BERGER LAHR

Catalogue
Servodrives **CPD 17**

a company of Schneider Electric

Servodrive CPD 17

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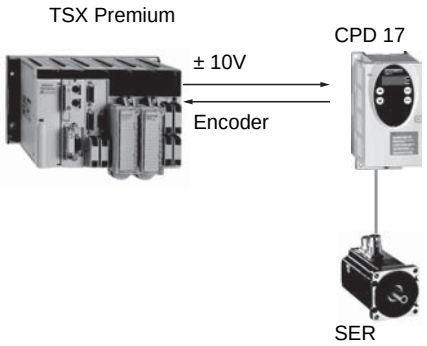
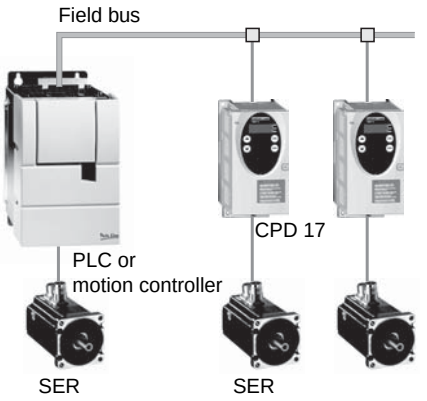
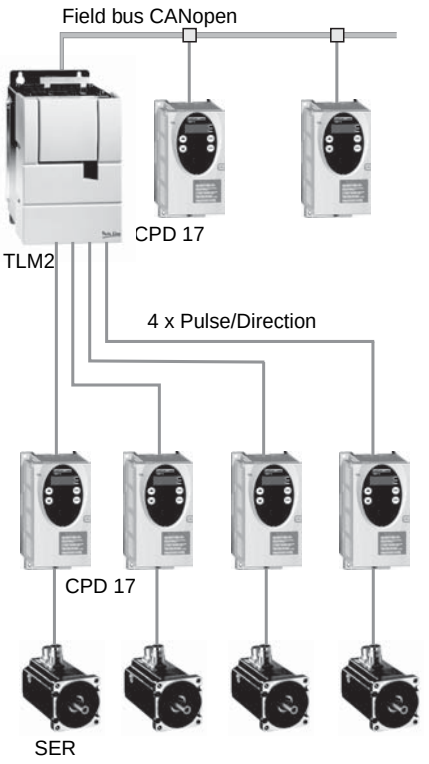






Product overview CPD17

The CPD17 is a servodrive for AC brushless servomotors.
The servodrive CPD17 receives its setpoint values from a PLC or a Berger Lahr Motion Controller, e.g. TLC6, TLCC, TLM2.
It offers a very compact and powerful drive system in combination with the proven SER servomotors by Berger Lahr.

Servodrive CPD17

The servodrive CPD17 by Berger Lahr offers the following advantages:

Simplicity

The servodrive CPD17 is available in predefined motor-unit combinations. This ensures that you receive the appropriate combination of servomotor and servodrive for your purpose.
For ease of commissioning the servodrive CPD17 has automatic motor detection and controller setting (autotuning).
The PC software "Power Suite 2" is available for easy and simple configuration and controller optimisation.

Flexibility

Another advantage of the servodrive CPD17 is the versatile application options:
- as torque or speed controller via the analogue inputs
- as electronic gearbox via the RS422 interface
- as positioning or speed controller via the field bus interface

The servodrive is available in four voltage types and can thus be used anywhere in the world.
- 115V_{AC}, 1-phase
- 230V_{AC}, 1 and 3-phase
- 400/480V_{AC}, 3-phase

Openness

The servodrive CPD17 has three standard interfaces for control:
- a field bus interface for CANopen or Modbus
- a signal interface with two analogue ±10V inputs and eight digital inputs/outputs
- a rotary encoder interface with pulse/direction or A/B encoder inputs or with outputs for the encoder simulation (ESIM).

Compact

The compact design of the servodrive and the integrated components (line filter, ballast resistor and safety function) reduces the space required in the control cabinet to a minimum.

Safety

The integrated "Safe Stop" safety function enables a category 0 or 1 stop as per EN 60204-1 without external power protection. This reduces system costs and response times.

SER brushless servomotors

The servomotors of the SER series by CPD17 are three-phase synchronous motors. They are fitted with neodymium-iron-boron magnets (NdFeB) and offer a high power density and dynamics with small dimensions.
The motors are available in the following models:
- With the "SinCos single turn" absolute encoders
- Degree of protection IP41
- With or without PLE gearbox in gear ratios 3:1, 5:1 or 8:1
- With smooth shaft end or shaft end with key
- With or without electromagnetic holding brake

Classification of SER motors and servodrive CPD17

SER motors | **Servodrive CPD17**



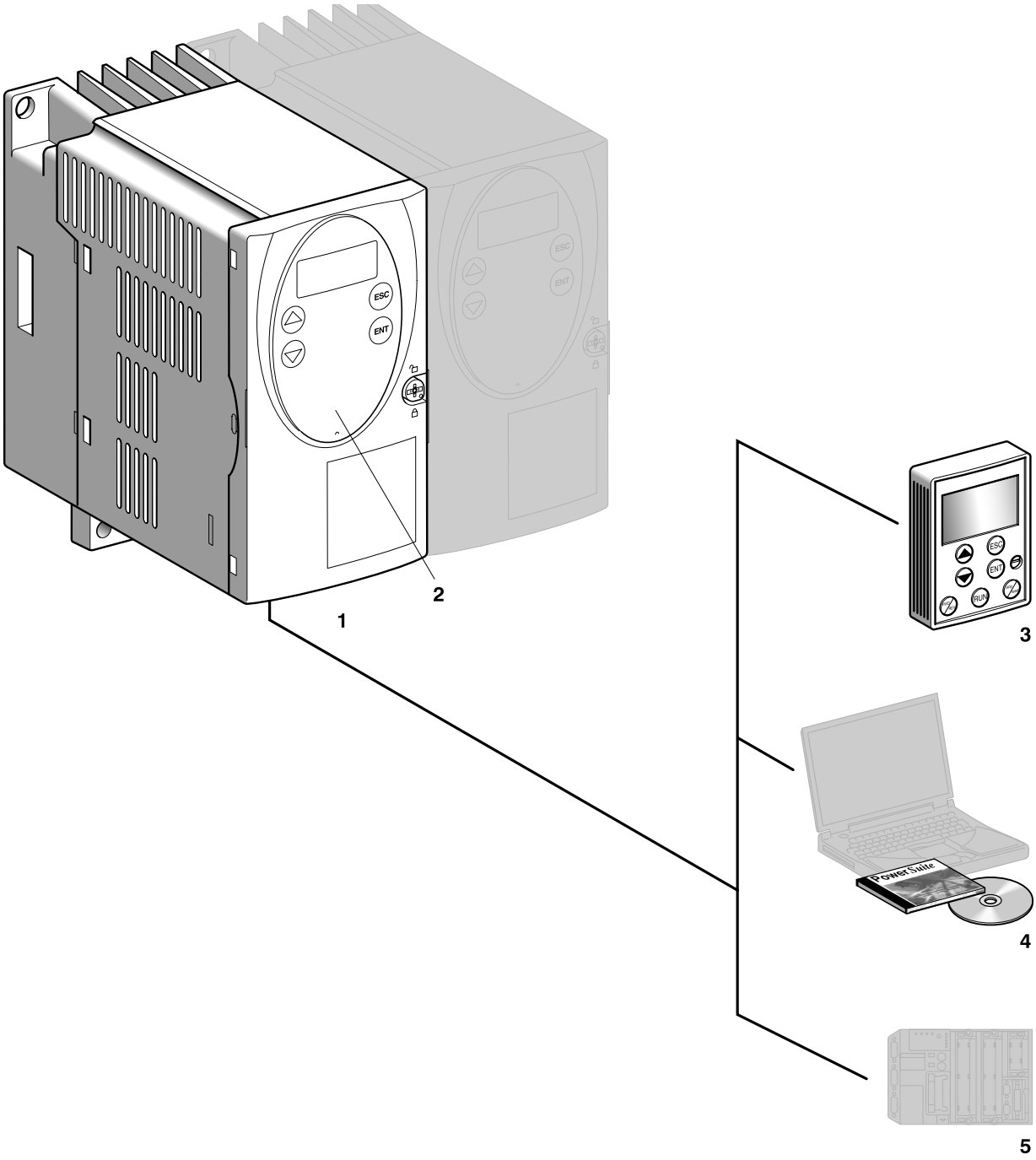

SER 3xx	Size 1 (CPD 170 ••••S1)		Size 2 (CPD 170 ••••S2)	Size 3 (CPD 170 ••••S3)		
	115V, 1-phase, with integrated EMC line filter			**230V, 1-phase, with integrated EMC line filter**		
	CPD 170 1F10S1	**CPD 170 1F17S2**	**CPD 170 1F28S3**	**CPD 170 2F10S1**	**CPD 170 2F17S2**	**CPD 170 2F28S3**
	Size 1, 0.4kW	**Size 2, 0.65kW**	**Size 3, 1.4kW**	**Size 1, 0.75kW**	**Size 2, 1.2kW**	**Size 3, 2.5kW**
SER 364 3L 3S	0.29/0.85 Nm					
SER 366 3L 3S	0.48/1.3 Nm			0.48/1.3 Nm		
SER 368 3L 3S	0.7/1.62 Nm	0.7/2.5 Nm			0.7/2.5 Nm	
SER 368 3L 5S				0.7/2.22 Nm		
SER 3610 3L 3S		0.9/2.85 Nm			0.9/2.85 Nm	
SER 397 4L 3S	1.1/2.7 Nm	1.1/3.4 Nm		1.1/2.73 Nm		
SER 3910 4L 3S				2.2/4.84 Nm	2.2/6.68 Nm	
SER 3913 4L 3S					2.9/8.35 Nm	
SER 31112 4L 3S			4.2/11.0 Nm		4.2/8.1 Nm	4.2/11.0 Nm
SER 31117 4L 3S			6.6/17.9 Nm			6.6/17.9 Nm
SER 31122 4L 5S						10.0/25.2 Nm

	230V, 3-phase, without integrated EMC line filter			**400/480V, 3-phase, with integrated EMC line filter**	
	CPD 170 3N10S1	**CPD 170 3N17S2**	**CPD 170 3N42S3**	**CPD 170 4F14S2**	**CPD 170 4F34S3**
	Size 1, 0.75kW	**Size 2, 1.4kW**	**Size 3, 3.2kW**	**Size 2, 1.4kW**	**Size 3, 3.0kW**
SER 366 3L 3S	0.48/1.3 Nm				
SER 368 3L 3S		0.7/2.5 Nm			
SER 368 3L 5S	0.7/2.22 Nm				
SER 3610 3L 3S		0.9/2.84 Nm			
SER 397 4L 3S	1.1/2.73 Nm				
SER 3910 4L 3S	2.2/4.84 Nm			2.2/6.2 Nm	
SER 3913 4L 3S		2.9/8.35 Nm		2.9/7.3 Nm	
SER 3913 4L 5S	2.9/7.5 Nm			2.9/9.5 Nm	
SER 31112 4L 3S		4.2/8.1 Nm	4.2/11.7 Nm		
SER 31112 4L 5S				4.2/10.16 Nm	
SER 31117 4L 3S		6.6/11.8 Nm	6.6/20.8 Nm		6.6/20.0 Nm
SER 31117 4L 5S				6.6/12.8 Nm	
SER 31122 4L 5S			10.0/30.0 Nm		10.0/28.0 Nm
SER 31127 4L 5D			13.4/36.0 Nm		13.4/31.5 Nm

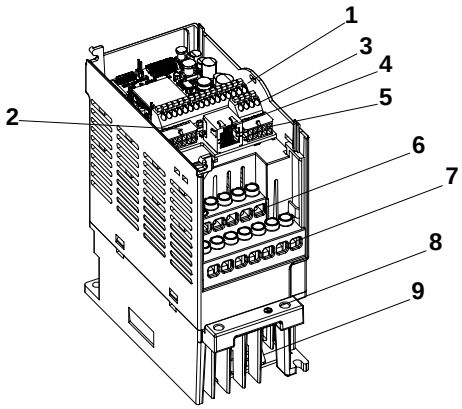
The 1st value is the continuous torque at standstill, the 2nd value is the peak torque at standstill.

Selected example: The combination of motor SER 397 4L 3S and servodrive CPD 170 1F10S1 corresponds to the requirements with max. 1.1Nm continuous torque at standstill and max. 2,7Nm peak torque at standstill. For more precise selection please note the torque/speed curves of the motor.

Description CPD 17



(1) Servodrive CPD17• ••••S1 (size 1)
(2) User interface with display (HMI)
One communications interface for:
(3) Decentralised control terminal
(4) PC with "Power Suite 2" software
(5) PLC or Motion Controller



Unit overview

(1) I/O signal connection CN1 (spring-loaded terminals)
- Two analogue setpoint inputs ±10V in the speed regulation and current regulation operating modes (torque regulation)
- Eight digital inputs/outputs. The assignment depends on the selected operating mode
- CANopen for field bus control

(2) 12-pin Molex CN2 socket for motor encoder (SinCos Hiperface® sensor)
(3) CN3 terminal for 24V power supply
(4) RJ45 socket CN4 for connection of
- Field bus: Modbus or CANopen
- PC with "Power Suite 2" software
- Decentralised control terminal

(5) 10-pin CN5 Molex socket for
- Output of actual motor position via A/B encoder signals in speed regulation and current regulation operating modes for position feedback for a higher level position controller (e.g. PLC with Motion Control card).
- Infeed of pulse/direction or A/B encoder signals to electronic gear operating mode

(6) Screw terminals for connection of the mains power
(7) Screw terminals for connection of the motor and external brake resistors
(8) Bracket for EMC mounting plate
(9) Heat sink and fan with sizes 2 and 3

Options for use

CPD17 is a servodrive for brushless servomotors of the SER series. It is robust, space-saving and simple to use.
CPD17 complies with the international standards EN 50178, IEC/EN 61800-3 and is UL-approved (USA and Canada) and has the CE mark.
The servodrive CPD17 can be used for many applications in mechanical engineering and industrial automation, such as packaging, cutting, filling, assembly, pallettizing, welding, labelling etc.

Control

Setpoint values are also set by:
- Field bus: Modbus or CANopen for point-to-point positioning movements, speed control and torque/speed regulation
- ±10V analogue signals for torque regulation or speed regulation. The position feedback of the actual motor position is fed through A/B encoder signals.
- Pulse/direction signals or A/B encoder signals for implementation of an electronic gearbox

Power supply

The servodrive CPD17 is available in three sizes and four power supply types:
- 100 to 120V_{AC}, 1-phase, nominal output power 0.4 to 1.4kW
- 200 to 240V_{AC}, 1-phase, nominal output power 0.75 to 2.5kW
- 200 to 240V_{AC}, 3-phase, nominal output power 0.75 to 3.2kW
- 380 to 480V_{AC}, 3-phase, nominal output power 1.4 to 3.0kW

A 24V_{DC} power supply is required for the internal electronics and the I/O signals.

Local communication

Overview

The servodrive CPD17 can be operated locally as follows:

- Control panel (HMI) on CPD17 with control keys and display
- Decentralised control terminal
- PC "Power Suite 2" commissioning software

The dialogue options enable access to the configuration, setting, control and status display functions of the servodrive.

Control panel (HMI)

The integrated control panel (HMI) of the CPD17 provides the following options:

- Edit drive parameters
- Conduct autotuning
- Move motor manually
- Display diagnostic values

Decentralised control terminal

A decentralised control terminal can be connected to CPD17, which can be attached with an IP65 seal to a control cabinet door.
The terminal has a display and enables access to the same functions as the control panel integrated in the servodrive (HMI).

PC "Power Suite 2" commissioning software

The Windows-based "Power Suite 2" software is used for easy commissioning, parameter setting, simulations and diagnostics of CPD17.
"Power Suite 2" includes the options of loading and saving controller parameters and motor data.
Compared to the HMI "Power Suite 2" offers more extensive options, such as:

- Setting controller parameters in a graphic interface
- Extensive diagnostic tools for optimisation and maintenance
- Long-term recording as an aid to assessing operating behaviour
- Archiving of all unit settings and records (with export functions for data processing)
- Testing input and output signals
- Tracking signal sequences on the monitor
- Interactive optimisation of controller behaviour

The CPD17 servodrive has a variety of functions. The most important functions are explained in more detail below.

Commissioning functions

Control over field bus or locally

When a unit is started for the first time, the menu "First-Setup“ must be used to specify whether access and parameter setting will be via local controller or via field bus. This specification can only be changed by restoring the delivery status (factory setting). The availability of operating modes of the unit also depends on this setting.

To set parameters the local controller uses the integrated HMI (user interface with display and control keys), the decentralised control terminal (functionally equivalent to the integrated HMI) or the "Power Suite 2" software (PS2). The movement is then preset with analogue signals (±10V) or with RS422 signals (e.g. pulse/direction). Limit switches and reference switches cannot be connected with the local controller.

Automatic controller setting

The "autotuning" function can be used after the initial setup for automatic controller setting via the HMI or the "Power Suite 2" software. Some settings can be made before start-up. Among other settings the traverse range in which the servodrive will be optimised can be defined. By default this is set to ±0.5 motor revolutions. Acceleration torque and friction torque can also be specified.
If this setting is not sufficient for the application, the HMI or the "Power Suite 2" software can be used to optimise the controller.

Setting signal logic

At the first setup the signal logic (positive or negative) of the 24V inputs and outputs can be specified. This setting affects the wiring and the control of sensors and must be thoroughly clarified during planning with regard to the application.
This product can switch the 24V inputs and outputs as follows depending on the setting:

- Logic of active status, positive logic: current flows to the input, output drives current.
- Negative logic: current flows from the input, output absorbs current

By default the servodrive is set to positive signal logic. The inputs for the "Safe Stop" safety function are always executed in positive logic, see Chapter "Safety Function".

Operating functions

Overview of operating modes

Operating mode	Controller via		Setpoint value via
	Field bus	local	
Speed profile	•		Field bus or PS2
Point-to-point mode	•		Field bus or PS2
Referencing	•		Field bus or PS2
Current control	•	•	Analogue input, field bus or PS2
Speed control	•	•	Analogue input, field bus or PS2
Electronic gear	•	•	Pulse/direction or A/B signals
Manual movement	•	•	Field bus, PS2 or integrated HMI

Speed profile

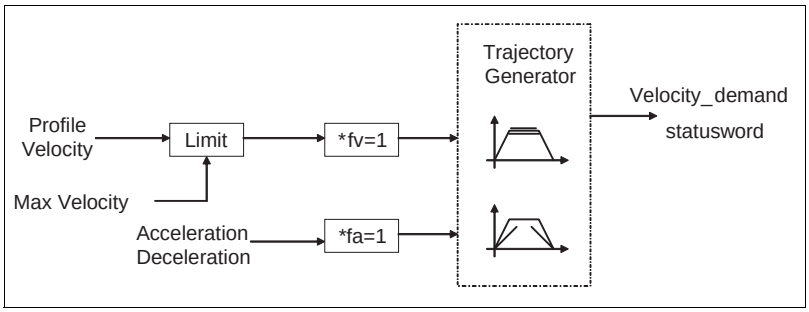
A setpoint speed (without a target position) is set for the motor with the profile generator. The motor retains this speed until a transition to a different setpoint speed or the operating mode is ended. If the setpoint speed is changed, the drive accelerates or decelerates to the new setpoint speed at the specified acceleration and deceleration ramps.

Setpoint value default

The setpoint value default is set over the field bus or with "Power Suite 2".

Example of application

Coating application in CD manufacture



"Speed profile" operating mode, effect of adjustable parameters

Point-to-point mode

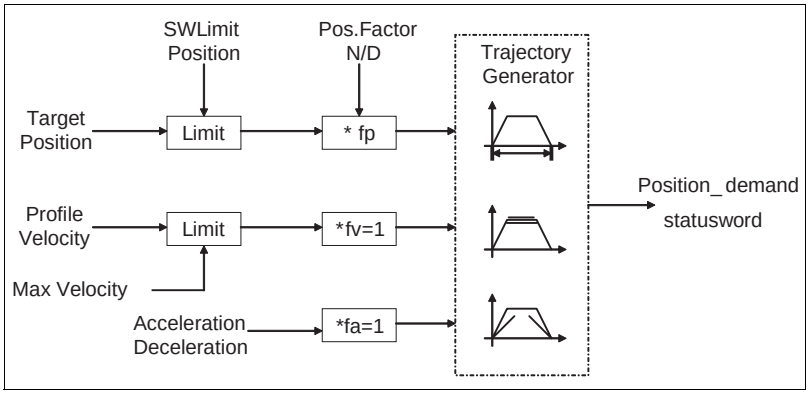
In "point-to-point" operating mode, also referred to as PTP mode, the motor is positioned from a point A to a point B with the profile generator. The positioning distance is given in absolute terms with reference to the zero point of the axis or in relative terms with reference to the current axis position. Before an absolute positioning the reference point must be defined by referencing.

Setpoint value default

The setpoint value default is set over the field bus or with "Power Suite 2".

Example of application

Pick-and-place with a linear robot



"Point-to-point" operating mode, effect of adjustable parameters

Referencing

Before the first absolute positioning in PTP mode a referencing move must be executed. An absolute dimension reference of the motor position is established at a defined axis position. Referencing can be carried out by a referencing movement or by dimension setting.

Reference movement

A defined position on the axis, the zero or reference point, is approached to establish the absolute scale reference of the motor position to the axis. The reference point is used as the point of reference for all subsequent absolute positioning operations.

Dimension setting

Dimension setting allows the current motor position to be defined as the new axis reference point to which all subsequent position data relate.

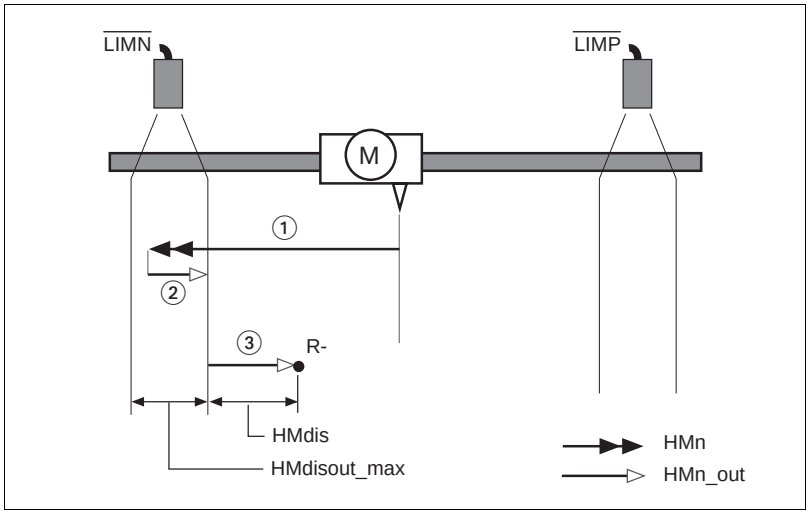
Types of reference movements

The controller supports four standard reference movements:

- Reference movement towards negative limit switch $\overline{\texttt{LIMN}}$
- Reference movement towards positive limit switch $\overline{\texttt{LIMP}}$
- Reference movement to reference switch `REF` with first movement in negative sense of rotation
- Reference movement to reference switch `REF` with first movement in positive direction of rotation

These standard reference movements can be executed with or without index pulse.

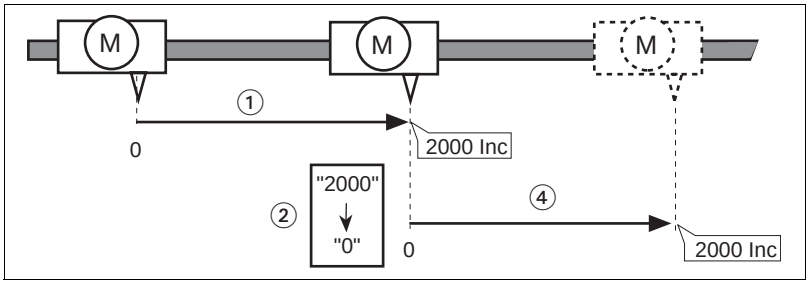
Example 1: Reference movement towards limit switch without index pulse



"Referencing" operating mode, reference movement to limit switch with movement to safety distance

(1) Movement at search speed `HMn`
(2) Movement at clearance speed `HMn_out`
(3) Movement to clearance `HMdis` at clearance speed.

Example 2: Dimension setting



"Referencing" operating mode, reference movement to limit switch with movement to safety distance

(1) The motor positions 2000 increments with the start on the reference point.
(2) By calling up referencing by dimension setting, the current position is set to the scale position in user-defined units.
(3) After triggering a new movement command at 2000 increments the new target position without dimension setting is 4000 increments.
(4) After triggering a new movement command at 2000 increments the new target position with dimension setting is 2000 increments.

Setpoint value default

The setpoint value default is set over the field bus or with "Power Suite 2".

Example of application

Before absolute positioning in point-to-point mode.

Current regulation (torque regulation)

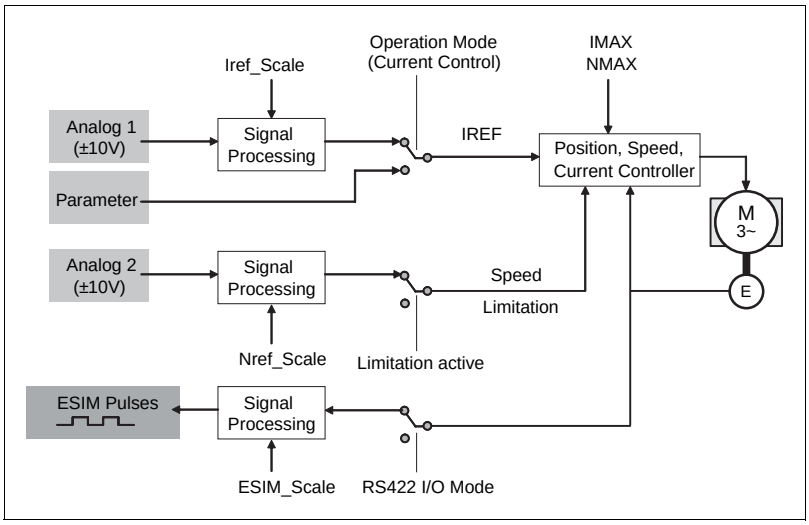
The torque of the motor is proportional to the motor current. The setpoint value default of the motor current is set via parameter or ±10V analogue input. A direction inversion function is not possible in "current regulation" mode.

Setpoint value default

The setpoint value default is set via analogue input, field bus or with "Power Suite 2". The second input can be used for speed and current limitation. The return of the motor position to the superordinate control system is carried out with encoder signals (ESIM) via RS422 interface.

Example of application

Regulating a constant pull force in foil production



"Current regulation" operating mode, effect of adjustable parameters

Speed control

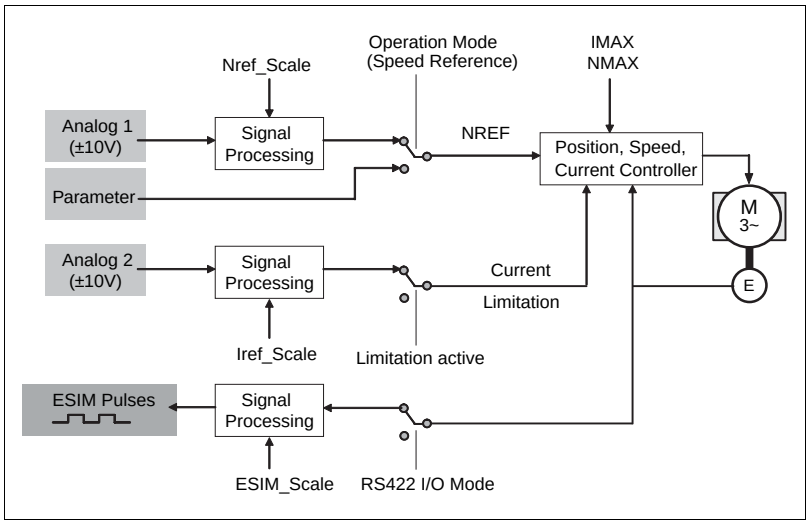
The setpoint value of the motor speed is set via parameters or ±10V analogue input.

Setpoint value default

The setpoint value default is set via analogue input, field bus or with "Power Suite 2". The second input can be used for speed and current limitation. The return of the motor position to the superordinate control system is carried out with encoder signals (ESIM) via RS422 interface.

Example of application

Regulating the constant speed of a winding machine.



"Speed regulation" operating mode, effect of adjustable parameters

Electronic gear

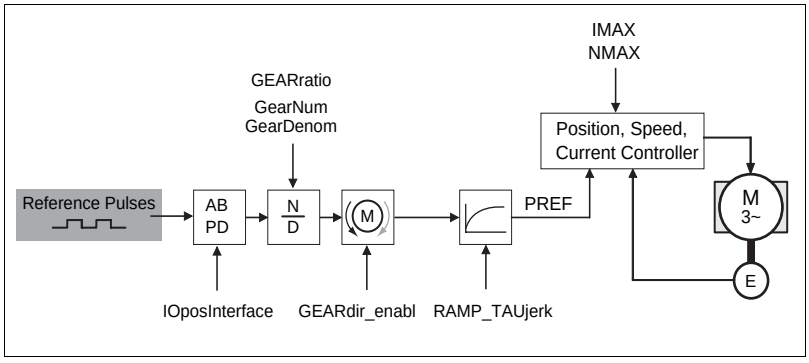
In "electronic gear" operating mode the reference signals are fed from an encoder or as pulse/direction and are offset to a new position setpoint with an adjustable gear factor.

Setpoint value default

The setpoint value default is set via pulse/direction or A/B encoder signals.

Example of application

Synchronisation of motion sequences, e.g. cutting material on a conveyor.



"Electronic gear" operating mode, effect of adjustable parameters

Manual movement

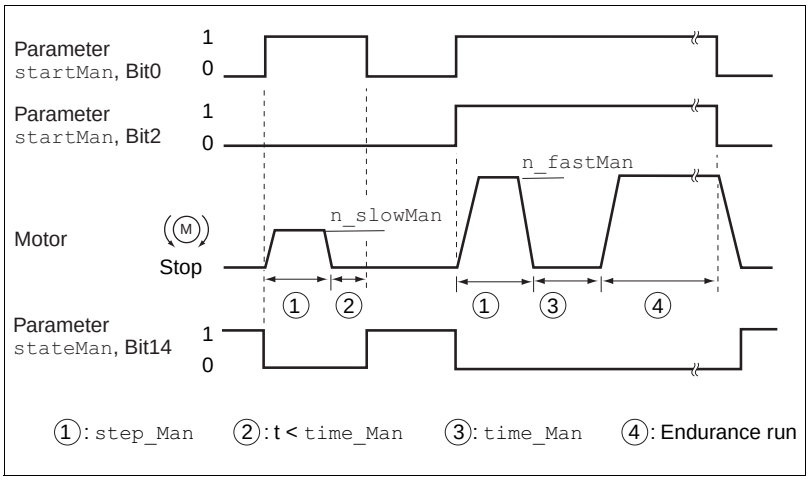
The motor traverses one path unit or continuous movement at a constant speed. The length of the path unit, the speed steps and the switching time in continuous movement can be specified.

Setpoint value default

The setpoint value default is set via field bus or with "Power Suite 2" or with the HMI.

Example of application

Setting up the machine during commissioning



Manual movement, slow and fast

Additional operating functions

Additional monitoring functions and operating parameters can be enabled via digital inputs/outputs, field bus, PC or HMI.

- Monitoring functions
  - Status monitoring in movement mode
  - Monitoring of axis signals
  - Monitoring internal signals
  - Commutation Monitoring
  - Monitoring communications with field bus
- Input of standardisation factor via position values
- Setting travel profile via profile generator
- Setting STOP signal
- Triggering Quick-Stop function
- Trigger braking function on motor with brake and HBC (Holding Brake Controller)
- Reversing direction of rotation of motor
- Read out analogue signals

Safety function

Definition

Safe stop

With Safe Stop the power supply to the drive is positively interrupted. The drive cannot generate torque and thus cannot make a hazardous movement. The standstill position is not monitored.

Category 0 stop (EN 60204-1)

Standstill but immediate cut-off of power feed to the machine drive components (i.e. uncontrolled standstill)

Category 1 stop (EN 60204-1)

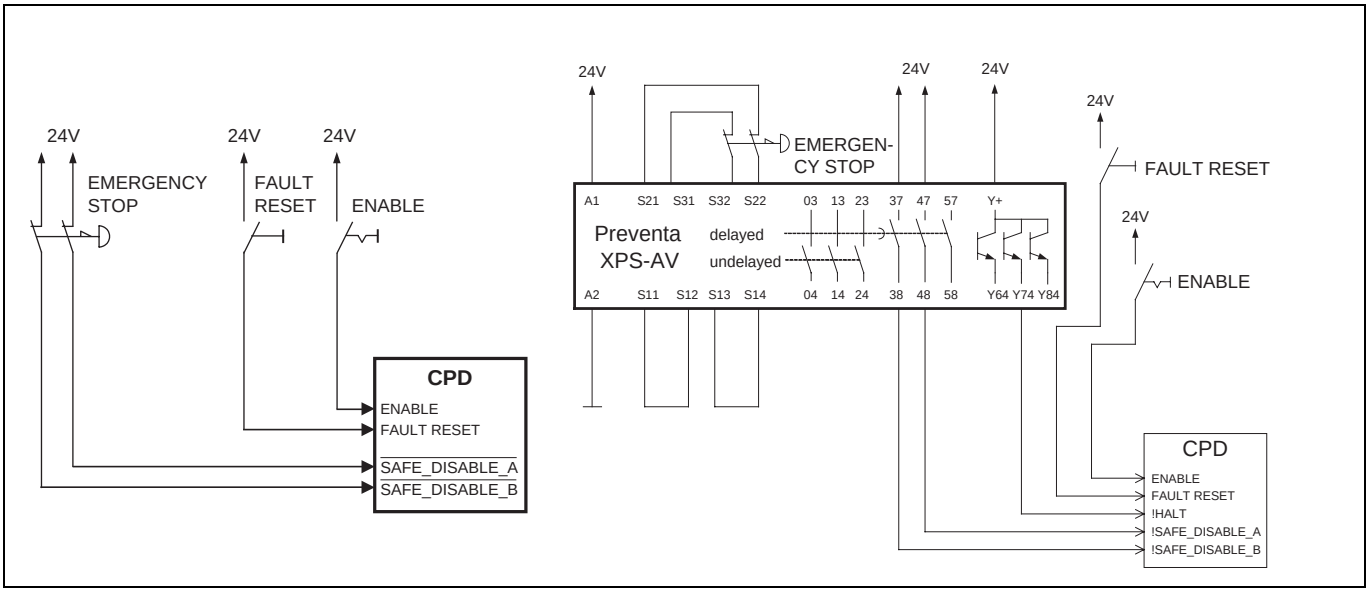
Controlled standstill in which the power feed to the machine drive components is retained to bring the machine to standstill. Power feed is only interrupted when everything has come to a standstill.

Description

The "Safe Stop" safety function integrated into the unit can be used to implement the control function "Standstill in Emergency" (EN60204-1) for Stop Category 0 and Stop Category 1. The safety function "Safe Stop" also prevents the drive from restarting unexpectedly.
The following safety stages are implemented in accordance with the standards for functional safety:

- SIL 2, IEC 61508
- Category 3, EN 954-1
- PL d (Performance Level d), EN 13849-1

Examples of applications



Example of stop category 0: Circuit without EMERGENCY STOP module, Stop category 0, no upstream PLC/CNC.

Example of stop category 1: Circuit without EMERGENCY STOP module, Stop category 1, no upstream PLC/CNC

Environmental conditions

Ambient temperature, humidity and installation height		
Operating temperature limit	°C	-10 to +50
Ambient temperature	°C	-25 to +70
Rel. humidity		corresponding to IEC60721-3-3, Class 3K3, 5% to 85%, no condensation permissible
Installation height above mean sea level	m	<1000
Oscillation and shock loading		
Oscillation and vibration		10Hz to 57Hz: 0.075mm amplitude 57Hz to 150Hz: 1g
Shock loading		according to EN 61131 Sect. 6.3.5.2

Mechanical data

Size		**Size 1 (CPD 17• ••••S1)**	**Size 2 (CPD 17• ••••S2)**	**Size 3 (CPD 17• ••••S3)**
Dimensions (H*W*D)	mm	72 * 130* 140	105 * 130* 150	140 * 170* 150
Weight				
with line filter	kg	1.1	1.4	2.0
without line filter	kg	1.1	1.3	2.0
Type of cooling		Convection	Fan	Fan
Degree of protection		IP20 (IP40)	IP20 (IP40)	IP20 (IP40)
		IP40 restricted: from above only, without removal of the protective cover		

Electrical Data

Mains power supply		
Voltage range and tolerance		
115V_{AC}	V	100V -15% to 120V + 10%
230V_{AC}	V	200V -15% to 240V + 10%
400V_{AC}	V	380V -15% to 480V + 10%
Frequency	Hz	50Hz -5% to 60Hz + 5%
Transient overvoltage		Overvoltage category III
Short-circuit currents depending on power and voltage range		
115V_{AC}	A	1000
230V_{AC}, 1-phase	A	1000
230V_{AC}, 3-phase	A	5000
400V_{AC}	A	5000
Starting current and leakage current		
Starting current	A	<60
Leakage current (as per IEC 60990)	mA	<30
24V_{DC} power supply		
Input voltage	V	24V -15% / +20%
Input current (without load)	A	≤ 1
Ripple voltage (ripple)		<5%

Performance data for single-phase units		115V			230V		
Servodrive type CPD17 ...		**1F10S1**	**1F17S2**	**1F28S3**	**2F10S1**	**2F17S2**	**2F28S3**
Size		1	2	3	1	2	3
Nominal voltage	V	115	115	115	230	230	230
Power consumption at nominal voltage	A_{rms}	7.3	11	21.6	7	11	20
Max. permissible short circuit current of network	kA	1	1	1	1	1	1
Rated power (motor power output)	kW	0.4	0.65	1.4	0.75	1.2	2.5
Continuous output current at 4kHz	A_{rms}	4	8	15	4	8	15
Peak output current at 4kHz	A_{rms}	7	12	20	7	12	20
Continuous output current at 8kHz	A_{rms}	3.2	7	13	3.2	7	13
Peak output current at 8kHz	A_{rms}	6	11	20	6	11	20
Series-connected fuses [1]	A	10	15/16	25	10	15/16	25
Performance data for three-phase units		**230V**			**400/480V**		
Servodrive type CPD 17...		**3N10S1**	**3N17S2**	**3N42S3**	**4F14S2**	**4F34S3**	
Size		1	2	3	2	3	
Nominal voltage	V	230	230	230	400	400	
Power consumption at nominal voltage	A_{rms}	4.5	7.75	16.5	4	9.2	
Max. permissible short circuit current of network	kA	5	5	5	5	5	
Rated power (motor power output)	kW	0.75	1.4	3.2	1.4	3.0	
Continuous output current at 4kHz	A_{rms}	4	8	17	6	15	
Peak output current at 4kHz	A_{rms}	7	12	30	10	24	
Continuous output current at 8kHz	A_{rms}	3.2	7	15	5	11	
Peak output current at 8kHz	A_{rms}	6	11	30	7.5	18	
Series-connected fuses [1]	A	10	10	25	10	15/16	

[1] Fuses: UL-approved Class CC or J fusible links, as an alternative automatic circuit-breakers with B characteristic: specification 15/16 A: automatic circuit-breakers are available with 16 A nominal current, UL fuses with 15 A.

Signals

Signal inputs are reverse polarity protected, outputs are resistant to short-circuit. There is an electrical connection to $0V_{DC}$. The signal logic (positive or negative) of the 24V inputs and outputs can be specified at First-Setup. By default the servodrive is set to positive signal logic.

24V input signals		
The level of the inputs when configured as positive logic corresponds to EN 61132-2, type 1		
Logical 1 (U_{high})	V	+15 to +30
Logical 0 (U_{low})	V	-3 to +5
Debounced, debounce interval	ms	>1ms Safe Stop
24V output signals		
The 24V output signals correspond to IEC 61131-2.		
Output voltage	V	≤30
Max. switching current	mA	≤50
Voltage drop at 50 mA load	V	≤1
Analogue input signals		
Differential input voltage range	V	-10 to +10
Input resistance	kΩ	≥10
Resolution analogue input 1		14 bit
Resolution analogue input 2		12 bit
Pulse/direction, A/B input signals		
Symmetrical		corresponding to RS422
Asymmetrical	V	-7 to +12
Input resistance	kΩ	5
Input frequency pulse/direction	kHz	≤100
Input frequency A/B	kHz	≤450
ESIM output signals (encoder simulation)		
Logic level		corresponding to RS422
Output frequency	kHz	≤450
Motor encoder signals		
Output voltage for encoder		+10V / 100mA
SIN/COS input signal voltage range		$1V_{SS}$ with 2.5V offset, $0.5V_{SS}$ at 100kHz
Input resistance	Ω	120

Field bus interfaces

CANopen

Supported services
- Implicit exchange of PDOs (Process Data Objects)
  - 3 PDOs per DSP 402 (Profile Position Mode and Profile Velocity Mode)
  - 1 PDOs free configurable mapping
- Explicit exchange of SDOs (Service Data Objects): receive 2 SDOs, send 2 SDOs
- Boot-up messages, emergency messages, node guarding and heartbeat for generators and consumers, sync, NMT

Number of addresses: the address of the servodrive can be configured from 1 to 127
Maximum number of connected servodrives: 127
Transmission speed: 125, 250, 500, 1000 kbps

Modbus

Serial multipoint interface RS 485:
Modbus in RTU mode
Supported services: Function codes in decimal 03, 06, 16, 23, 43
Circular transmission mode
Number of addresses: the address of the servodrive can be configured from 1 to 247
Max. number of connected servodrives: 31
Transmission speed: 9600, 19200, 38400 bps

Suitable for connecting the following units:
- decentralised control terminal (optional accessories)
- PC with the "Power Suite 2" software
- programmable logic controller (PLC)
- microprocessor board

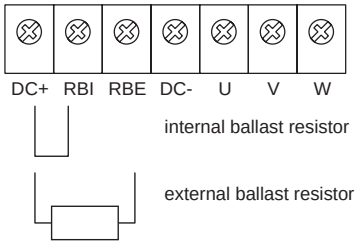
References for servodrive CPD17

CPD 170 ••••S1 (size 1)

CPD 170 ••••S2 (size 2)

CPD 170 ••••S3 (size 3)

Size	Nominal voltage	Current consumption (at nominal voltage)	Nominal power (power output motor)	Continuous output current (at 4kHz)	Peak output current	Continuous output current (at 8kHz)	Peak output current	References	Weight
	V	A_{rms}	kW	A_{rms}	A_{rms}	A_{rms}	A_{rms}		kg
CPD17 , 1-axes universal servodrive (analogue, pulse/direction, Modbus, CANopen DS402)									
115V, 1-phase. 50/60Hz, with integrated EMC line filter									
1	115	7.3	0.4	4	7	3.2	6	**CPD 170 1F10S1**	1.100
2		11	0.65	8	12	7	11	**CPD 170 1F17S2**	1.400
3		21.6	1.4	15	20	13	20	**CPD 170 1F28S3**	2.000
230V, 1-phase. 50/60Hz, with integrated EMC line filter									
1	230	7	0.75	4	7	3.2	6	**CPD 170 2F10S1**	1.100
2		11	1.2	8	12	7	11	**CPD 170 2F17S2**	1.400
3		20	2.5	15	20	13	20	**CPD 170 2F28S3**	2.000
230V, 3-phase. 50/60Hz, without integrated EMC line filter									
1	230	4.5	0.75	4	7	3.2	6	**CPD 170 3N10S1**	1.100
2		7.75	1.4	8	12	7	11	**CPD 170 3N17S2**	1.300
3		16.5	3.2	17	30	15	30	**CPD 170 3N42S3**	2.000
400/480V, 3-phase. 50/60Hz, with integrated EMC line filter									
2	400	4	1.4	6	10	5	7.5	**CPD 170 4F14S2**	1.400
3		9.2	3.0	15	24	11	18	**CPD 170 4F34S3**	2.000



Ballast resistor

Internal ballast resistor

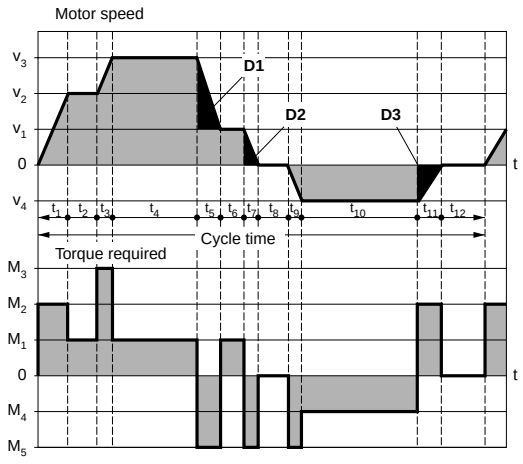
A ballast resistor is integrated in the unit to absorb braking energy. If the DC bus voltage exceeds a specified value, this ballast resistor is switched on. The returned energy is converted to heat by the ballast resistor.

External ballast resistor

An external ballast resistor is required for applications in which the motor is heavily braked and the internal ballast resistor can no longer dissipate the excess braking energy. When an external ballast resistor is used, the internal ballast resistor must be disabled. The bridge between DC+ and RBI must be removed and the external ballast resistor connected between DC+ and RBE.
Two or more ballast resistors can also be connected in parallel.
The unit monitors the power of the ballast resistor. The load on the ballast resistor can be read out.

Dimensioning the ballast resistor

During braking the kinetic energy of the moving load must be absorbed by the servodrive. The absorbed energy loads the capacitors integrated in the servodrive. As soon as the voltage at the terminals of the capacitors exceeds the permissible threshold value, the ballast resistor (internal or external) is switched on to absorb this energy. The calculation of the power that the ballast resistor must absorb requires knowledge of the controller diagram. The controller diagram shows the motor torques and speeds, for identification of the curve segments in which the drive controller brakes the load, against the time.



Controller diagram for the motor cycle

These two curves are also used for dimensioning of the motor. The curve segments that must considered in which the servodrive brakes are identified by (D_i).
Calculation of energy at constant run-down:
The total inertia (J_t) must be known.
For J_t the following applies:
$J_t = J_m + J_c$
J_m: Motor inertia with or without brake
J_c: Load inertia
The energy for every run-down segment is calculated as follows:

$$E_i = \frac{1}{2} J_t \cdot \omega_i^2 = \frac{1}{2} J_t \cdot \left(\frac{2\pi v_i}{60}\right)^2$$

The following is derived for the segments (D_1) … (D_3):

$$E_1 = \frac{1}{2} J_t \cdot \left(\frac{2\pi [v_3 - v_1]}{60}\right)^2$$

$$E_2 = \frac{1}{2} J_t \cdot \left(\frac{2\pi v_1}{60}\right)^2$$

$$E_3 = \frac{1}{2} J_t \cdot \left(\frac{2\pi v_4}{60}\right)^2$$

Units: E_i in joules, J_t in kg/m², ω in rad and v_i in rpm.

Energy absorbed by the internal capacitor

The table below lists the energy absorption capacity E_{var} of the individual drive controllers (without considering an internal or external ballast resistor).
When the calculation is continued only consider the segment D_i, whose energy E_i exceeds the absorption capacities shown in the table. This additional energy E_{Di} must be dissipated via the ballast resistor (internal or external).
E_{Di} is calculated with the following formula:
$E_{Di} = E_i - E_{var}$ (in joules)

Calculation of continuous output

The continuous output P_c is calculated for every machine cycle:

$$P_c = \frac{\sum E_{Di}}{\text{Cycletime}}$$

Units: P_c in W, E_{Di} in J and cycle time T in s

Selection of the ballast resistor (internal or external)

Note:

This is a simplified selection procedure. Under extreme conditions, such as vertical axes, this procedure will be insufficient.
Please contact your dealer to ensure a safe procedure.

The selection is made in two steps:

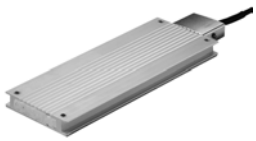
1 The maximum energy during a braking procedure must be less than the peak energy that the internal ballast resistor can absorb: $(E_{Di}) < (E_{Cr})$ and the continuous output of the internal ballast resistor must not be exceeded: $(P_C) < (P_{Pr})$. If these conditions are met, the internal ballast resistor is sufficient.

2. If one of the above conditions is not met, an external ballast resistor that meets these conditions must be used.
The value of the external ballast resistor must be between the minimum and maximum values specified in the table, otherwise the unit may be destroyed and the load will no longer be safely braked.

Technical data

			Size 1			Size 2					Size 3				
Supply voltage		V	115	230	230	115	230	230	400	480	115	230	230	480	480
Number of phases			1	1	3	1	1	3	3	3	1	1	3	3	3
Ballast treshold		V_{DC}	250	430	430	250	430	430	780	780	250	430	430	780	780
Energy absorption of the internal capacitor	E_{var}	Joule (Ws)	10.8	17.7	17.7	16.2	26.6	26.6	26.0	6.0	26	43	43	52	12
Internal resistance															
Resistance value		Ω	40	40	40	40	40	40	40	40	20	20	30	30	30
Continuous output	P_{Pr}	W	20	20	20	40	40	40	40	40	60	60	60	60	60
Peak energy	E_{Cr}	Joule (Ws)	200	900	900	200	900	900	1000	1000	1000	1600	1600	1600	1600
External resistor															
minimum external resistor		Ω	27	50	50	20	27	27	60	60	10	16	10	25	25
maximum external resistor		Ω	45	75	75	27	45	45	80	80	20	27	20	36	36

References

Ballast resistors	**Resistance value**	**Power (P_{Pr})**	**Peak energy (E_{Cr})**			**Length connector cable**	**References**	**Weight**
	Ω	**W**	**Joule (Ws)**			**m**		**kg**
	10	400	18800	13300	n. m.	0.75	**GEA3ERA010C5A**	1.420
						2.00	**GEA3ERA010C52**	1.470
						3.00	**GEA3ERA010C53**	1.620
	27	100	4200	3800	1900	0.75	**GEA3ERA027A5A**	0.630
		200	9700	7400	4900	0.75	**GEA3ERA027B5A**	0.930
						3.00	**GEA3ERA027B53**	1.200
		400	25500	18100	11400	0.75	**GEA3ERA027C5A**	1.420
						2.00	**GEA3ERA027C52**	1.470
						3.00	**GEA3ERA027C53**	1.620
	72	100	5500	3700	3000	0.75	**GEA3ERA072A5A**	0.620
						2.00	**GEA3ERA072A52**	0.750
		200	14600	9600	7600	0.75	**GEA3ERA072B5A**	0.930
		400	36500	24700	18300	0.75	**GEA3ERA072C5A**	1.420
						2.00	**GEA3ERA072C52**	1.470
						3.00	**GEA3ERA072C53**	1.620

Line reactors

Description

We recommend the use of a line reactor under the following conditions:

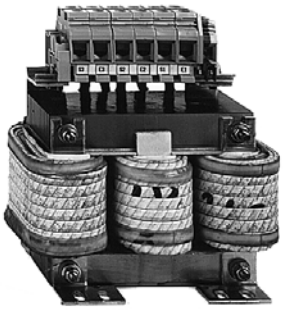
- Operation on networks with a low impedance (if the possible short-circuit current of the mains network exceeds that of the unit.)
- If the average output power is greater than half of the rated power during operation of the unit.
- With high demands on the service life of the unit
- Operation on networks with reactive-current compensation systems
- For improvement of cos φ at the network input and to reduce the network feedback
- For reduction of any overvoltages greater than overvoltage category III

Multiple units can be operated with one line reactor. The current consumption of the devices (at nominal voltage) must be less than the rated current of the line reactor. On units with an assumed short-circuit current of 1kA the inductivity of the line reactor must be greater than 0.8mH.
Supplementary current harmonics place a heavy load on the internal DC bus capacitors. This greatly reduces the service life of the unit.

Technical Data

		VZ1L007UM50	VZ1L018UM20	VW3A66502	VW3A66503	VW3A66504	VW3A66505
Compliance with the standards		EN 50178 (VDE 0160 severity 1, network feedback)					
Voltage drop		Between 3% and 5% of the rated voltage of the network. A high value causes torque loss.					
Degree of protection							
Reactor		IP00					
Terminals		IP20				IP10	
Inductivity of the reactor	mH	5	2	4	2	1	0.5
Rated current	A	7	18	10	16	30	60
Losses	W	20	30	65	75	90	80

References



Designation	Description		References	Weight kg
Line reactors	1-phase, 50/60 Hz	7A, 5mH, IP00	**VZL007UM50**	0.880
		18A, 2mH, IP00	**VZL018UM20**	1.990
	3-phase, 50/60 Hz	10A, 4mH, IP00	**VW3A66502**	3.000
		16A, 2mH, IP00	**VW3A66503**	3.500
		30A, 1mH, IP00	**VW3A66504**	6.000
		60A, 0.5mH, IP00	**VW3A66505**	11.000

EMC line filter

Function

CPD 17 contains line filters to comply with the IEC/EN 61800-3 standards on electromagnetic compatibility (EMC). These standards must be met for the CE approval under the EMC directive.
The additional line filters enable compliance with more rigid requirements.
You can see whether your unit has an integrated line filter by the type code and the specifications. Devices with integrated line filter have an "F" in the type code, e.g. ...2F10S1, devices without integrated line filter have an "N" in the type code, e.g. ...3N17S2. When using a unit without an integrated line filter an external line filter is required.
The line filter is installed under or beside the unit. It has threaded holes for attaching the unit, for which it acts as a carrier. The operator must ensure that the EMC directives are observed with an external line filter.

Usage depending on the power network type

This line filter can only be used in TN networks (connection to neutral conductor) and TT networks (neutral conductor connected to earth).
The filters cannot be used in IT networks (isolated or over a high impedance earthed neutral conductor).
The IEC 61800-3, Appendix D2.1, standard states that the line filter must not be used with this network type, because correct operation of the isolation monitoring equipment cannot be assured with it.
In addition, the efficiency of the line filter in this network type depends on the type of impedance between neutral conductor and earth. Therefore, the efficiency is not predictable.
An isolating transformer is required for machines that must be installed on an IT network to allow the machine to be operated locally as on a TN or TT system.

Technical Data

Compliance with the standards		EN 133200
Degree of protection		IP20 and IP40 [1]
Maximum relative humidity		5% to 85% corresponding to IEC 60721-3-3, Class 3K3, no condensate or surface water accumulation permissible
Ambient temperature		
Operation	°C	-10 to +50
Storage, transport	°C	-25 to +70
Maximum installation height	m	1000 (at heights above 1000 m up to 2000 m reduced phase current 1% per 100 m must be assumed.)
Vibration resistance		0.075mm at 10Hz to 57Hz 1g at 57Hz to 150Hz
Impact resistance		As per EN 61131, Section 6.3.5.2
Maximum nominal voltage		
50/60Hz, 1-phase	V	120 +10% 240 +10%
50/60Hz, 3-phase	V	240 +10% 480 +10%

1) IP40 from above only with protective cover installed

Accessories

EMC line filters

Application case, category: EN 61800-3: 2001-02; IEC 61800-3, Ed. 2	Description
First environment, general availability; category C1	Operation in living areas, e.g. sale by hardware supplier
First environment, restricted availability; category C2	Operation in living areas, sale through dealers only
Second environment; category C3	Operation in industrial networks

References

EMC line filters	For servodrive	Max. motor line length, EMC category		References	Weight
		internal EMC line filter	External EMC line filter		kg
	CPD 1-phase				
	170 1F10S1 **170 2F10S1**	max. 10m, category C3	max. 20m, category C2; max. 40m, category C3	**VW3A31401**	0.482
	170 1F17S2 **170 2F17S2**	max. 10m, category C3	max. 20m, category C2; max. 40m, category C3	**VW3A31403**	0.620
	170 1F28S3 **170 2F28S3**	max. 10m, category C3	max. 20m, category C2; max. 40m, category C3	**VW3A31405**	0.810
	CPD 3-phase				
	170 3N10S1	–	max. 20m, category C2; max. 40m, category C3	**VW3A31402**	0.550
	170 3N17S2	–	max. 20m, category C2; max. 40m, category C3	**VW3A31404**	0.900
	170 4F14S2	max. 10m, category C3			
	170 3N42S3	–	max. 20m, category C2; max. 40m, category C3	**VW3A31406**	1.350
	170 4F34S3	max. 10m, category C3			

Holding brake controller

Description

A motor with a holding brake requires appropriate control logic (HBC) that releases the brake when current is applied to the motor and fixes the motor axis at the right time when the motor is stopped.

Technical Data

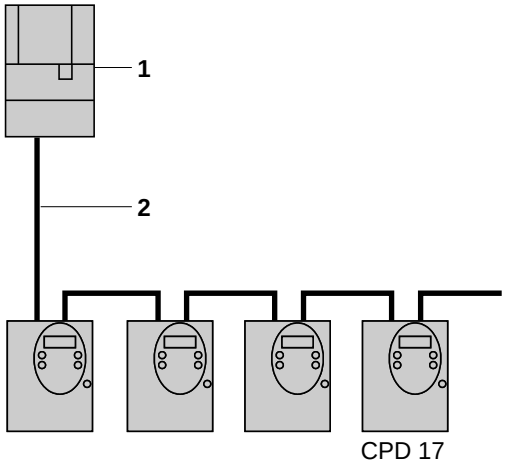
Dimensions (H * W * D)	mm	99 * 22.5 * 114.5
Installation on top-hat rail		55
Supply voltage, input	V	19.2 to 30
Input current HBC	A	Input current = 0.5 A + breaking current
Output, brake		
DC voltage	V	20 to 30
Current at 24 V for 100 ms	A	0.5 to 2.5
Continuous current	A	0.5 to 1.25
DC voltage with voltage reduction	V	9.5 to 15
Current at 12 V	A	0.5 to 2

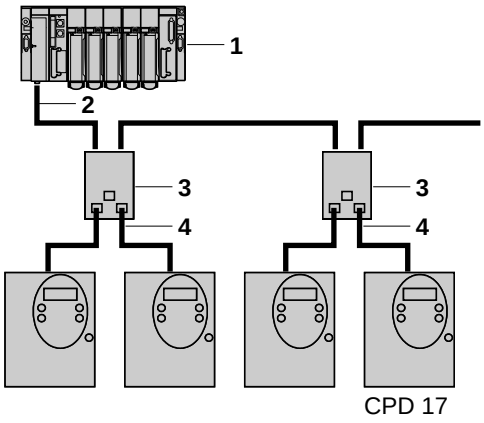
Safe electrical isolation between 24V input, control input and brake output

References

	Designation	Description	References	Weight kg
	Holding brake controller	$24V_{DC}$ power supply, max. braking current 2.1A, max. power 50W, IP20, for top-hat rail installation	**GEA3EB001**	

Field bus CANopen





CANopen connection with and without junction box

(1) PLC or Motion Controller, e.g.TLM2
(2) CANopen cable
(3) CANopen junction box VW3CANTAP2
(4) CANopen cable VW3CANCARR••

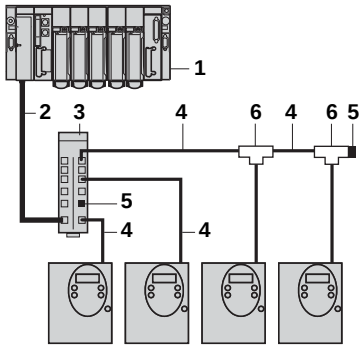
The servodrive CPD17 can be connected directly to a CANopen field bus over two interfaces (CN1 or CN4).
At interface CN1 three pins as spring-loaded terminals and three connections are available. The CN4 interface is a RJ45 plug.
In a CAN bus multiple network devices can be connected over one bus cable. Up to 32 devices can be addressed in one CAN bus network branch and up to 128 devices in an extended network. Every network device must be configured before operation on the network. The baud rate must be the same for all units in the field bus. Address and baud rate are set during commissioning.
The units at the two ends of a bus cable string must be terminated. On a CAN bus this can be done with terminating resistors. A terminating resistor is integrated in the unit. It is enabled with the S1 switch.

References

Designation	Description		References	Weight kg
CANopen junction box			**VW3CANTAP2**	0.482
CAN cable	with 2 RJ45 connectors	0.3m	**VW3CANCARR03**	0.050
		1.0m	**VW3CANCARR1**	0.500

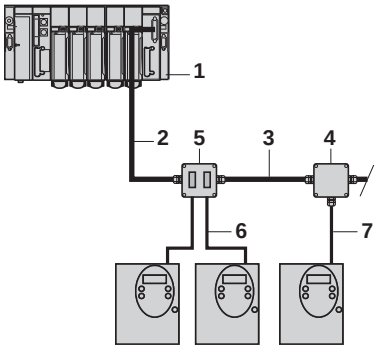
Field bus MODBUS

Connection through terminal modules and RJ45 connectors



(1) PLC
(2) Modbus cable, depending on the types of control unit or PLC
(3) Modbus LU9GC3 terminal module
(4) Modbus cable VW3A8306R••
(5) RC terminal adapter VW3A8306RC
(6) Modbus T branch module VW3A8306TF••

Connection via junction boxes



(1) PLC
(2) Modbus cable, depending on the types of control unit or PLC
(3) Modbus cable VW3A8306
(4) Modbus junction box TSXSCA50
(5) Modbus 2-way junction box TSXSCA62
(6) Modbus cable VW3A8306
(7) Modbus cable VW3A8306D30

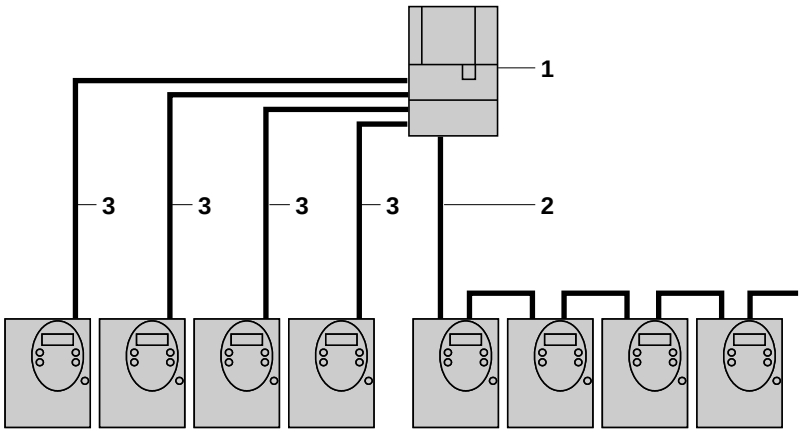
Connection via screw terminals:
In this case a Modbus VW3A8306D30 cable and an RC VW3A8306DRC terminal adapter are required.

The servodrive CPD17 can be connected directly to a Modbus field bus through a CN4 interface.
In MODBUS, multiple network devices can be connected over one bus cable. Every network device must be configured before operation on the network. Every unit is assigned a unique node address.
The baud rate must be the same for all units in the field bus.

References

Designation	Description		References	Weight kg
Modbus junction box	3 screw terminal strips, RC terminal adapter, for connection to VW3A8306D30 cable		**TSXSCA50**	0.520
Modbus 2-way junction box	2 15-pin SubD socket connectors, 2 screw terminal strips, RC terminal adapter, for connection with VW3A8306 cable		**TSXSCA62**	0.570
Modbus connector module	10 RJ45 connectors, 1 screw terminal strip		**LU9GC3**	0.500
Modbus RC terminal adapter	For RJ45 connectors	120Ω, 1 nF	**VW3A8306RC**	0.200
		150Ω	**VW3A8306R**	0.200
	For screw terminal strip	120Ω, 1 nF	**VW3A8306DRC**	0.200
		150Ω	**VW3A8306DR**	0.200
Modbus T-branch module	With integrated cable	0.3m	**VW3A8306TF03**	0.188
		1.0m	**VW3A8306TF10**	0.211
Modbus cable	With 1 RJ45 connector, 1 end isolated, for Modbus tapping box TSXCA50	3.0m	**VW3A8306D30**	0.150
Modbus cable	With 1 RJ45 connector, 1 15-pin SubD connector, for Modbus 2-way tapping box TSXCA62	3.0m	**VW3A8306**	0.150
Modbus cable	2 RJ45 connectors	0.3m	**VW3A8306R03**	0.050
		1.0m	**VW3A8306R10**	0.050
		3.0m	**VW3A8306R30**	0.150
Modbus cable	4-strand, shielded and twisted, RS485, without connectors	100m	**TSXCSA100**	5.000
		200m	**TSXCSA200**	10.000
		500m	**TSXCSA500**	25.000

Pulse/direction interface



CPD 17

(1) PLC or Motion Controller, e. g. TLM2
(2) CANopen cable
(3) Interface cable GEA2RBAABD•••

The unit is suitable for setpoint value default via externally fed pulse/direction signals. For example, they are required for electronic gear operating mode.
In this case, the CN5 interface is used for feeding the reference signals (pulse/direction) and the power amplifier enable (Enable).

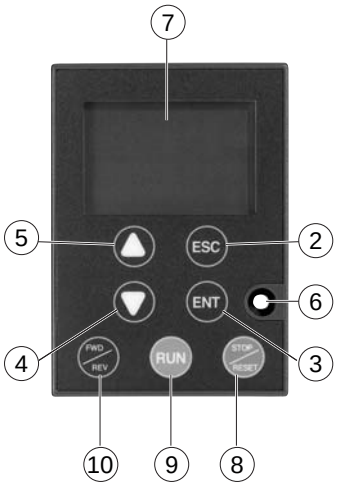
References

Designation	Description		References	Weight kg
Cable for pulse/direction, ESIM, A/B	Unit side with 10-pin Molex connector, other cable end open	0.5m	**GEA2RAAABA005**	
		1.5m	**GEA2RAAABA015**	
		3.0m	**GEA2RAAABA030**	
		5.0m	**GEA2RAAABA050**	
Pulse/direction connector cable on Schneider Premium CFY	Unit side with 10-pin Molex connector, CAY side with 15-pin SubD connector	0.5m	**GEA2REAABC005**	
		1.5m	**GEA2REAABC015**	
		3.0m	**GEA2REAABC030**	
		5.0m	**GEA2REAABC050**	
Pulse/direction connector cable on Siemens S5 IP247	Unit side with 10-pin Molex connector, IP247 side with SubD9 connector	3.0m	**GEA2RFAABE030**	
Pulse/direction connector cable on Siemens S5 IP267	Unit side with 10-pin Molex connector, IP267 side with SubD9 connector	3.0m	**GEA2RGAABE030**	
Pulse/direction connector cable on Siemens S7-300 FM353	Unit side with 10-pin Molex connector, FM353 side with SubD15 connector	3.0m	**GEA2RHAABD030**	
Pulse/direction connector cable, ESIM, A/B on GEA3EC002 signal distribution adapter, USIC GEA3EC001, TLM2 or WP/WPM 311	Unit side with 10-pin Molex connector, other end of cable with SubD15 socket	0.5m	**GEA2RCAABD005**	
		1.5m	**GEA2RCAABD015**	
		3.0m	**GEA2RCAABD030**	
		5.0m	**GEA2RCAABD050**	

Decentralised control terminal

A decentralised control terminal can be connected to CPD17, which can be attached with an IP65 seal to a control cabinet door.
The terminal has a display and enables access to the same functions as the control panel integrated in the servodrive (HMI).

Description



(2) ESC:
- Closing a menu or parameter
- Return from displayed to last saved value

(3) ENT:
- Calling a menu or parameter
- Save the displayed value

(4) Arrow down:
- Switch to next menu or parameter
- Reduce the displayed value

(5) Arrow up:
- Switch to previous menu or parameter
- Increase the displayed value

(6) Red LED on: DC bus under voltage

(7) Seven-segment display:
- 4 seven-segment displays, still legible from 5 m away
- Display of numeric values and codes
- Save values when display flashes
- Flashing display on unit fault

(8) Quick-Stop (Software stop)

(9) Error reset (Continue)

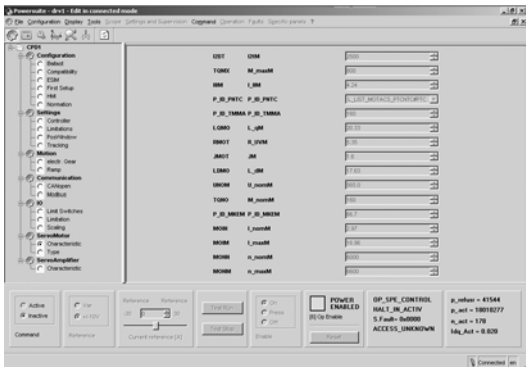
(10) No function

References

Designation	Description	References	Weight kg
Decentralised control terminal	Incl. cable with 2 connectors, seal and screws for installation in degree of protection IP65 on the control cabinet door	**VW3A31101**	0.376

PC "Power Suite 2" software

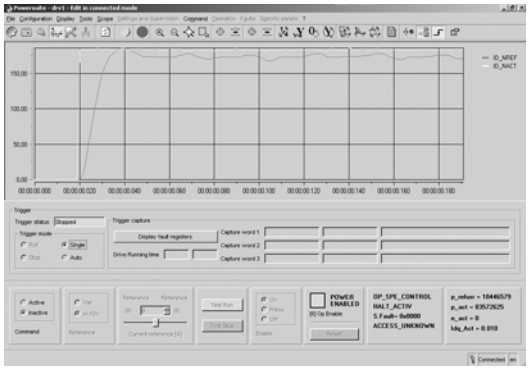
Description



The Windows-based "Power Suite 2" software is used for easy commissioning, parameter setting, simulations and diagnostics of CPD17.
"Power Suite 2" includes the options of loading and saving controller parameters and motor data.
Compared to the HMI "Power Suite 2" offers more extensive options, such as:

- Setting controller parameters in a graphic interface
- Extensive diagnostic tools for optimisation and maintenance
- Long-term recording as an aid to assessing operating behaviour
- Archiving of all unit settings and records (with export functions for data processing)
- Testing input and output signals
- Tracking signal sequences on the monitor
- Interactive optimisation of controller behaviour

Connections



The PC with an RS232 interface can be connected to the RS485 interface (RJ45 socket) of the servodrive with an adapter. The interface adapter with a connector cable is available as an accessory. It can be connected to one or more servodrives.

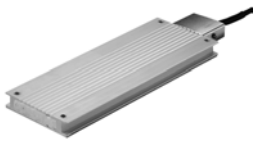
System requirements

You will require a PC or laptop with a free RS232 interface and MS Windows® 98SE or higher.

References

Designation	Description		References	Weight kg
Power Suite Version 2	CD-ROM		**VW3A8104**	0.100
Power Suite Version 2	Upgrade, CD-ROM		**VW3A8105**	0.100
PC connection kit	with RS232/RS485-converter		**VW3A8106**	0.350
RJ45 programming cable with RS485/RS232 adapter		3.0m	**ACC2CRAAEF030**	

References for ballast resistors

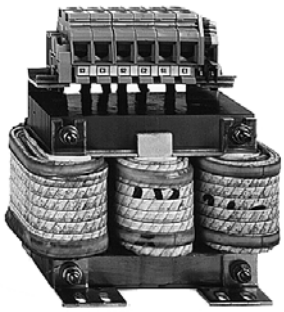


Resistance value	Power (P_{Pr})	Peak energy (E_{Cr})			Length connector cable	References	Weight
Ω	W	Joule (Ws)			m		kg
10	400	18800	13300	n. p.	0.75	**GEA3ERA010C5A**	1.420
					2.00	**GEA3ERA010C52**	1.470
					3.00	**GEA3ERA010C53**	1.620
27	100	4200	3800	1900	0.75	**GEA3ERA027A5A**	0.630
	200	9700	7400	4900	0.75	**GEA3ERA027B5A**	0.930
					3.00	**GEA3ERA027B53**	1.200
	400	25500	18100	11400	0.75	**GEA3ERA027C5A**	1.420
					2.00	**GEA3ERA027C52**	1.470
					3.00	**GEA3ERA027C53**	1.620
72	100	5500	3700	3000	0.75	**GEA3ERA072A5A**	0.620
					2.00	**GEA3ERA072A52**	0.750
	200	14600	9600	7600	0.75	**GEA3ERA072B5A**	0.930
	400	36500	24700	18300	0.75	**GEA3ERA072C5A**	1.420
					2.00	**GEA3ERA072C52**	1.470
					3.00	**GEA3ERA072C53**	1.620

References

EMC line filters	For servodrive	Max. motor line length, EMC category		References	Weight
		internal EMC line filter	External EMC line filter		kg
	CPD 1-phase				
	170 1F10S1 **170 2F10S1**	max. 10m, category C3	max. 20m, category C2; max. 40m, category C3	**VW3A31401**	0.482
	170 1F17S2 **170 2F17S2**	max. 10m, category C3	max. 20m, category C2; max. 40m, category C3	**VW3A31403**	0.620
	170 1F28S3 **170 2F28S3**	max. 10m, category C3	max. 20m, category C2; max. 40m, category C3	**VW3A31405**	0.810
	CPD 3-phase				
	170 3N10S1	–	max. 20m, category C2; max. 40m, category C3	**VW3A31402**	0.550
	170 3N17S2	–	max. 20m, category C2; max. 40m, category C3	**VW3A31404**	0.900
	170 4F14S2	max. 10m, category C3			
	170 3N42S3	–	max. 20m, category C2; max. 40m, category C3	**VW3A31406**	1.350
	170 4F34S3	max. 10m, category C3			

References for line reactors



Designation	Description		References	Weight kg
Line reactors	1-phase, 50/60Hz	7A, 5mH, IP00	**VZL007UM50**	0.880
		18A, 2mH, IP00	**VZL018UM20**	1.990
	3-phase, 50/60Hz	10A, 4mH, IP00	**VW3A66502**	3.000
		16A, 2mH, IP00	**VW3A66503**	3.500
		30A, 1mH, IP00	**VW3A66504**	6.000
		60A, 0.5mH, IP00	**VW3A66505**	11.000

References additional accessories

Designation	Description		References	Weight kg
Decentralised control terminal	Incl. cable with 2 plugs, seal and screws for installation in degree of protection IP65 on the switch cabinet door		**VW3A31101**	0.376
Holding brake controller	$24V_{DC}$ power supply, max. braking current 2.1A, max. power 50W, IP20, for top-hat rail installation		**GEA3EB001**	
RS422 interface				
Signal distribution adapter	For distribution of A/B encoder signals or P/R signals to 6 units with $24V_{DC}$ power supply to $5V_{DC}$ encoder power supply		**GEA3EC002**	
Cascading cable	For GEA3EC002 signal distribution adapter	0.5m	**GEA2SAAADC005**	
USIC (Universal Signal Interface Converter)	For adaptation of activation signals to RS442 standard		**GEA3EC001**	
Cable for pulse/direction, ESIM, A/B	Unit side with 10-pin Molex connector, other cable end open	0.5m	**GEA2RAAABA005**	
		1.5m	**GEA2RAAABA015**	
		3.0m	**GEA2RAAABA030**	
		5.0m	**GEA2RAAABA050**	
ESIM cable, A/B	Both ends with 10-pin Molex connector for master-slave operation of 2 devices	0.5m	**GEA2RBAABB005**	
		1.5m	**GEA2RBAABB015**	
		3.0m	**GEA2RBAABB030**	
		5.0m	**GEA2RBAABB050**	
ESIM connector cable on Schneider Premium CAY	Unit side with 10-pin Molex connector, CAY side with 15-pin SubD connector	0.5m	**GEA2RDAABC005**	
		1.5m	**GEA2RDAABC015**	
		3.0m	**GEA2RDAABC030**	
		5.0m	**GEA2RDAABC050**	
Pulse/direction connector cable on Schneider Premium CFY	Unit side with 10-pin Molex connector, CAY side with 15-pin SubD connectorr	0.5m	**GEA2REAABC005**	
		1.5m	**GEA2REAABC015**	
		3.0m	**GEA2REAABC030**	
		5.0m	**GEA2REAABC050**	
Pulse/direction connector cable on Siemens S5 IP247	Unit side with 10-pin Molex connector, IP247 side with SubD9 connector	3.0m	**GEA2RFAABE030**	
Pulse/direction connector cable on Siemens S5 IP267	Unit side with 10-pin Molex connector, IP267 side with SubD9 connector	3.0m	**GEA2RGAABE030**	
Pulse/direction connector cable on Siemens S7-300 FM353	Unit side with 10-pin Molex connector, FM353 side with SubD15 connector	3.0m	**GEA2RHAABD030**	
ESIM connector cable on Siemens S7-300 FM354	Unit side with 10-pin Molex connector, FM354 side with SubD15 connector	3.0m	**GEA2RIAABC030**	

References additional accessories

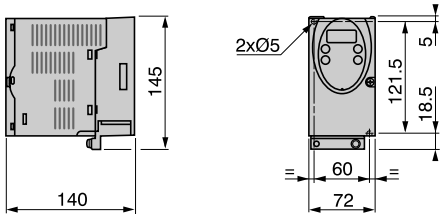
Designation	Description		References	Weight kg
Pulse/direction, ESIM, A/B connector cable on Signal distribution adapter GEA3EC002, USIC GEA3EC001, TLM2 or WP/WPM 311	Unit side with 10-pin Molex connector, other end of cable with SubD15 socket	0.5m	**GEA2RCAABD005**	
		1.5m	**GEA2RCAABD015**	
		3.0m	**GEA2RCAABD030**	
		5.0m	**GEA2RCAABD050**	
CAN				
CANopen junction box			**VW3CANTAP2**	0.482
CAN cable with 2 RJ 45 connectors		0.3 m	**VW3CANCARR03**	0.050
		1.0 m	**VW3CANCARR1**	0.500
Modbus				
Modbus junction box	3 screw terminal strips, RC terminal adapter, for connection to VW3A8306D30 cable		**TSXSCA50**	0.520
Modbus 2-way junction box	2 15-pin SubD socket connectors, 2 screw terminal strips, RC terminal adapter, for connection with VW3A8306 cable		**TSXSCA62**	0.570
Modbus connector module	10 RJ45 connectors, 1 screw terminal strip		**LU9GC3**	0.500
Modbus RC terminal adapter	For RJ45 connectors	120Ω, 1nF	**VW3A8306RC**	0.200
		150Ω	**VW3A8306R**	0.200
	For screw terminal strip	120Ω, 1nF	**VW3A8306DRC**	0.200
		150Ω	**VW3A8306DR**	0.200
Modbus T-branch module	With integrated cable	0.3m	**VW3A8306TF03**	0.188
		1.0m	**VW3A8306TF10**	0.211
Modbus cable	With 1 RJ45 connector, 1 end isolated, for Modbus tapping box TSXCA50		**VW3A8306D30**	0.150
Modbus cable	With 1 RJ45 connector, 1 15-pin SubD connector, for Modbus 2-way tapping box TSXCA62		**VW3A8306**	0.150
Modbus cable	2 RJ45 connectors	0.3m	**VW3A8306R03**	0.050
		1.0m	**VW3A8306R10**	0.150
		3.0m	**VW3A8306R30**	0.150
Modbus cable	4-strand, shielded and twisted, RS485	100m	**TSXCSA100**	5.000
		200m	**TSXCSA200**	10.000
		500m	**TSXCSA500**	25.000
PC "Power Suite 2" software				
Power Suite Version 2	CD-ROM		**VW3A8104**	0.100
Power Suite Version 2	Upgrade, CD-ROM		**VW3A8105**	0.100
PC connection kit	With RS232/RS485 converter		**VW3A8106**	0.350
RJ45 programming cable with RS485/RS232 adapter		3.0m	**ACC2CRAAEF030**	
Micellaneous accessories				
Connector set	With 5 10-pin Molex connectors, with crimp contacts		**GEA3CS001**	
	With 5 12-pin Molex connectors, with crimp contacts		**GEA3CS002**	
ENMC installation clamps	For standard earth plate 15x N2, 15x N4, 5x N7		**GEA3CS003**	
Adapter plate for installation on top-hat rail	for size 1		**VW3A11851**	0.200
	for size 2		**VW3A31852**	0.200
Documentation				
CPD 17, Technical Documentation	CD-ROM	Multilingual	**ACC1RDAAM00XX**	0.077
CPD 17, Unit documentation	DIN A4, bound	German	**ACC1MDADM00DE**	1.050
		English	**ACC1MDADM00EN**	1.050
CPD 17 short introduction	DIN A4, bound	German	**ACC1MDASD00DE**	0.400
		English	**ACC1MDASD00EN**	0.400
CANopen documentation CPD 17	DIN A4, bound	German	**ACC1MDACA01DE**	0.639
		English	**ACC1MDACA01EN**	0.639
Modbus documentation CPD 17	DIN A4, bound	German	**ACC1MDAMB00DE**	0.639
		English	**ACC1MDAMB00EN**	0.639

Dimensions

Servodrive CPD 17

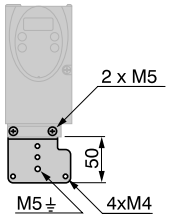
CPD 17• ••••S1 (Size 1)

Dimensions in mm



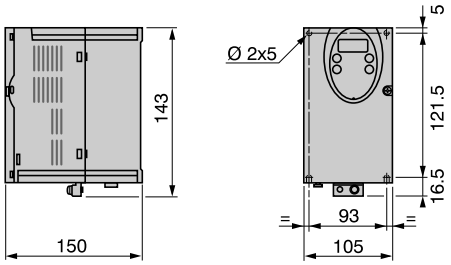
EMC plate

(included with the servodrive)



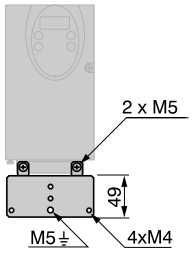
CPD 17• ••••S2 (Size 2)

Dimensions in mm



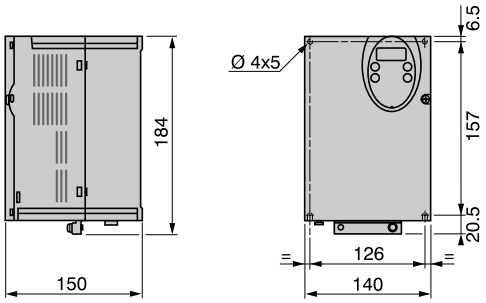
EMC plate

(included with the servodrive)



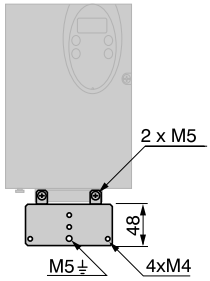
CPD 17• ••••S3 (Size 3)

Dimensions in mm



EMC plate

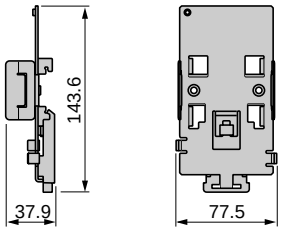
(included with the servodrive)



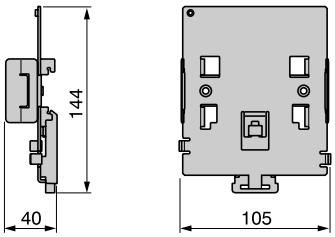
Adapter plate for installation on top-hat rail

Size 1 (VW3 A11851)

Dimensions in mm



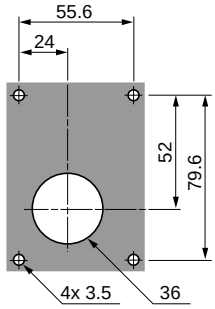
Size 2 (VW3 A31852)



Decentralised control terminal

VW3 A31101

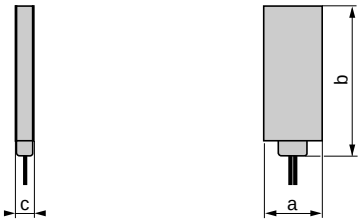
Dimensions in mm



Ballast resistor

GEA3ERA••••••

Dimensions in mm



	a	b	c
GEA3ERA•••A5•	80	110	15
GEA3ERA•••B5•	80	216	15
GEA3ERA•••C5•	80	216	30

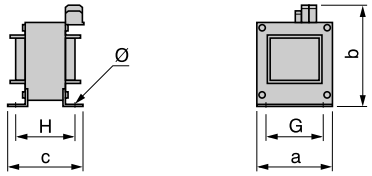
Dimensions

Line reactors, EMC line flters

Line reactors

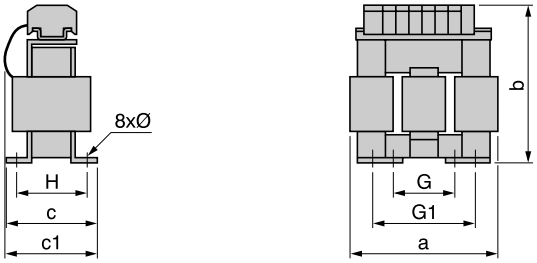
1-phase (VZ1L007UM•0)

Dimensions in mm



	a	b	c	G	H	Ø
VZ1L007UM20	60	100	95	50	60	4x9
VZ1L007UM50	85	120	105	70	70	5x11

3-phase (VW3A6650•)

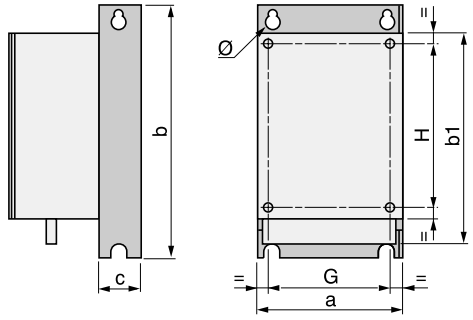


	a	b	c	c1	G	G1	H	Ø
VW3A66502	130	155	85	90	60	80.5	62	6x12
VW3A66503	130	155	85	90	60	80.5	62	6x12
VW3A66504	155	170	115	135	75	107	90	6x12
VW3A66505	180	210	125	165	85	122	105	6x12

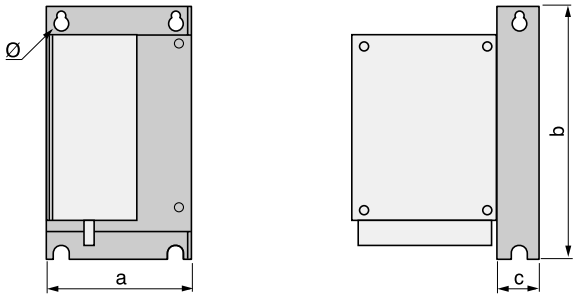
Additional EMC line filter

Installation of line filter under servodrive

Dimensions in mm



Installation of line filter beside servodrive



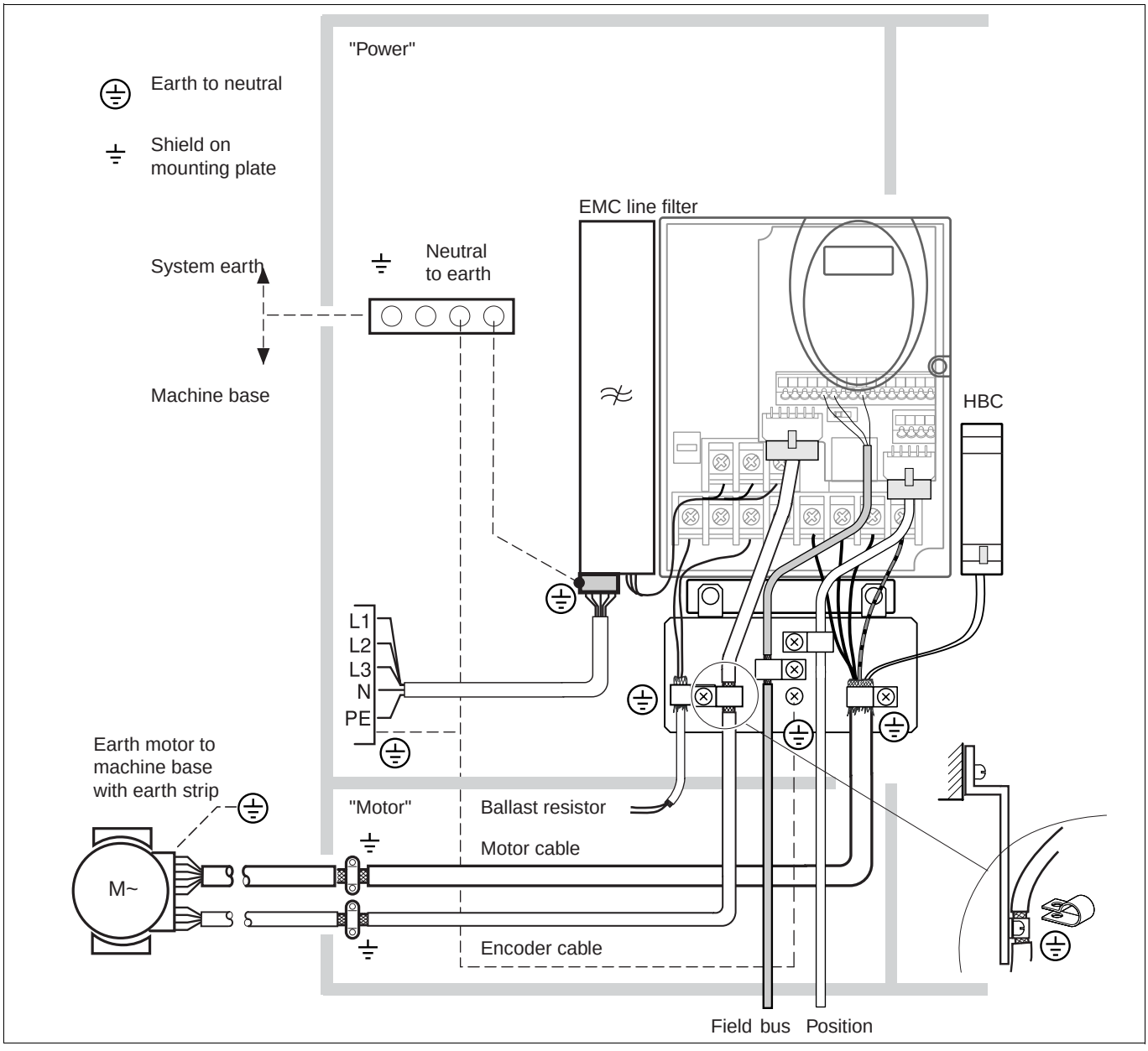
	a	b	b1	c	G	H	Ø
VW3A31401, ...402	72	185	–	50	60	121.5	2xM4
VW3A31403, ...404	105	185	–	60	93	121.5	2xM4
VW3A31405, ...406	140	225	–	60	126	157	4xM4

EMC-compliant installation

Basics

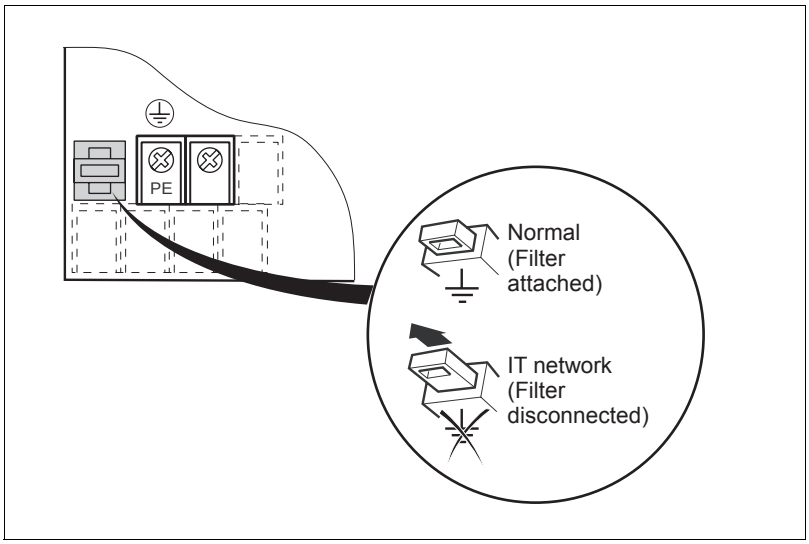
- The product has been developed for electromagnetic compatibility in accordance with the standards EN 61800-3:2001-02 and IEC 61800-3, Ed. 2. The requirements of the "second environment" (industrial network) have been met with reference to the interference resistance.
- An EMC-compliant design is required to maintain the specified limit values. e.g. upstream line reactors or external line filters, installation in a closed control cabinet.
- The scope of delivery includes earth clamps and an EMC plate.
- Please note the information on EMC-compliant installation in the CPD-17 documentation.

EMC measures for servodrive CPD17

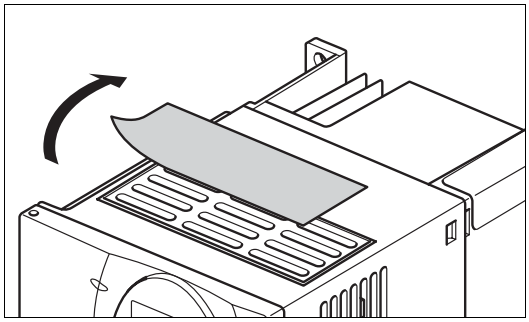


Operation in IT network

An IT network has an isolated or a high impedance neutral conductor. Use a permanent isolation monitor that is compatible with non-linear loads. To ensure correct function, the earth connection of the filter must be separated in units with an integrated line filter.
Units of sizes 1 to 3: Units with an integrated line filter have a switch on the left side of the earth terminal.
Open the switch for operation in the IT network. The position of the switch is different in the different sizes.



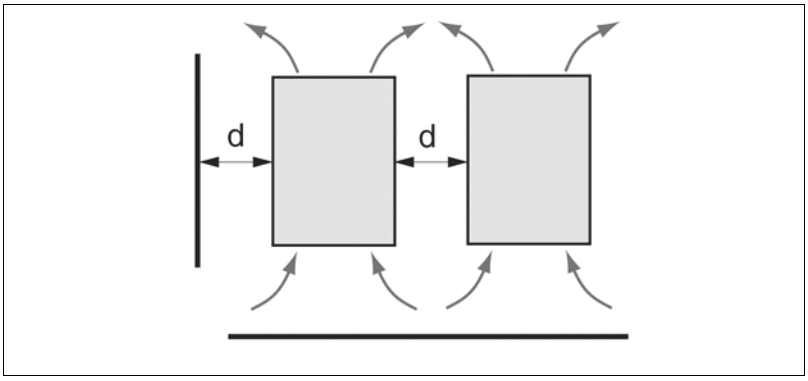
Enable internal line filter for units of size 1 to 3 or disable for IT network



Installation clearances and ventilation

Size 1 units are ventilated by air circulation from bottom to top. Units of sizes 2 and 3 have an integrated fan.
When selecting the position of the unit in the control cabinet note the following instructions regarding temperature and degree of protection.

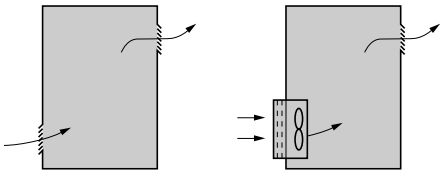
- The unit must be adequately cooled by compliance with the minimum installation distances.
- Do not install the unit adjacent to heat sources.
- Do not mount the unit on flammable materials.
- The heated airflow from other units and components, such as an external ballast resistor, must not heat the air used for cooling the unit.
- The drive will switch off because of overtemperature when operated above the thermal limits.
- If degree of protection IP20 is sufficient, we recommend removal of the protective foil on completion of installation.
- Install the unit in a vertical position (±10%).



Installation spacing and air circulation

Ambient temperature	Installation clearances	Actions required if IP20 is possible	Actions required if IP40 is required
-10°C to +40°C	d > 50mm	None	None
	d < 50mm	Removing protective foil	Reduce nominal current and continuous current by 2.2 % per 1°C above 40°C
+40°C to +50°C	d > 50mm	Removing protective foil	Reduce nominal current and continuous current by 2.2 % per 1°C above 40°C
	d < 50mm	Remove protective foil; reduce nominal current and continuous current by 2.2% per 1°C above 40°C.	Not possible
+50°C to +60°C	d > 50mm	Remove protective foil; reduce nominal current and continuous current by 3% per 1°C above 50°C.	Not possible
	d < 50mm	Not possible	Not possible

At least 10mm of free space is required in front of the unit.
At least 50mm of free space is required above the unit.
The connecting cables come out of the bottom of the case. At least 200 mm free space under the unit is required to ensure that wiring can be installed without excessive bending.
An alternative to fastening the unit directly to the control cabinet mounting plate is adapter plates for snap-mounting to top-hat rails, which are available as accessories for unit sizes 1 and 2. In this case line filters cannot be attached directly beside or behind the unit.



Installation in a case or a control cabinet

Follow the instructions for installation on page 37.
Proceed as follows to ensure adequate unit ventilation:

- Provide ventilation openings on the case.
- The ventilation openings must provide a minimum air flow per unit as specified in the table.
- Use special IP54 filter.
- Remove the top cover on the servodrive.

Air flow of fan according to the size of the CPD17	
Servodrive	**Air flow in m³/min**
Size 1 (CPD 170 ••••S1)	0.3
Size 2 (CPD 170 ••••S2)	0.55
Size 3 (CPD 170 ••••S3)	1.55

Sheetmetal case and control cabinet (degree of protection IP54)

The servodrive CPD17 must be installed in a sealed case under specific environmental conditions: dust, corrosive gases, high humidity with the danger of condensation and water deposition…
In this cases the servodrive CPD17 can be installed in a case with a maximum internal temperature of 50°C.

Calculation of case dimensions

Maximum heat resistance R_{th} in °C/W

$R_{th} = (q - q_e)/P$

q = maximum temperature (°C) in interior of case
q_e = maximum outside temperature (°C)
P = total heat dissipation (W) in case

Power loss of servodrive see Chapter "Technical Data".
Consider the power loss of the other components.

Usable heat dissipation area of case A in m²

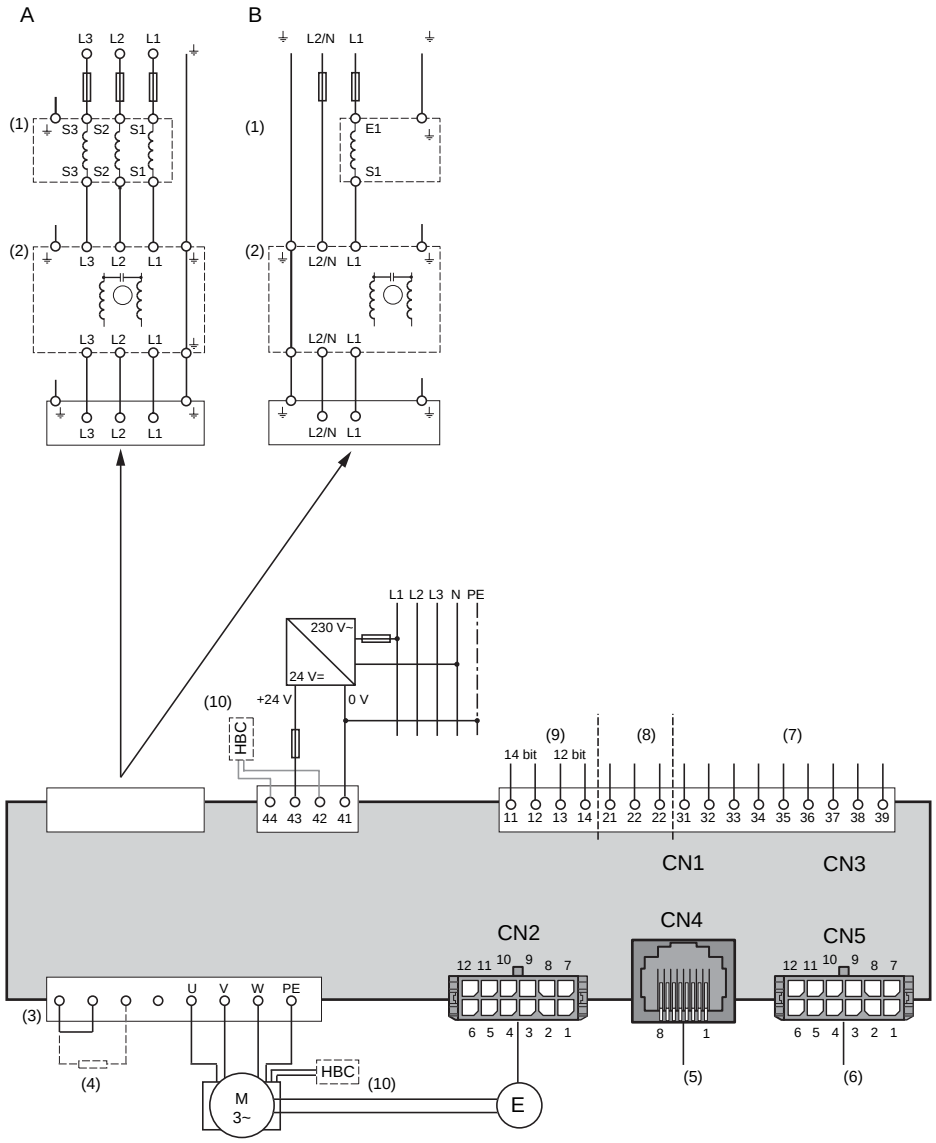
(with wall mounting: sides + top + front)

$A = K/R_{th}$

K = heat resistance, based on the case area
Sheetmetal case: K = 0.12 with internal fan, K = 0.15 without internal fan

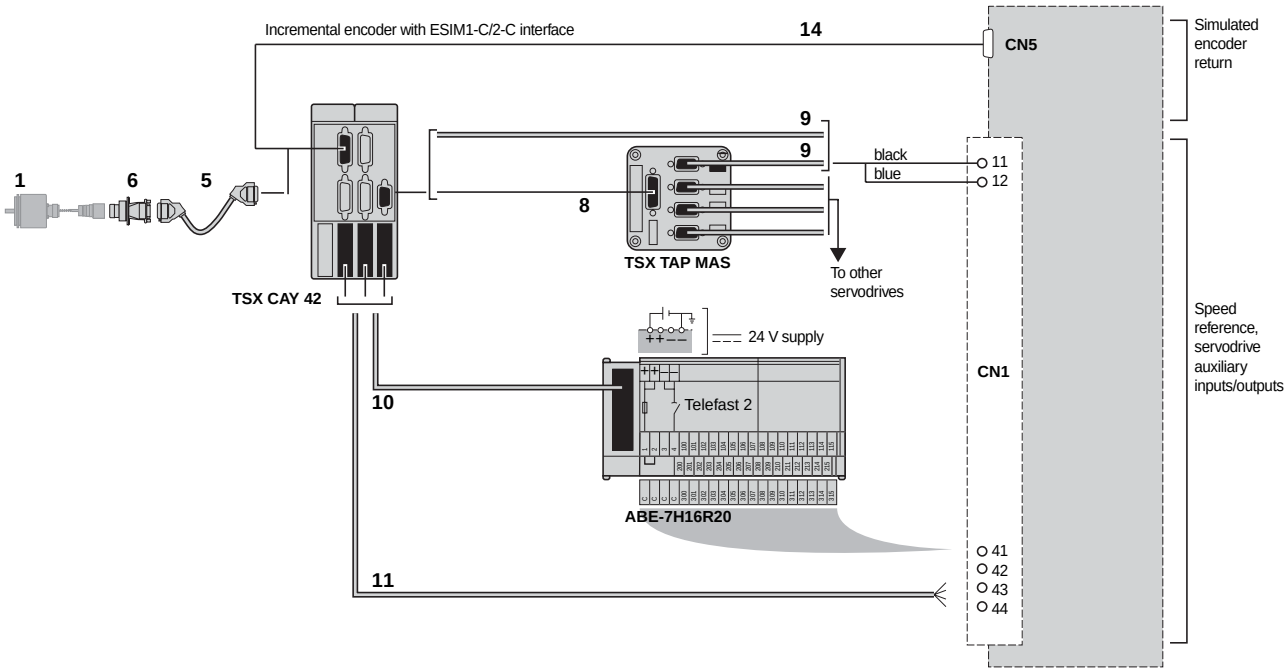
Note: Because of the poor heat dissipation insulated cases must not be used.

Connection scheme



(A) Mains power 3-phase
(B) Mains power 1-phase
(1) Line reactor (optional)
(2) EMC line filter (optional)
(3) Internal ballast resistor
(4) External ballast resistor (optional)
(5) PC "Power Suite 2" software, decentralised control terminal, Modbus, CANopen
(6) ESIM, PULSE/DIR, encoder
(7) Digital inputs/outputs
(8) CANopen terminal
(9) Analogue inputs
(10) Holding brake controller (HBC, optional)

Connecting the servodrive with a TSX CAY Premium ±10V motion control module

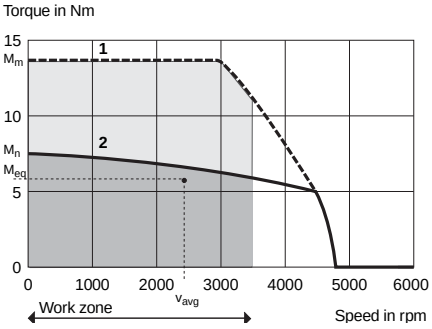


(1) Incremental or absolute encoder
(5) TSX CCP S15 ••• cable with connectors
(6) TSX TAP S15 05 connector
(8) TSX CXP 213/613 cable with connectors
(9) TSX CDP 611 cable with connectors
(10) TSX CDP ••3 cable with connectors
(11) TSX CDP •01 cable with connectors
(14) GEA2RDAABC••• ESIM cable with connectors (simulated incremental encoder feedback)

Presentation

SER servomotors are equipped with Neodymium Iron Borium (NdFeB) magnets and provide a high power density within a confined space, as well as a dynamic velocity range that meets all machine requirements.
Thermal protection is provided by an integral probe in the motor. These motors support high overloads without risk of demagnetization. SER motors are certified "Recognized" (UR) by the Underwriters Laboratories. They are compliant with standard UL1004 and with European directives (marking CE).
Depending on the model, SER servomotors can be equipped with a holding brake and/or a gearbox.
For further information see SER documentation.

Speed/torque characteristics



SER motors show torque/speed profiles similar to the example opposite with:
(1) Peak torque (depending on the servodrive model).
(2) Continuous torque (depending on the servodrive model).
where:
6,000 (in rpm) corresponds to the motor's maximum mechanical speed.

(Mm) (in Nm) represents the peak stall torque value.

(Mn) (in Nm) represents the continuous stall torque value.

Principle for determining the motor size according to the application

Torque/speed curves can be used to determine optimum motor size.
- Locate the work zone of the application in terms of speed.
- Verify, using the motor cycle diagram, that the torques required by the application during the different cycle phases are located within the area bounded by graph (1) in the work zone.
- Calculate the average speed (v_{avg}) and the equivalent thermal torque (M_{eq}).
- The point defined by (v_{avg}) and (M_{eq}) must be within the area bounded by graph (2) in the work zone.

Functions

SER servomotors have been developed to meet the following requirements:
- Functional characteristics, robustness, safety, in compliance with IEC 34-1.
- Ambient operating temperature: -20 to +40°C in compliance with DIN 50019R14.
- Relative humidity: < 75% yearly average/95% for 30 days without condensation.
- Storage and transport temperature: -25 to +70°C.
- Angular acceleration: 200,000rad/s²
- Winding insulation class: F (threshold temperature for windings 155°C) in compliance with VDE 0530.
- Supply and sensor connections.
- Thermal protection by built-in PTC thermistor probe, controlled by the servodrive.
- Out-of-round, concentricity and perpendicularity between flange and shaft as per DIN 42955, class N.
- Flange compliant with standard DIN 42948.
- Permitted mounting positions: no mounting restriction for IMB5 – IMV1 and IMV3 as per DIN 42950.
- Polyester resin based paint: opaque black (RAL 9005).
- Degree of protection of the motor casing: IP56 as per IEC 529.
- Degree of protection of the shaft end: IP41 in accordance with IEC 529.
- Degree of protection of the gearbox (depending on model): IP54 as per IEC 529.
- Integrated sensor, single turn encoder (1 revolution) SinCos Hiperface interface.
- Standard sized shaft end (as per DIN 42948):
  – motor without gearbox: smooth shaft end or shaft end with key,
  – motor equipped with gearbox: shaft end with key.

Holding brake (optional)

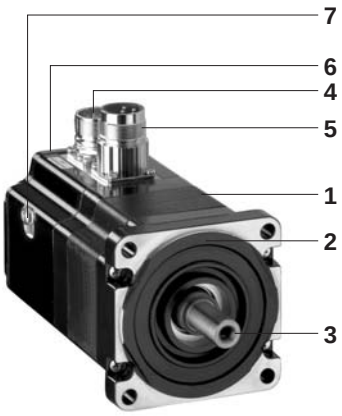
The integral brake fitted on SER motors (depending on the model) is a failsafe electromagnetic holding brake.
For SER 39x and 311x: The brake torque decreases when the motor temperature exceeds 80°C. Unless the maximum temperature of the motor is known and is less than 80°C according to the loads applied, do not expose the brake to more than 50% of its continuous torque value.
Do not use the holding brake as a dynamic brake for deceleration purposes.
The holding brake must be controlled by a holding brake controller, see page 23.

Built-in encoder

The motor is fitted with a single turn high-resolution absolute encoder with an angular shaft position precise to less than ±45 arc seconds.
This performs the following functions:

- Gives the angular position of the rotor in such a way that flows can be synchronized.
- Measures the motor speed via the associated servodrive. This information is used by the speed controller of the servodrive.
- May measure position information for the position controller of the servodrive.
- Measures and, where necessary, transmits position information in incremental or absolute format, for the position controller.

Design



SER servomotors with a 3-phase stator and an 8-pole (SER 36x: 6-pole) rotator with Neodymium Iron Borium magnets (NdFeB) comprise of:

(1) Housing with a square cross-section, protected by black opaque polyester resin paint RAL 9005.
(2) Axial flange with 4 fixing points in compliance with standard DIN 42948.
(3) A smooth shaft end compliant with the standard DIN 42948.
(4) A screw connector for connecting the power cable.
(5) A screw connector for connecting the encoder cable.
(6) A manufacturer's type plate.
(7) A ground terminal for EMC (not for SER 36x).

Berger Lahr has taken great care to achieve the most appropriate match between SER motors and CPD17 servodrives. This compatibility is only guaranteed when cables sold by Berger Lahr are used, see page 54.

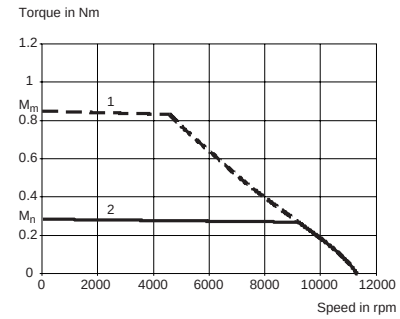
Characteristics of SER 364 and 366 motors

Types of SER motor				364 3L 3S	366 3L 3S	366 3L 3S	366 3L 3S
Associated with CPD17 size				1	1	1	1
Power supply	Voltage			115	115	230	230
	Phases			1	1	1	3
Torque	Continuous stall	M_n	Nm	0.29	0.48	0.48	0.48
	Peak stall	M_m	Nm	0.85	1.3	1.3	1.3
Current	Permanent		A_{rms}	2.07	2.45	2.45	2.45
	Maximum		A_{rms}	7	7	7	7
Demagnetization current			A	11.5	13.5		
Maximum mechanical speed			rpm	12,000	12,000		
Constants	Torque		Nm/A_{rms}	0.14	0.19		
	Back emf		V_{rms}·s/rad	0.087	0.11		
Rotor	Number of poles			6	6		
	Inertia without brake	J_m	gm²	0.01	0.018		
	Inertia with brake	J_m	gm²	0.017	0.025		
Stator	Resistance (phase/phase)		Ω	4.7	3.7		
	Inductance (phase/phase)		mH	9.2	7.9		
	Electrical time constant		ms	1.9	2.1		

Speed/torque graphs

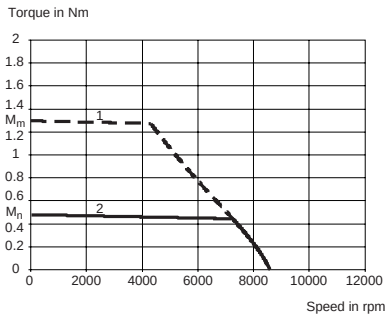
SER 364 3L 3S

with CPD 17 size 1, 115V, 1-phase



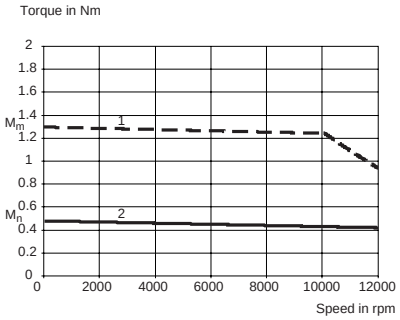
SER 366 3L 3S

with CPD 17 size 1, 115V, 1-phase



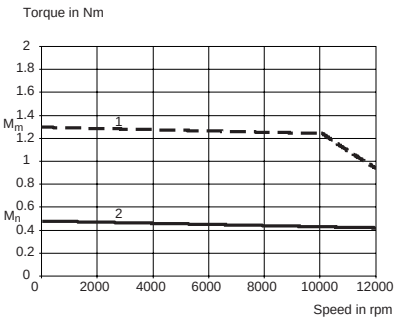
SER 366 3L 3S

with CPD 17 size 1, 230V, 1-phase



SER 366 3L 3S

with CPD 17 size 1, 230V, 3-phase



1) Peak torque

2) Continuous torque

SER brushless motors

Characteristics

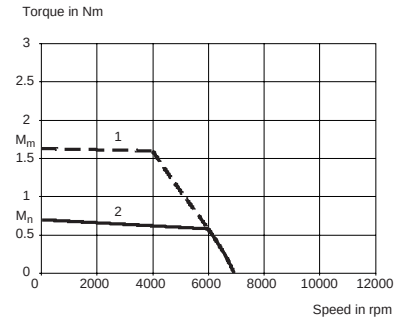
Characteristics of SER 368 motors

Types of SER motor				368 3L 3S	368 3L 3S	368 3L 3S	368 3L 3S	368 3L 5S	368 3L 5S
Associated with CPD17 size				1	2	2	2	1	1
Power supply	Voltage			115	115	230	230	230	230
	Phases			1	1	1	3	1	3
Torque	Continuous stall	M_n	Nm	0.7	0.7	0.7	0.7	0.7	0.7
	Peak stall	M_m	Nm	1.62	2.5	2.5	2.5	2.22	2.22
Current	Permanent		A_{rms}	2.9	2.9	2.9	2.9	2	2
	Maximum		A_{rms}	7	12	12	12	7	7
Demagnetization current			A	15.3				10.5	
Maximum mechanical speed			rpm	12,000				12,000	
Constants	Torque		Nm/A_{rms}	0.24				0.35	
	Back emf		V_{rms}.s/rad	0.14				0.21	
Rotor	Number of poles			6				6	
	Inertia without brake	J_m	gm^2	0.026				0.026	
	Inertia with brake	J_m	gm^2	0.033				0.033	
Stator	Resistance (phase/phase)		Ω	3.4				7.3	
	Inductance (phase/phase)		mH	7.6				15.9	
	Electrical time constant		ms	2.2				2.1	

Speed/torque graphs

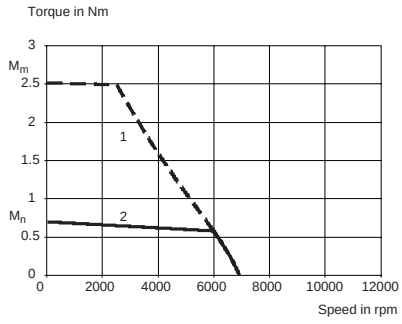
SER 368 3L 3S

with CPD 17 size 1, 115V, 1-phase



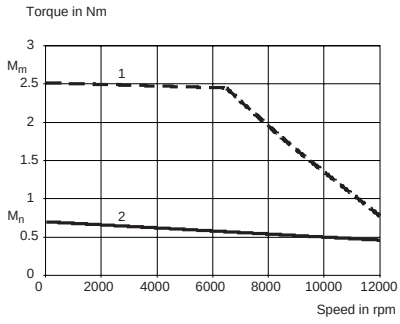
SER 368 3L 3S

with CPD 17 size 2, 115V, 1-phase



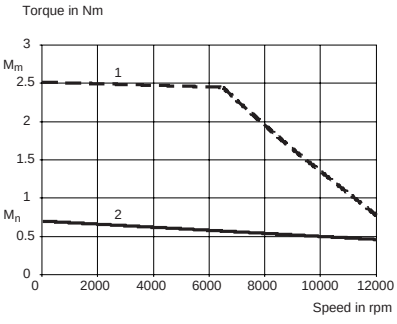
SER 368 3L 3S

with CPD 17 size 2, 230V, 1-phase



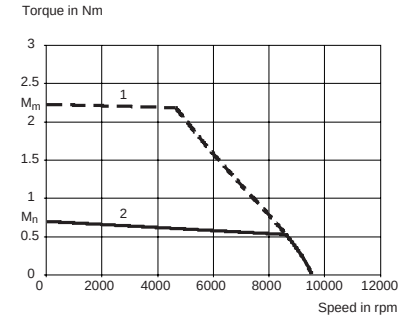
SER 368 3L 3S

with CPD 17 size 2, 230V, 3-phase



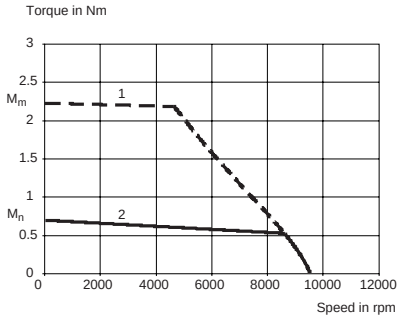
SER 368 3L 5S

with CPD 17 size 1, 230V, 1-phase



SER 368 3L 5S

with CPD 17 size 1, 230V, 3-phase



1) Peak torque

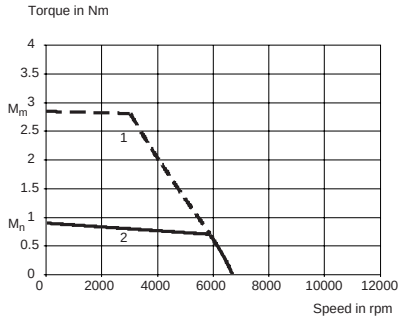
2) Continuous torque

Characteristics of SER 3610 motors

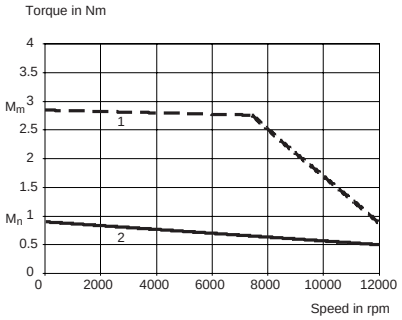
Types of SER motor				3610 3L 3S	3610 3L 3S	3610 3L 3S
Associated with CPD17 size				2	2	2
Power supply	Voltage			115	230	230
	Phases			1	1	3
Torque	Continuous stall	M_n	Nm	0.9	0.9	0.9
	Peak stall	M_m	Nm	2.85	2.85	2.84
Current	Permanent		A_{rms}	3.53	3.53	3.53
	Maximum		A_{rms}	12	12	12
Demagnetization current			A	17.5		
Maximum mechanical speed			rpm	12,000		
Constants	Torque		Nm/A_{rms}	0.25		
	Back emf		V_{rms}·s/rad	0.15		
Rotor	Number of poles			6		
	Inertia without brake	J_m	gm²	0.034		
	Inertia with brake	J_m	gm²	0.041		
Stator	Resistance (phase/phase)		Ω	2.7		
	Inductance (phase/phase)		mH	6		
	Electrical time constant		ms	2.2		

Speed/torque graphs

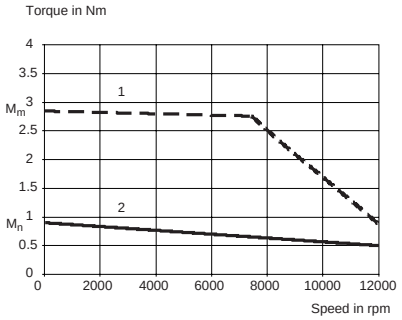
SER 3610 3L 3S
with CPD 17 size 2, 115V, 1-phase



SER 3610 3L 3S
with CPD 17 size 2, 230V, 1-phase



SER 3610 3L 3S
with CPD 17 size 2, 230V, 3-phase



1) Peak torque
2) Continuous torque

SER brushless motors

Characteristics

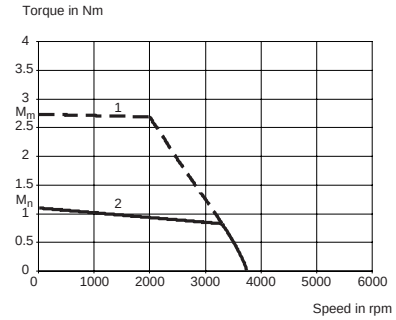
Characteristics of SER 397 motors

Types of SER motor				397 4L 3S	397 4L 3S	397 4L 3S	39 4L 3S
Associated with CPD17 size				1	1	1	2
Power supply	Voltage			115	230	230	115
	Phases			1	1	3	1
Torque	Continuous stall	M_n	Nm	1.1	1.1	1.1	1.1
	Peak stall	M_m	Nm	2.7	2.73	2.73	3.4
Current	Permanent		A_{rms}	2.6	2.6	2.6	2.6
	Maximum		A_{rms}	7	7	7	10.4
Demagnetization current			A	12			
Maximum mechanical speed			rpm	6,000			
Constants	Torque		Nm/A_{rms}	0.42			
	Back emf		$V_{rms}.s/rad$	0.26			
Rotor	Number of poles			8			
	Inertia without brake	J_m	gm^2	0.085			
	Inertia with brake	J_m	gm^2	0.105			
Stator	Resistance (phase/phase)		Ω	3.7			
	Inductance (phase/phase)		mH	13.6			
	Electrical time constant		ms	3.7			

Speed/torque graphs

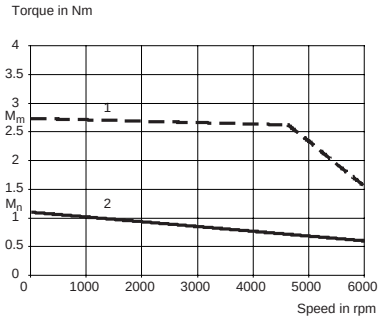
SER 397 4L 3S

with CPD 17 size 1, 115V, 1-phase



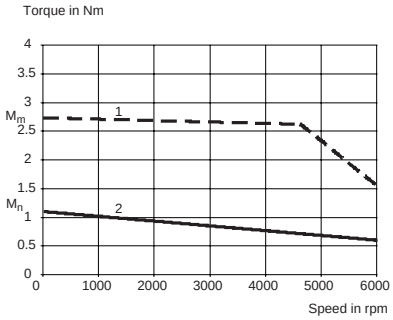
SER 397 4L 3S

with CPD 17 size 1, 230V, 1-phase



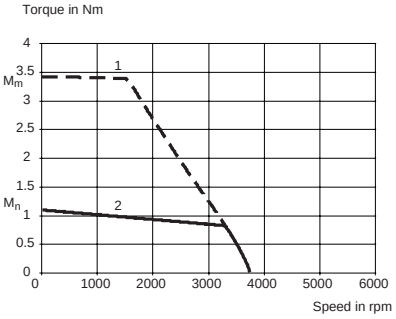
SER 397 4L 3S

with CPD 17 size 1, 230V, 3-phase



SER 397 4L 3S

with CPD 17 size 2, 115V, 1-phase



1) Peak torque

2) Continuous torque

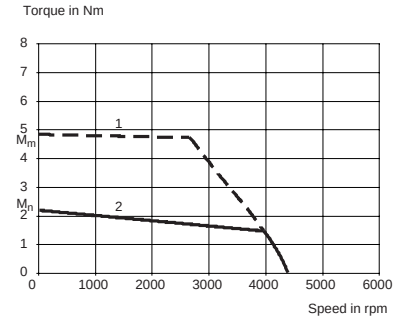
Characteristics of SER 3910 motors

Types of SER motor				3910 4L 3S	3910 4L 3S	3910 4L 3S	3910 4L 3S
Associated with CPD17 size				1	1	2	2
Power supply	Voltage			230	230	230	400/480
	Phases			1	3	1	3
Torque	Continuous stall	M_n	Nm	2.2	2.2	2.2	2.2
	Peak stall	M_m	Nm	4.84	4.84	6.68	6.2
Current	Permanent		A_{rms}	3	3	3	3
	Maximum		A_{rms}	7	7	12	10
Demagnetization current			A	12			
Maximum mechanical speed			rpm	6,000			
Constants	Torque		Nm/A_{rms}	0.73			
	Back emf		V_{rms}·s/rad	0.45			
Rotor	Number of poles			8			
	Inertia without brake	J_m	gm²	0.16			
	Inertia with brake	J_m	gm²	0.18			
Stator	Resistance (phase/phase)		Ω	5.4			
	Inductance (phase/phase)		mH	20.3			
	Electrical time constant		ms	3.7			

Speed/torque graphs

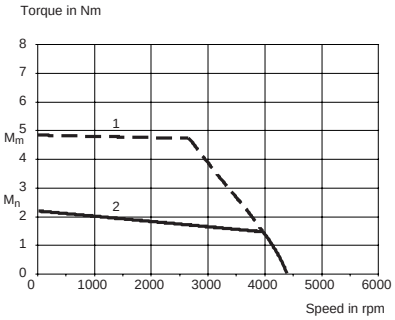
SER 3910 4L 3S

with CPD 17 size 1, 230V, 1-phase



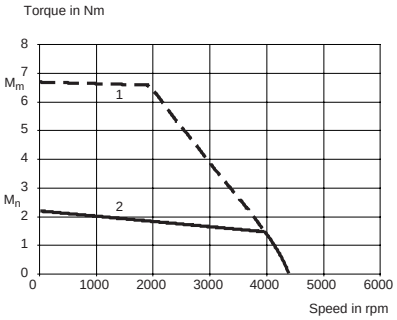
SER 3910 4L 3S

with CPD 17 size 1, 230V, 3-phase



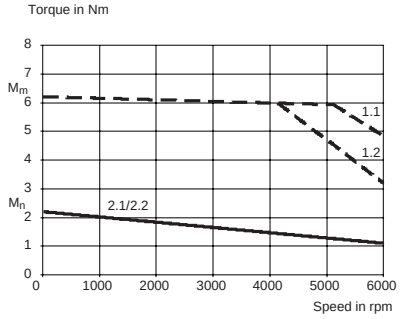
SER 3910 4L 3S

with CPD 17 size 2, 230V, 1-phase



SER 3910 4L 3S

with CPD 17 size 2, 400/480V, 3-phase



1) Peak torque
2) Continuous torque

1.1) Peak torque at 400V, 3-phase
2.1) Continuous torque at 400V, 3-phase

1.2) Peak torque at 480V, 3-phase
2.2) Continuous torque at 480V, 3-phase

SER brushless motors

Characteristics

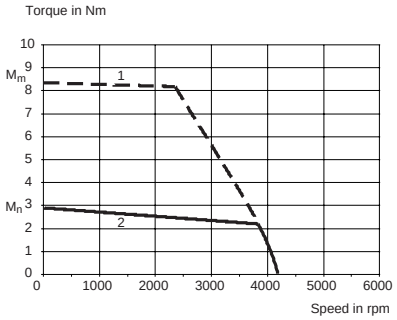
Characteristics of SER 3913 motors

Types of SER motor				3913 4L 3S	3913 4L 3S	3913 4L 3S	3913 4L 5S	3913 4L 5S
Associated with CPD17 size				2	2	2	1	2
Power supply	Voltage			230	230	400/480	230	400/480
	Phases			1	3	3	3	3
Torque	Continuous stall	M_n	Nm	2.9	2.9	2.9	2.9	2.9
	Peak stall	M_m	Nm	8.35	8.35	7.3	7.5	9.5
Current	Permanent		A_{rms}	3.7	3.7	3.7	2.5	2.5
	Maximum		A_{rms}	12	12	10	7	10
Demagnetization current			A	18			12	
Maximum mechanical speed			rpm	6,000			6,000	
Constants	Torque		Nm/A_{rms}	0.78			1.16	
	Back emf		V_{rms}·s/rad	0.47			0.69	
Rotor	Number of poles			8			8	
	Inertia without brake	J_m	gm²	0.24			0.24	
	Inertia with brake	J_m	gm²	0.26			0.26	
Stator	Resistance (phase/phase)		Ω	3.3			7.5	
	Inductance (phase/phase)		mH	14.1			30.3	
	Electrical time constant		ms	4.3			4	

Speed/torque graphs

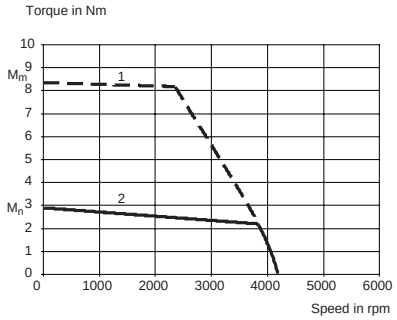
SER 3913 4L 3S

with CPD 17 size 2, 23 V, 1-phase



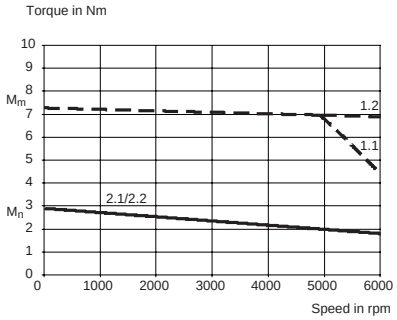
SER 3913 4L 3S

with CPD 17 size 2, 230V, 3-phase



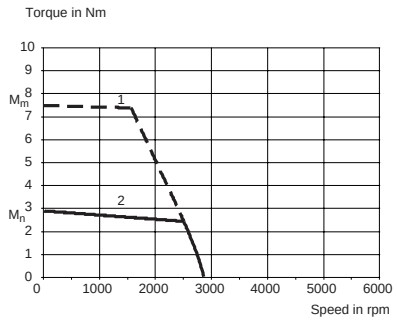
SER 39134L 3S

with CPD 17 size 2, 400/480V, 3-phase



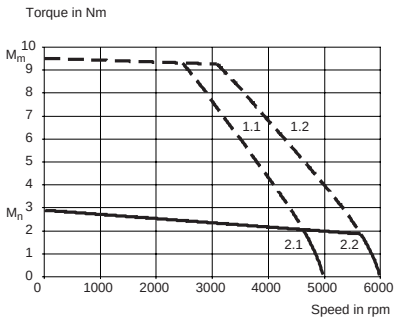
SER 3913 4L 5S

with CPD 17 size 1, 230V, 3-phase



SER 3913 4L 5S

with CPD 17 size 2, 400/480V, 3-phase



1) Peak torque
2) Continuous torque

1.1) Peak torque at 400V, 3-phase
2.1) Continuous torque at 400V, 3-phase

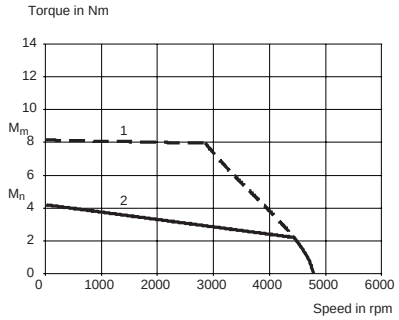
1.2) Peak torque at 480V, 3-phase
2.2) Continuous torque at 480V, 3-phase

Characteristics of SER 31112 motors

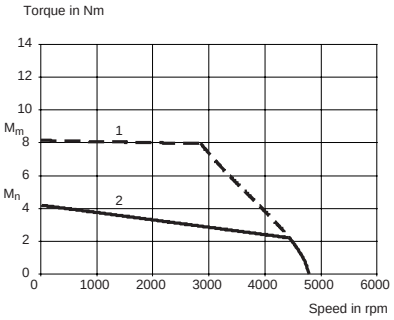
Types of SER motor				31112 4L 3S	31112 4L 3S	31112 4L 3S	31112 4L 3S	31112 4L 3S	31112 4L 5S
Associated with CPD17 size				2	2	3	3	3	2
Power supply	Voltage			230	230	115	230	230	400/480
	Phases			1	3	1	1	3	3
Torque	Continuous stall	M_n	Nm	4.2	4.2	4.2	4.2	4.2	4.2
	Peak stall	M_m	Nm	8.1	8.1	11	11	11.7	10.16
Current	Permanent		A_{rms}	6	6	6	6	6	3.6
	Maximum		A_{rms}	12	12	20	20	24	10
Demagnetization current			A	30					16.5
Maximum mechanical speed			rpm	6,000					6,000
Constants	Torque		Nm/A_{rms}	0.7					1.7
	Back emf		V_{rms}·s/rad	0.42					0.7
Rotor	Number of poles			8					8
	Inertia without brake	J_m	gm²	0.4					0.4
	Inertia with brake	J_m	gm²	0.43					0.43
Stator	Resistance (phase/phase)		Ω	1.5					4.5
	Inductance (phase/phase)		mH	12.6					40.3
	Electrical time constant		ms	8.4					9

Speed/torque graphs

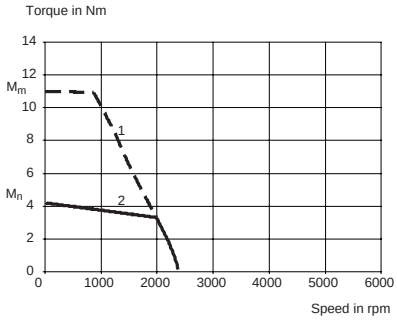
SER 31112 4L 3S
with CPD 17 size 2, 230V, 1-phase



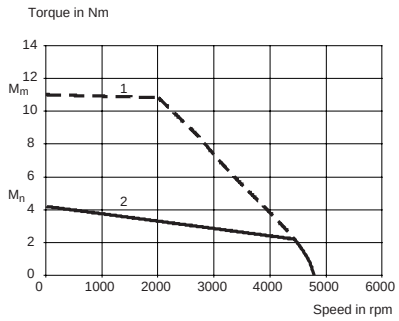
SER 31112 4L 3S
with CPD 17 size 2, 230V, 3-phase



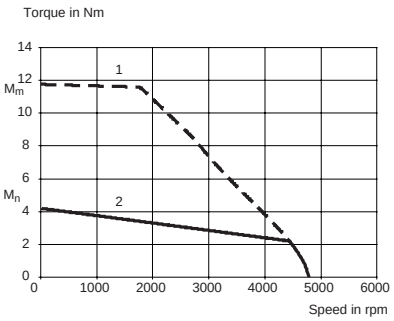
SER 31112 4L 3S
with CPD 17 size 3, 115V, 1-phase



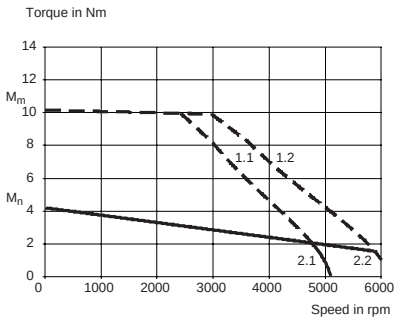
SER 31112 4L 3S
with CPD 17 size 3, 230V, 1-phase



SER 31112 4L 3S
with CPD 17 size 3, 230V, 3-phase



SER 31112 4L 5S
with CPD 17 size 2, 400/480V, 3-phase



1) Peak torque
2) Continuous torque

1.1) Peak torque at 400V, 3-phase
2.1) Continuous torque at 400V, 3-phase

1.2) Peak torque at 480V, 3-phase
2.2) Continuous torque at 480V, 3-phase

SER brushless motors

Characteristics

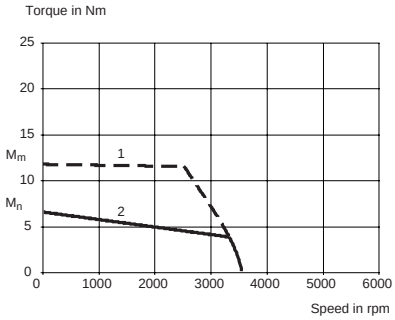
Characteristics of SER 31117 motors

Types of SER motor				31117 4L 3S	31117 4L 3S	31117 4L 3S	31117 4L 3S	31117 4L 3S	31117 4L 5S
Associated with CPD17 size				2	3	3	3	3	2
Power supply	Voltage			230	115	230	230	400/480	400/480
	Phases			3	1	1	3	3	3
Torque	Continuous stall	M_n	Nm	6.6	6.6	6.6	6.6	6.6	6.6
	Peak stall	M_m	Nm	11.8	17.9	17.9	20.8	20	12.8
Current	Permanent		A_{rms}	6.6	6.6	6.6	6.6	6.6	5
	Maximum		A_{rms}	12	20	20	26.4	24	10
Demagnetization current			A	32					24
Maximum mechanical speed			rpm	6,000					6,000
Constants	Torque		Nm/A_{rms}	1					1.32
	Back emf		V_{rms}·s/rad	0.56					0.78
Rotor	Number of poles			8					8
	Inertia without brake	J_m	gm²	0.8					0.8
	Inertia with brake	J_m	gm²	0.83					0.83
Stator	Resistance (phase/phase)		Ω	1.2					2.3
	Inductance (phase/phase)		mH	11.3					21.2
	Electrical time constant		ms	9.4					9.2

Speed/torque graphs

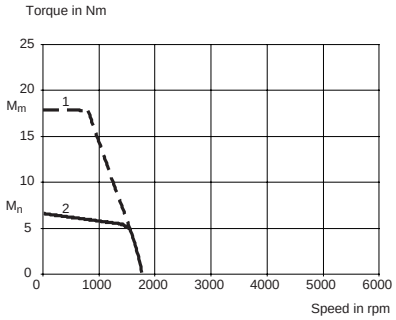
SER 31117 4L 3S

with CPD 17 size 2, 230V, 3-phase



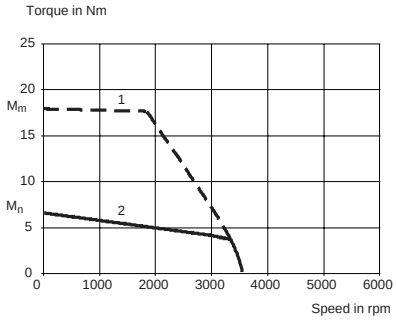
SER 31117 4L 3S

with CPD 17 size 3, 115V, 1-phase



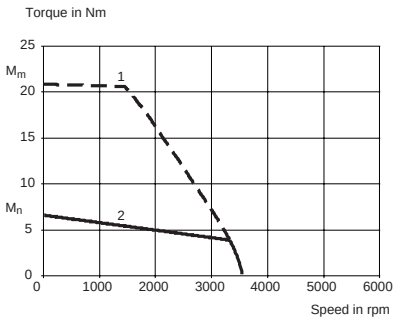
SER 31117 4L 3S

with CPD 17 size 3, 230V, 1-phase



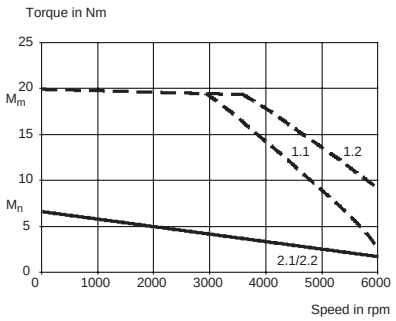
SER 31117 4L 3S

with CPD 17 size 3, 230V, 3-phase



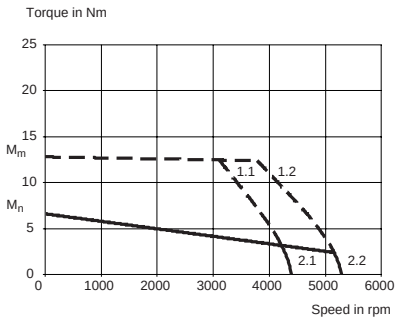
SER 31117 4L 3S

with CPD 17 size 3, 400/480V, 3-phase



SER 31117 4L 5S

with CPD 17 size 2, 400/480V, 3-phase



1) Peak torque

2) Continuous torque

1.1) Peak torque at 400V, 3-phase

2.1) Continuous torque at 400V, 3-phase

1.2) Peak torque at 480V, 3-phase

2.2) Continuous torque at 480V, 3-phase

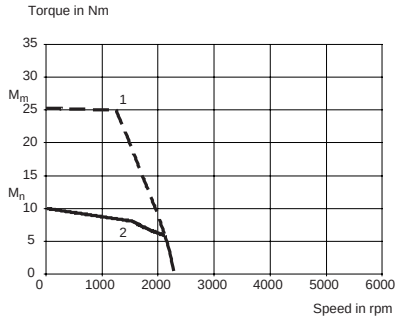
Characteristics of SER 31122 and 31127 motors

Types of SER motor				31122 4L 5S	31122 4L 5S	31122 4L 5S	31127 4L 5D	31127 4L 5D
Associated with CPD17 size				3	3	3	3	3
Power supply	Voltage			230	230	400/480	230	400/480
	Phases			1	3	3	3	3
Torque	Continuous stall	M_n	Nm	10	10	10	13.4	13.4
	Peak stall	M_m	Nm	25.2	30	28	36	31.5
Current	Permanent		A_{rms}	7	7	7	9.2	9.2
	Maximum		A_{rms}	20	28	24	?	24
Demagnetization current			A	32			45	
Maximum mechanical speed			rpm	4,500			4,500	
Constants	Torque		Nm/A_{rms}	1.43			1.46	
	Back emf		V_{rms}·s/rad	0.87			0.84	
Rotor	Number of poles			8			8	
	Inertia without brake	J_m	gm²	1.16			1.55	
	Inertia with brake	J_m	gm²	1.19			1.58	
Stator	Resistance (phase/phase)		Ω	1.7			1.3	
	Inductance (phase/phase)		mH	17.2			14.5	
	Electrical time constant		ms	10.1			11.2	

Speed/torque graphs

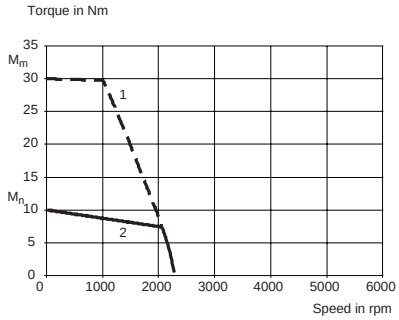
SER 31122 4L 5S

with CPD 17 size 3, 230V, 1-phase



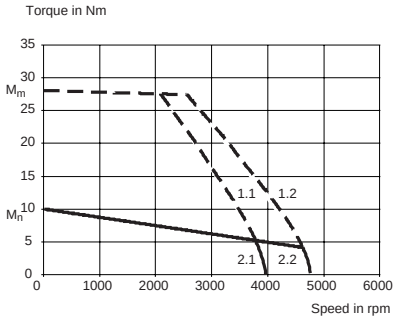
SER 31122 4L 5S

with CPD 17 size 3, 230V, 3-phase



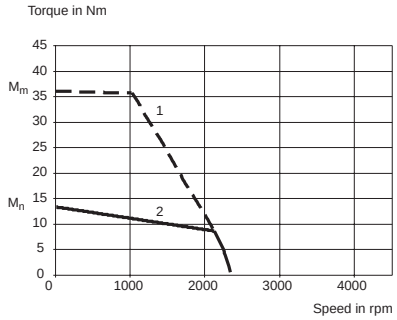
SER 31122 4L 5S

with CPD 17 size 3, 400/480V, 3-phase



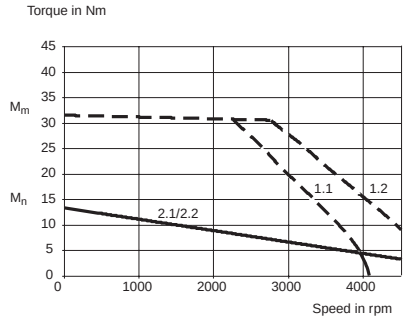
SER 31127 4L 5D

with CPD 17 size 3, 230V, 3-phases



SER 31127 4L 5D

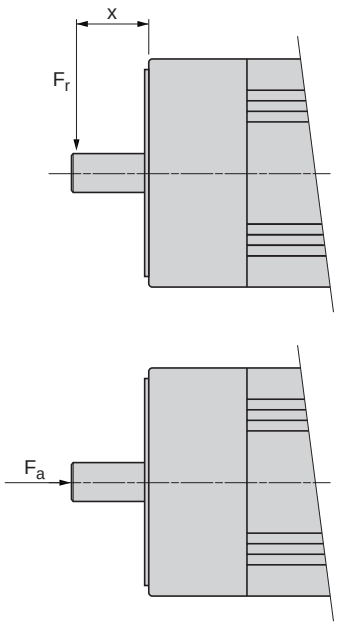
with CPD 17 size 3, 400/480V, 3-phase



1) Peak torque
2) Continuous torque

1.1) Peak torque at 400V, 3-phase
2.1) Continuous torque at 400V, 3-phase

1.2) Peak torque at 480V, 3-phase
2.2) Continuous torque at 480V, 3-phase



Radial and axial forces permissible on the motor shaft

Even when motors are used under optimum conditions, their lifetime is limited by that of the bearings.

Condtions	
Nominal life time of bearings [1]	L10h = 20,000 hours
Speed	N = 4,000 rpm
Ambient temperature (temperature of bearings: 100 °C)	40°C
Peak torque	cyclic ratio of 10%
Continuous torque	cyclic ratio of 100%
Force application point	x = 10mm with SER 36• motors x = 15mm with SER 39• motors x = 20mm with SER 311• motors

[1] Hours of use with a failure probability of 10%.

HAZARD: The following conditions must be respected
- Radial and axial forces must not be applied simultaneously.
- The maximum press-on force permissible on the shaft end is 490N for SER 36x, 1,300N for SER 39x and 1,800N for SER 311x.
- Shaft end with IP41 degree of protection.
- Bearings cannot be changed by the user as the built-in position sensor must be realigned after disassembly of the apparatus.

SER motors			364	366	368	3610	397	3910	3913	31112	31117	31122	31127
Maxium radial force F_r	**Cyclic ratio 10%**	N	231	275	302	320	600	520	500	1480	1550	1530	760
	Cyclic ratio 100%	N	89	107	117	124	340	400	430	690	800	860	760
Maxium axial force F_a	**Cyclic ratio 10%**	N	299				1240			1770			
	Cyclic ratio 100%	N	104				450			600			

Characteristics of motor-servodrive power connection cables

		GEA 2M 0AAAA 0••	GEA 2M 0ABAA 0••
External sleeve		PUR orange colored RAL 2003	
Insulation		TPM or PP/PE	
Capacity	pF/m	< 70 (conductors/shielding)	
Number of conductors (shielded)		[(4 x 1.5mm^2) + (2 x 1.0mm^2)]	[(4 x 2.5mm^2) + (2 x 1.0mm^2)]
External diameter	mm	11	13
Curvature radius (bend)	mm	110 (suitable for daisy-chaining)	130 (suitable for daisy-chaining)
Working voltage	V	600	
Maximum service length [1]	m	20	
Service temperature	°C	-15 to +85 (storage: -40 to +85)	
Certification		UL, CSA	

[1] For cable lengths of over 20 m, consult our Regional Berger Lahr Service Office

Characteristics of motor-servodrive encoder connection cables

		GEA 2E AAAAA 0••
Type of encoder		SinCos Hiperface Encoder
External sleeve		PUR green colored RAL 6018
Insulation		Polyester
Number of conductors (shielded)		5 x (2 x 0.25mm^2) + (2 x 0.5mm^2)
Connector		2 x 15-pin SubD type connectors
External diameter	mm	8.5 max.
Curvature radius (bend)	mm	85 (suitable for daisy-chaining)
Working voltage	V	300
Maximum service length [1]	m	20
Service temperature	°C	-15 to +85 (storage: -40 to +85)
Certification		UL, CSA

[1] For cable lengths of over 20 m, consult our Regional Berger Lahr Service Office

References for SER servomotors

Continuous stall torque	Associated servodrive	Peak stall torque	Maximum mechanical speed	References [1]	Weight
Nm		Nm	rpm		kg
0.29	CPD 170 1F10S1	0.85	12,000	**SER 364 3L 3S ••••**	1.110
0.48	CPD 170 1F10S1	1.3	12,000	**SER 366 3L 3S ••••**	1.420
	CPD 170 2F10S1	1.3			
	CPD 170 3N10S1	1.3			
0.7	CPD 170 1F10S1	1.62	12,000	**SER 368/3L 3S ••••**	1.730
	CPD 170 1F17S2	2.5			
	CPD 170 2F17S2	2.5			
	CPD 170 3N17S2	2.5			
0.7	CPD 170 2F10S1	2.22	12,000	**SER 368 3L 5S ••••**	1.730
	CPD 170 3N10S1	2.22			
0.9	CPD 170 1F17S2	2.85	12,000	**SER 3610 3L 3S ••••**	2.010
	CPD 170 2F17S2	2.85			
	CPD 170 3N17S2	2.84			
1.1	CPD 170 1F10S1	2.7	6,000	**SER 397 4L 3S ••••**	2.200
	CPD 170 2F10S1	2.73			
	CPD 170 3N10S1	2.73			
	CPD 170 1F17S2	3.4			
2.2	CPD 170 2F10S1	4.84	6,000	**SER 3910 4L 3S ••••**	3.300
	CPD 170 3N10S1	4.84			
	CPD 170 2F17S2	6.68			
	CPD 170 4F14S2	6.2			
2.9	CPD 170 2F17S2	8.35	6,000	**SER 3913 4L 3S ••••**	4.400
	CPD 170 3N17S2	8.35			
	CPD 170 4F14S2	7.3			
2.9	CPD 170 3N10S1	7.5	6,000	**SER 3913 4L 5S ••••**	4.400
	CPD 170 4F14S2	9.5			
4.2	CPD 170 2F17S2	8.1	6,000	**SER 31112 4L 3S ••••**	5.000
	CPD 170 3N17S2	8.1			
	CPD 170 1F28S3	11			
	CPD 170 2F28S3	11			
	CPD 170 3N42S3	11.7			
4.2	CPD 170 4F14S2	10.16	6,000	**SER 31112 4L 5S ••••**	5.000
6.6	CPD 170 3N17S2	11.8	6,000	**SER 31117 4L 3S ••••**	8.000
	CPD 170 1F28S3	17.9			
	CPD 170 2F28S3	17.9			
	CPD 170 3N42S3	20.8			
	CPD 170 4F34S3	20			
6.6	CPD 170 4F14S2	12.8	6,000	**SER 31117 4L 5S ••••**	8.000
10	CPD 170 2F28S3	30	4,500	**SER 31122 4L 5S ••••**	11.000
	CPD 170 3N42S3	30			
	CPD 170 4F34S3	28			
13.4	CPD 170 3N42S3	36	4,500	**SER 31127 4L 5D ••••**	13.000
	CPD 170 4F34S3	31.5			

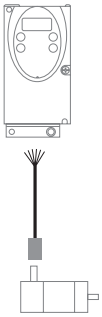
[1] To order an SER motor, fill out the end of each reference, see next page

		SER 364 3L 3S	**•**	**•**	**•**	**•**
Sensor integrated in motor	SinCos Hiperface, single turn encoder		**SO**			
Shaft seal Holding brake	IP41	Without holding brake		**COIP41**		
		With holding brake		**CBIP41**		
Gearbox						
Without gearbox					**OO**	
	Shaft end	Smooth				**O**
		With key according to DIN 6885				**K**
With gearbox	(shaft end with key)					
	Type [1]	PLE 60			**2•**	
		PLE 80			**3•**	
		PLE 120			**4•**	
		PLE 160			**5•**	
	Reduction ratio	Ratio 3:1			**•3**	
		Ratio 5:1			**•5**	
		Ratio 8:1			**•8**	

[1] For PLE gearboxes, see details on page 57. For other motor options, please consult your Regional Berger Lahr Service Office.

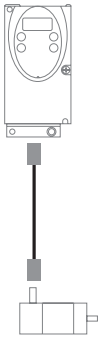
Connecting cables

Cables equipped with 1 connector (motor side)



Description	From	To	Composition	Length [1] m	Reference	Weight kg
Power cables with one connector	SER Motors	CPD17 servodrives, size 1 to 3	[(4 x 1.5mm^2) + (2 x 1mm^2)]	3	**GEA 2M 0AAAA 003**	0.810
				5	**GEA 2M 0AAAA 005**	1.215
				10	**GEA 2M 0AAAA 010**	2.285
				15	**GEA 2M 0AAAA 015**	3.405
				20	**GEA 2M 0AAAA 020**	4.510
		CPD17 servodrives, size 2 to 3	[(4 x 2.5mm^2) + (2 x 1mm^2)]	3	**GEA 2M 0BAAA 003**	1.070
				5	**GEA 2M 0BAAA 005**	1.670
				10	**GEA 2M 0BAAA 010**	3.213
				15	**GEA 2M 0BAAA 015**	4.760
				20	**GEA 2M 0BAAA 020**	6.300

Cables fitted with connector at both ends

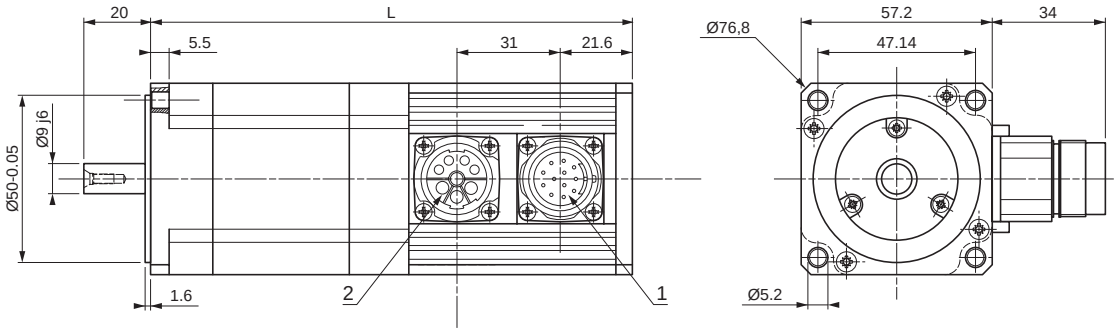


Description	From	To	Composition	Length m	Reference	Weight kg
SinCos Hiperface encoder cables fitted with two connectors	SER Motors	CPD17 servodrives	[5 x (2 x 0.25mm^2) + 1 x (2 x 0.5mm^2)]	3	**GEA 2E AAAAA 003**	-
				5	**GEA 2E AAAAA 005**	-
				10	**GEA 2E AAAAA 010**	-
				15	**GEA 2E AAAAA 015**	-
				20	**GEA 2E AAAAA 020**	-

[1] For cable length of over 20m, consult your Regional Berger Lahr Service Office

Dimensions

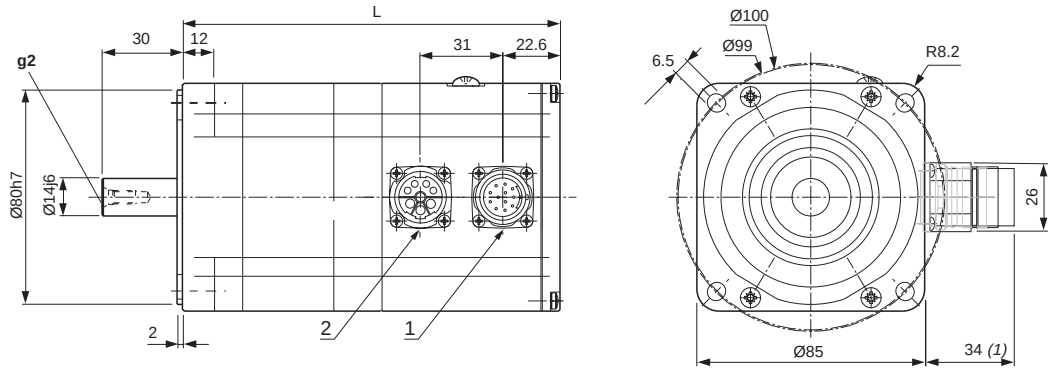
SER 364/366/368/3610



(1) Encoder connector
(2) Motor supply connector

(in mm)	L (without brake)	L (without brake)
SER 364	125.8	165.3
SER 366	144.3	183.8
SER 368	162.8	202.3
SER 3610	181.3	220.8

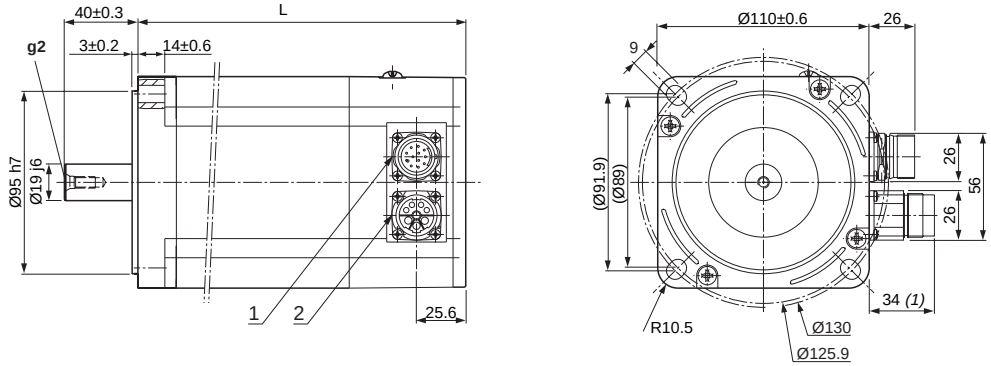
SER 397/3910/3913



(1) Encoder connector
(2) Motor supply connector

(in mm)	L (without brake)	L (without brake)
SER 397	141	186.3
SER 3910	171	216.5
SER 3913	201	246.5

SER 31112/31117/31122/31127



(1) Encoder connector
(2) Motor supply connector

(in mm)	L (without brake)	L (without brake)
SER 31112	132	198
SER 31117	180	246
SER 31122	228	294
SER 31127	276	342

Presentation

Holding brake (optional)

The holding brake is an electromagnetic pressure spring brake that blocks the motor's axle after the motor's current has been switched off. In case of an emergency, such as a power outage or an emergency stop, the drive is immobilized, significantly increasing safety. Blocking the motor's axis is also necessary in cases of torque overload, such as in case of vertical axis movement.
The holding brake must be controlled by an external holding brake controller GEA3EB001, see page 23.
The holding brake controller is for safe electrical isolation and lessenes the heating of the brake by reducing the control voltage.

Encoder

The measuring device is the single turn SinCos Hiperface. This measurement device is perfectly suitable for the CPD 17 range of controls. The use of this interface allows the motor to be identified by the servodrive and the control loops of the drive to be automatically initialized. This significantly simplifies installation.

Characteristics

Holding brake

Type of motor			SER 36•	SER 39•	SER 311•
Holding torque	M_{Br}	Nm	1.2	6	16
Inertia of rotor (brake only)	J_{Br}	kgcm²	0.07	0.2	0.35
Electrical clamping power	P_{Br}	W	10	24	28
Supply voltage		V	24 ±10%		
Current		A	0.42	1	1.17
Opening time		ms	14	40	60
Closing time		ms	13	20	30
Weight (brake only)		kg	0.3	1.8	3.0

Encoders

Type of encoder		SinCos single turn
Resolution using a CPD 17 servodrive	inc/rev.	16384 (default), 131072 max.
Precision of encoder (non-linear)	arc second	±45
Measurement method		High resolution, optical
Interface		Hiperface
Operating temperature range	°C	-20 to +115

Presentation

SER motors are also available with mounted PLE-type gearboxes.
Berger Lahr has selected and standardized the following gearbox models, available in a choice of 3 speed reduction ratios 3:1, 5:1 and 8:1.
The continuous stall torque and the peak torque values available from the gearbox are obtained by multiplying the characteristic values of the motor by the reduction ratio and the effiency of the gearbox (0.96).
The following table shows the preferred gearboxes for the motors. For other combinations see motor data sheets.

Type of motor	Speed reduction ratio		
	3:1	**5:1**	**8:1**
SER 364	PLE 60	PLE 60	PLE 60
SER 366	PLE 60	PLE 60	PLE 60
SER 368	PLE 60	PLE 60	PLE 80
SER 3610	PLE 60	PLE 60	PLE 80
SER 397	PLE 80	PLE 80	PLE 80
SER 3910	PLE 80	PLE 80	PLE 120
SER 3913	PLE 80	PLE 80	PLE 120
SER 31112	PLE 120	PLE 120	PLE 120
SER 31117	PLE 120	PLE 120	PLE 120
SER 31122	PLE 160	PLE 160	PLE 160
SER 31127	PLE 160	PLE 160	PLE 160

Characteristics

Gearbox		**PLE 60**	**PLE80**	**PLE 120**	**PLE 160**
Type of gearbox		Planetary gearbox with single reduction stage, straight teeth			
Backlash	min arc	<20	<12	<8	<6
Torsion rigidity	Nm/ min arc	1.5	4.5	11	32.5
Noise level	db (A)	58	60	65	70
Housing		Black anodized aluminium			
Shaft material		C 45			
Tightness of shaft output		IP54			
Lubrication		No lubrication required			
Average lifetime [1]	h	10000: S1 mode (permanent service) and 100% continuous torque			
		20000: S1 mode (permanent service) and 85% continuous torque			
Mounting position		All positions			
Operating temperature	°C	-25 to +90 (shot term, +120)			
Weight (gearbox only)	kg	0.900	2.100	6.000	18.000

[1] Data in operating hours for a 10% fault probability rating

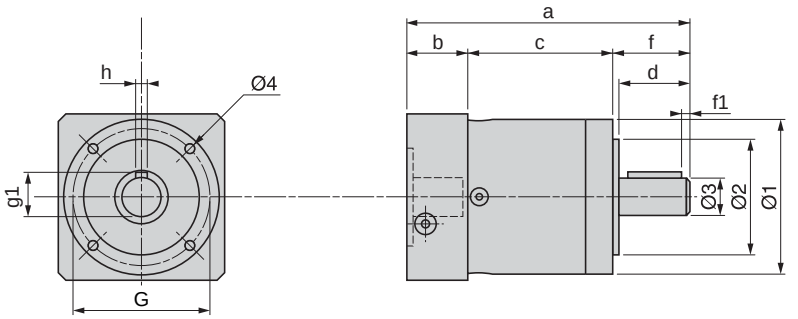
Combining an SER motor with a PLE gearbox

Gearbox			**PLE 60**	**PLE80**	**PLE 120**	**PLE 160**
Efficiency			0.96			
Maximum permitted radial force [1] [2]		N	500	950	2000	6000
Maximum permitted axial force [2]		N	600	1200	2800	8000
Inertia of gearbox	3:1	kgcm²	0.135	0.77	2.63	12.14
	5:1	kgcm²	0.078	0.45	1.53	6,07
	8:1	kgcm²	0.065	0.39	1.32	4.3
Continuous output torque (T_{2N})	3:1	Nm	12	40	80	4000
	5:1	Nm	16	50	110	450
	8:1	Nm	15	50	120	450

[1] Data in operating hours for a 10% fault probability rating

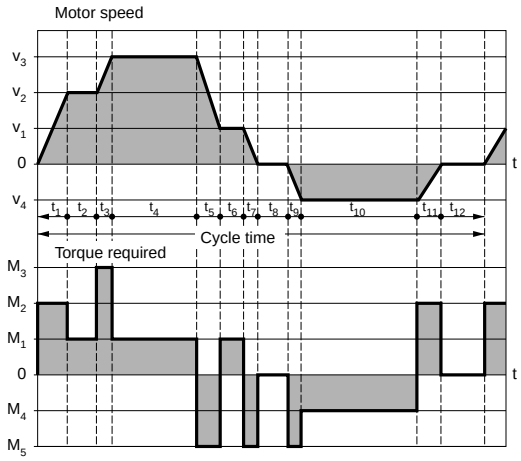
[2] Force applied at mid-distance of the output shaft.

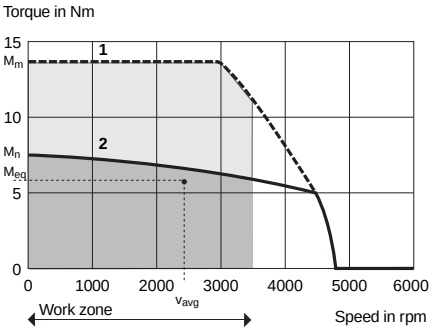
Dimensions (in mm)



	PLE 60	PLE80	PLE 120	PLE 160
a	106.5	134	176.5	255.5
b	24.5	33.5	47.5	64.5
c	47	60.5	74	104
d	30	36	50	80
f	35	40	55	87
f1	2.5	4	5	8
g1	16	22.5	28	43
h	5	6	8	12
Ø1	60	80	115	160
Ø2 [1)]	40	60	80	130
Ø3 [1]	14	20	25	40
G	52	70	100	145
Ø4	M5 x 8	M6 x 10	M10 x 16	M12 x 20

1) Tolerance H7





Sizing the servomotor

This page is to help you to understand the method used for calculation.
In order to size a motor, you need to know the equivalent thermal torque and average speed required by the mechanics to be associated with the motor. Both values are calculated by using a motor cycle trend diagram. They should be compared with the speed/torque curves given for each motor.

Motor cycle trend diagram

The motor cycle is made up of several sub-cycles with constant torques.
This division can be used to calculate, for each phase:

- the duration (t_i)
- the speed (v_i)
- the required torque (M_i)

The trend diagrams opposite show the 4-phase types :

- constant acceleration during t_1, t_3 and t_9
- at work during times t_2, t_4, t_6, and t_{10}
- constant deceleration during t_5, t_7 and t_{11}
- motor stopped during t_8 and t_{12}

The total duration of the cycle is calculated as follows:
Cycle time = $t_1 + t_2 + \ldots + t_{12}$

Calculating the average speed

The average speed is calculated using the formula:

$$v_{avg} = \frac{\sum(|v_i| \cdot t_i)}{\sum t_i}$$

- v_i corresponds to the various working speeds
- $v_i/2$ corresponds to the average speeds during the constant acceleration and deceleration phases. In the example above:

Duration t_i	t_1	t_2	t_3	t_4	t_5	t_6	t_7	t_8	t_9	t_{10}	t_{11}	t_{12}
Speed $\lvert v_i \rvert$	$\frac{\lvert v_2 \rvert}{2}$	$\lvert v_2 \rvert$	$\frac{\lvert v_2 \rvert + \lvert v_3 \rvert}{2}$	$\lvert v_3 \rvert$	$\frac{\lvert v_1 \rvert + \lvert v_3 \rvert}{2}$	$\lvert v_1 \rvert$	$\frac{v_i}{2}$	0	$\frac{\lvert v_4 \rvert}{2}$	$\lvert v_4 \rvert$	$\frac{\lvert v_4 \rvert}{2}$	0

The average speed is calculated as follows:

$$v_{avg} = \frac{\frac{v_2}{2} \cdot t_1 + v_2 \cdot t_2 + \frac{v_2 + v_3}{2} \cdot t_3 + v_3 \cdot t_4 + \frac{v_1 + v_3}{2} \cdot t_5 + v_1 \cdot t_6 + \frac{v_1}{2} \cdot t_7 + \frac{v_4}{2} \cdot t_9 + v_4 \cdot t_{10} + \frac{v_4}{2} \cdot t_{11}}{\text{Cycletime}}$$

Calculating the equivalent thermal torque

The equivalent thermal torque is calculated using the formula:

$$M_{eq} = \sqrt{\frac{\sum(M_i^2 \cdot t_i)}{\text{Cycletime}}}$$

In the example above, this formula gives the following calculation:

$$M_{eq} = \sqrt{\frac{M_2^2 \cdot t_1 + M_1^2 \cdot t_2 + M_3^2 \cdot t_3 + M_5^2 \cdot t_5 + M_1^2 \cdot t_6 + M_5^2 \cdot t_7 + M_5^2 \cdot t_9 + M_4^2 \cdot t_{10} + M_2^2 \cdot t_{11}}{\text{Cycletime}}}$$

Determining the motor size

The point defined by the 2 calculations above, where:

- the vertical axis represents the average speed (v_{avg})
- the horizontal axis represents the thermal torque (M_{eq})

The point must be within the area bounded by curve (2) and the work zone.
The motor cycle trend diagram should also be used to ensure that all torques M_i required for the different speeds v_i during the various cycle phases are within the area bounded by curve (1) and the work zone.

(1) Maximal torque

(2) Nominal torque

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