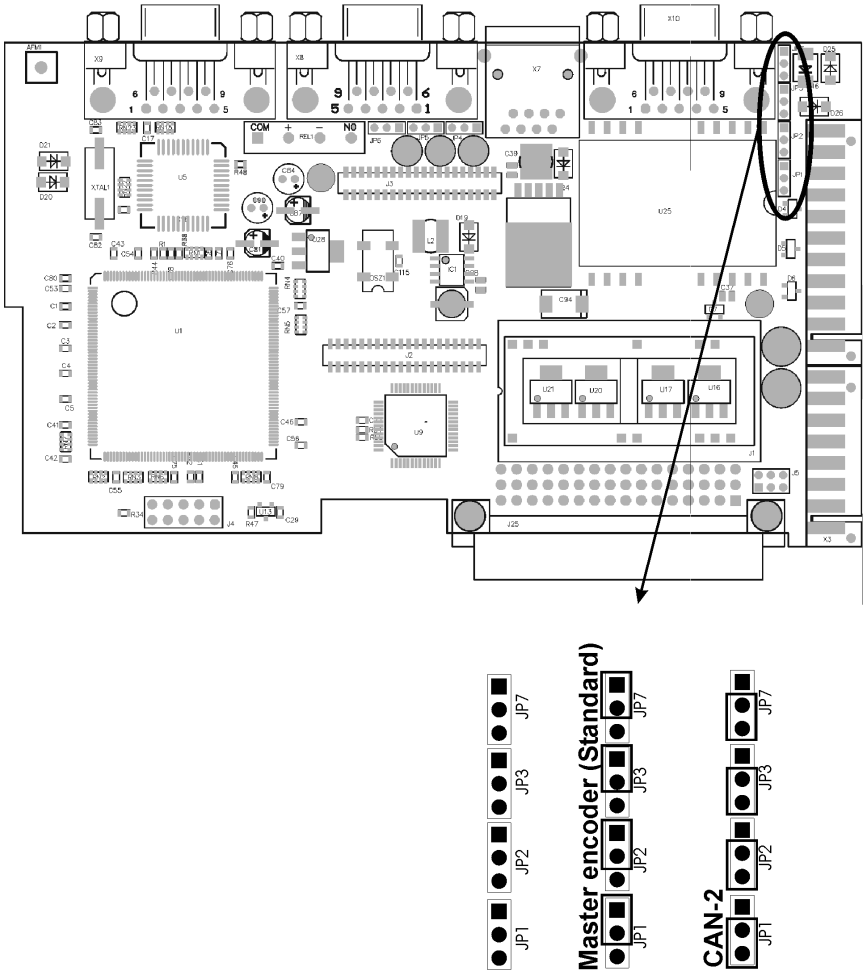
Pin	Description
2	CAN-L
3	CAN-GND
7	CAN-H

Note:
The termination (120 Ω) for CAN-2 is activated with a DIP-switch. For that switch the DIP-switch to “ON”.



The 12 VDC feed is not necessary with this kind of networking. For wiring of the CAN bus, cables of our standard delivery program can be used (see page 68).

9.10.2 Jumper settings



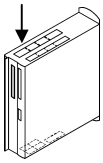
A manual for installation of the PMCprimo-board is available.

ESD!

ESD : electrostatic discharge
ESDS : electrostatic sensitive devices

Motion control units contain electrostatic sensitive devices which will be damaged by electrostatic discharge. Therefore servicing shall only be performed in ESD safe areas and by ESD protected personnel.

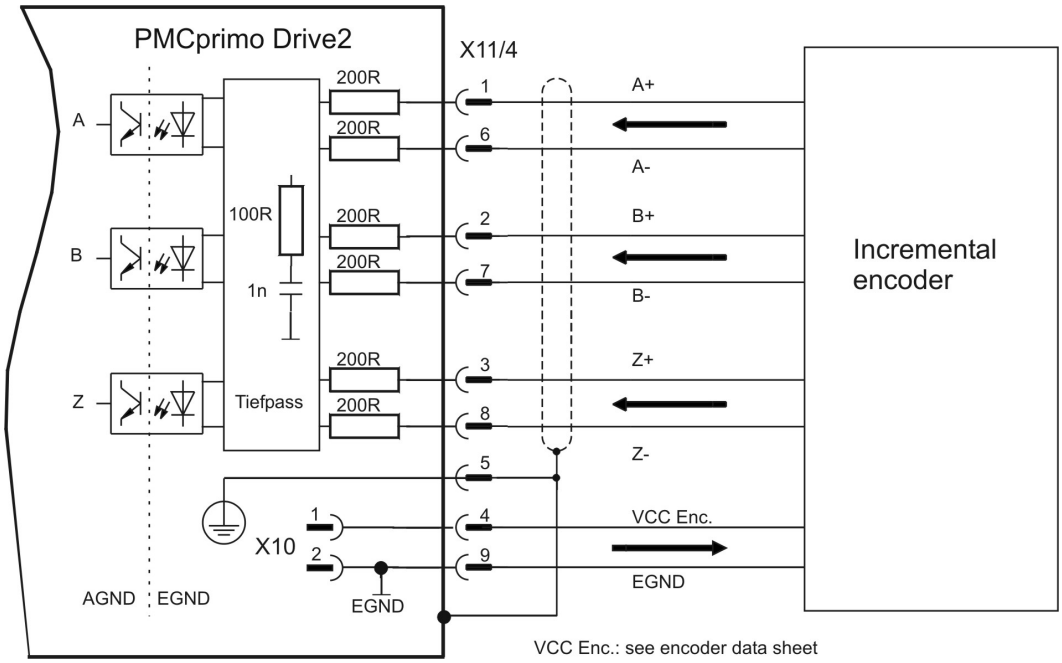
9.10.3 Incremental encoder

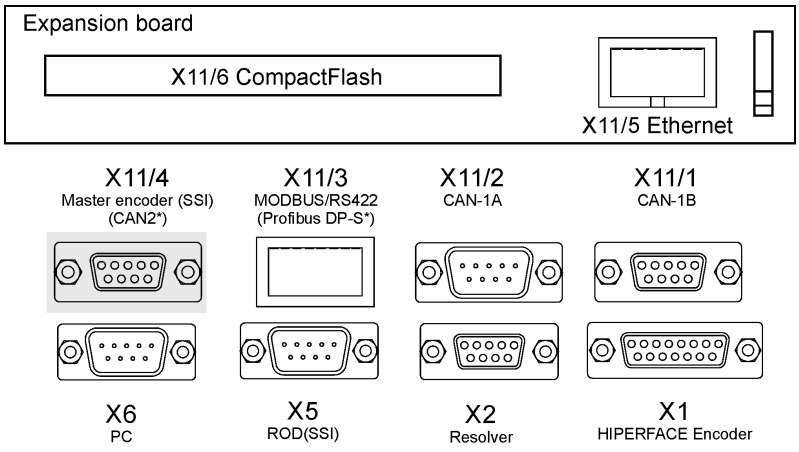


- Reference ground is EGND (terminal X10 Pin 2)
- For encoders with differential line drivers – track A, B and Z (0-Index)
- Quadrature encoder x1, x2 and x4
- Maximum input frequency: 1 MHz
- Minimum track width Z-track: 200 ns
- Maximum voltage range ref. to EGND: 5 V DC

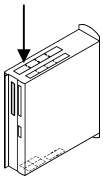
The maximum input frequency is 2.5 MHz, this means 10 million counts per second (x4) .

Resolution encoder	max. encoder speed
4096	36621 U/min
10000	15000 U/min

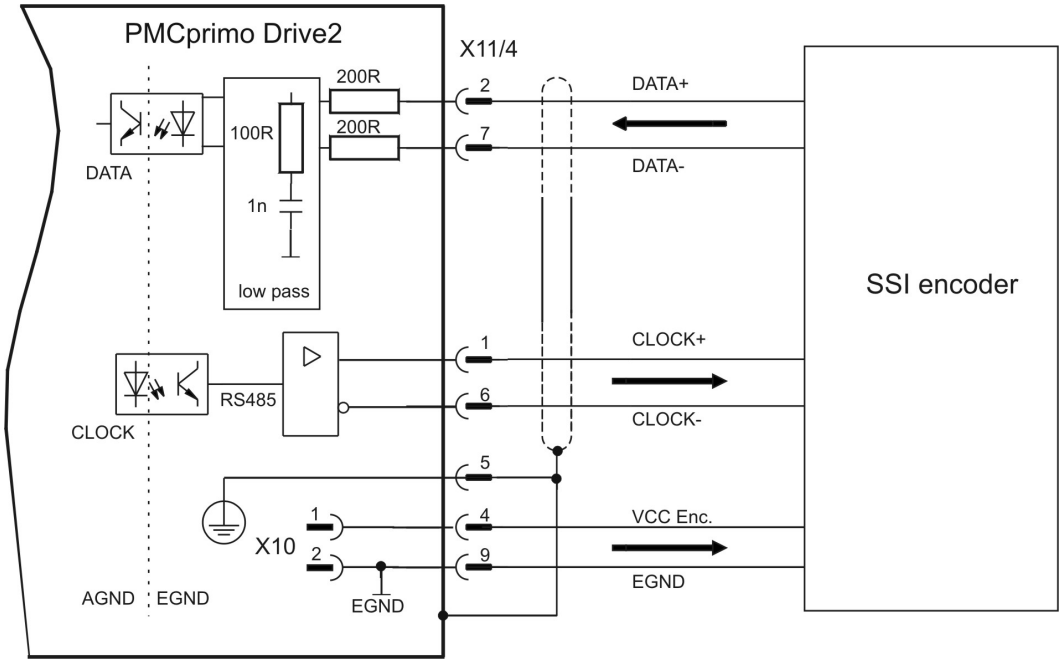


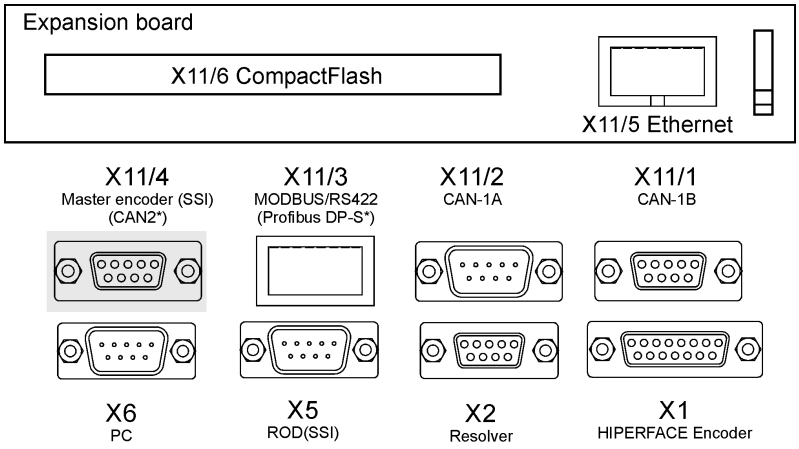


9.10.4 Absolute encoder (SSI)



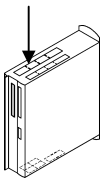
- Reference ground is EGND (terminal X10 Pin 2)
- Number of bits: 13..32
- Format: Binary or Gray
- Clock frequency SSI-Clock: 100 kHz or 300 kHz (set with command **FS**)
- Maximum voltage range ref. to EGND: 5 V DC





9.11 Bus interface (X11/3)

9.11.1 General



You can directly connect MODBUS-panels (e.g. our PMI 315). To connect, an adapter cable is need (see page 41). You can order a cable from us.

The PMCprimo Drive2 is equipped alternative with Profibus DP-S small. The connection is done always by the connector X11/3. When using the option Profibus DP-S, the MODBUS is out of service.

In Standalone mode (see PMCprimo programming manual) at every control a panel can be connected.

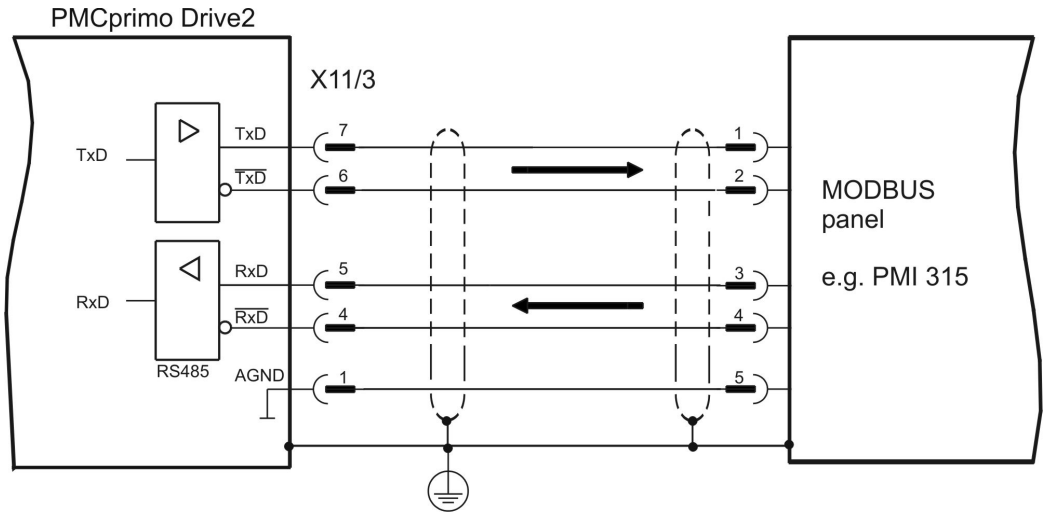
In networked systems (CAN) the panel has to be connected to the host system. Only the host's Bus-interface is active in this mode.

9.11.2 MODBUS Interface

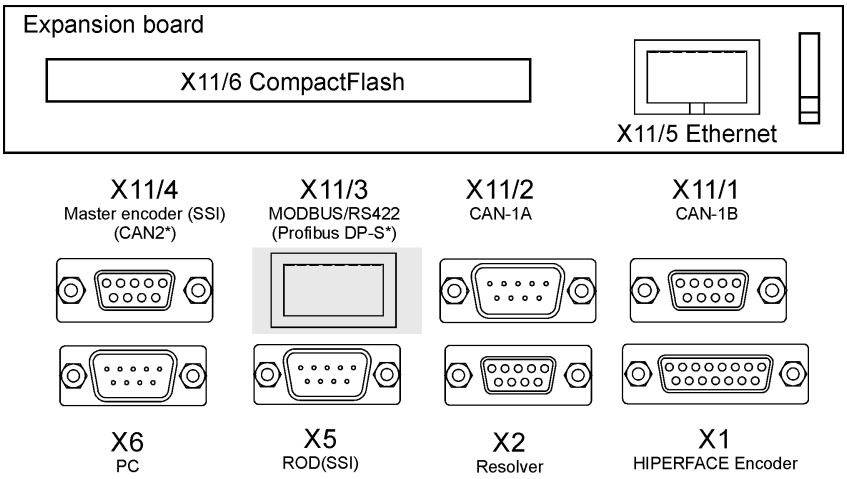
The communication uses a 5-core cable (RS422 full duplex). The communication parameters are:

- 9600 Baud, 8N1, no handshake

With the command **BM** the baud rate can be changed (see PMCprimo programming manual)



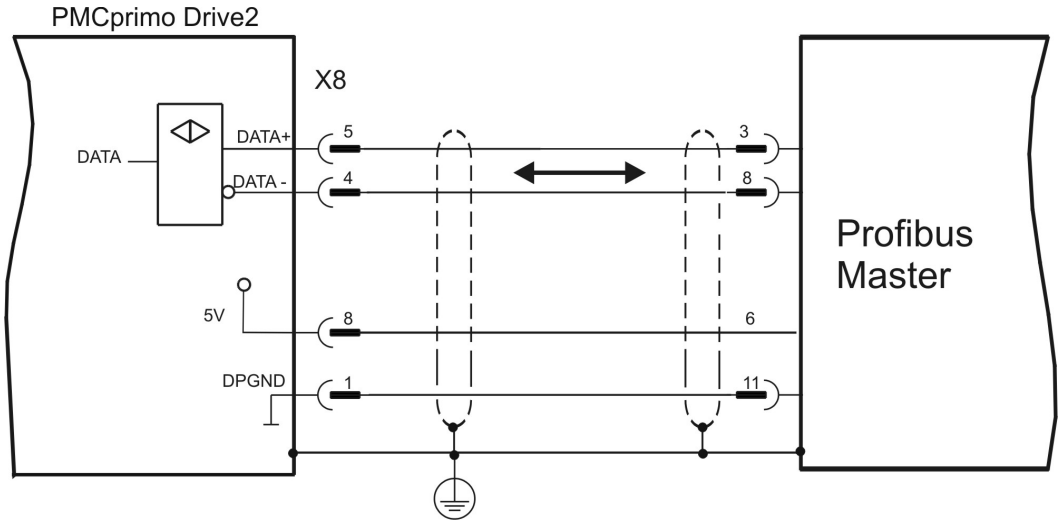
No termination required!



9.11.3 Profibus interface (Option)

The setting for the Profibus (slave address) can be done with the “CD“ command (see PMCprimo programming manual).

The needed GSD-file (HMS_1810.GSD) is located on the CD-ROM.



External termination required!

9.11.4 Using the MODBUS / Profibus interface with PMCprimo

With modbus panels 108 bus variables can be used for data exchange. (See PMCprimo programming manual „bus variables“.)

- Notation: $B1 - $B108 Bus variables MODBUS
- Notation: $B1 - $B16 Bus variables Profibus DP-S small
- Data bits : 16 Bit (=2 Bytes = 1 Word) signed.
- Range: -32768 to 32767 (Hex: 0x8000 to 0x7FFF).

Bus variables can be defined as trigger variables, so a program can be executed when the variable is updated.

9.11.5 Example: Profibus DP slave module

After setting the slave address (command CD 11; <address>) the PMCprimo Drive2 has to be restarted. The following message appears when the module is recognized.

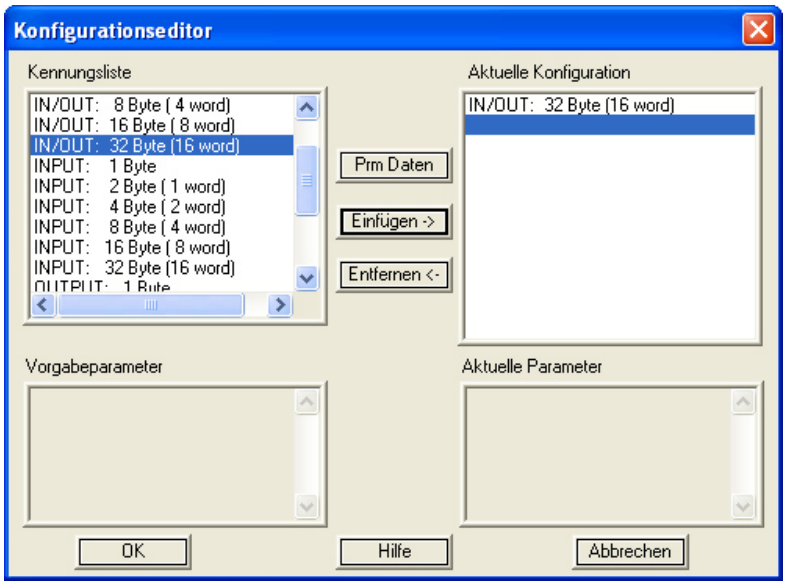
```
S T A R T

Ser.Nr.:3094, Version 2.004d Sep  1 2004, 10:37:49
Operate Mode: STANDALONE
Profibus-DP-IC found
Channel 0.1 found
Channel 0.2 found
Channel 0.3 found
Channel 0.4 found
Channel 0.5 found
Channel 0.6 found
Channel 0.7 found
Channel 0.8 found
Channel 0.9 found
Channel 0.10 found
```

In this example the bus variables $B1 up to $B16 are read and written (16 Words = 32 Bytes at all).

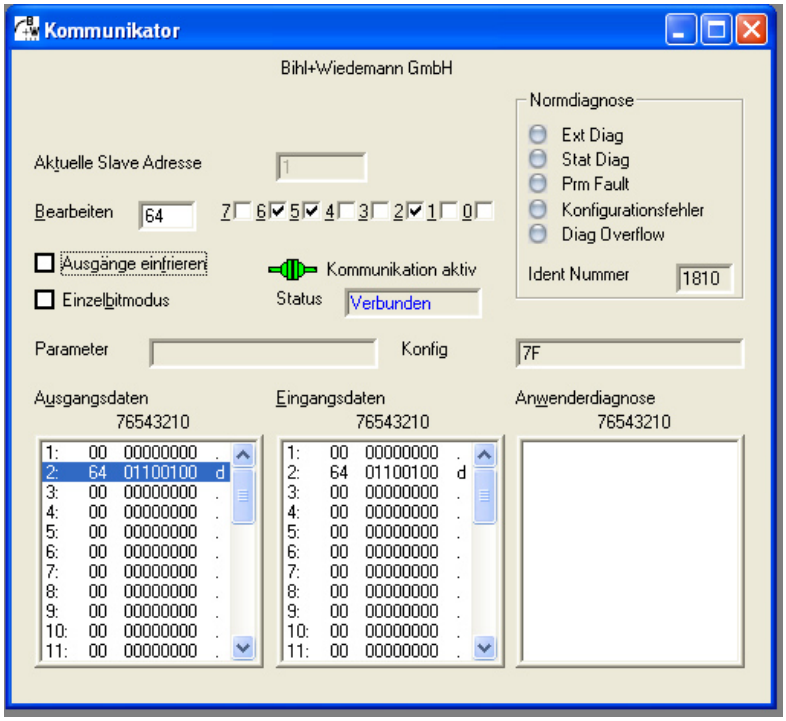
Subsequent, the Profibus-DP-Master has to be configured to IN/OUT: 32 Byte (16 word). The GSD file is named: HSM_1810.gsd.

Example: Profibus-DP-Master simulator:



After starting the Profibus communication the bus variables can be set or read.

Example: Setting the bus variable $B1 to value 100 (0x0064):




```
0.1: $B1=100    (0x00000064)
```

More information can be found in the technical documentation.

9.12 Virtual inputs and outputs

In addition to the real digital inputs and outputs there are 16 virtual inputs and 16 virtual outputs on each PMCprimo Drive2 system.

The virtual inputs and outputs don't have any terminals. But all input and output commands are available (see PMCprimo programming manual).

9.12.1 Terms

Virtual inputs: E3:1 – E3:8 / E4:1 – E4:8

Virtual outputs (O2:1 – O2:8) / O3:1 – O3:8 / O4:1 – O4:8

The virtual inputs an outputs are connected (internal) together as shown below:

Outputs O2:x to input E3:x
Outputs O3:x to input E3:x
Outputs O4:x to input E4:x

9.12.2 Application example

You define a position output on the virtual output (e.g.0.3:2).

If you define an input function on input 0.3:2, this program will be executed each time the output 0.3:2 is set. You don't need any wiring!

For further details see PMCprimo programming manual.

10 Commissioning

10.1 Important notes

Only professional personnel with extensive knowledge in the fields of electrical/ drive technology are allowed to commission the PMCprimo Drive2.

The procedure for commissioning is described as an example. Depending on the application, a different procedure may be sensible or necessary.

Caution !
Check that all live connecting elements are protected from accidental contact.
Deadly voltages can be present, up to 900V.
Never disconnect any of the electrical connections to the PMCprimo Drive2 while it is live.
Capacitors can still have residual charges with dangerous levels up to 300 seconds after switching off the supply power.
Heat sinks and front panels of the amplifier can reach a temperature of up to 80°C in operation. Check (measure) the heat sink temperature. Wait until the heat sink has cooled down below 40°C before touching it.

Warning!
If the PMCprimo Drive2 has been stored for longer than 1 year, then the DC-link capacitors will have to be reformed.
To do this, disconnect all the electrical connections.
Supply the PMCprimo Drive2 for about 30 min. from single-phase 230V AC to the terminals L1 / L2. This will re-form the capacitors.

Further information on commissioning:
The adaptation of parameters and the effects on the control loop behaviour are described in the software manual PDRIVE.

The following instructions should help you to carry out the commissioning in a sensible order, without any hazards to people or machinery.

Check installation	**Disconnect PMCprimo Drive2 from power supply**.
Inhibit ENABLE input	0V (DGND) on terminal X3, Pin 15 (Enable) ⇒ page 61
Switch on 24-V auxiliary voltages **at the same time**	24V DC on terminal X4 (Pin 1) and X10 (Pin 3), Ground on terminal X4 (Pin 3) and X10 (Pin 4) ⇒ page 46 **Both 24 V voltages must be switched on at the same time.** After booting (ca 0,5s) the drive status is displayed (⇒ page 85)
Switch on PC Start setup software **PRIVE**	Click „*PC <--> Drive connect*“ ➔ the stored (PMCprimo Drive2) parameters are loaded into the PC (s. software manual **PDrive**).
Check displayed parameters Correct if necessary	**Caution !** **It is especially important to check the following parameters.** **If you do not set them properly, parts of the system can be damaged or destroyed.**

Supply voltage	: set to the actual mains supply voltage
Rated motor voltage	: at least as high as the DC-link voltage of the PMCprimo Drive2
Motor pole-no.	: must match the motor (see motor manual)
Feedback	: must match the feedback unit in the motor
I_{RMS}	: maximum is the motor standstill curent I_0 (on nameplate)
I_{PEAK}	: maximum is 4 x motor standstill curent I_0
Limit speed	: maximum is the rated motor speed (on nameplate)
Regen power	: maximum is the permitted regen resistor dissipation

Check safety devices	**Caution !** **Make sure that any unintended movement of the drive cannot cause danger to machinery or personnel**
Switch on supply power	Through the ON/OFF button of the contactor control
ENABLE-	(500 ms after switching on the supply power) 24V DC on terminal X3, Pin 15, motor stands with standstill torque M_0
Optimize servo amplifier with **PDRIVE**	Optimize speed and current controllers.
Optimize PMCprimo Drive	Optimize position controller (s. PMCprimo programming manual).

10.2 Setup software PDRIVE

This chapter describes the installation of the setup software **PDrive** for the PMCprimo Drive2.

The parameter settings are described detailed in the software manual for **PDrive**.
The programming is described in the PMCprimo programming manual.
Both manuals can be found on the CD-ROM PMCprimo Motion Control Tools.

10.2.1 Use as directed

The setup software **PDRIVE** is intended to be used for setting up and storing the operational parameters for the PMCprimo Drive2.

Only professional personnel who have the relevant expertise described on page 11 are permitted to carry out online parameter setting for a drive which is running.
Sets of data which are stored on data media are not safe against unintended alteration by other persons. After loading a set of data you must therefore check all parameters thoroughly before enabling the PMCprimo Drive2.

10.2.2 Software description

The parameters of the PMCprimo Drive2 must be adapted to the requirements of the installation. This parametrization is done with the setup software **PDrive** which provides the communication between PC and PMCprimo Drive2.

With very little effort you can alter parameters and instantly observe the effect on the drive, since there is a continuous (online) connection to the drive.

With the tool **PSCOPE** you can easily watch the drive‘s current, the speed and the position error.

Sets of data can be stored on data media (archived) and loaded again. Sets of data which are stored on data media can be printed.

We supply you with motor-specific default sets of data for all the reasonable combinations of PMCprimo Drive2 and motor. In most applications you will be able to use these default values to get your drive running without any problems.

10.2.3 Hardware requirements

The PC interface (X6, RS232) of the PMCprimo Drive2 is connected to the serial interface of the PC by a null-modem cable (⇒ page 56).

The interface in the PMCprimo Drive2 is electrically isolated by an optocoupler.

10.2.4 Minimum requirements for the PC:

Processor	:	Pentium or higher
Operating system	:	WINDOWS 95/98 , WINDOWS NT/2000/XP
Grafics adapter	:	800 x 600, color
Drives	:	Hard disk (15 MB free) CD-ROM drive
Main memory	:	at least 32MB
Interface	:	one free serial interface (COM1 or COM2)

10.2.5 Installation under WINDOWS 95 / 98 / NT / 2000 / XP

On the CD-ROM an installation program called **SETUP.EXE** can be found, which makes it easy to install the setup software on your PC.

Start **MSETUP.EXE** and follow the instructions.

10.2.6 Working with PDRIVE

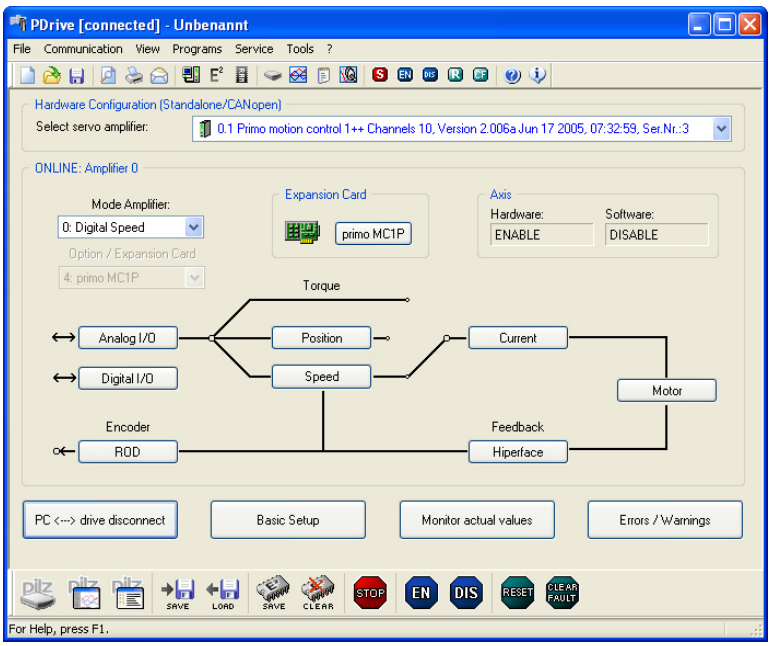
The parameter settings and using the tools are described detailed in the software manual for **PDRIVE**.

10.3 Parametrization of the PMCprimo Drive2

To facilitate the parametrization der PMCprimo Drive2, a motor database is supplied with the drive.

You can find the parameters for a lot of possible combinations between the PMCprimo Drive2 and the motors of the PMCtendo AC1 and AC2 series.

An exact description of all parameters and the possibilities for optimizing the control loop characteristics can be found in the software manual **PDrive** .

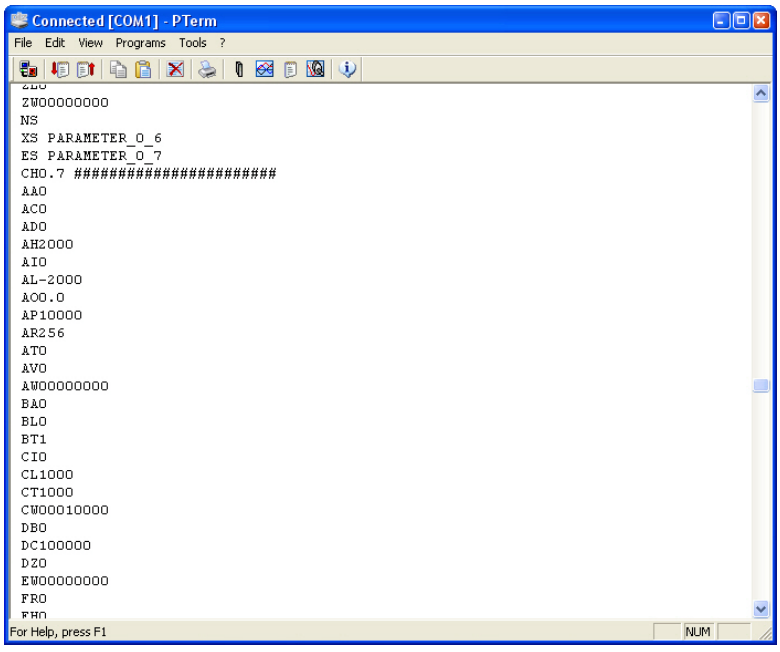


10.4 Programming of the PMCprimo Drive2

All programming of the PMCprimo Drive2 is done with a normal terminal program e.g. **PTERM**.

A succesful optimation of the PMCprimo Drive2 position controller is only possible after an well done optimation of the current and speed controllers with PDRIVE.

For further details see the the PMCprimo programming manual.



10.5 Error messages

PMCprimo error messages are shown as a ticker on the display.

A flashing error message is caused from the amplifier

10.5.1 Error messages PMCprimo

Errors which occur are shown in coded form by an error number in the LED display on the front panel (ticker).

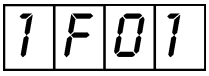
All error messages are also displayed on the connected terminal program (e.g. **PTerm**)

The error messages **xF20 - xF39** result in the BTB/RTO contact being opened, and the output stage of the PMCprimo Drive2 being switched off (motor looses all torque). If a motor-holding brake is installed, it will be activated.

X=Number of axis

Number	Meaning
xF01	Position error
xF03	High position limit
xF04	Low position limit
xF05	Reference timeout
xF06	Reference out of limits
xF07	Reference overrun
XF13	Motor timeout
xF20	Heat sink temperature too high (limit is set by manufacturer to 80°C)
xF21	Overvoltage in DC-link
xF22	Feedback error (cable break, short circuit, short to ground)
xF23	Undervoltage in DC-link
xF24	Motor temperature too high (limit is set by manufacturer to145°C)
xF25	Aux. voltage not OK
xF26	Overspeed (motor running away, speed is too high)
xF27	EEprom checksum error
xF28	Flash-Eprom checksum error
xF29	Brake: cable break, short circuit, short to ground
xF30	Motor phase missing (cable break or similar)
xF31	Internal temperature too high
xF32	Fault in the output stage
xF33	I^2t max. value exceeded
xF34	2 or 3 phases missing in the supply feed
xF35	Error in the analog-digital conversion
xF36	Regen circuit faulty or incorrect setting
xF37	A supply phase is missing (can be switched off for 2-phase operation)
xF38	System software not responding correctly
xF39	ENABLE not active
xF40	Commutation error

Example of an error message (ticker):



Error code 1F01: Position error on axis 1.

With the command “CD17,1” (as of firmware version 2.004) the 7 segment display can be configured, to just show “run” when there is no error. With “CD17,0” the previous display will be activated.

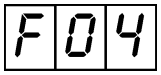
10.5.2 Error messages amplifier

Errors of the amplifier are shown in coded form by an error number in the LED display on the front panel (**flashing**).

In this case the error occurs before PMCprimo was active.

Number	Meaning
F01	Heat sink temperature
F02	Overvoltage DC link
F03	Following error
F04	Feedback error
F05	Undervoltage DC link
F06	Motor temperature
F07	Internal aux. volage not OK
F08	Overspeed
F09	EEprom checksum error
F10	Flash-Eprom checksum error
F11	Brake
F12	Motor phase missing
F13	Internal temperature
F14	Output stage
F15	I^2t-limit
F16	2 or 3 phases missing
F17	A/D-converter
F18	Regen
F19	Mains phase missing
F20	Error PMCprimo card
F23	CAN bus error (X6)
F24	Warning
F25	Commutation error
F26	Limit switch
F27	AS-Option
F28	Reserved
F29	Reserved
F32	System fault amplifier

Example of an error message (flashing):



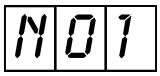
F04: Feedback error (resolver)

10.6 Warnings

Faults which occur, but which do not cause a switch-off of the amplifier output stage (BTB/RTO contact remains closed) , are indicated in the LED display on the front panel by a coded warning number.

Number	Meaning
n01	I²t threshold exceeded
n02	preset regen power reached
n04	response monitoring (watchdog) is active
n05	supply phase missing
n12	HIPFERFACE: motor default values were loaded
n13	mc1p card not functioning correctly

Example of a warning (flashing):



warning n01: I²t threshold exceeded

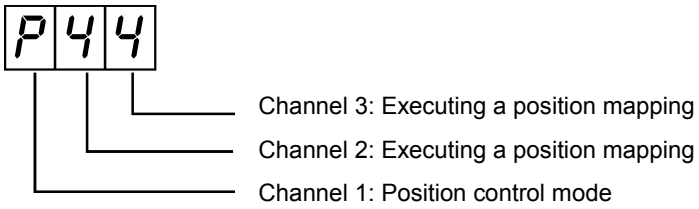
10.7 Status messages

10.7.1 Status messages PMCprimo

The LED-Display shows the actual state of the 3 channels.

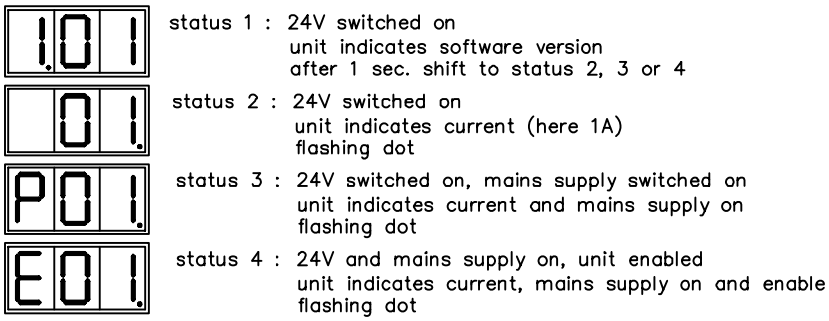
Display	Meaning	Command
P	Position control mode	PC
0	Motor off mode	MO
1	Velocity control mode	VC
2	Moving to new position	MA, MR
4	Executing a position mapping	XM
5	Stopping under normal deceleration	ST
6	Initializing to reference position	IN, IB
7	Torque control mode	AM, XM
9	Waiting	WA, WB, WI, etc.
A	Alignment move	XM
C	Software clutch	XM, ST

Example of a status message:



10.7.2 Status messages drive

When a malfunction of the PMCprimo-card occurs, the actual drive status can be read:



Further information can be found in the installation manual of the PMCtendo DD4 drive.

11 Appendix

11.1 Notes on EMC problems

This chapter will give you useful information to avoid EMC problems when installing the PMCprimo Drive2.

Especially when using long motor cable (>25m) the noise immunity will increase.

11.1.1 Cable screening

- Run as many as possible of the cables that are connected to the equipment as screened cables
- Make a wide-area grounding (earth) of the screen at both ends. The screen braid should provide at least 85% coverage
- Ground any unused cores of the motor cable to the PE at both ends
- Route all control, bus and signal cables with at least 20 cm separation from the screened motor cable
- Route all the cables inside the switchgear cabinet as close as possible to the reference ground - cables in free air act simultaneously as transmitting and receiving antennae

The cables listed below must be screened. Screen terminal clamps must be installed as close to the equipment as possible

Cable	Screening
Resolver	Connect the screen to the connectors at both ends
Motor cable/ Brake cable	Connect the screen to the connector or PG screw gland on the motor, and to ground at the PMCprimo Drive 2 end
Ballast cable	Connect the screen to the PG screw gland on the external ballast resistor, to ground at the PMCprimo Drive 2 end
Power supply cable	No screen required (built in filter)
24 V cable	No screen required (built in filter)
Analog signals	Connect the screen to the analog reference ground at the PLC, to ground at the PMCprimo Drive2 end
Digital signals	No screen required
Master encoder signals	Connect the screen to the connectors at both ends
CAN bus	Connect the to the connectors at both ends

11.1.2 Metallic, large area connections

- Make a large-area, electrically conductive connection between all metallic components (equipment housing of the PMCprimo Drive2, filter housing, motor housing, screen braid of the cables) and a star point (mounting plate).)
- Avoid using coated surfaces such as Eloxal or yellow-chroming (rails, screws). These can have very high frequency-dependent impedances (skin effect).

11.1.3 PE connection, earthing, grounding

PE connections as per VDE 0100 or EN 60204 are dimensioned purely for the protection against contact voltage and dangerous body currents.

- Connect the PMCprimo Drive2 to the EMC ground by a short connection with a large surface area (braided band) to ensure low lead inductance.
- Wire the PE connection for the individual system components in a star connection to the potential equalization rail
- Connect all metal parts with the PE rail

11.1.4 Motor choke

A motor choke damps the slew rate of the motor current (reducing the speed of the switching edges), thus reducing the current that is produced in the screen

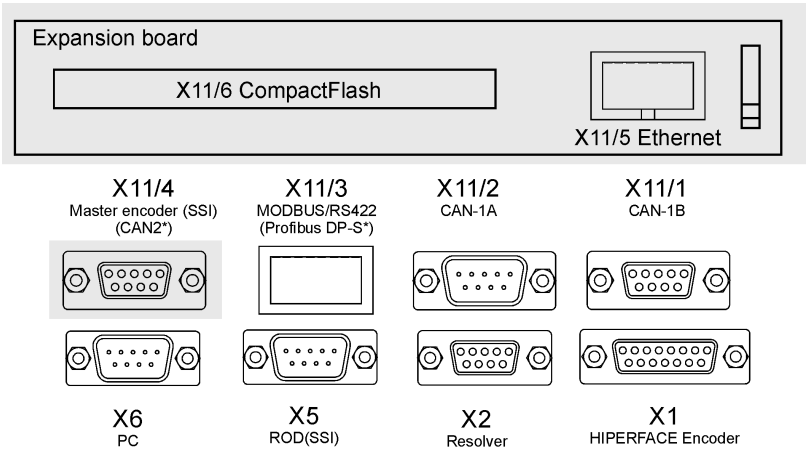
- motor chokes makes it possible to use longer motor cables
- reduced load on the PMCprimo Drive2 output stages and rectifiers
- reduced stress on the insulation of the motor windings

You can order a special motor choke from us.

11.1.5 Expansion board

The new expansion board offers 2 new additional interfaces. On the board you can find a slot for compact-flash cards (up to 1 GB) and an Ethernet interface. There is also a second CAN interface on the board. The connector for this CAN interface is located on the PMCprimo-card.

The Ethernet interface can be used as alternative, or additionally, to the serial connection.



Further hardware on the expansion board are battery backed RAM memory (8kB) and a real-time clock.

Note:

It is not possible to use the CAN-2 interface with a incremental or SSI encoder at the same time. The configuration is made via jumpers (see page 71)

11.1.6 Ethernet interface of the expansion board X11/5

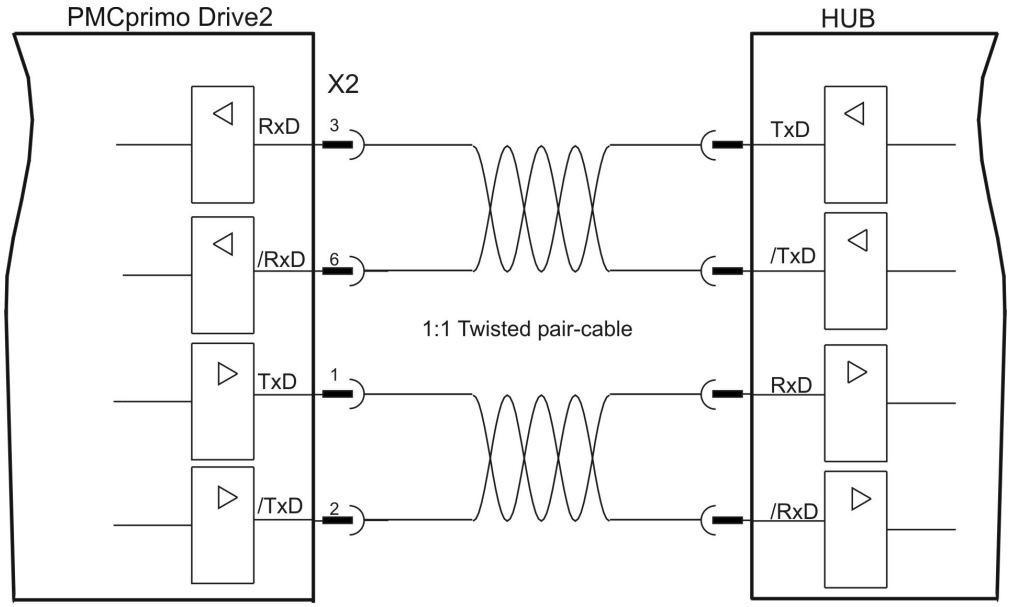
11.1.6.1 General

The Ethernet interface of the expansion board (RJ45, X11/5) is a fast alternative to the RS232 transfer.

With the terminal software **PTerm** data can transmitted with a speed of 100 Mbit/s.

The PMCprimo Drive2 can also be programmed and monitored locally in a Ethernet-network, without direct presence of a programmer.

11.1.6.2 Interface



Pin	Description
1	TxD (send data)
2	/TxD (send data inverted)
3	RxD (receive data)
6	/RxD (receive data inverted)

Note!

For direct connection of the Ethernet interface with a PC you must use a crossover cable. The shown cable here is only for use with a hub.

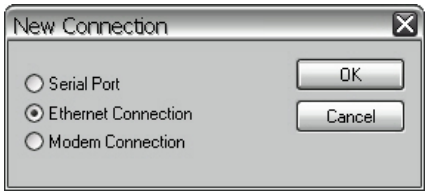
11.1.6.3 Configuration IP address

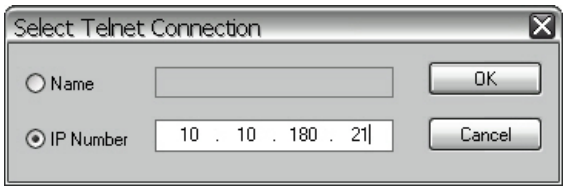
To establish a connection to a PMCprimo Drive2, an IP address must configured for the control.

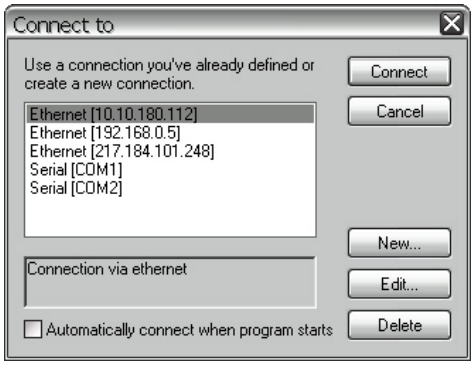
This is done with the "**CD**" command (see PMCprimo programming manual).

```
1.1: CD
Actual configuration:
Operate Mode: HOST+NODE
Actual IP address 10.10.180.180
Actual Netmask 255.255.0.0
Fieldbus Address 0
Fieldbus In/Out length 50 words
Fieldbus In/Out offset 0
RS-232 Software-Handshake Xon/Xoff
RS-422 point to point
RS422 used for Modbus
CAN baudrate: 500 KBit
Startup delay  0s
Display mode channel state
************************************
0: Exit menu
1: Change operating mode
2: Delete application data
3: Change CANbus configuration
4: Change Ethernet
5: Change in/out length for Fieldbus
6: Change offset for Fieldbus
11: Change Fieldbus address
12: Change number of channels
13: Change time and date
14: Change RS-232 configuration
15: Change RS-422 configuration
16: Change startup delay
17: Change display mode
18: Change usage RS422 for PLC
Choice [Return; ESC exits menu]: 4
New IP address (10.10.180.112) ? 10.10.180.21
New Netmask (255.255.0.0) ?
************************************
0: Exit menu
1: Change operating mode
2: Delete application data
3: Change CANbus configuration
4: Change Ethernet
5: Change in/out length for Fieldbus
6: Change offset for Fieldbus
11: Change Fieldbus address
12: Change number of channels
13: Change time and date
14: Change RS-232 configuration
15: Change RS-422 configuration
16: Change startup delay
17: Change display mode
18: Change usage RS422 for PLC
Choice [Return; ESC exits menu]: 0
1.1:
```

Now you can establish an Ethernet connection:







After confirmation of the dialog with the 

Button, you can start with the programming.

11.2 Change of the buffer battery

The buffer battery must be replaced when “BATT” in the display appears. With present 24 V supply voltage, the buffer memory remains intact.

Type of battery: CR1225

Procedure:

1. Remove all connectors.
2. Unscrew both M3 screws.
3. Remove the PMCprimo-board.

4. Connect the 24 V power supply (X10, pin 2+3)
5. Change the battery, observe polarity
6. Unconnect the 24 V
7. Reinstall the PMCprimo-board, and screw both M3 screws
8. Connect all connectors
9. Check: The display “BATT” expires and shows the actual status of the control

ESD!

ESD : electrostatic discharge
ESDS : electrostatic sensitive devices

Motion control units contain electrostatic sensitive devices which will be damaged by electrostatic discharge. Therefore servicing shall only be performed in ESD safe areas and by ESD protected personnel.

11.3 Transport, storage, maintenance, disposal

Transport:
— only by qualified personnel
— only in the manufacturer's original recyclable packaging
— avoid shocks
— temperature –25 to +70°C, max. 20°C / hour rate of change
— humidity max. 95% relative humidity, no condensation
— the PMCprimo Drive2 contains electrostatically sensitive components which can be damaged by incorrect handling
Discharge yourself before touching the PMCprimo Drive2. Avoid contact with highly insulating materials (artificial fabrics, plastic films etc.).
— Place the PMCprimo Drive2 on a conductive surface.
— if the packaging is damaged, check the unit for visible damage.
— In this case, inform the shipper and the manufacturer.

Storage :
— only in the manufacturer's original recyclable packaging
— the PMCprimo Drive2 contain electrostatically sensitive components which can be damaged by incorrect handling
Discharge yourself before touching the PMCprimo Drive2. Avoid contact with highly insulating materials (artificial fabrics, plastic films etc.),
Place the PMCprimo Drive2 on a conductive surface.
— max. stacking height 8 cartons
— storage temperature –25 to +55 o C, max. 20°C/hr. rate of change
— humidity relative humidity max. 95%, no condensation
— storage duration < 1 year without restriction
> 1 year : capacitors must be re-formed before the PMCprimo Drive2 is commissioned.
To re-form, remove all electrical connections, and supply the PMCprimo Drive2 for about 30 min. from 230V AC, single-phase, on terminals L1 / L2.

Maintenance:
— the instruments do not require any maintenance
— opening the enclosure invalidates the warranty

Cleaning :
— if the casing is dirty, clean with Isopropanol or similar cleaning agent
Do not immerse or spray.
— dirt inside the unit must be cleaned by the manufacturer
— dirty protective grill (fan) may be cleaned with a dry brush

Disposal :
— the PMCprimo Drive2 can be reduced to its principal components by removing the screws (aluminium heat sink and front panel steel housing sections, electronics boards)
— disposal should be carried out by a certified disposal company.

11.4 Removing faults

The table below should be regarded as a “First-aid” box. Depending on the conditions in your installation, there may be a wide variety of reasons for the fault.

Error messages of the PMCprimo Drive2 are described detailed in the PMCprimo programming manual. Our applications department can give you further assistance with problems.

Fault	possible causes	Measures to remove the cause of the fault
message: communication fault	— wrong cable used — cable plugged into wrong position in PMCprimo Drive2 or PC — wrong COM port selected	— use null-modem cable — plug cable into the correct sockets on the PMCprimo Drive2 and PC — select correct interface
message: undervoltage	— supply voltage not present or too low when PMCprimo Drive2 is enabled	— only enable the PMCprimo Drive2 when the mains supply voltage has been switched on delay > 500 ms
message: overvoltage	— regen power is insufficient. regen power limit was reached and the regen resistor was switched off. This causes excessive voltage in the DC-link circuit. — supply voltage too high	— shorten the braking time RAMP or shorten the braking time RAMP or with a higher power rating and adjust the regen power parameter — use mains transformer
message: mains BTB/RTO	— enable was applied, although the supply voltage was not present. — at least 2 supply phases are missing	— only enable the servo amplifier when the mains supply voltage has been switched on — check electrical supply
message: brake	— short-circuit in the supply cable for the motor-holding brake — motor-holding brake is faulty — fault in brake cable — no brake connected, although the brake parameter is set to "WITH"	— remove short-circuit — replace motor — check shielding of brake cable — brake parameter set to "WITHOUT"“
message: output stage fault	— motor cable has short-circuit/ground short — motor has short-circuit / ground short — output module is overheated — output stage is faulty — short-circuit / short to ground in the external regen resistor	— replace cable — replace motor — improve ventilation — return the servo amplifier to the manufacturer for repair — remove short-circuit / ground short
message: heat sink temperature	— permissible heat sink temperature exceeded	— improve ventilation
message: aux. voltage	— the aux. voltage produced by the servo amplifier is incorrect	— return the servo amplifier to the manufacturer for repair

Fault	possible causes	Measures to remove the cause of the fault
message: feedback unit	— feedback connector not properly inserted — feedback cable is broken, crushed or otherwise damaged	— check connector — check cable
message: internal temperature	— permissible internal temperature exceeded	— improve ventilation
message motor temperature	— motor thermostat has been activated — feedback connector is loose or break	— wait until motor has cooled down, then check why it became so hot — tighten connector or use new feedback cable
motor does not rotate	— PMCprimo Drive2 not enabled — break in setpoint cable — motor phases swapped — brake not released — drive is mechanically blocked — no. of motor poles set incorrectly — feedback set up incorrectly	— apply enable signal — check setpoint cable — correct motor phase sequence — check brake control — check mechanism — set no. of motor poles — set up feedback correctly
motor runs away (overspeed)	— motor phases swapped — feedback set up incorrectly	— correct motor phase sequence — set up correct offset angle
motor oscillates	— gain too high (speed controller) — shielding in feedback cable has a break — AGND not wired up	— reduce Kp (speed controller) — replace feedback cable — join AGND to CNC-GND
drive reports following error	— Irms or. Ipeak is set to high — setpoint ramp is too long	— increase Irms or. Ipeak (keep within motor data !) — shorten setpoint ramp +/-
motor overheating	— Irms/Ipeak is set to high	— Ireduce rms/Ipeak
drive too soft	— Kp (speed controller) too low — Tn (speed controller) too high — PID-T2 too high — T-Tacho too high	— increase Kp (speed controller) — use motor default value for Tn (speed controller) — reduce PID-T2 — reduce T-Tacho
drive runs roughly	— Kp (speed controller) too high — Tn (speed controller) too low — PID-T2 too low — T-Tacho too low	— reduce Kp (speed controller) — use motor default value for Tn (speed controller) — increase PID-T2 — increase T-Tacho

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