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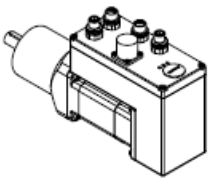
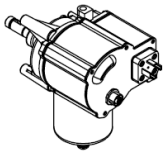
PROFIBUS®

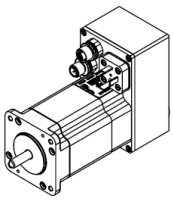
MD-300-PB-CXX



MD-025-PB-CXXX

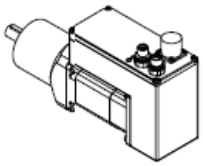


MMV200-XXXX



CANopen®

MD-300-CO-CXXX



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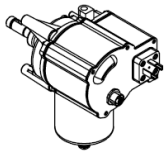

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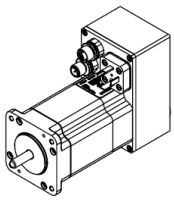

encoDrive

Projektierungsanleitung / Dezentrale Stellantriebe

Project Engineering Manual / Decentralized positioning drives

- Grundlegende Sicherheitshinweise / Verwendungszweck
- Allgemeine Produktbeschreibung
- Montage
- Projektierung, Installation , Inbetriebnahmevorbereitung

- *Basic safety instructions / Purpose*
- *General product descriptions*
- *Assembly*
- *Project Engineering, Installation, Preparation for commissioning*

TR electronic

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Engineering Manual

Decentralized Positioning Drives

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Revision	Date	Index
First release	10/31/07	00
New drive: MMV-200-CXXX	08/06/08	01
• Revision - Modification of the standards	07/22/09	02

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1 General information

This manual includes the following subjects:

- Basic safety information with particulars of use
- General product description
- Assembly
- Project Engineering, installation, preparation for commissioning

As the documentation is made up in a modular manner, this manual constitutes an addition to other documentation such as customer-specific or interface dependent user manuals, dimension drawings and brochures etc.

The Manual may be included in the customer's specific delivery package or it may be requested separately.

1.1 Target group

This documentation is directed towards

- Assembly, installation and commissioning personnel.

The respective qualifications of the personnel are defined in Chapter “Choice and qualifications of personnel; basic obligations”, page 65.

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1.2 Applicability

This manual applies exclusively to the following types of decentralized positioning drive with ***PROFIBUS-DP or CANopen*** interface:

PROFIBUS-DP

- MD-025-PB-CXXX
- MD-300-PB-CXXX
- MMV200-XXXX

CANopen

- MD-025-CO-CXXX
- MD-300-CO-CXXX
- MMV200-XXXX

The products are labeled with affixed nameplates and are components of a system.

The following documentation therefore also applies:

- operator's operating instructions specific to the system,
- this manual,
- the interface dependent user manual for the individual drive type,
- the customer-specific user manual (optional),
- commissioning instructions for Function modules/Handheld unit (optional)

1.3 Standards and Directives, EC Declaration of conformity

The decentralized positioning drives have been developed, designed and manufactured taking into account relevant European and international standards and directives.

As an electronic device the positioning drive is subject to the regulations of the EMC Directive.

An appropriate Declaration of conformity, which certifies conformity of the positioning drive with the Directives, can be requested from TR-Electronic GmbH.

The manufacturer of the products, TR-Electronic GmbH in D-78647 Trossingen, has a certified Quality Assurance system in accordance with ISO 9001.

As the positioning drive works with a DC voltage of less than 75 V, it is not subject to the EC Low Voltage Directive 73/23/EEC !

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1.4 Abbreviations used / Terminology

Drive specific	
MD-300-YY-CXXX	Positioning drive, 300 W output power
MD-025-YY-CXXX	Positioning drive, 27/39 W output power
MMV200-XXXX	Positioning drive, 200 W output power
encoTRive	TR-specific term for the drive
General	
EC	***E***uropean ***C***ommunity
EMC	***E***lectro ***M***agnetic ***C***ompatibility
ESD	***E***lectro ***S***tatic ***D***ischarge
IEC	***I***nternational ***E***lectrotechnical ***C***ommission
VDE	***V***erein ***D***eutscher ***E***lektrotechniker (German Electrotechnicians Association)
PROFIBUS	
PKW	Parameter ID/Parameter value
PNO	PROFIBUS Nutzerorganisation e.V. (PROFIBUS User Organization)
PROFIBUS	Process Field Bus (manufacturer independent, open field bus standard)
DP	***D***ezentralized ***P***eriphery
DP-V0	Cyclic data exchange
DP-V1	Acyclic data exchange
CANopen	
CAN	***C***ontroller ***A***rea ***N***etwork
CiA	***C***AN ***i***n ***A***utomation e.V.
EDS	***E***lectronic ***D***ata ***S***heet

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2 Basic safety information

2.1 Definition of symbols and instructions

WARNING !	means that death, serious injury or major damage to property could occur if the required precautions are not met.
CAUTION !	means that minor injuries or damage to property can occur if the stated precautions are not met.
	indicates important information or features and application tips for the product used.
	means that appropriate protective measures against ESD according to DIN EN 100 015-1 must be applied. (Equalizing the potential between the body and both the equipment ground and the housing ground by means of a high resistance (approx. 1 MOhm) e.g. with a commercially available ESD armband).

2.2 User's obligations before commissioning

As an electronic device the positioning drive is subject to the regulations of the EMC Directive.

It is therefore only permitted to start up the positioning drive if it has been established that the system/machine into which the positioning drive is to be fitted satisfies the provisions of the EC EMC Directive, the harmonized standards, European standards or the corresponding national standards.

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2.3 General risks when using the product

The product, hereinafter referred to as ***encoTRive***, is manufactured according to state-of-the-art technology and accepted safety rules. ***Nevertheless, improper use can pose a danger to life and limb of the user or third parties, or lead to impairment of the encoTRive or other property!***

Only use the encoTRive in a technically faultless state, and only for its designated use taking safety and hazard aspects into consideration, and with reference to

- this ***manual***
- the ***interface dependent user manual*** for the individual drive type
- the ***customer-specific user manual*** (optional)
- and the appropriate ***commissioning instructions*** (optional)

Faults which could threaten safety should be eliminated without delay!

2.4 Intended use

The encoTRive is intended as a decentralized positioning drive for setting up and adjustment tasks, or for travel and rotational movements in the industrial area in machines and systems, which are not subject to special electrical and mechanical safety requirements.
It is imperative that applications other than those described here be clarified with the manufacturer.

2.4.1 PROFIBUS-DP

The encoTRive is designed for operation with PROFIBUS-DP networks according to the European standards EN 50170 and EN 50254 up to max. 12 Mbaud. Parameterization and device diagnostics are performed via the PROFIBUS master according to the PROFIBUS User Organization's (PNO) PROFIdrive profile for variable speed drives, Version 3.0.
The technical guidelines for the structure of the PROFIBUS-DP network from the PROFIBUS User Organization are always to be observed in order to ensure safe operation.

2.4.2 CANopen

The encoTRive is designed for operation with CANopen networks according to the International Standard ISO/DIS 11898 and 11519-1 up to max. 1 Mbaud. Parameterization and device diagnostics are performed via the CANopen master according to the CANopen User Organization's CiA DSP 402 profile ***"Drives and Motion Control"*** for drives, Version 2.0.
The technical guidelines for the structure of the CANopen network from the CAN User Organization CiA are always to be observed in order to ensure safe operation.

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Proper use also includes:

- observing all instructions in this manual,
- taking into account all the attached documentation,
- observing the operating instructions from the machine/system manufacturer,
- observing the nameplate and any prohibition or instruction signs on the positioning drive,
- operating the encoTRive within the limit values specified in the technical data

The following areas of use are especially forbidden:

- in environments where there is an explosive atmosphere,
- for medical purposes

2.4.3 Monitoring functions

The encoTRive has several protection and monitoring mechanisms, with which the environment and the encoTRive itself can be protected from damage. It is imperative that the monitoring mechanisms specified below be incorporated by the user into his own safety concept.

What is monitored?	Where?	When?	Why?
Overall system	Hardware and software by means of watchdog and checksum	Run-up and running time	In order to detect internal faults, and to put the encoTRive into a safe state in the event of a fault.
Polarity of the supply voltage (see chapter “Polarity protection”, page 84)	Hardware	Continuously	In order to prevent damage to the electronics.
Bus communication	Software	After bus communication has been established for the first time	In order to put the encoTRive into a safe state in the event of communications failures.
Output stage temperature	Software and hardware	Running time	Protection against overheating and damage.
Supply voltage	Software and hardware	Running time	Prevention of undefined operating states and protection of the electronics.
Displacement measurement system	Software	Running time	Functional safety
Parameter values	Software	Run-up and running time	Functional safety
Position with the help of software limit switches	Software	Running time	Protection of the encoTRive and the coupled mechanics.

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2.5 Warranty and liability

The General Terms and Conditions (“Allgemeine Geschäftsbedingungen”) of TR-Electronic GmbH always apply. These are available to the operator with the Order Confirmation or when the contract is concluded at the latest. Warranty and liability claims in the case of personal injury or damage to property are excluded if they result from one or more of the following causes:

- Improper use of the encoTRive.
- Improper assembly, installation, start-up and programming of the encoTRive.
- Incorrectly undertaken work on the encoTRive by unqualified personnel.
- Operation of the encoTRive with technical defects.
- Mechanical or electrical modifications to the encoTRive undertaken autonomously.
- Repairs carried out autonomously.
- Third party interference and Acts of God.

2.6 Organizational measures

- This manual must always be kept accessible at the place of operation of the encoTRive.
- In addition to this manual and the documentation listed under Chapter “Applicability”, generally applicable statutory and compulsory regulations for the prevention of accidents and for environmental protection must be observed and must be communicated.
- The respective applicable national, local and system-specific provisions and requirements must be observed and mediated.
- The operator is obliged to inform personnel on special operating features and requirements.
- The personnel instructed to work with the encoTRive must have read and understood the Instructions, especially the chapter “**Basic safety information**” prior to commencing work.
- The nameplate and any prohibition or instruction symbols applied on the encoTRive must always be maintained in a legible state.
- Do not carry out any mechanical or electrical changes to the encoTRive other than those expressly described in this manual or in the associated documentation.
- Repairs may only be undertaken by the manufacturer or a center or person authorized by the manufacturer.

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2.7 Choice and qualifications of personnel; basic obligations

- All work on the encoTRive must only be carried out by qualified personnel.

  Qualified personnel includes persons, who, through their training, experience and instruction, as well as their knowledge of the relevant standards, provisions, accident prevention regulations and operating conditions, have been authorized by the persons responsible for the system to carry out the required work and are able to recognize and avoid potential hazards.

- The definition of “qualified personnel” also includes an understanding of the standards VDE 0105-100 and IEC 364 (source: e.g. Beuth Verlag GmbH, VDE-Verlag GmbH).

- Clear rules relating to responsibilities for assembly, installation, commissioning and operation must be defined. There is an obligation to provide supervision for trainee personnel!

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2.8 Safety information

WARNING !

- Before starting any work on the encoTRive, the motor must be properly isolated in accordance with the 5 safety rules according to DIN VDE 0105. As well as the main circuits, attention must also be paid to any additional or auxiliary circuits.

  The measures prescribed in DIN VDE 0105 may only be withdrawn when the assembly work on the motor is completely finished.
- As well as the general requirement of care, attention must be paid to the risk of hair or items of clothing being caught in the equipment.
- Take care when touching the encoTRive. Temperatures of over 100°C can occur on the surface of the encoTRive during operation. The temperature must therefore be checked before work can be carried out again on the encoTRive after operation.
- Risk of fire!
  Before assembly, it must be ensured that an adequately large distance is maintained from inflammable materials and cables laid in the immediate vicinity. Furthermore, it must be ensured that heat losses can be adequately dissipated.
- Protective devices must never be rendered inoperative, even during testing.
- In versions where the shaft is provided with a key slot, the key must be secured by suitable means if the encoTRive is used without drive elements (e.g. in test mode).
- Check the direction of rotation of the encoTRive in the uncoupled state before commissioning.
- Ensure that dangerous situations cannot occur on the encoTRive due to commissioning or test adjustments in order to prevent damage to persons or materials.
- Suitable measures must be taken to prevent limbs being trapped by moving actuators.
- All work on the encoTRive must be carried out in accordance with the information and instructions given in this assembly/commissioning manual.
- Ensure that no dangerous moments are produced by switching off equipment, machines and systems.
- When electrical components are used in complex systems, unpredictable functions may occur during normal operation of the system if the electrical parts of the system are not properly designed, or due to faulty components. Proper design in accordance with the relevant technical regulations is the responsibility of the system designer and the user.

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CAUTION !

- When the encoTRive is installed in a vertical position, it must be ensured that no liquids can get into the bearing.
- When installing, make sure that the permissible radial and axial forces on the encoTRive drive shaft are not exceeded. It may be necessary to use suitable output drive elements. Impacts and blows on the output drive shaft must be avoided in order to prevent damage to the electromechanical components.
- Guaranteeing the IP protection class
  Unused cable openings and access points for adjusting devices must be sealed with blanking plugs.

The encoTRive contains components and modules that are at risk from electrostatic discharge, and can be destroyed if not handled properly.

- Avoid touching the encoTRive connectors with the fingers. The appropriate protective measures against ESD must be applied.
- With some versions of the encoTRive, the housing cover must be removed for setting the BUS station address, connecting the BUS termination resistor and also for making off the connections. In doing so, the boards for the connector module and the power electronics module are freely accessible.
  - The modules may only be handled indirectly through the surrounding encoTRive housing.
  - Touching the modules with chargeable and highly insulating materials, such as plastic films or items of clothing made of artificial fibers, is to be avoided.

In addition to the above-mentioned measures, the protective measures against ESD must be observed and applied.

- Disposal
  If disposal has to be undertaken after the lifespan of the encoTRive, the respective applicable country-specific regulations are to be observed.
- The technical details of special customer-specific designs, including the drive equipment, may differ from the versions described here. In case of doubt, the manufacturer should be consulted, specifying the item number.

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3 encoTRive variants

3.1 encoTRive product designation

Discrimination is made between different variants according to the power class and field bus interface.

The product designation can be determined from the following scheme:

MD-025-YY-**C**XXX
MD-300-YY-**C**XXX

MD..	Product type [motion, drive]
025, 300..	Power class, 25 W, 300 W
YY..	Field bus connection [PB.. ProfiBus, CO..CANopen]
XXX..	Consecutive sequence number, customer-specific design

MMV200-XXXX

MMV..	Product type [motion, magnetic, solid shaft]
200..	Power class, 200 W
XXXX..	Consecutive sequence number, customer-specific design

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3.2 encoTRive PROFIBUS, type overview

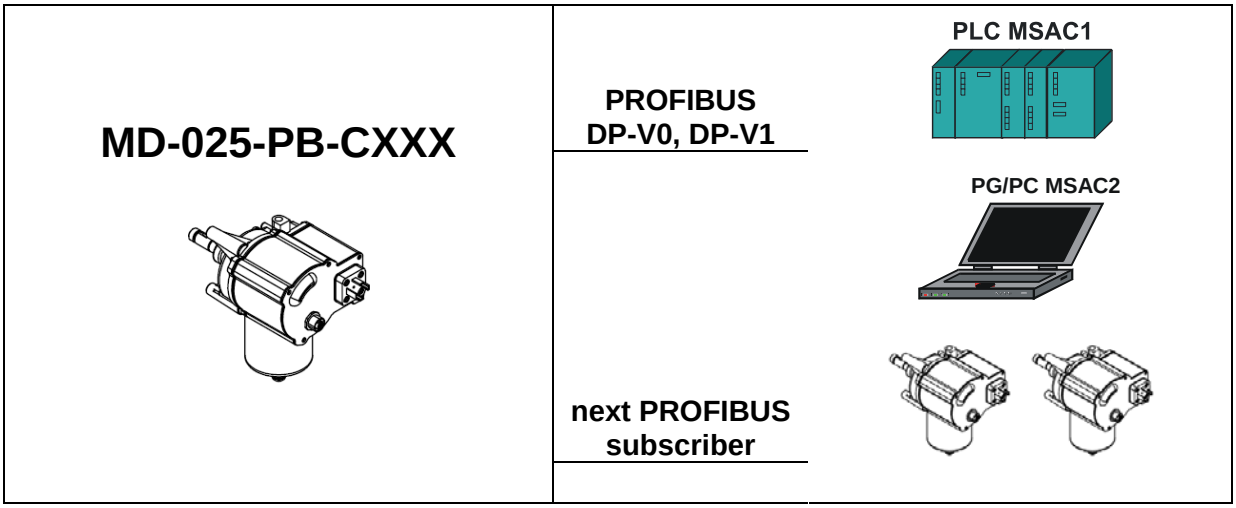

Figure 3.1: encoTRive PROFIBUS, type overview

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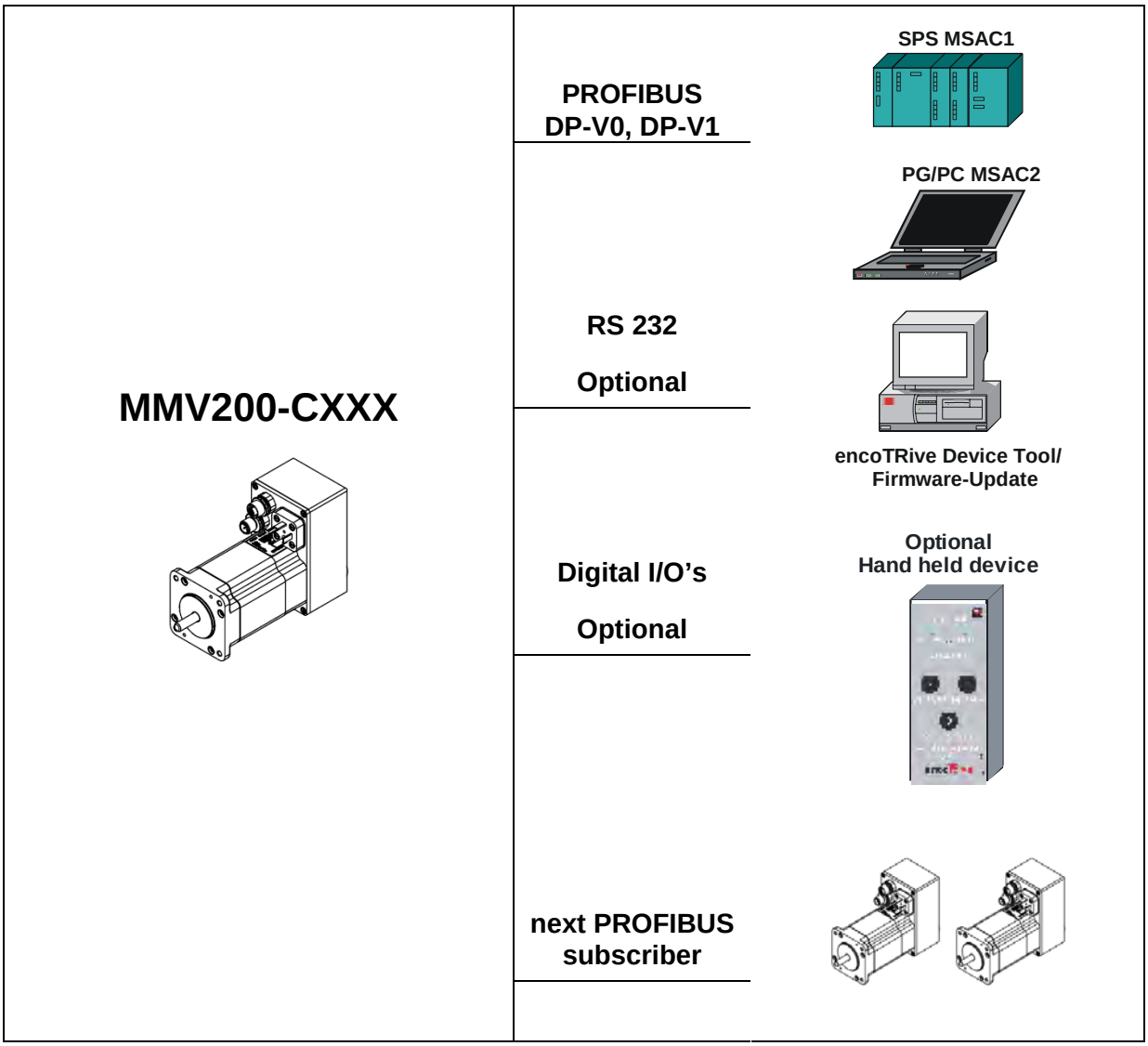

Figure 3.2: encoTRive PROFIBUS, type overview

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3.3 encoTRive CANopen, type overview

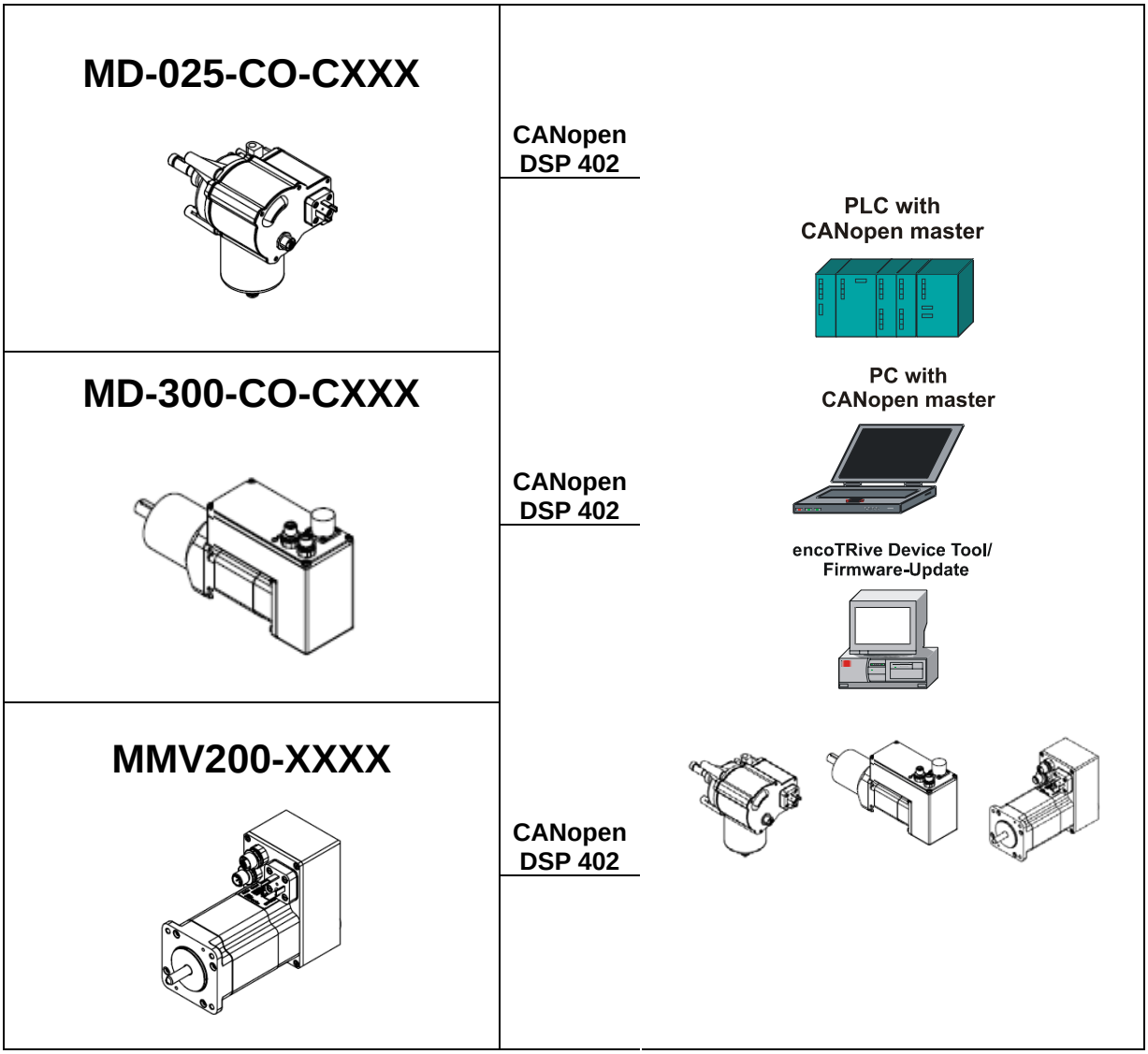

Figure 3.3: encoTRive CANopen, type overview

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3.4 Commissioning options

The sequences are programmed in the control system, and are then implemented by the drive in the application. To simplify this task, function modules can be provided for the control and parameterization of the encoTRive on request.

3.4.1 Function modules for S7 (PROFIBUS)

Functions	Documentation		
	MD-025-PB-CXXX	MD-300-PB-CXXX	MMV-200-CXXX
SIEMENS S7 / CPU 400 / 300			
Control of the drive / DP-V0, based on pre-defined telegram	TR-EMO-TI-DGB-0037	TR-EMO-TI-DGB-0037	TR-EMO-TI-DGB-0037
Single parameterizing via PKW	TR-EMO-TI-DGB-0044	TR-EMO-TI-DGB-0044	TR-EMO-TI-DGB-0044
Parameterizing of all parameters via PKW	TR-EMO-TI-DGB-0028	TR-EMO-TI-DGB-0028	TR-EMO-TI-DGB-0028
Single parameterizing via DPV1	TR-EMO-TI-DGB-0017	TR-EMO-TI-DGB-0017	TR-EMO-TI-DGB-0017
TR-Systemtechnik / S7 Slot -PLC			
Control of the drive / DP-V0, based on pre-defined telegram	–	TR-EMO-TI-DGB-0037	–
Single parameterizing via PKW	–	TR-EMO-TI-DGB-0044	–
Parameterizing of all parameters via PKW	–	TR-EMO-TI-DGB-0028	–
Single parameterizing via DPV1	–	–	–

3.4.2 Function modules for CoDeSys (CANopen)

Functions	Documentation		
	MD-025-PB-CXXX	MD-300-PB-CXXX	MMV-200-CXXX
TR-Systemtechnik / HMI Control VDC 5.7			
Control of the drive / PDO- & SDO communication	TR-EMO-TI-DGB-0059	TR-EMO-TI-DGB-0059	TR-EMO-TI-DGB-0059

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3.4.3 encoTRive Device Tool

The “encoTRive Device Tool” is own WINDOWS®-based PC program, which makes it easy to parameterize encoTRive drives via the field bus interface and additionally via an RS-232 interface. Target and speed demands etc., and therefore also positioning orders, can be carried out via the program user interface.

The user does not require any knowledge of the internal fieldbus parameter formats or order identifications etc. in order to do this.

In order to be able to benefit from newly implemented encoTRive functionalities, the encoTRive Device Tool will also be able to be used for firmware updates.

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3.5 Typical applications

The main application for the encoTRive is its use as a decentralized positioning drive for absolute position adjustment.

The following applications are examples of this:

- Tool and end stop adjustment in wood and metal processing machines
- Register adjustment in printing machines
- Knife adjustment in paper processing machines
- Format changing in packaging machines

4 Transport / Storage

Shipping information

Use only the original packaging!

Inappropriate packaging material may cause damage to the unit in transit.

Storage

- Storage temperature: -25 to +70°C
- Store in a dry place

5 Technical data

- **MD-300 PROFIBUS-DP / CANopen**
  – TR-EMO-TI-DGB-0008
- **MD-025 PROFIBUS-DP / CANopen**
  – TR-EMO-TI-DGB-0030
- **MMV200 PROFIBUS-DP / CANopen**
  – TR-EMO-TI-DGB-0054

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6 Assembly information

The unit can be mounted in any position, but the preferred orientation is horizontal.

The fixing flange is symmetrical, i.e. the drives can be fitted to the mounting flange in different angular positions depending on the hole pattern in the gearbox.

6.1 Fitting the gearbox

With drives of the series MD-300-YY-CXXX and MMV200-XXXX the gearbox can be exchanged if necessary by the user.
The drive of the series MD-025-YY-CXXX contains an integrated worm gear, which cannot be exchanged by the user.

6.1.1 Assembly instruction for gearboxes of the PLE-60 series

WARNING !

Damage of the motor shaft (shaft displacement) and malfunction by too high axial forces (30 N) in case of non-compliance of the work procedure sequence!

Gearbox mounting

- Bring motor into its end position
- Fasten motor
- Fasten shaft coupling
- After that, the motor screws may not be retighten any more

Gearbox demounting

- Remove shaft coupling
- Remove motor mounting screws

- For security reasons and in case of repeated mounting or demounting works: In order to be able to recognize a shaft displacement, the length of the shaft up to the centering ring should be measured and should be compared with the dimensional drawing.

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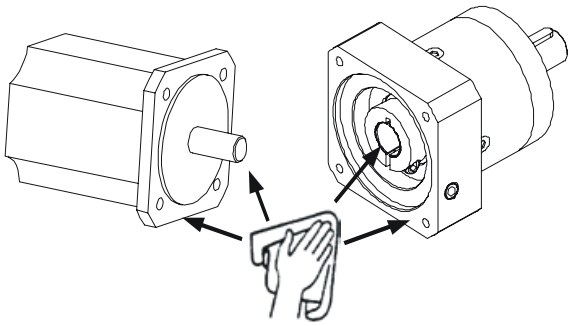
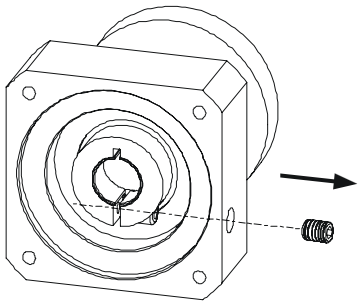
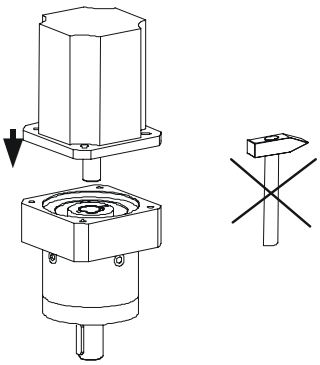


- Clean off all grease
- Remove any damage

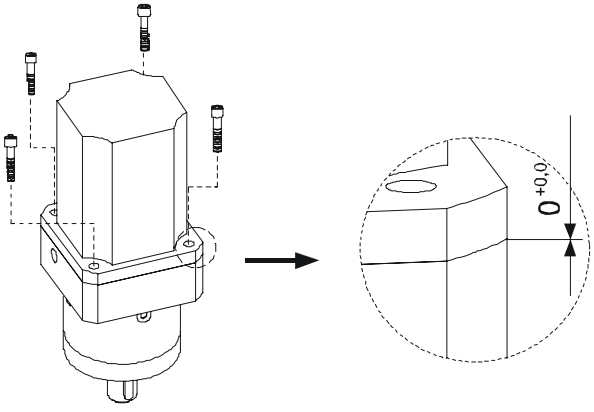


- Remove cover screw
- Adjust clamping screw setting



Open clamping screw,
$d_{motor} < d_{hollow\ shaft}$:

- Use bush
- Fit motor and gearbox together



- Motor flange must be in contact with gearbox flange
- Tighten screws diagonally

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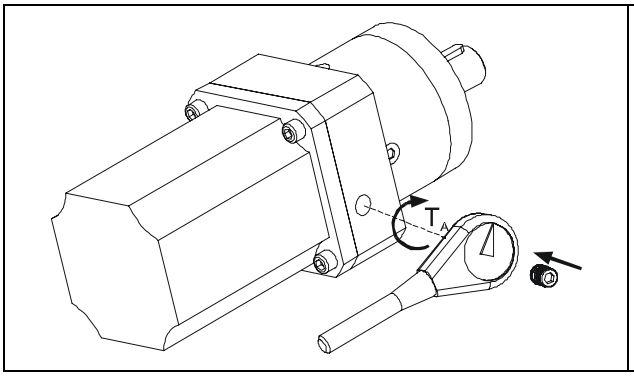

- Tighten clamping ring to T_A
- Fit cover screw

Positioning drive MD-300	
Gearbox	PLE 60
Shaft diameter [mm]	≤ 14
T_A [Nm]	4,5
SW [mm]	3

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7 Project Engineering / Installation / Preparation for commissioning

7.1 Planetary gearbox

The following points must be taken into account when sizing the gearbox!
Following gearbox parameters refer to the planetary gearbox of the PLE-60 series.

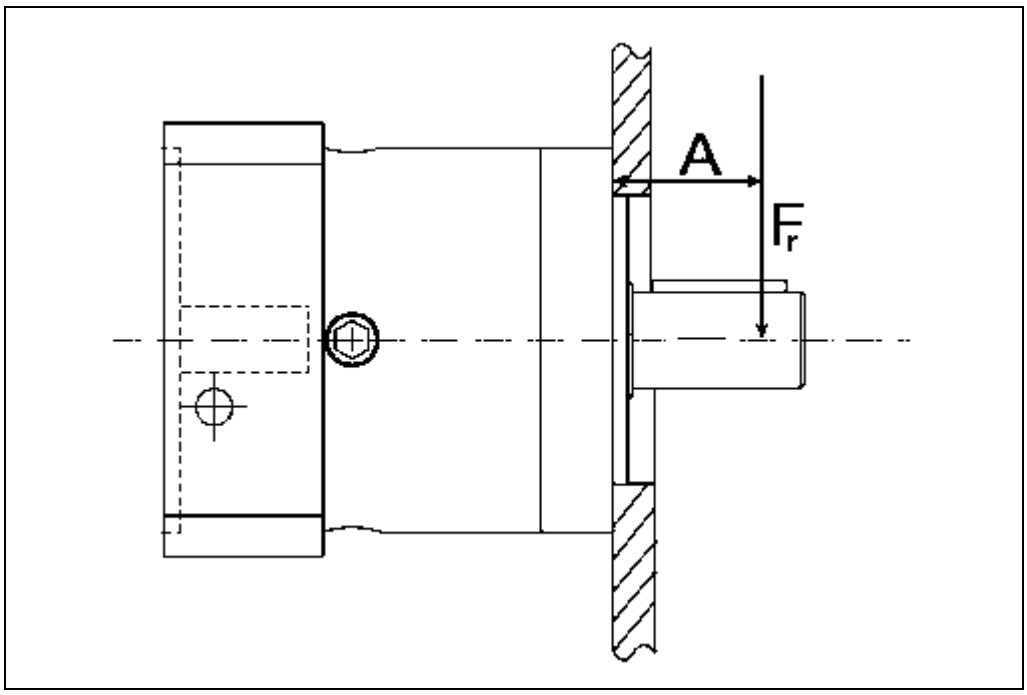

Figure 7.1: Definition of the life span parameters at the gearbox

7.1.1 Maximum permissible radial force F_{rmax}

The maximum permissible radial force depends on the breaking load of the shaft and the distance A from the load application point.
For the PLE-60 series $F_{r\max} = 500N$

7.1.2 Permissible radial force F_{rzul}

The permissible radial force Fr depends on the desired life of the unit. It is determined as a function of the mean drive speed and the distance A from the load application point.

7.1.3 Permissible axial force F_{amax}

This is proportional to the permissible radial force, and depends on the distance A from the load application point.
For the PLE-60 series it is valid: $F_{a\max} = F_{rzul} * (0{,}019 * A + 0{,}296) \leq 600N$

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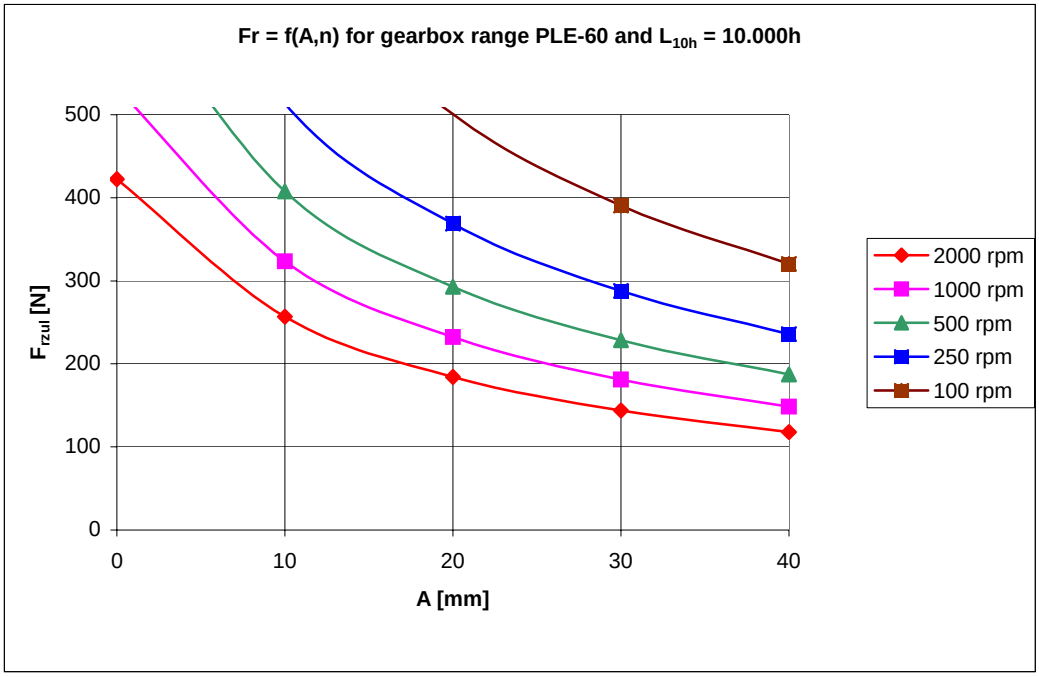

Figure 7.2: Radial forces depending on speed and distance

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7.1.4 Nominal life L10h

This value specifies the nominal life for a probability of failure of 10%.

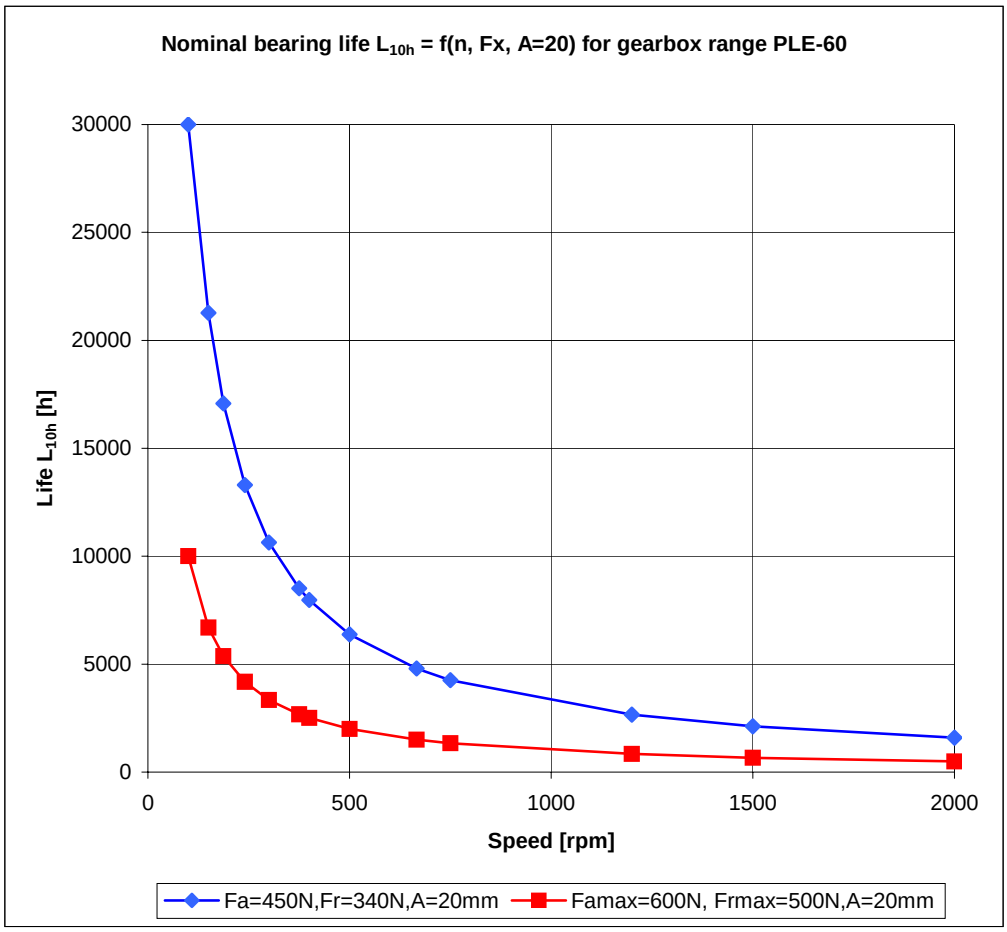

Figure 7.3: Bearing life time depending on load and distance

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7.1.5 Maximum output moment of the planetary gearbox

At nominal moment planetary gearboxes are designed for endurance strength. If the application moments remain always under the nominal moment, then no recalculation is necessary.
With short torque peaks or long intermittent duty it is also possible to transfer higher application moments. The following illustration serves for control.

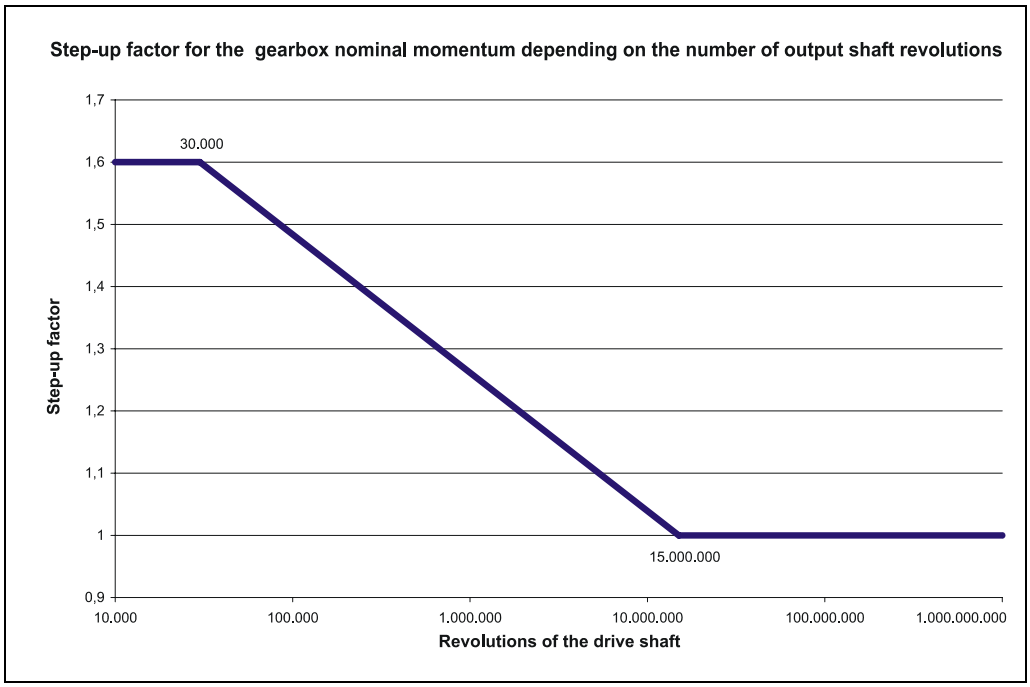

Figure 7.4: Step-up factor for the gearbox moment depending on the shaft revolutions

If the number of revolutions is > 15.000.000, then the gearbox may be loaded only with the nominal moment.
At a number of revolutions < 15.000.000 following formula is to be used:

$f = -0.1039 * \ln (10^5/30.000 * \text{Number of revolutions}) + 2.79$

f>1.6 -> f=1.6 **f <1 -> f=1**

The maximum transferable moment is T_{max} = f * nominal moment. The maximum application moment must not exceed T_{max}.

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In general, for the PLE-60 range:

$$L_{10h} = \frac{16666}{n} * \left(\frac{6050N}{F_{rl}} \right)^3 \qquad \text{with } F_{rl} = Fr * \frac{A + 15{,}5}{11{,}5}$$

Characteristic rules

1. **The lifetimes specified in the data sheet refer to a speed of 100 rpm at the output shaft.**
2. **The speed has a linear effect on the life.**
3. **The load affects the life with a power of three.**
4. **The lifetime refers to a probability of bearing failure of 10%.**

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7.1.6 MD-025 / Integrated worm gear

CAUTION !

Damage of the drive by inadmissible axial or radial forces at the drive shaft!

- The axial and radial values for the load defined in the data sheet of the drive must be maintained mandatorily.
- On the side of the output a coupling should be used.

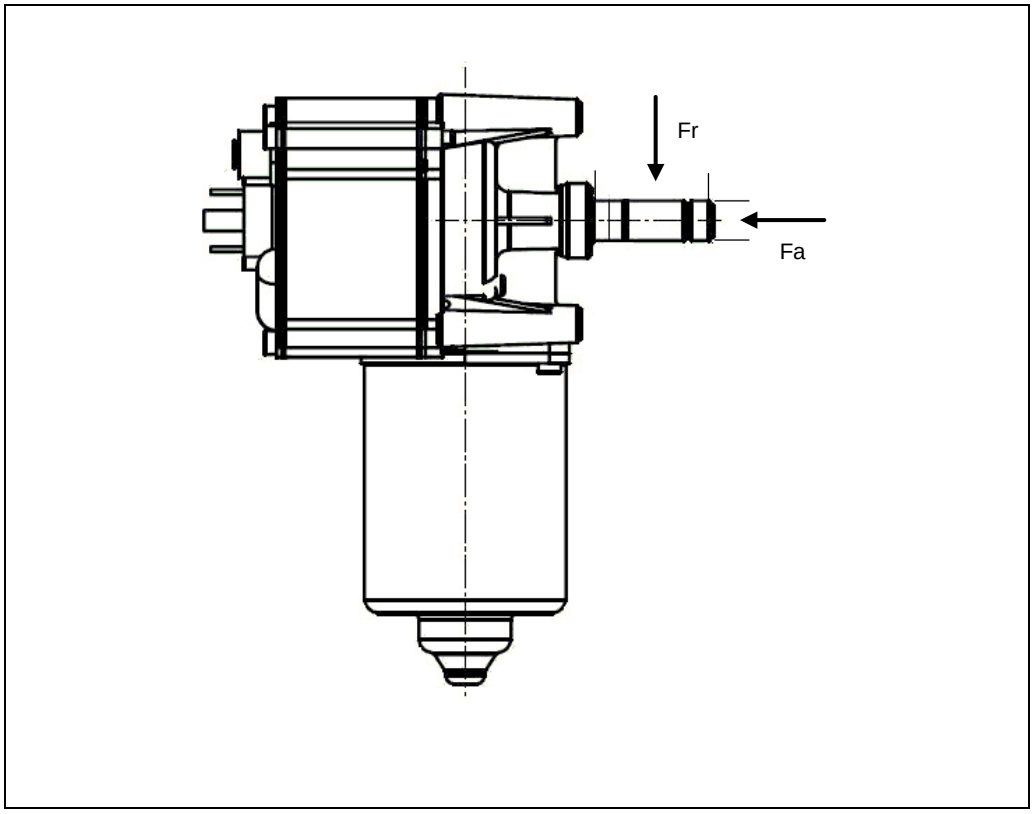

Figure 7.5: Admissible axial- and radial forces

The behavior of the running-in phase of the drives can be different. Normally, operating noises disappear after few operation minutes.

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7.2 Voltage supply

7.2.1 External Power packs

WARNING !

Danger of death and serious injury by electric shocks, caused by the use of a power pack, which does not correspond to the PELV-requirements according to DIN EN 50178!

- A power pack is to be used, which corresponds to the PELV requirements, the negative output of the power pack is to be connected with PE.
- If the application is designed it is to be observed that the drive can consume a higher current during the acceleration phase as it is the case when the drive is operated with a constant speed.

7.2.2 Regeneration

In case of deceleration (dependent on the whole mass inertia in the drive line and the adjusted delay ramp) or in break operation the drive can provide energy. See also chapter “Regeneration protection and ballast circuit” on page 89.

CAUTION !

Danger of damage to property by overvoltages on the supply line, caused by the drive in the case of deceleration!

- If in an application regenerative energy can occur, appropriate measures must be taken. Power packs with a large output capacitance (e. g. 10.000 µF), a passive regeneration protection with diode and capacity, or an external ballast circuit can be used.

7.2.3 Polarity protection

Model	available	NOT available
MD-300-YY-CXXX	X	
MD-025-YY-CXXX		X
MMV200-XXXX		X

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7.2.4 Ground connection

To protect the application from disturbances the screens must be connected on both sides. Potential differences can lead to inadmissible currents on the screen and have to be prevented by potential equalization conductors. The necessary cross sections must correspond to the valid guidelines.

The grounding can be made by means of the motor flange or by the electronics housing. Usually by screwing the motor onto an electrically well conductive and grounded machine part a sufficient grounding of the drive is reached.

The cables for the power supply and the digital inputs can be designed unshielded.

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7.2.5 Feeding possibilities

Pay attention to the respective drive plug configuration according to the customer's drawing!

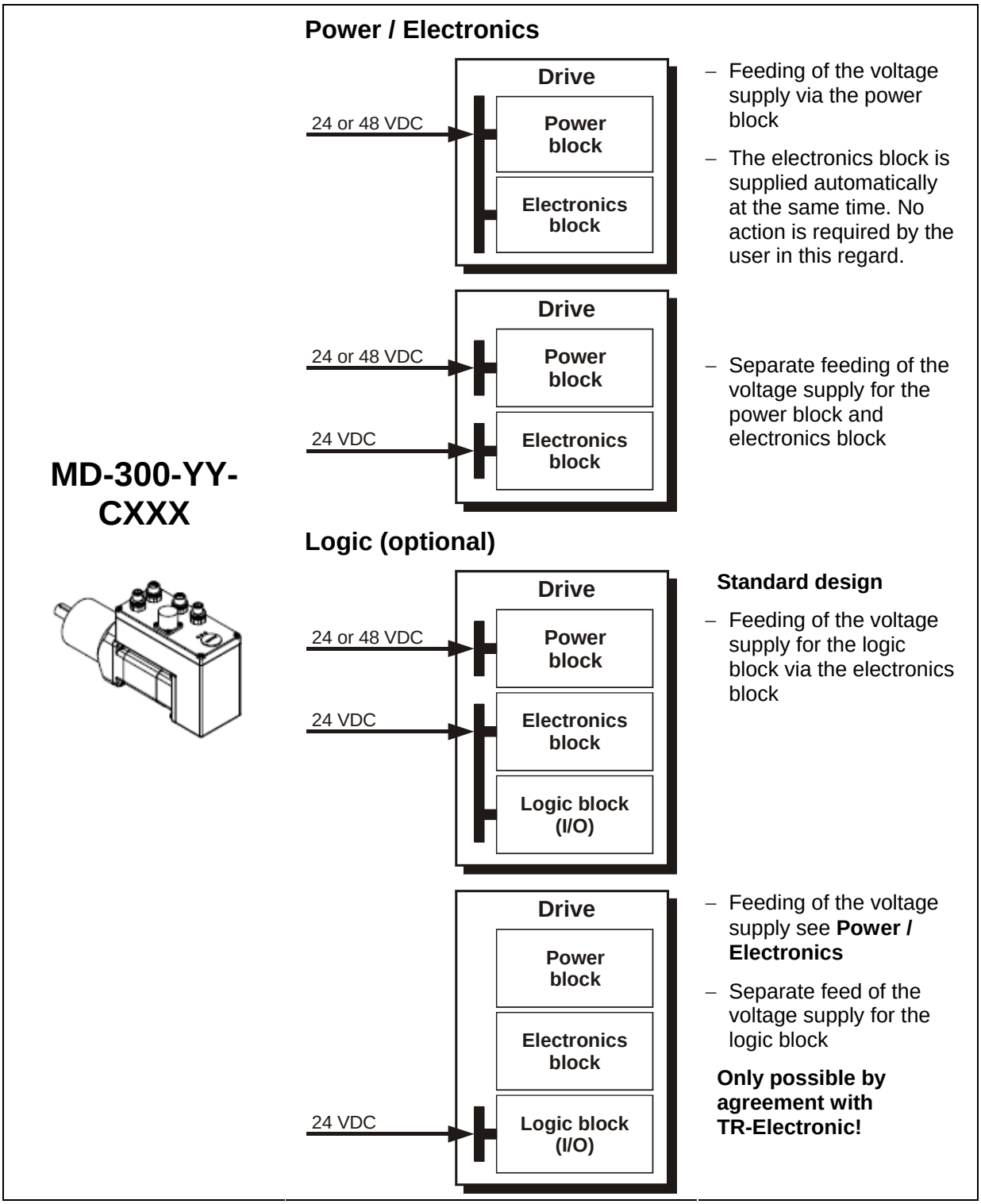

Figure 7.6: Voltage supply MD-300-YY-CXX

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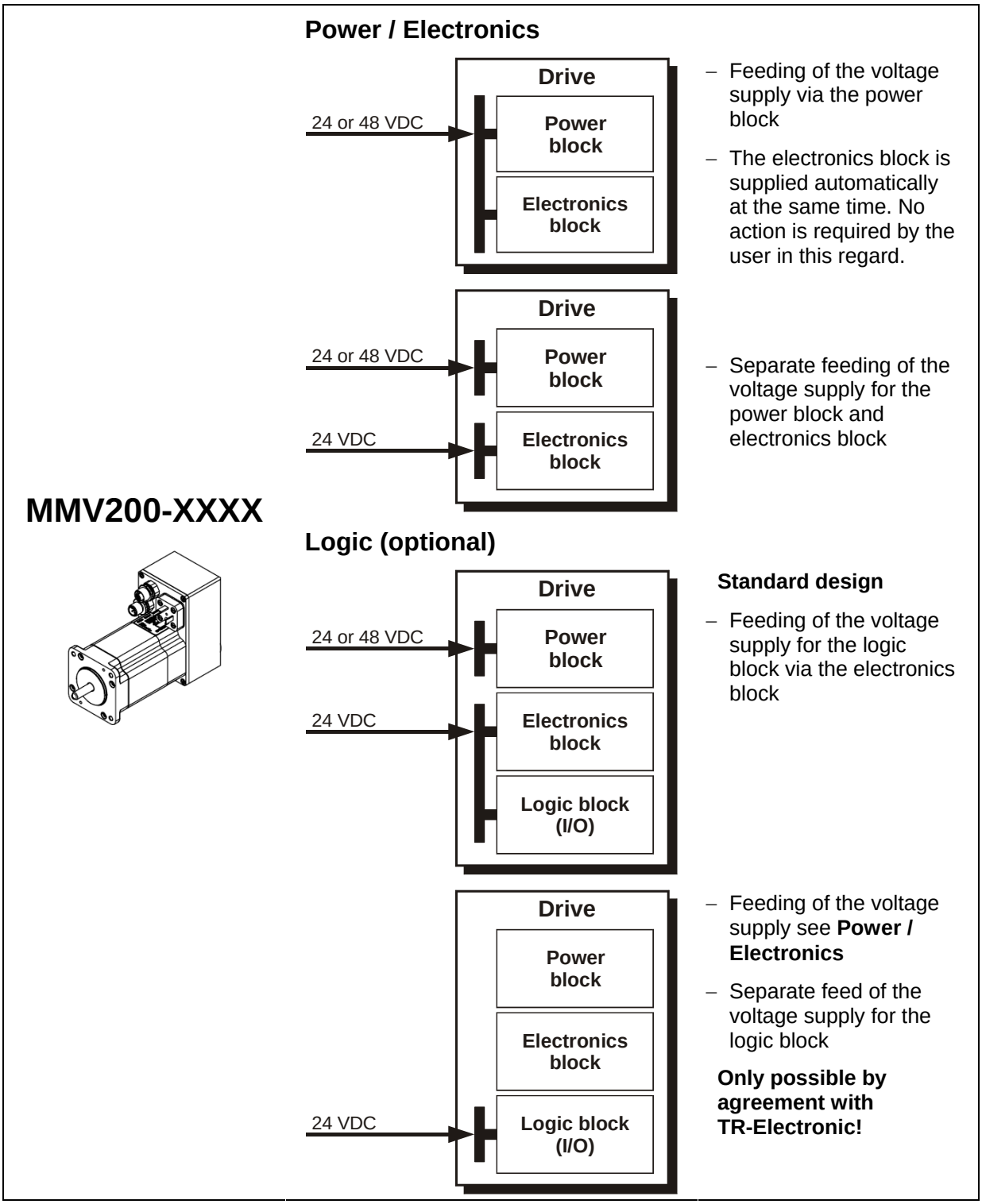

Figure 7.7: Voltage supply MMV200-XXXX

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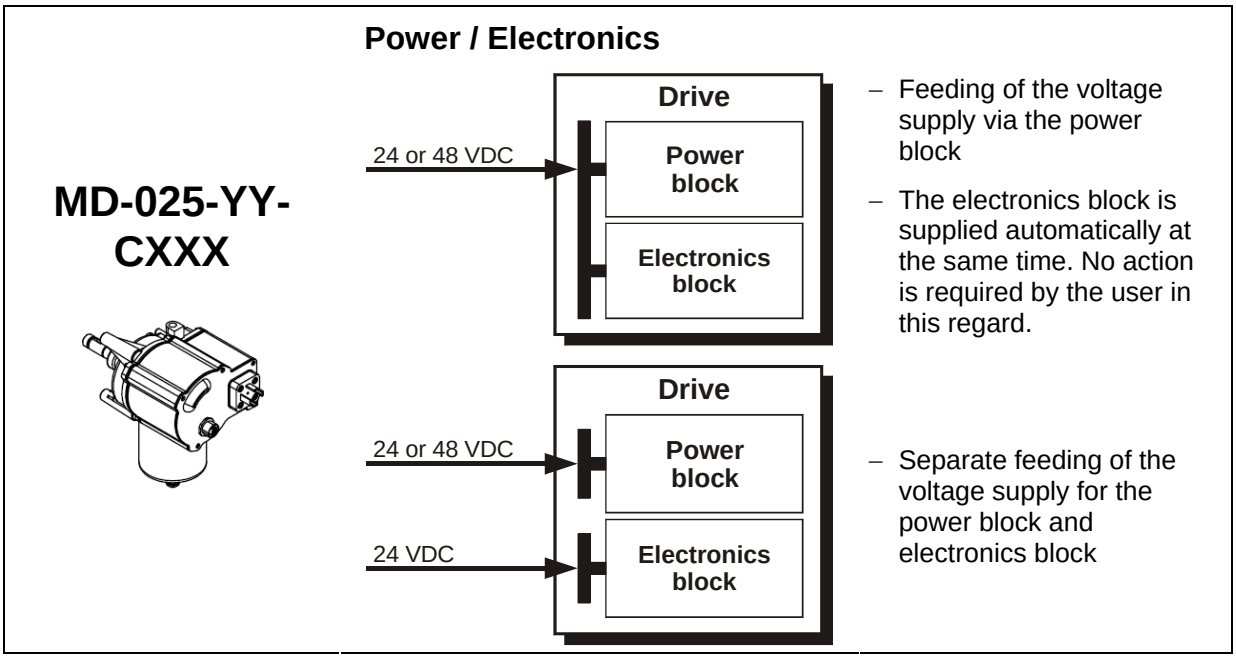

Figure 7.8: Voltage supply MD-025-YY-CXX

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7.2.6 Coincidence factor

When using several drives that are not all in operation simultaneously, it is possible to use a load power supply with a lower rating.

The user is responsible for sizing the power supply.

- **Example 1: 3x encoTRive 300W**
  - Coincidence factor = 0,4
  - Rated power, rated speed
  - 3x8A*0,4 = 9,6 A

7.2.7 Regeneration protection and ballast circuit

In the case of applications with low mechanical friction, the excess energy when the drive brakes can affect the power supply to the load. The magnitude of the regenerative energy is dependent on:

- the number of motors operated in train
- the friction conditions in the application
- the prevailing moment of inertia
- the coincidence factor in the train

and is roughly estimated by means of the following formula:

$$W = \frac{1}{2} * J * \omega^2$$

W.. Braking energy [Ws]
J.. Moment of inertia [kgm²]
ω.. Angular frequency = 2*π* n/60 [1/s]
n.. Speed [rpm]

A ballast circuit is incorporated in the encoTRive as standard, and is adequate for most operating situations. This must be checked in the individual case, however.
In critical cases, we recommend the use of an external ballast circuit.

System	Max. permissible mean braking power	Max. energy per braking
MD-300-YY-CXXX	50 W	35 Ws
MD-025-YY-CXXX	-	-
MMV200-XXXX	-	-

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Example:

- MD-300-PB-Cxxx without brake
- Total moment of inertia 5*Motor moment of inertia
- Operation at rated speed
- Deceleration occurs every 0.5s.

Mean braking power:

$$P = \frac{W}{t} = \frac{J * \omega^2}{2 * t}$$

$$P = \frac{5 * 512 gcm^2 *}{10^{-7} * 0{,}5s} * \left(\frac{2 * \pi * 4350}{60} \right)^2 = 106W$$

Use an external ballast circuit, because P > 50 W.

If the power supply used is not proof against regeneration and the internal ballast circuit is not adequate, an inadmissible overvoltage can be prevented by means of passive regeneration protection in the form of a diode and capacitor.

The capacitance of the electrolytic capacitor required is calculated from:

$$C_{\min} = \frac{4\pi^2 * J * n^2}{U_{z\max}{}^2 - U_z{}^2}$$

J.. Total moment of inertia [kgm²]
n .. Speed [rps]
U_{zmax}.. Maximum permissible link circuit voltage
U_z.. Rated voltage

Example:

MD-300: U_{zmax}=63V, U_z=48V, n=4350 rpm, J=512gcm² > C_{min}= 6380µF

The dielectric strength of the electrolytic capacitor must be at least 2x the rated voltage of the drive, i.e. 50V in the case of 24V systems and 100V in the case of 48V systems.

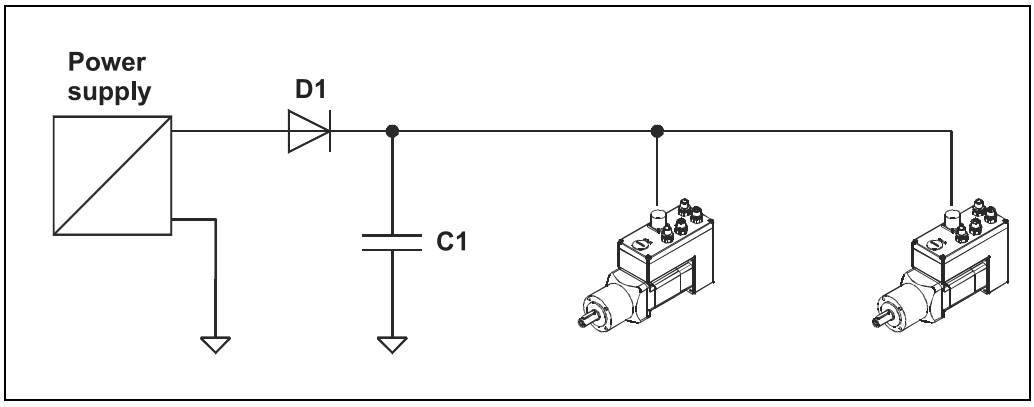

Figure 7.9: Passive regeneration protection

As an alternative, regeneration protection can be provided by means of an external ballast circuit.

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7.3 PROFIBUS installation

7.3.1 RS485 transmission technology

All devices are connected in a bus structure (line). Up to 32 clients (master or slaves) can be connected together in a segment.
The bus is terminated with an active bus termination at the beginning and end of each segment. For stable operation, it must be ensured that both bus terminations are always supplied with voltage. The selection of the bus termination is to be taken out of the pin allocation list of the respective drive type.

Repeaters (signal amplifiers) have to be used with more than 32 clients or to expand the network scope in order to connect the various bus segments.

All cables used must conform with PROFIBUS specifications for the following copper data cable parameters:

Parameter	Cable type A
Wave impedance in Ω	135...165 at a frequency of 3...20 MHz
Operating capacitance (pF/m)	30
Loop resistance (Ω/km)	≤ 110
Wire diameter (mm)	> 0,64
Wire cross-section (mm²)	> 0,34

The PROFIBUS transmission speed may be set between 9.6 kBit/s and 12 Mbit/s and is automatically recognized by the encoTRive. It is selected for all devices on the bus at the time of commissioning the system.

The range is dependent on the transmission speed for cable type A:

Baud rate (kbits/s)	9.6	19.2	93.75	187.5	500	1500	12000
Range / Segment	1200 m	1200 m	1200 m	1000 m	400 m	200 m	100 m

A shielded data cable must be used to achieve high electromagnetic interference stability. The shielding should be connected with low resistance to protective ground using large shield clips at both ends. It is also important that the data line is routed separate from current carrying cables if at all possible. At data speed ≥ 1.5 Mbit, drop lines should be avoided under all circumstances.

The PROFIBUS guidelines and other applicable standards and guidelines are to be observed to insure safe and stable operation.
In particular, the applicable EMC directive and the shielding and grounding guidelines must be observed!

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7.4 CANopen installation

The CANopen system is wired in bus topology with terminating resistors (120 ohms) at the beginning and at the end of the bus line. If it is possible, drop lines should be avoided. The cable is to be implemented as shielded twisted pair cable and should have an impedance of 120 ohms and a resistance of 70 mΩ/m. The data transmission is carried out about the signals CAN-H and CAN-L with a common GND as data reference potential. Optionally also a 24 V supply voltage can be carried.

In a CANopen network max. 127 slaves can be connected. The drive supports the Node-ID range from 0-127. The transmission rate can be adjusted via DIP-switches and supports the baud rates 10 kbit/s, 20 kbit/s, 50 kbit/s, 100 kbit/s, 125 kbit/s, 250 kbit/s, 500 kbit/s, 800 kbit/s and 1000 kbit/s.

The length of a CANopen network is depending on the transmission rate and is represented in the following for a cable cross section of 0.25 mm^2 – 0.34 mm^2:

Baud rate [kbit/s]	10	20	50	100	125	250	500	800	1.000
Range [m]	5.000	2.500	1.000	625	500	250	100	50	25

The

- *ISO 11898,*
- *the recommendations of the CiA DR 303-1 (CANopen cabling and connector pin assignment)*
- *and other applicable standards and guidelines are to be observed to insure safe and stable operation!*

In particular, the applicable EMC directive and the shielding and grounding guidelines must be observed!

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7.5 Connection

Pay attention to the respective drive plug configuration according to the customer's drawing!

7.5.1 MD-300-PB-CXXX Bus cover

CAUTION !

The connector pins can be mechanically damaged if the connector cover is not removed and replaced in the proper manner!

- Remove and replace the connector cover carefully, ensuring that it is kept parallel.
- When fitting, tighten the screws in turn, evenly and diagonally

The encoTRive electronics can be destroyed by voltage flash-overs if the connecter cover is removed or replaced when live.

- The connecter cover may only be removed and replaced when the power is off

The bus hood can be rotated through 180° to change the connector orientation

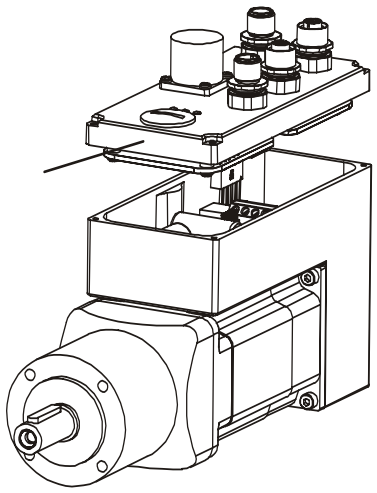

Figure 7.10: MD-300-PB-CXXX connector cover removed

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7.6 Plug connectors, equipment side

Pay attention to the respective drive plug configuration according to the customer's drawing!

7.7 Mating plugs and accessories

Mating plugs are **not** included in the scope of supply and must be ordered separately.

7.7.1 Power connectors

Function	System	Figure	Order No.:
DESINA (Bus+Power)	Han-Brid CU socket	Socket, set for self-assembly, without cable	62-200-020
	Han-Brid CU plug	Plug, set for self-assembly, without cable	62-200-021
DESINA Han-Brid Cu	Han-Brid CU Cable	Unitronic TFD P Profibus Hybrid, suitable for drag chains, 1x2x0,64²+4*1,5²	64-200-128 please specify the necessary length!

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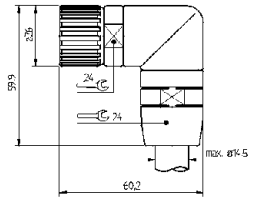
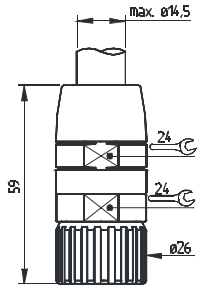
Function	System	Figure	Order No.:
Supply	M23	Cable inlet max. ∅14.5 mm  Socket, self-assembly	62-000-1209
		Cable inlet max. ∅14.5 mm  Plug, self-assembly	62-000-1334
		Cable inlet ∅ 6-8 mm Power outlet with cable relief / 3+PE	62-000-1364

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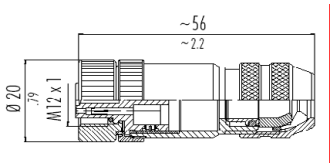
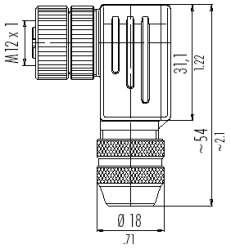
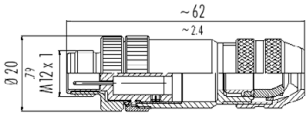
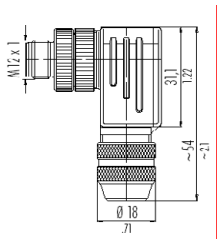
7.7.2 Profibus

Function	System	Figure	Order No.:
Profibus Input	M12 socket b-coded	 screened, self-assembly, cable aperture 6-8 mm	62-000-1291
		 angle, screened, self-assembly, cable aperture 6.5-8.5 mm	62-000-1317
Profibus Output	M12 plug b-coded	 screened, self-assembly, cable aperture 6-8 mm	62-000-1290
		 angle, screened, self-assembly, cable aperture 6.5-8.5 mm	62-000-1314

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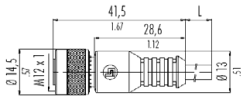
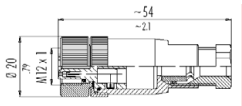
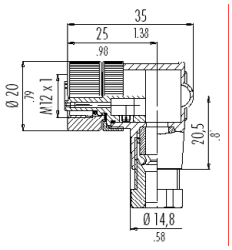
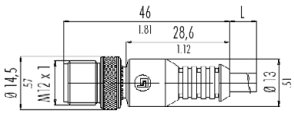
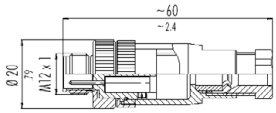
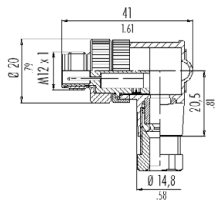
7.7.3 CANopen

Function	System	Figure	Order No.:
CAN input	M12 socket (a-coded)	 molded cable, screened, not suitable for drag chains, L=5m	62-000-1176
		 metal lock, self-assembly Cable aperture 4-6 mm	62-000-1169
		 angle, metal lock, self-assembly, Cable aperture 6-8 mm	62-000-1319
CAN output	M12 plug (a-coded)	 molded cable, screened, not suitable for drag chains, L=5m	62-000-1175
		 metal lock, self-assembly Cable aperture 4-6 mm	62-000-1168
		 angle, metal lock, self-assembly, cable aperture 6-8 mm	62-000-1318

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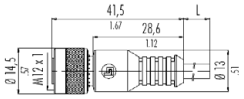
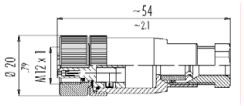
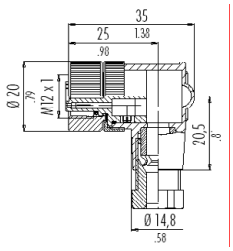
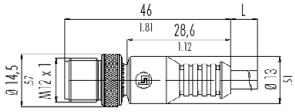
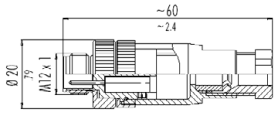
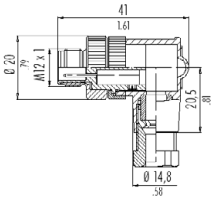
7.7.4 Digital inputs and outputs / PROFIBUS variant

Function	System	Figure	Order No.:
Digital inputs	M12 socket (a-coded)	 molded cable, screened, not suitable for drag chains, L=5m	62-000-1176
		 metal lock, self-assembly Cable aperture 4-6 mm	62-000-1169
		 angle, metal lock, self-assembly, Cable aperture 6-8 mm	62-000-1319
Digital outputs	M12 plug (a-coded)	 molded cable, screened, not suitable for drag chains, L=5m	62-000-1175
		 metal lock, self-assembly Cable aperture 4-6 mm	62-000-1168
		 angle, metal lock, self-assembly, cable aperture 6-8 mm	62-000-1318

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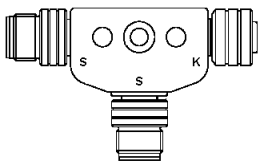
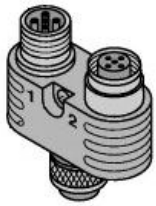
7.7.5 Y-Distributors

Function	System	Figure	Order No.:
PROFIBUS IN / OUT	M12	5-pole T-piece  Plug-Socket-Plug	62-000-1386

Function	System	Figure	Order No.:
CANopen IN / OUT	M12	5-pole Y-piece  Socket-Plug-Socket	62-000-1365

7.7.6 External terminating resistors

Function	System	Figure	Order No.:
PROFIBUS terminating resistor	M12-plug (b-coded)	4-pole 220 ohm	40803-40005

Function	System	Figure	Order No.:
CANopen terminating resistor	M12-plug (a-coded)	5-pole 120 ohm	620-000-1366

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7.7.7 Protective caps

Function	System	Figure	Order No.:
Protective cap with retaining bail, for plugs	M12		62-000-1170
Protective cap with retaining bail, for sockets	M12		62-000-1171
Screw cap (yellow)	M12		62-000-1427
Protective cap for distributors and sockets (black)	M12		62-000-1344

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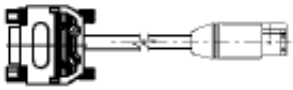
7.7.8 Parameterizing interfaces / Communication interfaces

For a successful communication connection between encoTRive Tool (see page 73) and drive different interfaces are available.

Function	System	Figure	Order No.:
RS-232 only MD-300-PB-Cxxx	IEEE-1394	 9-pole Sub-D socket, IEEE-1394 plug (6-pole), 2.2 m	511-00001

Function	System	Figure	Order No.:
Converter PC USB to CAN interface	CAN – Specification 2.0A		63-100-200

Function	System	Figure	Order No.:
PROFIBUS-DP/FMS-Master	PCMCIA Card		709-10020

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7.8 Optional Hand-held device

System	**Handheld device --> Drive MD-300 and MMV200 - PROFIBUS** **Useable with drive firmware version 4.09 and later.**
Function	**Initial operation** – Jog in positive and negative direction up to the software limit switches – Set reference point (referencing) – Quit failure – Release internal break (optional) manually
Figure	
Order No.:	511-0009

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7.9 Demo Kits

Demo Kit

Figure: Order No.: 511-00003

Drive	Interface	Gearbox	Brake	Order No.:
MD-025	**CANopen**	**-**	**-**	511 -00005
MD-025	**PROFIBUS**	**-**	**-**	511 -00010
	Kit equipment: – Power pack 5 A / 230/110 V AC - 24-28 VDC Interface-dependent accessories: – Terminal resistance – Y-Distributor or T-piece – Ready made-up connection cable set – USB to CAN adapter – Documentation (CD)			
MD-300	**CANopen / PROFIBUS**	**with gearbox / i=8**	**with brake**	511 -00003
MD-300	**CANopen**	**with gearbox / i=8**	**with brake**	511 -00004
MD-300	**CANopen**	**without gearbox**	**with brake**	511 -00006
MD-300	**PROFIBUS**	**without gearbox**	**with brake**	511 -00007
	Kit equipment: – Power pack 5 A / 230/110 V AC – 48 VDC Interface-dependent accessories: – Terminal resistance – Ready made-up connection cable set – USB to CAN adapter – RS 232 Cable – User software (encoTRive Tool) (CD) – Documentation (CD)			

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