SEW EURODRIVE

Smart Servo Package

Simple, fast and diverse

The Smart Servo Package – simple, fast and diverse

The Smart Servo Package from SEW-EURODRIVE contains all the components required for a complete automation solution in one coordinated product package. It has been optimized specifically for the most important application criteria in the power range up to 5.5 kW and in the voltage range of 1x and 3x AC 230 V.

The aim is to make a servo or automation task simpler, faster, and able to be implemented efficiently. The most various user and customer interfaces have been optimized and simplified for this purpose.

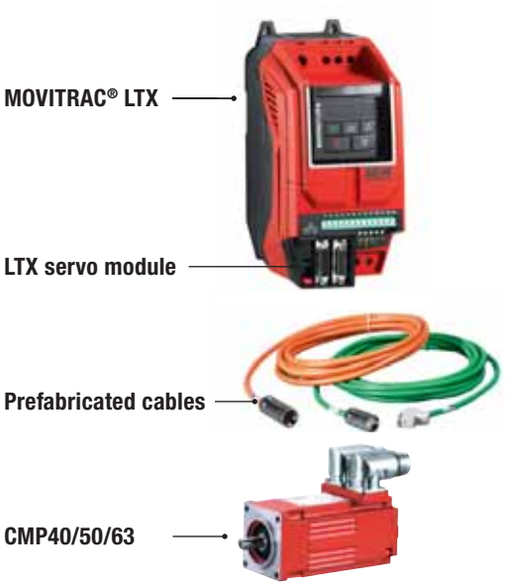
The Smart Servo Package includes the following components:

- Programmable or configurable SEW controller (MOVI-PLC® / CCU)
- Flexible universal servo inverter (MOVITRAC® LTX)
- Highly dynamic servomotors with absolute encoders (CMP40, 50, 63)
- Compact servo gear units (planetary/right-angle*) (PSC / W*)
- "Ready-to-use" accessories (cables, chokes, filters, etc.)

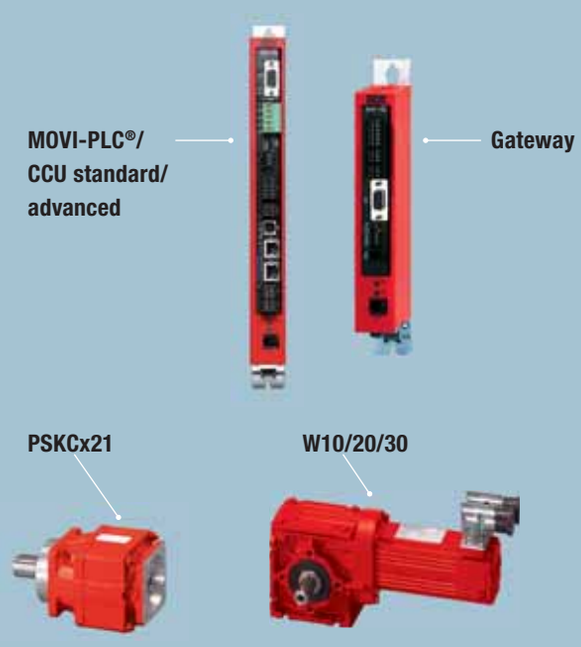
* in preparation

The simple combination design of the Smart Servo Package allows for an extremely high level of flexibility with various extension products, which can be optionally combined, based on a standard package. This means the Smart Servo Package can be flexibly set up and adjusted according to the requirements of the application, communication and automation structure.

Core products (standard package)



Extension products (can be optionally combined)



The advantages of the Smart Servo Packages at a glance:

Smart Automation – Controllers from SEW-EURODRIVE let you easily and conveniently create programmable and / or configurable automation solutions.

Smart Technology – The MOVITRAC® LTP universal inverter with LTX servo module provides two motor operating modes. Servo closed loop, and asynchronous motors can be operated.

Smart Selection – Predefined combinations make product selection and coordination more efficient, less time consuming and less prone to errors, while offering a high level of flexibility.

Smart Integration – Controllers and gateways let you connect the Smart Servo Package just as easily to higher-level controllers (Profibus, ProfiNet, EtherNet/IP, DeviceNet, Modbus TCP) as with analog interfaces (+/– 10 V, step/dir, encoder).

Controllers from SEW-EURODRIVE: MOVI-PLC® or CCU

Description from page 6
Techn. data from page 44

MOVI-PLC®
- IEC 61131 programming (LD, FBD, STL, ST, SFC)
- Preconfigured program module to quickly implement an application
- Graphical configuration and diagnostics (MultiMotion)
- CPU performance class “Standard”
  - Positioning and speed applications
- CPU performance class “Advanced”
  - Functions of the performance class “standard”
  - Synchronous operation, caming, kinematics, etc.

CCU
- Simple and convenient startup with operating software (MotionStudio)
- Simple configuration of the application without programming using the Application Configurator
- Standardized fieldbus interfaces to the higher-level controller
- CPU performance class “Standard”
  - Positioning and speed applications
- CPU performance class “Advanced”
  - Functions of the performance class “standard”
  - Multi-axis application modules (energy-efficient SRS, SyncCrane, etc.)

Connection to non-SEW controllers

Fieldbus interfaces
Using the UOH/DFx gateways, the Smart Servo Package can be easily used as speed controlled drive on any controller.

Analog interfaces
Connection with a non-SEW controller can be easily established with the interfaces +/–10 V, step & direction and encoder control.

MOVITRAC® LTX servo inverters

Description from page 10
Techn. data from page 44

- 1x / 3x AC 230 V (750 – 5500 W)
- 2 frame sizes / 6 different power ratings
- Powerful output stage – Overload: 200% for 60 s / 250% for 2 s
- Controller interfaces or analog interfaces
- Suitable motors:
  - Synchronous motors with HIPERFACE®
  - Asynchronous motors without encoder

Servomotors

Description from page 14
Techn. data from page 45

- Optimized combination with MOVITRAC® LTX
- CMP 40/50/63 motors
- Standstill torques up to 7.1 Nm
- Peak torques up to 17.9 Nm
- Multi-turn absolute encoder
- Electronic nameplate for automatic motor parameterization
- Optional holding brake

Optional servo gear units

Description from page 16
Techn. data from page 45

- With adapter mounting or directly mounted at the factory
- Single-stage planetary servo gear units PSKC 221/321/521
  - Gear ratios i = 5, 7, 10
- Right-angle servo gear units based on W10, 20, 30 gear units*

Prefabricated cables and accessories

Description from page 18
Techn. data from page 46

- Prefabricated cables in standard lengths: 5 / 10 / 15 / 20 / 25 m

* in preparation

Smart Automation with controllers from SEW-EURODRIVE

SEW-EURODRIVE offers various software packages and program modules for implementing drive tasks and motion control tasks. These software packages and program modules are based on the performance class of the controllers. Corresponding variants are offered as part of the Smart Servo Package. The software package MultiMotion or MultiMotion light is used for applications with MOVI-PLC® as freely programmable solution. The CCU software package is used for purely configurable solutions.

Controller (Hardware)

- Different CPU performance classes (**standard**: DHx**21**, **advanced**: DHx**41**)
- Different types (IP20 as option card, master module or UOH housing, integrated in MOVIFIT® or MOVIPRO®)
- Periphery such as I/O system, remote maintenance modem

CCU

(configurable application controller)

- SD card OMC41B-Tx
- Application modules
- No programming tool

MOVI-PLC®

(freely programmable motion and logic controller)

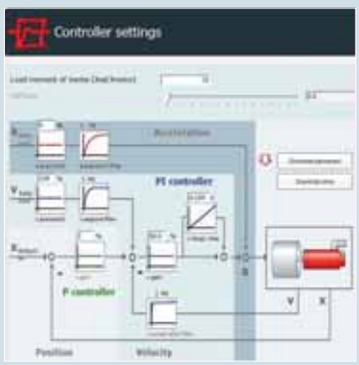
- SD card OMH41B-Tx
- IEC 61131-3 programming
- Libraries/program modules
- Programming tool

Smart Automation – with the CCU software package (Configurable Control Unit): configurable, standardized and simple

For applications with a predominant share of positioning and speed requirements, motion control made by SEW-EURODRIVE offers a configurable control unit (CCU) with standardized and immediately executable application modules, which just have to be parameterized. Its functions match the specific application and can be configured easily and quickly without any programming knowledge. An integrated diagnostic function enables quick and simple startup. The predefined solution modules make programming redundant and even impossible.

MOVITRAC® LTX configuration

Tool: DriveStartup
- Motor startup
- Communication settings
- Perform for every drive



CCU controller configuration

Tool: Application Configurator
- Communication settings
- Selection of application modules
- Configuration of the application
- Diagnostics/control mode

Overview of benefits:

- Parameterizable solutions for demanding motion control applications
- Application modules can be used for all drive electronics components from SEW-EURODRIVE
- Easy graphical configuration
- Convenient module diagnostics with control mode for fast startup without active higher-level PLC
- Process data monitor with control mode to support fieldbus startup
- Integrated trace for drive optimization and process diagnostics
- Engineering via USB or Ethernet
- Data management via SD card for the entire application module and all drive parameters

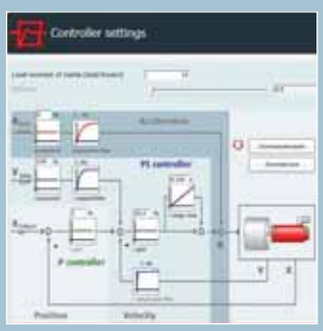
Smart Automation – MOVI-PLC® with the MultiMotion software package: universal, customizable and fast

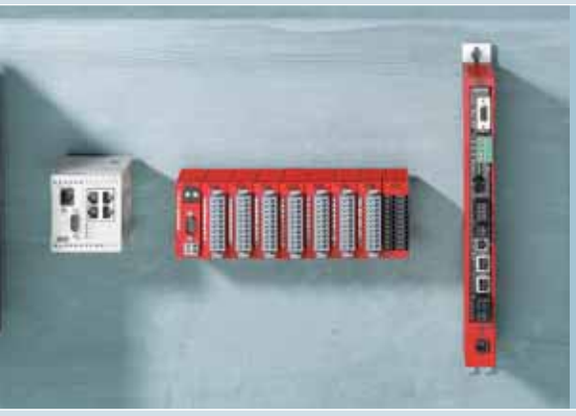
MultiMotion is the ideal program module for applications where several axes are connected via synchronization or electronic cam. This makes it the ideal solution platform for all types of processing machines. The functionality of the program module is independent of the drive electronics used, for example the MOVITRAC® LTX universal inverter or MOVIAXIS®.

The automation solution can be simulated, parameterized and programmed offline at the desk using virtual axes. The MultiMotion program module is available in two types: "MultiMotion" or "MultiMotion light". The performance of MultiMotion makes it suited as a general solution platform for all production machines, while Multi-Motion light is primarily suited for positioning.

MOVITRAC® LTX configuration

Tool: DriveStartup
- Motor startup
- Communication settings
- Perform for every drive





MultiMotion program package configuration

Tool: Configuration wizard

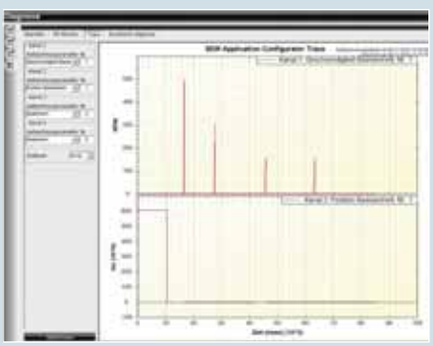
A graphical wizard is used to conveniently enter all relevant axis-to-axis relationships and to preconfigure the basic properties of the entire driveline of the machine/system. Only specific functions of the individual applications have to be programmed additionally.

Tool: Diagnostics

Graphical diagnostics provides a quick overview of the current status of an axis. The integrated control mode allows for starting up complex sequences, such as electronic cam, even without programming.

Tool: Trace

Any variable can be recorded for a defined time interval using an integrated trace function.



Overview of benefits:

- Universal (MOVIDRIVE®, MOVIAXIS®, MOVITRAC® LTX, MOVIGEAR® B)
- Engineering via USB or Ethernet
- Data is managed using an SD card for the entire application module and all drive parameters
- Real and virtual axes are treated the same
- Program functions can be tested offline without physical axes
- Graphical configuration and diagnostics without programming tool
- Comprehensive functionality
  - Automatic coupling to any position in the cam profile
  - Overlaying profiles
  - Ideal as motion platform for the entire machine spectrum

Smart Drive with Smart Technology – MOVITRAC® LTP and LTX servo module

The MOVITRAC® LTX universal servo inverter is based on a MOVITRAC® LTP-B, which is additionally equipped with the optional LTX servo module. The result is an inverter for universal use with all the required motion control functions, high power density, and simple operation.

MOVITRAC® LTP B + **LTX servo module** = **MOVITRAC® LTX**

MOVITRAC® LTX is basically available in two sizes for 1x / 3x AC 230 V and covers a power range of up to 5.5 kW.

MOVITRAC® LTX is easy to use, saves time during startup and is cost-optimized for its field of application. MOVITRAC® LTX is particularly suited for normal positioning applications and multi-axis applications with dynamic control in small to medium-sized machines or machine modules.

Overview of benefits:

MOVITRAC® LTX excels by its functionality, flexibility and connectivity.

- Two motor operating modes (asynchronous, synchronous)
- Analog interfaces for connecting non-SEW controllers
- Gateway and controller connection for higher-quality automation and drive tasks
- Integrated brake chopper and braking resistors that can be integrated
- Simple and convenient keypad

1-phase system AC 230 V for 3-phase AC 230 V motors

Type MC LTP B. …	Size	Part number	I_N 100%	Up to 60 s 200%	Up to 2 s 250%	Power
0008-2B1-4-00	2	1825 1382	3.2 A	6.3 A	7.9 A	750 W
0015-2B1-4-00		1825 1528	5.5 A	10.9 A	13.7 A	1500 W
0022-2B1-4-00		1825 1641	6.9 A	13.7 A	17.2 A	2200 W

3-phase system AC 230 V for 3-phase AC 230 V motors

Type MC LTP B. …	Size	Part number	I_N 100%	Up to 60 s 200%	Up to 2 s 250%	Power
0008-2A3-4-00	2	1825 1358	3.2 A	6.3 A	7.9 A	750 W
0015-2A3-4-00		1825 1471	5.5 A	10.9 A	13.7 A	1500 W
0022-2A3-4-00		1825 1617	6.9 A	13.7 A	17.2 A	2200 W
0030-2A3-4-00	3	1825 1722	9.5 A	18.9 A	23.6 A	3000 W
0040-2A3-4-00		1825 1765	12.6 A	25.2 A	31.5 A	4000 W
0055-2A3-4-00		1825 1846	16.5 A	24.7 A	33.0 A	5500 W

Servo module – The LTX servo module is obligatory

Type	Part number
LTX-H1A	1823 9226

MOVITRAC® LTX – Overview of functions

Size	Dimensions (mm)		
	Height	Width	Depth
2	221	110	185
3	261	132	205

MOVITRAC® LTX – Simple and complete

Fieldbus/network communication	
PROFIBUS DP-V1	○
DeviceNet	○
PROFINET	○
EtherNet/IP	○
Modbus/TCP	○
SBUS	●
Ethernet TCP/IP, UDP/IP	○

Technology functions	
X, V control	●
Easy tuning	●
2x touch probe	●
Analog interface +/– 10 V (setpoint values)	●
Step + direction interface (setpoint values)	●
Step + direction interface (setpoint values)	●
Jog mode	●
Reference travel	●
Limit switches	●

Encoder/motor data	
Suitable motors: synchronous, synchronous without encoder*, asynchronous	●
Automatic motor identification	●
Multi-turn encoder	●

Basic unit functions	
User level – password management	●
Keypad (5 keys)	●
Bus that can be integrated	●
DC bus can be connected upstream*	●
Brake management, hoist capable	●
Digital inputs (5)/analog inputs (2)	●
Digital outputs/analog outputs (2)	●
2x relays (brake control)	●

Diagnostics/service/monitoring	
C2 EMC class	●
Scope/trace	○
Therm. motor management	●
Therm. inverter management	●
Electronic nameplate	●
Central data storage/SD card	○
Auto reload data record for axis replacement	○

Safety technology	
STO (Safe Torque Off) cat. 3*	●

● Basic function

○ With controllers from SEW-EURODRIVE or UOH/DFx gateways

* in preparation

Smart Motors – CMP servomotors: compact and functional

The CMP servomotors with matched AC 230 V windings are part of the electromechanics of the Smart Servo Package. Their control range is optimized for MOVITRAC® LTX based on a multiturn feedback with nameplate function. The motors are optionally available with or without brake and come equipped with keyway and key as standard.

The following motors are available with the corresponding assignment to MOVITRAC® LTX units:

Maximum acceleration torques in the Smart Servo Package

Motor type	**M_0 (Nm)**	**MC LTP-B… (AC 230 V units)**						
		P_n (W)	750	1500	2200	3000	4000	5500
		I_n (A)	3.2	5.5	6.9	9.5	12.6	16.5
		I_{max} (A)	7.9	13.7	17.2	23.6	31.5	33.0
			LTX size 2			LTX size 3		
CMP40M	0.8	M_{max} (Nm)	**3.4**					
CMP50S	1.3	M_{max} (Nm)	**3.9**					
CMP50M	2.4	M_{max} (Nm)		**7.2**				
CMP50L	3.3	M_{max} (Nm)			**9.2**	**12.2**		
CMP63S	2.9	M_{max} (Nm)				**9.8**		
CMP63M	5.3	M_{max} (Nm)					**14.6**	
CMP63L	7.1	M_{max} (Nm)						**17.9**

Motors within the Smart Servo Package

CMP servomotor with brake, speed class 4500 rpm

Type[1)]	Part number for logistics and stockkeeping	J_{MOT} x 10^{-4} kgm²	M_B Nm
CMP40M / BP / KY /AK0H / SB1	1477 0490	0.18	0.95
CMP50S / BP / KY /AK0H / SB1	1477 0504	0.48	3.1
CMP50M / BP / KY /AK0H / SB1	1477 0512	0.73	4.3
CMP50L / BP / KY /AK0H / SB1	1477 0520	0.98	4.3
CMP63S / BP / KY /AK0H / SB1	1477 0539	1.49	7
CMP63M / BP / KY /AK0H / SB1	1477 0547	2.26	9.3
CMP63L / BP / KY /AK0H / SB1	1477 0555	3.03	9.3

[1)] Motors come equipped with key and conform to European (CE), USA (UR) and Canadian (CSA) standards.

CMP servomotor, speed class 4500 rpm

Type[1)]	Part number for logistics and stockkeeping	J_{MOT} x 10^{-4} kgm²
CMP40M / BP / KY /AK0H / SM1	1477 0415	0.15
CMP50S / BP / KY /AK0H / SM1	1477 0423	0.42
CMP50M / BP / KY /AK0H / SM1	1477 0431	0.67
CMP50L / BP / KY /AK0H / SM1	1477 0458	0.92
CMP63S / BP / KY /AK0H / SM1	1477 0466	1.15
CMP63M / BP / KY /AK0H / SM1	1477 0474	1.92
CMP63L / BP / KY /AK0H / SM1	1477 0482	2.69

[1)] Motors come equipped with key and conform to European (CE), USA (UR) and Canadian (CSA) standards.

Overview of benefits:

The CMP series allows for fast and simple connection via right-angle flanged socket connectors. The standard shaft type of CMP servomotors has a keyway/key. As an option, this servomotor series can be combined with single-stage right-angle or planetary gear units (with adapter or directly mounted).

- Very compact, convection-cooled motor
- Electronic nameplate for quick and simple startup
- Low-inertia rotor of the CMP minimizes the percentage of energy required for motor acceleration
- Spring-loaded holding brake
- Can be used worldwide with

Smart Gears – PSC planetary servo gear units: flexible and economical

The servomotors can optionally be combined with right-angle* or planetary gear units with B5 flange for further adaptation to the application. In the standard version as adapter gear units, they are especially suited for flexible and simple installation, also by the customer. SEW-EURODRIVE offers these servo gear units also for direct mounting according to the requirements. The gear units in the Smart Servo Package are always single-stage gear units with key.

* in preparation

Motor/servo gear unit combination for planetary gear units

Motor type	**M_0 (Nm)**	**PSKC planetary servo gear units**								
		Torque class (Nm)	30			65			160		
		Size	221			321			521		
		Gear ratios 1-stage (i)[1)]	5:1	7:1	10:1	5:1	7:1	10:1	5:1	7:1	10:1
CMP40M	0.8		■	■	■						
CMP50S	1.3		■	■	■	■	■	■			
CMP50M	2.4		■	■	■	■	■	■			
CMP50L	3.3		■	■	■	■	■	■			
CMP63S	2.9					■	■	■	■	■	■
CMP63M	5.3					■	■	■	■	■	■
CMP63L	7.1					■	■	■	■	■	■

1) Other gear ratios (also 2-stage) are available on request

Low-backlash PSKC planetary servo gear unit with ECH adapter mounting to CMP40-63 Smart Motors.

Planetary servo gear units within the Smart Servo Package

PSKC servo gear units with ECH motor adapter

Type	Part number for logistics and stockkeeping	Motor	J_{GEAR} x 10^{-4} kgm²
PSKC221 with motor adapter ECH02/01/02	1477 0563	CMP40	0.26
	1477 0571		0.23
	1477 0598		0.22
PSKC221 with motor adapter ECH02/08/04	1477 0601	CMP50	0.26
	1477 0628		0.23
	1477 0636		0.22
PSKC321 with motor adapter ECH03/08/04	1477 0644	CMP50	0.92
	1477 0652		0.85
	1477 0660		0.81
PSKC321 with motor adapter ECH03/13/06	1477 0679	CMP63	0.92
	1477 0687		0.85
	1477 0695		0.81
PSKC521 with motor adapter ECH05/13/6	1477 0709	CMP63	3
	1477 0717		2.7
	1477 0725		2.5

Overview of benefits:

- High permitted torques up to 163 Nm (in the Smart Servo Package)
- High permitted overhung loads up to 6000 N
- 99% efficiency for highest energy efficiency
- Highest level of reliability, availability and durability
- Low rotational clearance < 10 angular minutes for accurate positioning
- Lubrication for life with oil lubrication (for maintenance-free operation)
- Low self-heating due to high efficiency
- Any mounting position is possible resulting in great installation flexibility and reduced stockkeeping
- Motor can be mounted easily using ECH adapter
- With surface protection OS1 through OS4 as option
- Direct mounting as option

Smart Accessories – The connection between the products: complete, fast and trouble-free

The matching accessories are crucial to ensure proper functioning. Their purpose is to optimally ensure startup and the ongoing process. SEW-EURODRIVE offers the system accessories for the Smart Servo Package that are necessary to implement your application in an easy, quick, and efficient manner.

Available accessory components in the Smart Servo Package:

Motor and encoder cables

For simple connection to motors and inverters, all cables are available in 5 predefined standard lengths. Furthermore, variants are offered for cable carrier installation and fixed installation as well as brakemotor and non-brakemotor cables. Using non-SEW cables can reduce the package performance.

Cable length	Part number: Encoder cable, 6 x 2 x 0.25 mm²	
	Fixed installation	Cable carrier installation
type	13324535	13324551
5	1840 3255	1840 3301
10	1840 3263	1840 3328
15	1840 3271	1840 3336
20	1840 3743	1840 3786
25	1840 3751	1840 3794

Cable length	Part number: Motor cable without brake, 4 x 1.5 mm²	
	Fixed installation	Cable carrier installation
type	5904544	5906245
5	1840 2992	1840 8036
10	1840 3492	1840 8044
15	1840 3018	1840 8052
20	1840 3506	1840 8060
25	1840 3514	1840 8079

Cable length	Part number: Brakemotor cable with brake, 4 x 1.5 mm² + 2 x 1 mm²	
	Fixed installation	Cable carrier installation
type	13354345	13354388
5	1840 7897	1840 7951
10	1840 7900	1840 7978
15	1840 7919	1840 7986
20	1840 7927	1840 7994
25	1840 7935	1840 8001

Braking resistors

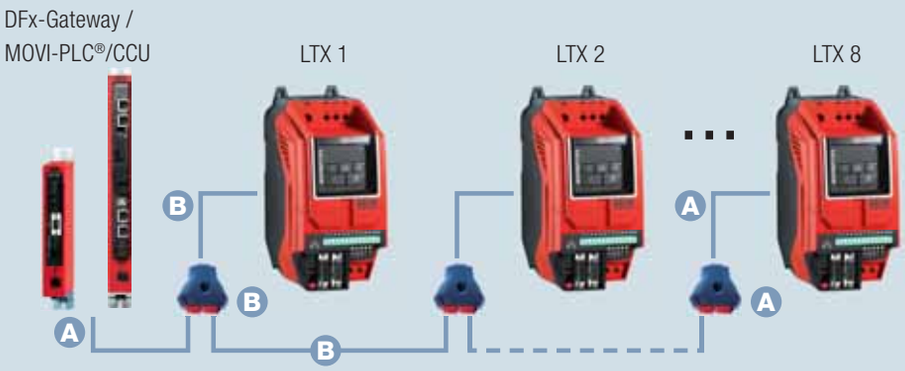
Due to the DC link with high temporary energy storage capacity, braking resistors are basically only needed with high dynamics/mass moments of inertia. In such cases, you can choose between braking resistors that can be integrated directly in the housing or braking resistors that are mounted externally.

LTX		Braking resistor		
Output current I_N [A]	Size	Horizontal travel distance		
		Type	Part no.	Design
3.2	2	BWLT 100 002	1820 8770	Flat design*
5.5	2	BW047-003	0826 2659	Flat design
6.9	2	BW047-005	0826 2683	Flat design
9.5	3	BW047-005	0826 2683	Flat design
12.6	3	BW147-T	1820 1342	Wire resistor
16.5	3	BW147-T	1820 1342	Wire resistor

LTX		Braking resistor		
Output current I_N [A]	Size	Vertical travel distance		
		Type	Part no.	Design
3.2	2	BWLT 100 002	1820 8770	Flat design*
5.5	2	BW047-005	0826 2683	Flat design
6.9	2	BW147-T	1820 1342	Wire resistor
9.5	3	BW047-005	0826 2683	Flat design
12.6	3	BW147-T	1820 1342	Wire resistor
16.5	3	BW147-T	1820 1342	Wire resistor

* can be integrated in the inverter

Cable sets for easily connecting inverters and controllers (CCU/MOVI-PLC® and gateway)



Example: Number of cable sets in a 4-axis system = 1 basic set + (4 - 1) x extension set

Basic set A: Includes a MOVI-PLC® /gateway connection cable, branch cable to an axis, and a Y terminating resistor.
Is required when connecting at least one axis to MOVI-PLC®/gateway.

Cable set A (basic set)	Cable length to axis 0.5 m	Content	Quantity	Description
			1	Controller + Gateway connection RJ45 open end, 0.5 m
Part number	1840 8095		1	Cable terminator
Designation	(OP LT 003 A)		1	Drive connector cable 0.5 m, RJ45-RJ45

Extension set B: Includes a 0.5 m axis branch cable, an axis-axis cable with a length of 0.5 m, and a Y splitter.
Is required for every additional axis in addition to the first axis. (Number B = number of axes - 1)

Cable set B (Extension set)	Cable length to axis		Content	Quantity	Description
	0.5 m	1 m			
				1	Cable splitter
Part number	1840 8109	1840 8117		1	Drive connector cable 0.5 m, RJ45-RJ45
Designation	(OP LT 005 B)	(OP LT 010 B)		1	Cable between drives, with variable length

Line chokes

The optional line chokes reduce the generation of harmonics and power supply distortion. Furthermore, they protect MOVITRAC® LTX against voltage peaks and power supply peaks.

LTX				
Output current I_N [A]	**Size**	**Output choke**	**Phase**	**Part no.**
3.2	2	ND LT 010 290 53	3	1820 1679
5.5	2	ND LT 010 290 53	3	1820 1679
6.9	2	ND LT 010 290 53	3	1820 1679
9.5	3	ND LT 036 081 53	3	1820 1687
12.6	3	ND LT 036 081 53	3	1820 1687
16.5	3	ND LT 036 081 53	3	1820 1687

Line filters and EMC

Separate/external line filters are not required because LTX/LTP-B always meets the C2 level according to EN 61800-3.

The automation concept of SEW-EURODRIVE – open and powerful

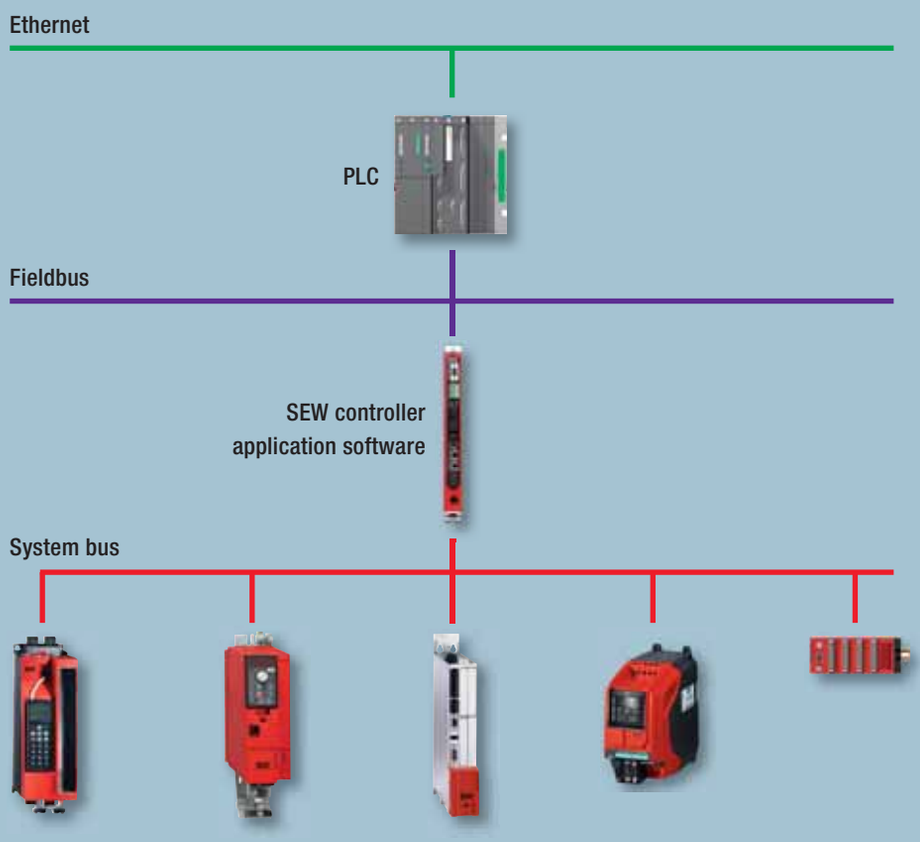
SEW-EURODRIVE offers automation solutions in two basic integration variants with the focus on motion control.

One option for generating added value with automation systems from SEW-EURODRIVE is the seamless and high-performance integration and connection of PLC systems – **Motion control with non-SEW PLC**.

Another option is the **complete automation with SEW-EURODRIVE** based on the various controller classes and library, application and program modules.

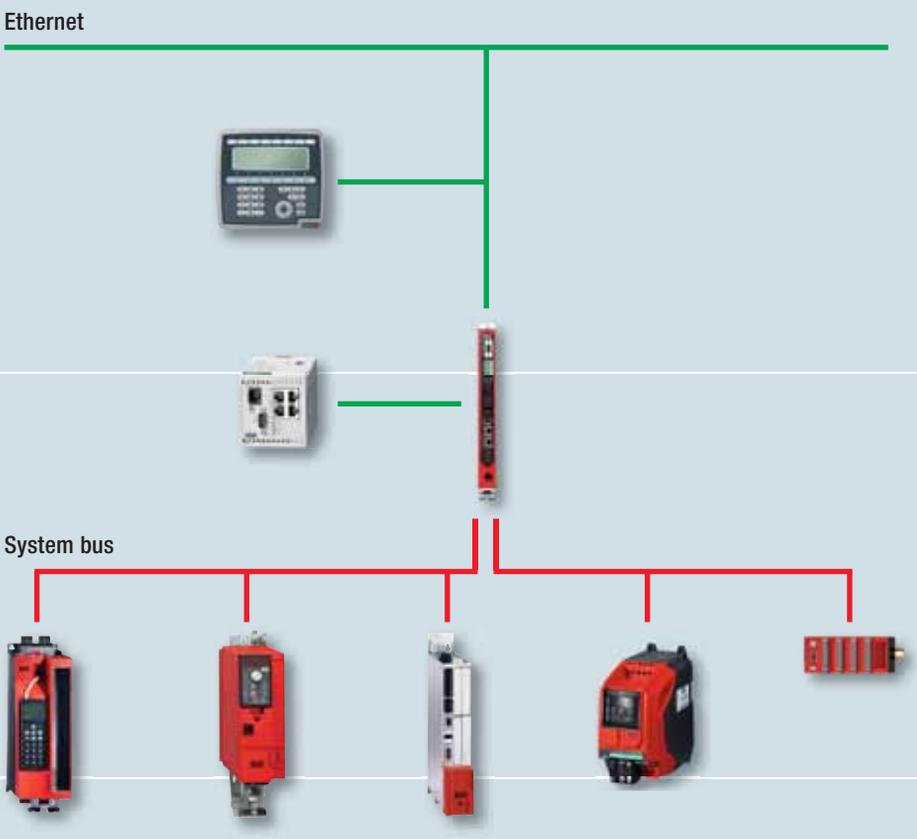
Motion control with non-SEW PLC

- Open connection to the PLC via standard interfaces (fieldbus, industrial Ethernet)
- (Module) controller from SEW-EURODRIVE: Can be programmed or configured
- Application software
- Engineering access
- Data storage
- Scalable functionality with standardized, system-independent interface

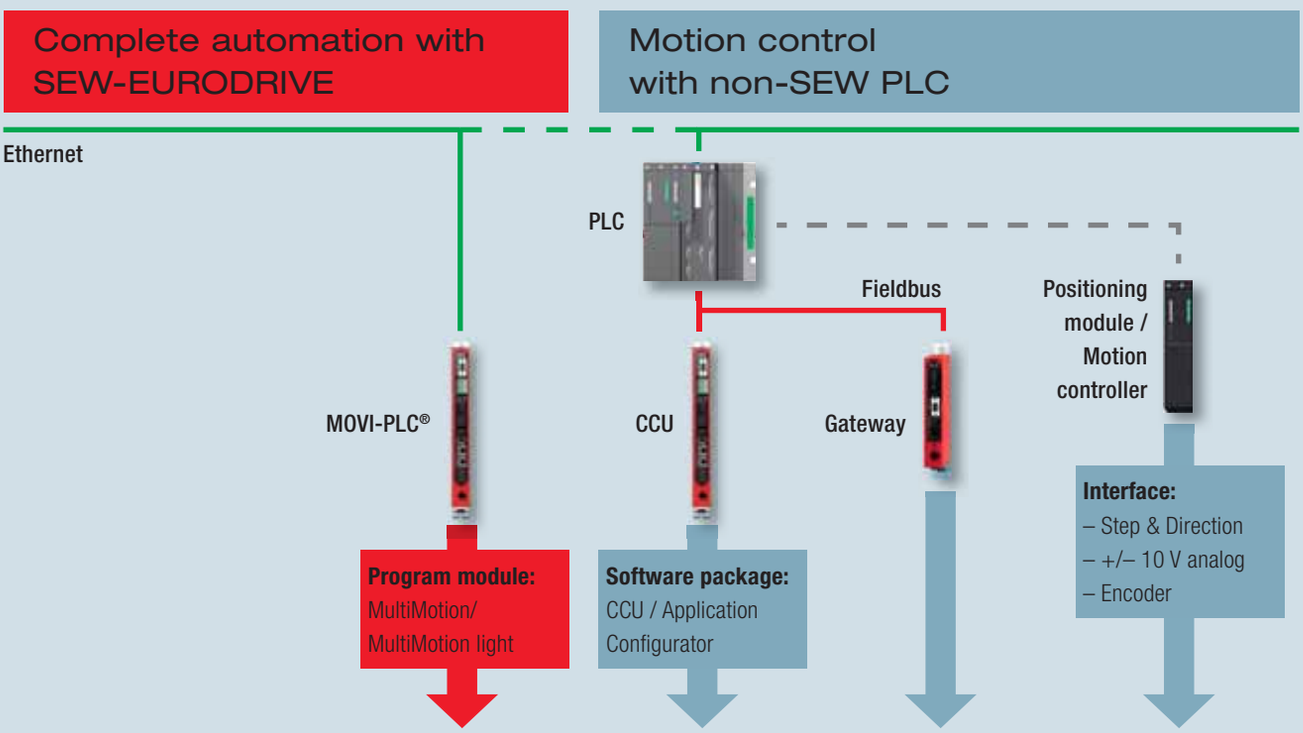


Complete automation with SEW-EURODRIVE

- Stationary and mobile DOP operator panels
- OPC server for connection to PC-based visualization systems
- Driver for non-SEW panels
- MOVI-PLC® programmable in IEC 61131-3
- Extensive motion control functions and Standard PLC functionality
- Variety of interfaces for connecting periphery
- Remote maintenance via modem or Ethernet



Smart Solutions – Applications and fields of operation



Application requirements

Speed-controlled applications (MultiMotion, MultiMotion light)		– Speed reference – Open loop – Closed loop	– Speed reference – With 1, 3, 4, 6 PD (process data)	– Speed reference with 3 PD (process data), variable ramps	According to positioning module	
Single-axis positioning applications (MultiMotion, MultiMotion light)		– Reference travel – Positioning (modulo/ absolute/relative) – Touch probe	– Reference travel – Positioning (Touch probe/ fieldbus 6 PD) – Universal module for positioning and master-slave		According to positioning module	
Multi-axis applications*		– Reference travel – Synchronous operation – Electronic cam – Touch probe – Multi-axis interpolation				
		– Max. 16 axes – Central data storage with SD card		Max. 8 axes via SBus		

* only with MultiMotion

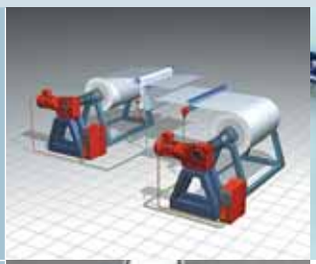
A variety of application and control options is available ranging from simple, speed-controlled applications to positioning applications up to multi-axis applications. The two motor operating modes allow for choosing between synchronous and asynchronous as the drive basis.

The following table shows the **application options**. A distinction is made between Smart Servo Package **with SEW controllers or SEW gateways** and the combination **with non-SEW controllers**.

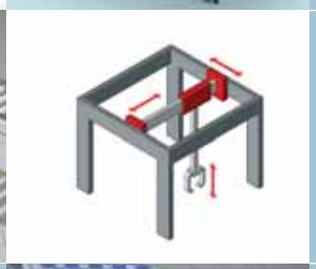
The application categories (speed-controlled application, etc.) are shown as selection criteria. The solution options are described according to the chosen controller/gateway and the required application.

The Smart Servo Package is the perfect solution for nearly any industry. Logistics, packaging or handling systems are particularly appropriate fields of application as these are automation-intensive industries. The various control and integration options into the automation structure create the prerequisites for using the Smart Servo Package in a flexible manner.

Examples of speed-controlled applications:
- Simple, energy-optimized conveyor belt/fan application with synchronous motors
- Winder applications



Examples of positioning applications:
- Feed motions
- Simple gantries
- Feeder/dispenser
- Switches
- Packer
- Carton erector



Examples of multi-axis applications:
- Linked conveyor belts with processing stations
- Electronic cam applications
- Applications with electronic gear unit
- Wrapper
- Packer
- Carton erector

Smart Benefits
with controllers from SEW-EURODRIVE

The most convenient and powerful option for using the Smart Servo Package is to combine it with controllers from SEW-EURODRIVE as all components are optimally matched in the overall system to yield functions with added value.

The benefits for customers are varied and obvious and can be described by the keywords **simple, fast** and **diverse**:

Simple

stands for straightforward processing, optimized serviceability, and streamlined stock-keeping:

- **One** basic unit offers two different motor operating modes.
- The option card can be integrated by the customer resulting in maximum order picking flexibility.
- All parts of the Smart Servo Package can be ordered easily and quickly by their part numbers.
- All gear units are available as adapter gear units and can therefore be easily installed/removed by the customer.
- Central data management of the axis system in the controllers and auto reload for service purposes.

Fast

stands for maximum time savings due to predefined product combinations and function solutions:

- When selecting your Smart Servo Package.
- When carrying out the project planning for drive components.
- When installing and assembling the motors and gear units.
- When starting up the drive package (e.g. electronic nameplate for automatic basic startup of the motor).

Diverse

stands for broad applicability and a high level of adaptability:

- In the product combinations using the appropriate motor and gear unit types.
- In the integration and connection through a wide range of controllers/gateways/analog interfaces.
- Due to gear unit lubrication regardless of the mounting position.
- By configurable or parameterizable/programmable software packages on different controller platforms.

If a drive/automation solution is required for 1x / 3x AC 230 V up to 5.5 kW with peak torques up to 163 Nm, with optional planetary or right-angle gear units*, there is no “smarter” choice than the Smart Servo Package from SEW-EURODRIVE. www.smart-servo-package.com

* in preparation

Smart Benefits with non-SEW controllers

The advantages of the Smart Servo Package can also be used with non-SEW controllers thanks to the analog interfaces offered.

Overview of benefits:

- Step, direction and analog interfaces make it possible to replace stepper motor amplifiers and to use the most basic controllers and motion controllers.
- The integrated electronic gear unit allows for gradually adjusting the input pulse/frequency to the required setpoint speed.
- All internal unit functions are available and usable via digital inputs (reference travel, fixed speeds, touch probe inputs, limit switches, etc.).
- Unit-internal convenient functions, such as the electronic nameplate, continue to be fully usable.
- Unit parameterization and diagnostics is possible at any time via LT Shell using the parameterization interface, which is accessible from the front panel.

Smart Selection – fast, reliable and result oriented

The Smart Selection process makes it extremely easy to select and combine the components to form a customer-specific package.
This was made possible by consistently implementing the following optimization potential:

- Reducing dimensioning calculations to the absolutely required minimum
- Simplifying the basic conditions of an application according to the Pareto principle
- Iterative integration of the mass inertia of the servo (gear)motor
- Creating verified, fixed combinations between motors and servo gear units
- Using combined speed/torque characteristic curves of motor and gear unit to being able to directly verify both operating points

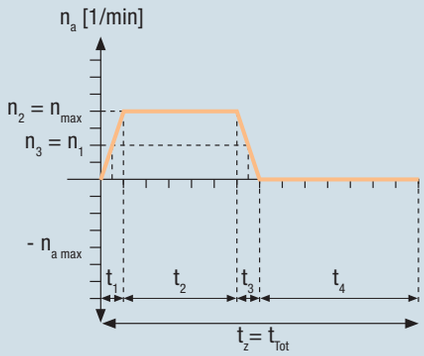
The result is an easy and clear selection process. The output of this process is the perfect solution package with all the necessary product components.

Information required for selecting a Smart Servo Package

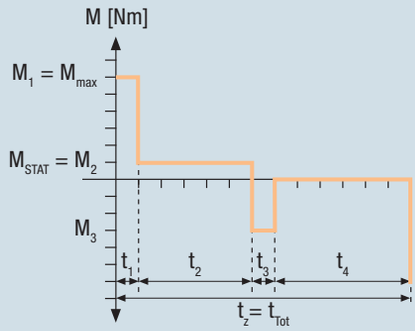
- Travel diagram of the application (travel cycle) that must show the following values per travel section (s_1, s_2 … s_n) (see examples below)):
  - **a) Load values**
    Either: Acceleration and/or braking torques (M_{DYN}) within the travel cycle per travel section
    or load mass moment of inertia on the output shaft (J load) within the travel cycle per travel section
  - **b) Duration** (t_1, t_2, … t_n) of the individual travel sections in the travel cycle
  - **c) Total duration** ($t_{Tot} = \sum t_1, t_2, \ldots t_n$) of the trave cycle
  - **d) Travel velocities** (n_{max}, n_{const}) of the travel sections with constant velocity
  - **e) If applicable, static torques** (M_{STAT}, friction, counter torques, etc.) per travel section during constant travel
- Overhung loads on the output shaft

Sample travel diagrams of a positioning movement/travel cycle

Speed – time characteristics



Torque – time characteristics



Example of a duty cycle with 4 travel sections with a total cycle time t_z.

Smart Selection – Project planning chapter

Your way to the Smart Servo Package

- Removable project planning flow chart
- Combined speed-torque diagrams CMP and PSKF
- Outer dimensions
- Formula collection

Project planning flow chart

Removable project planning flow chart with additional information needed for selecting all the required products. It includes all the part numbers and a detailed structure of how to size and select a Smart Servo Package / **pages 29 – 34**

Outer dimensions

Detailed drawing with outer dimensions (details in the individual documentation or in the system manual) / **pages 44 – 46**

Speed-torque diagrams

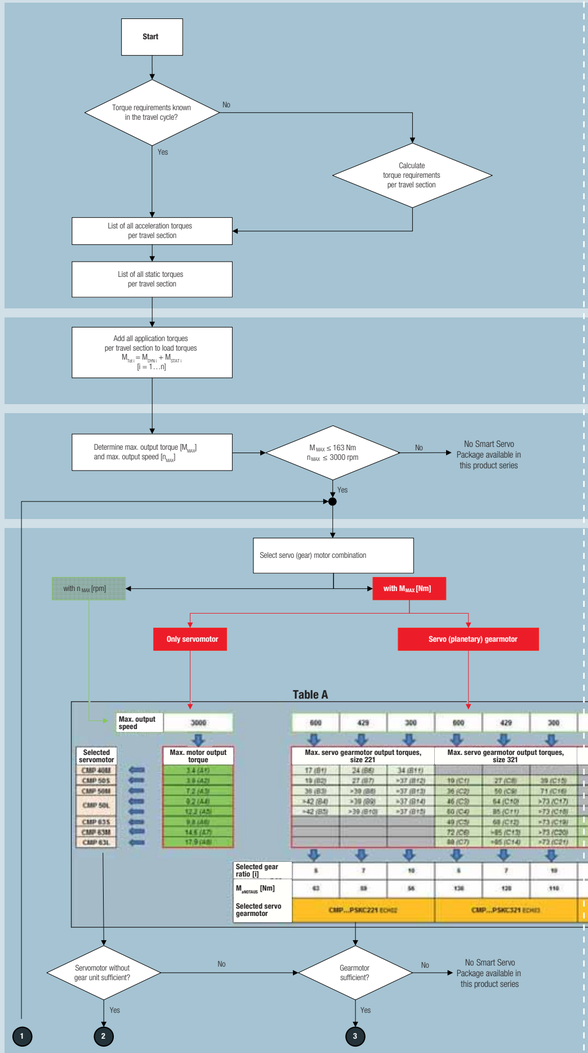
Combined speed torque diagrams of all stand-alone motors and servo gearmotors / **pages 35 – 43**

Formula collection

A collection of the most important formula required for sizing and calculating drive systems / **pages 47 – 49**

Start

Step 1



Note

– Determine/calculate all $M_{DYN\,i}$ and $M_{STAT\,i}$ per travel section i

$M_{DYN\,i}$ = acceleration torque
$M_{STAT\,i}$ = static torques

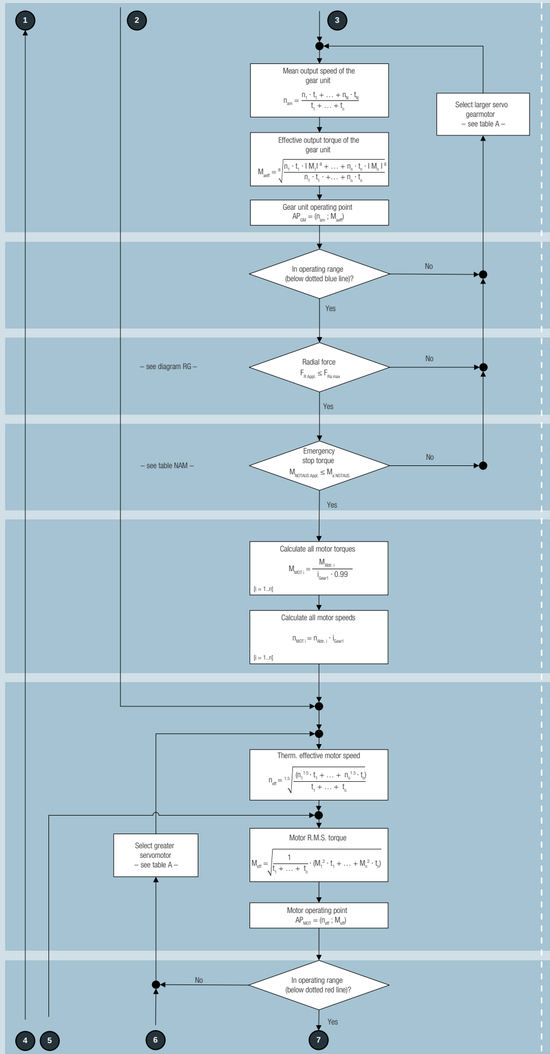
– Calculate the application torques $M_{tot\,i}$ per travel section without taking account of the intrinsic inertia of the servo (gear) motor
$M_{DYN\,i} + M_{STAT\,i} = M_{tot\,i}$

– Choose max. torque + max. speed in the travel cycle from all $M_{tot\,i}$
$M_{MAX} \geq M_{tot\,i\,MAX}$
$n_{MAX} \geq n_{i\,MAX}$

– Select a first servomotor/servo gearmotor combination with M_{MAX} and n_{MAX} from table A
– The green table fields to the left indicate the M_{MAX_OUTPUT} that can be reached with this motor (gear unit) combination. The designation in parenthesis indicates the corresponding M/n diagram for later detailed project planning

! Note the selected M/n diagram designation A1…D9 and the motor (gear unit) combination

Step 2



Note

– Calculate and check the gear unit utilization
– Determine the gear unit operating point
AP_{GM} (n_{gm} ; M_{gmR})
$n_1 \ldots n_N$ – Output speeds per travel section
$M_1 \ldots M_N$ – Output torques per travel section
$t_1 \ldots t_N$ – Duration of the travel sections

– For checking, use the corresponding M/n diagram (A1...D9), see pages 35 – 43
– If the operating point lies below (– · · –), the selection is correct

– Radial force acting on the shaft center ≤ radial force of the gear unit – see diagram RG in "STEP 3"
$F_{R\,Appl.} \leq F_{Ra\,max}$

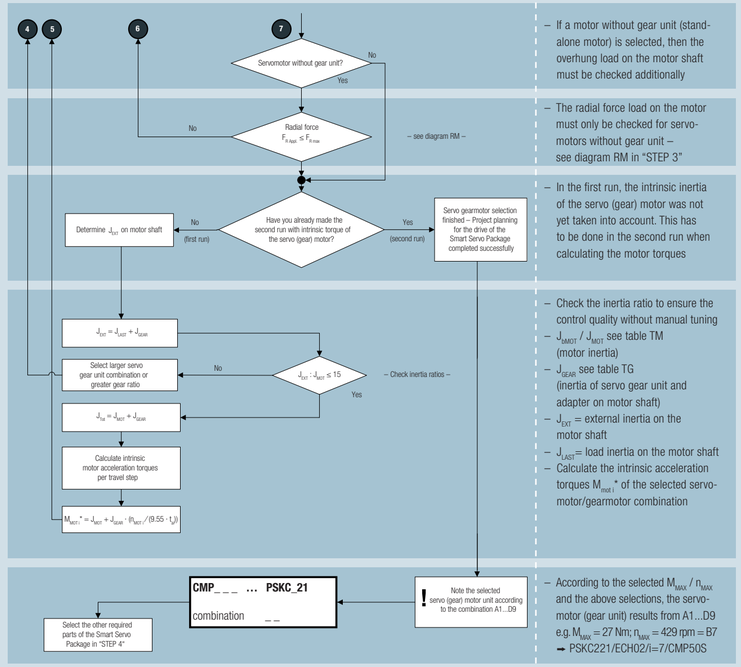
– Emergency stop torque ≤ max. emergency stop torque of the servo gearmotor – see table NAM in "STEP 3"

– Determine all motor torques $M_{Mot\,i}$ and speeds $n_{MOT\,i}$ per travel section
– $M_{Abt\,i} = M_1 \ldots M_N$ = output torque per travel section
– $n_{Abt\,i} = n_1 \ldots n_N$ = output speeds per travel section

– $n_1 \ldots n_N$ = $n_{mot\,i}$ = motor speed per travel section
$M_1 \ldots M_N$ = $M_{mot\,i}$ = motor torque per travel section
– Calculate and check the motor utilization
– Determine the motor operating point
$AP_{MOT} = (n_{eff}; M_{eff})$
– IMPORTANT: in the 2nd run, the M_{mot}* of the intrinsic motor inertia must be added to $M_{mot\,i}$ of the application and this project planning step must be repeated

– For checking, use the corresponding M/n diagram (A1...D9), see pages 35 – 43
– If the operating point lies within the continuous operating range (· — · —), the selection is correct

Step 3



Note

– If a motor without gear unit (stand-alone motor) is selected, then the overhung load on the motor shaft must be checked additionally

– The radial force load on the motor must only be checked for servo-motors without gear unit – see diagram RM in "STEP 3"

– In the first run, the intrinsic inertia of the servo (gear) motor was not yet taken into account. This has to be done in the second run when calculating the motor torques

– Check the inertia ratio to ensure the control quality without manual tuning
– J_{MOT} / J_{MOT} see table TM (motor inertia)
– J_{GEAR} see table TG (inertia of servo gear unit and adapter on motor shaft)
– J_{EXT} = external inertia on the motor shaft
– J_{LAST} = load inertia on the motor shaft
– Calculate the intrinsic acceleration torques $M_{mot\,i}$* of the selected servo-motor/gearmotor combination

– According to the selected M_{MAX} / n_{MAX} and the above selections, the servo-motor (gear unit) results from A1...D9
e.g. $M_{MAX} = 27$ Nm; $n_{MAX} = 429$ rpm = B7
➡ PSKC221/ECH02/i=7/CMP50S

Table TG

Gear unit	Gear ratio	J_{GEAR}
	[i]	[x 10^{-4} kgm²]
PSC221ECH02	5	0.26
	7	0.23
	10	0.22
PSC321ECH03	5	0.92
	7	0.85
	10	0.81
PSC521ECH05	5	3.0
	7	2.7
	10	2.5

Table NAM

Gear unit		PSKC								
		221ECH02			321ECH03			521ECH05		
Reduction ratio	i	5	7	10	5	7	10	5	7	10
Max. permitted emergency stop torque	M_{ACTAUS}	63	59	56	136	128	110	334	313	243

Table TM

Motor	J_{mot}	J_{mot}	M_{ps}
	[x 10^{-4} kgm²]	[x 10^{-4} kgm²]	[Nm]
CMP40M	0.15	0.18	0.95
CMP50S	0.42	0.48	3.1
CMP50M	0.67	0.73	4.3
CMP50L	0.92	0.98	4.3
CMP63S	1.15	1.49	7
CMP63M	1.92	2.26	9.3
CMP63L	2.69	3.03	9.3

Diagram RG

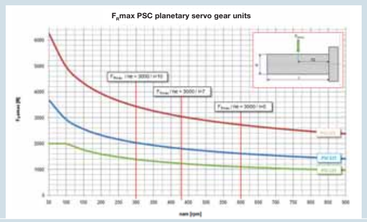
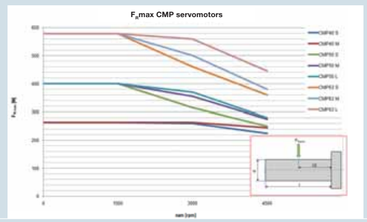


Diagram RM



Step 4

CMP_ _ _ **... PSKC_21**

Selected motor:
With brake: CMP _ _ _ / BP
Without brake: CMP_ _ _ /

Servomotor

	Type[1]	Part number for logistics & stockkeeping	M_0 Nm	M_{max} Nm
No brake	CMP40M / KY / AK0H / SM1	1477 0415	0.8	3.8
	CMP50S / KY / AK0H / SM1	1477 0423	1.3	5.2
	CMP50M / KY / AK0H / SM1	1477 0431	2.4	10.3
	CMP50L / KY / AK0H / SM1	1477 0458	3.3	15.4
	CMP63S / KY / AK0H / SM1	1477 0466	2.9	11.1
	CMP63M / KY / AK0H / SM1	1477 0474	5.3	21.4
	CMP63L / KY / AK0H / SM1	1477 0482	7.1	30.4

	Type[1]	Part number for logistics & stockkeeping	M_0 Nm	M_{max} Nm	M_4 Nm
With brake	CMP40M / BP / KY / AK0H / SB1	1477 0490	0.8	3.8	0.95
	CMP50S / BP / KY / AK0H / SB1	1477 0504	1.3	5.2	3.1
	CMP50M / BP / KY / AK0H / SB1	1477 0512	2.4	10.3	4.3
	CMP50L / BP / KY / AK0H / SB1	1477 0520	3.3	15.4	4.3
	CMP63S / BP / KY / AK0H / SB1	1477 0539	2.9	11.1	7
	CMP63M / BP / KY / AK0H / SB1	1477 0547	5.3	21.4	9.3
	CMP63L / BP / KY / AK0H / SB1	1477 0555	7.1	30.4	9.3

[1] Motors come equipped with key option and conform to European (CE), USA (UR) and Canadian (CSA) standards.

Servogear

Motor	Type	Gear ratio i	Part number for logistics & stockkeeping
CMP40	PSKC221 with motor adapter ECH02/01/02	5	1477 0563
		7	1477 0571
		10	1477 0598
CMP50	PSKC221 with motor adapter ECH02/08/04	5	1477 0601
		7	1477 0628
		10	1477 0636
CMP50	PSKC321 with motor adapter ECH03/08/04	5	1477 0644
		7	1477 0652
		10	1477 0660
CMP63	PSKC321 with motor adapter ECH03/13/06	5	1477 0679
		7	1477 0687
		10	1477 0695
CMP63	PSKC521 with motor adapter ECH05/13/6	5	1477 0709
		7	1477 0717
		10	1477 0725

Drive/inverter

LTX selection							
Motor			**LTP**	**Part no.**		**Servo module**	**Part no.**
CMP40M	1-phase	Size 2	MCLTP0008-2B1-4-00	1825 1382	+	LTX-H1A	1823 9226
CMP50S			MCLTP0008-2B1-4-00	1825 1382	+	LTX-H1A	1823 9226
CMP50M			MCLTP0015-2B1-4-00	1825 1528	+	LTX-H1A	1823 9226
CMP50L			MCLTP0022-2B1-4-00	1825 1641	+	LTX-H1A	1823 9226
CMP40M	3-phases		MCLTP0008-2A3-4-00	1825 1358	+	LTX-H1A	1823 9226
CMP50S			MCLTP0008-2A3-4-00	1825 1358	+	LTX-H1A	1823 9226
CMP50M			MCLTP0015-2A3-4-00	1825 1471	+	LTX-H1A	1823 9226
CMP50L			MCLTP0022-2A3-4-00	1825 1617	+	LTX-H1A	1823 9226
CMP50L		Size 3	MCLTP0030-2A3-4-00	1825 1722	+	LTX-H1A	1823 9226
CMP63S			MCLTP0030-2A3-4-00	1825 1722	+	LTX-H1A	1823 9226
CMP63M			MCLTP0040-2A3-4-00	1825 1765	+	LTX-H1A	1823 9226
CMP 63L			MCLTP0050-2A3-4-00	1825 1846	+	LTX-H1A	1823 9226

Continue with “STEP 5”

Note

- Determine whether servo (gear) motor CMP_ _ _ / PSKC_21 ECH0_ is required with or without BP holding brake

Servomotor
- Identify the resulting servomotor by its part number
- Decide whether a brake / no brankemotor is required

Servogear
- Select the projected servogear unit by its part number
- Make sure the adapter matches the motor size

Drive/inverter
- The inverter is determined by means of the motor determined in the project planning
- The matching inverter is selected according to 1x or 3x AC 230 V supply voltage
- **LTX-H1A is always required!**

Step 5

Motor	Braking resistor					
	Horizontal travel distance			Vertical travel distance		
	Type	Part no.	Design	Type	Part no.	Design
CMP40M	BW LT 100 002	1820 8770	Flat design*	BW LT 100 002	1820 1911	Flat design*
CMP50S						
CMP50M	BW047-003	0826 2659	Flat design	BW047-005	0826 2683	Flat design
CMP50L	BW047-005	0826 2683	Flat design	BW147-T	1820 1342	Braking resistor
CMP63S	BW047-005	0826 2683	Flat design	BW047-005	0826 2683	Flat design
CMP63M	BW147-T	1820 1342	Wire resistor	BW147-T	1820 1342	Wire resistor
CMP63L						

* Can be mounted during operation

LTX				
Output current I_N [A]	**Size**	**Output choke**	**Phase**	**Part no.**
3.2	2	ND LT 010 290 53	3	1820 1679
5.5	2	ND LT 010 290 53	3	1820 1679
6.9	2	ND LT 010 290 53	3	1820 1679
9.5	3	ND LT 036 081 53	3	1820 1687
12.6	3	ND LT 036 081 53	3	1820 1687
16.5	3	ND LT 036 081 53	3	1820 1687

Motor without brake			Motor with brake	
Cable length [m]	Motor cables, 4 x 1.5 mm²		Brakemotor cables, 4 x 1.5 mm² + 2 x 1 mm²	
	Fixed installation	Cable carrier installation	Fixed installation	Cable carrier installation
5	1840 2992	1840 8036	1840 7897	1840 7951
10	1840 3492	1840 8044	1840 7900	1840 7978
15	1840 3018	1840 8052	1840 7919	1840 7986
20	1840 3506	1840 8060	1840 7927	1840 7994
25	1840 3514	1840 8079	1840 7935	1840 8001

Encoder cable		
Cable length [m]	Encoder cable, 6 x 2 x 0.25 mm²	
	Fixed installation	Cable carrier installation
5	1840 3255	1840 3301
10	1840 3263	1840 3328
15	1840 3271	1840 3336
20	1840 3743	1840 3786
25	1332 4535-25	1840 3794

Continue with “STEP 6”

Note

Brake resistor
- The braking resistor is selected according to the horizontal or vertical travel distance
- **Info 1**: in horizontal operation, 1/7 of the rated power is assumed as braking power
- **Info 2**: in vertical operation, 1/3 of the rated power is assumed as braking power

Choke
- Optional: Select input choke for weak supply system conditions

Motor cable
- Select the motor cable according to the motor with or without brake, for cable carrier or fixed installation

Encoder cable
- Encoder cable is always needed! (Cable carrier or fixed installation)

Step 6

Controller/gateway selection				
Applications/operating modes	**Unit type**	**Bus system**	**Controller designation**	**Part no.**
– Speed command 3 process data words (not synchronized)	Gateway	PROFIBUS DP-V1	DFP21B/UOH11B	1840 4073
		DeviceNet	DFD11B/UOH11B	1840 5010
		PROFINET	DFE32B/UOH11B	1840 5029
		EtherNet/IP, Modbus/TCP	DFE33B/UOH11B	1840 5037
		EtherCAT®	DFE24B/UOH11B	1840 5045
– Speed command – Touch probe positioning – Bus positioning with 6 process data words – Single-axis universal module – Reference travel	Controller CCU (Configurable Control Unit)	PROFIBUS DP-V1, DeviceNet	DHF21B/OMC41B-T0/UOH21B	1840 8621
		PROFINET, EtherNet/IP, Modbus/TCP	DHR21B/OMC41B-T0/UOH21B	1840 8648
– Speed command – Touch probe positioning – Bus positioning with 6 process data words – Universal module including synchronous operation – Reference travel		PROFIBUS DP-V1, DeviceNet	DHF41B/OMC41B-T1/UOH21B	1840 8656
		PROFINET, EtherNet/IP, Modbus/TCP	DHR41B/OMC41B-T1/UOH21B	1840 8664
Freely programmable (MultiMotion Light) – Speed – Positioning – Reference travel	Controller MOVI-PLC®	EtherNet TCP/IP, UDP (no higher-level PLC)	DHE21B/OMH41B-T0/UOH11B	1840 8672
		PROFIBUS DP-V1, DeviceNet	DHF21B/OMH41B-T0/UOH21B	1840 8400
		PROFINET, EtherNet/IP, Modbus/TCP	DHR21B/OMH41B-T0/UOH21B	1840 8680
Freely programmable (MultiMotion) – Speed – Positioning – Reference travel – Synchronous operation – Electronic cam		EtherNet TCP/IP, UDP (no higher-level PLC)	DHE41B/OMH41B-T2/UOH11B	1840 8699
		PROFIBUS DP-V1, DeviceNet	DHF41B/OMH41B-T2/UOH21B	1840 8702
		PROFINET, EtherNet/IP, Modbus/TCP	DHR41B/OMH41B-T2/UOH21B	1840 8613

DFx-Gateway / MOVI-PLC®/CCU

Cable set A (basic set)	Cable length to axes 0.5 m	Content	Qty.	Description
			1	Controller Gateway connection RJ45 open end, 0.5 m
Part number	1840 8095		1	Cable terminator
Designation	(OP LT 003 A)		1	Drive connector cable 0.5 m, RJ45-RJ45

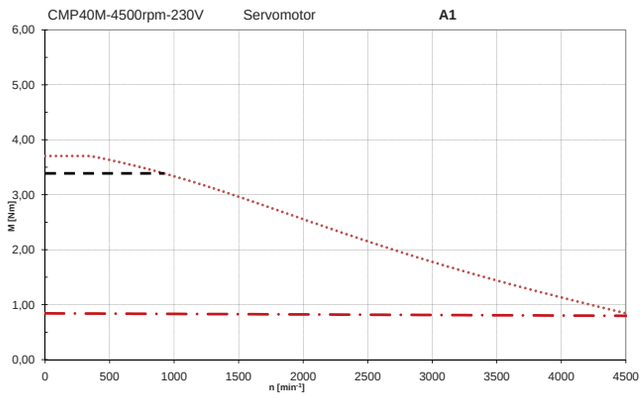
Cable set B (extension set)	Cable length to axis 0.5 m	1 m	Content	Qty.	Description
				1	Cable splitter
Part number	1840 8109	1840 8117		1	Drive connector cable 0.5 m, RJ45-RJ45
Designation	(OP LT 005 B)	(OP LT 010 B)		1	Cable between drives, with variable length

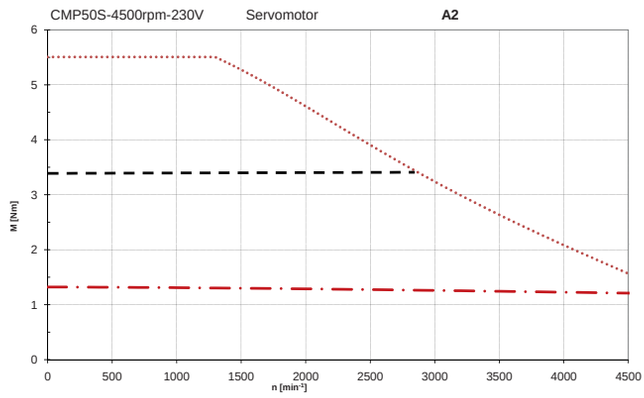
Note

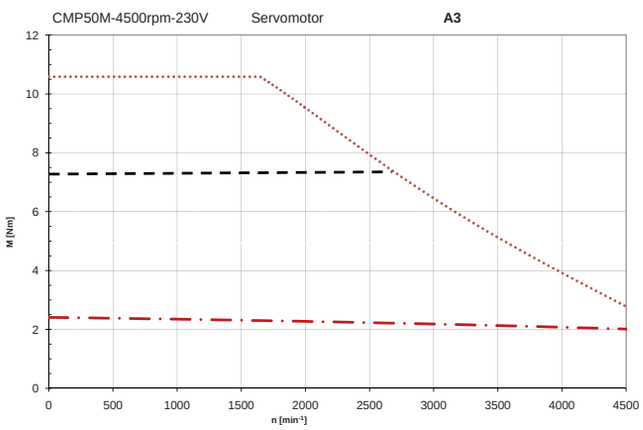
Controller
- Optional: Select CCU/MultiMotion controllers
- Optional: Select fieldbus gateways

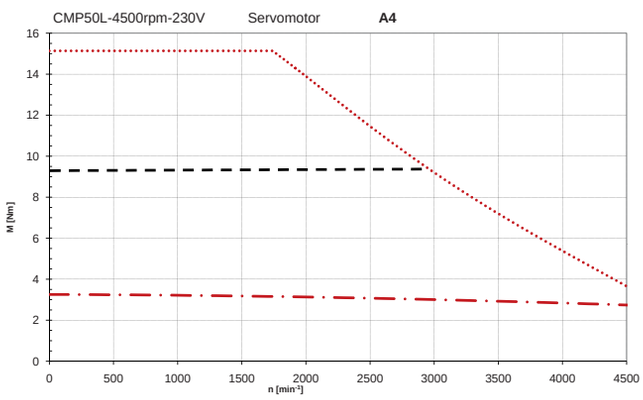
Cable set
- Select the cable sets for connecting the axes with one another and for connection with controllers or gateways from SEW-EURODRIVE
- **Cable set “A”** is always required for one axis or for the first axis
- **Cable set “B”** is required for every additional axis

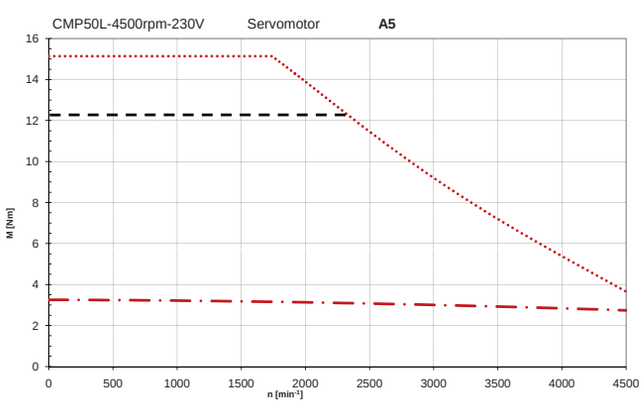
Example: Minimum required cables for an axis system with 5 axes:
➡ 1x cable set “A”
➡ (5 –1) = 4x cable set “B”

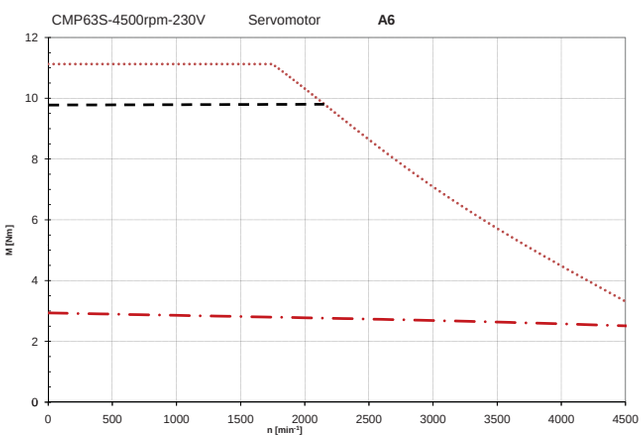


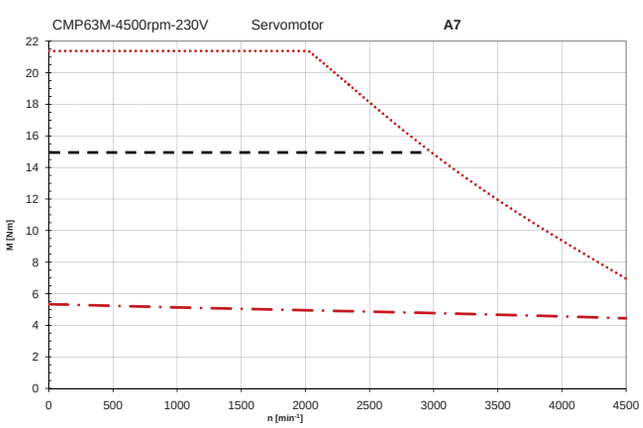


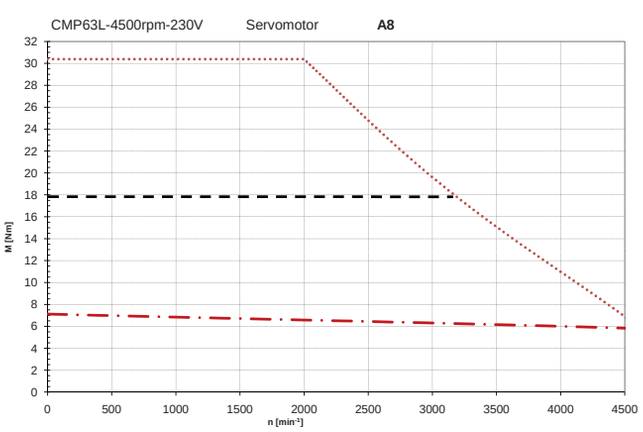










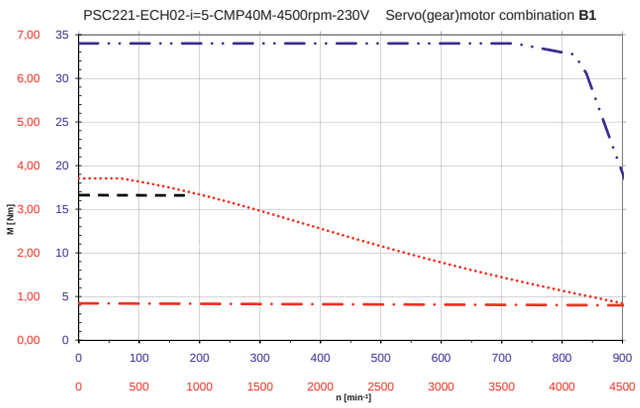


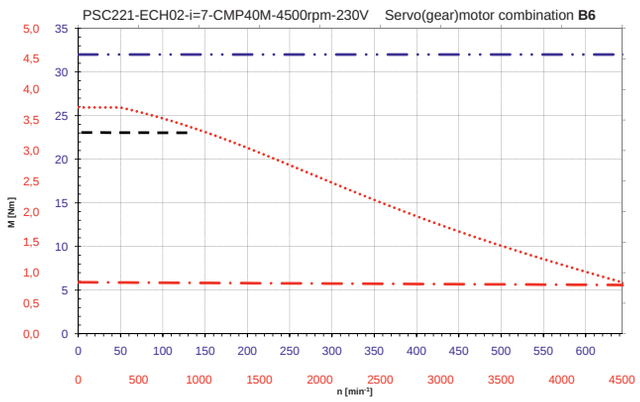
M_{max_output} of CMP Motor LTX combination

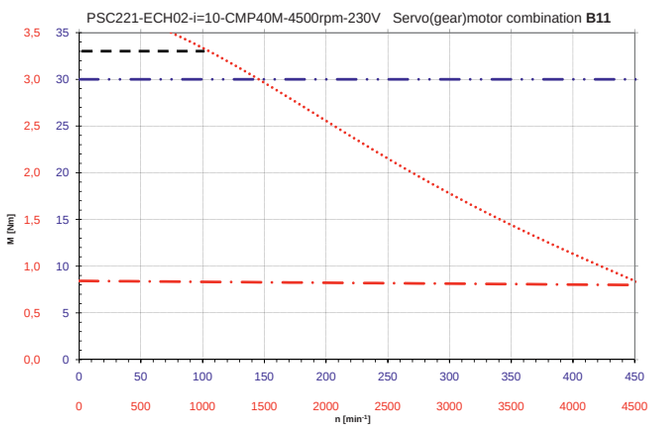
M_{pk} CMP 4500 rpm

M S1 CMP

(to enhance ease of reading, individual characteristic curves might not be visible as a result of scaling)







M_{max_output} of CMP Motor LTX combination

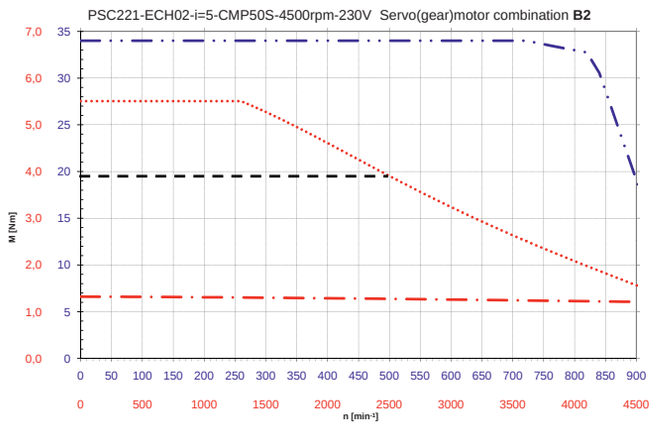
M_{apk} PSKC_21 ECH i=x

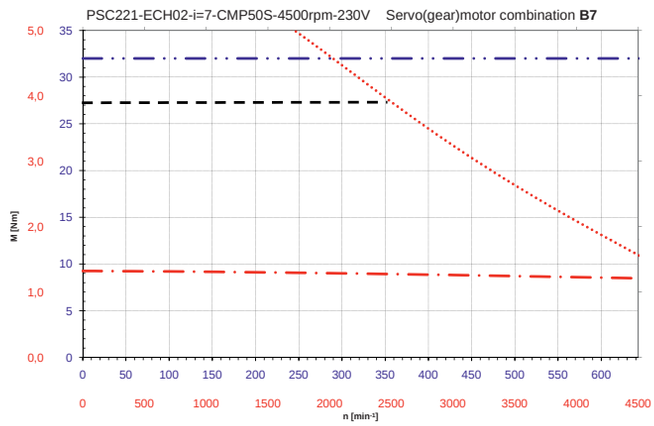
M_{azul} PSKC_21 ECH i=x

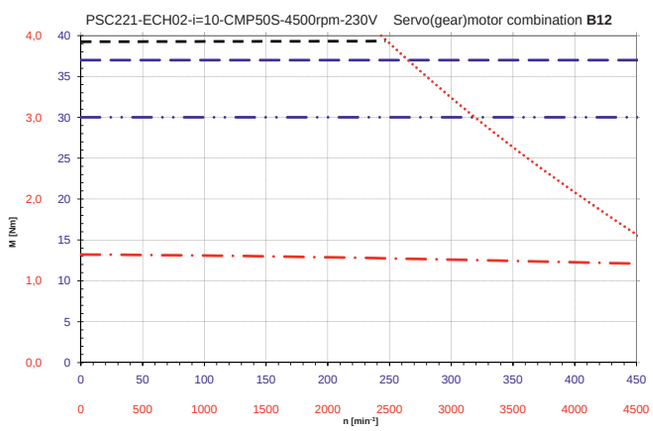
M_{pk} CMP 4500 rpm

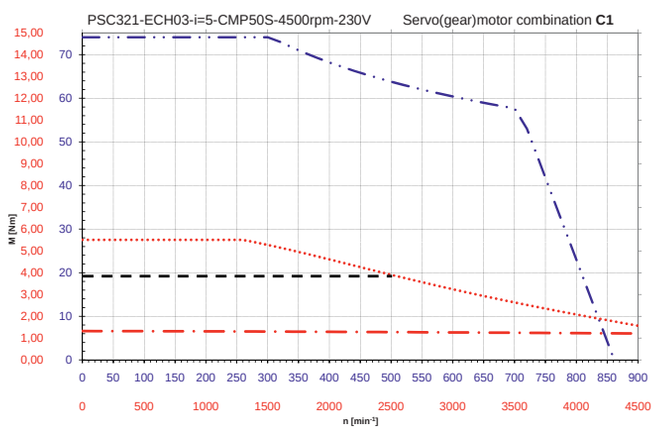
M S1 CMP

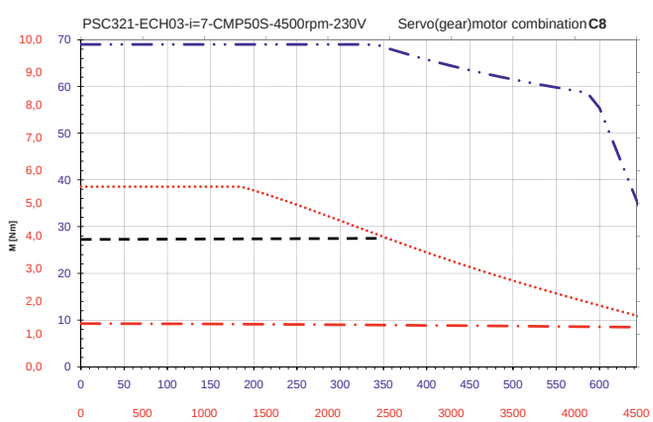
(to enhance ease of reading, individual characteristic curves might not be visible as a result of scaling)

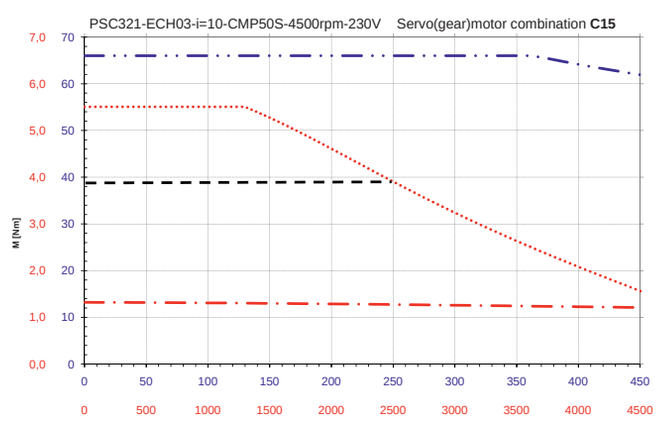






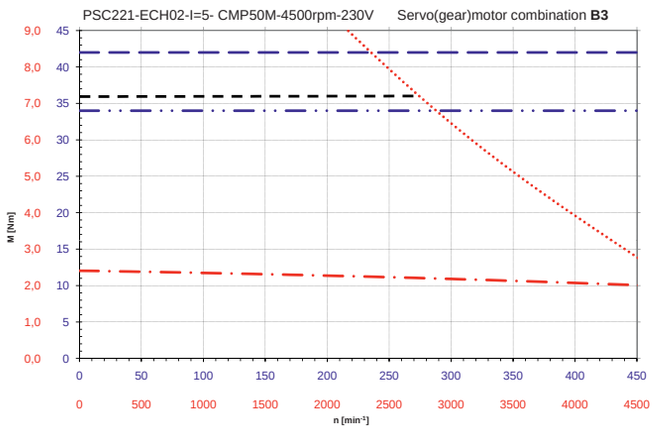


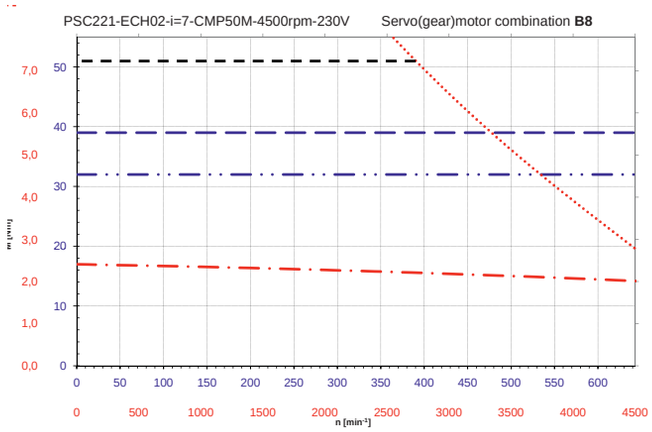


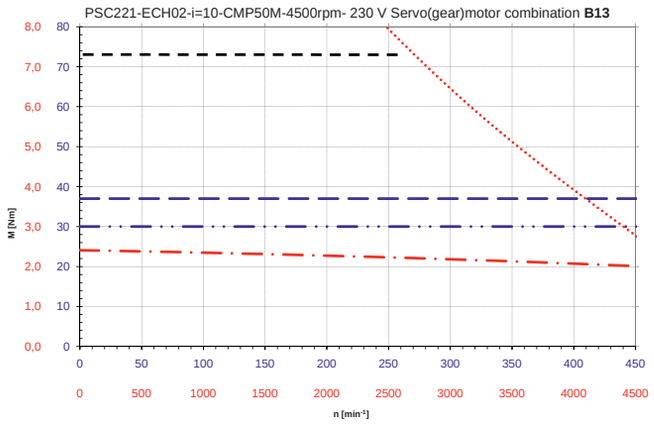


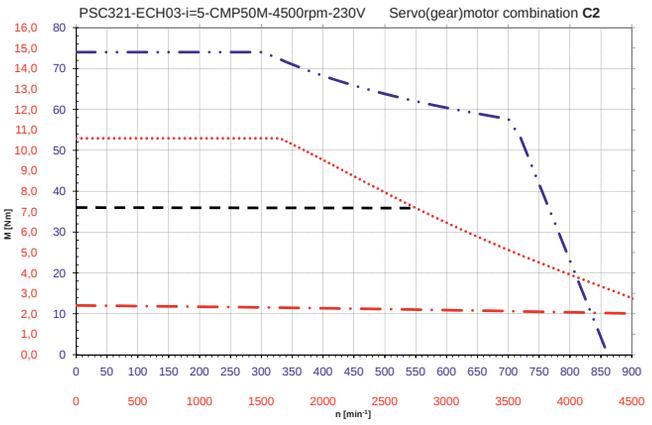
- M_{max_output} of CMP Motor LTX combination
- M_{apk} PSKC_21 ECH i=x
- M_{azul} PSKC_21 ECH i=x
- M_{pk} CMP 4500 rpm
- M S1 CMP

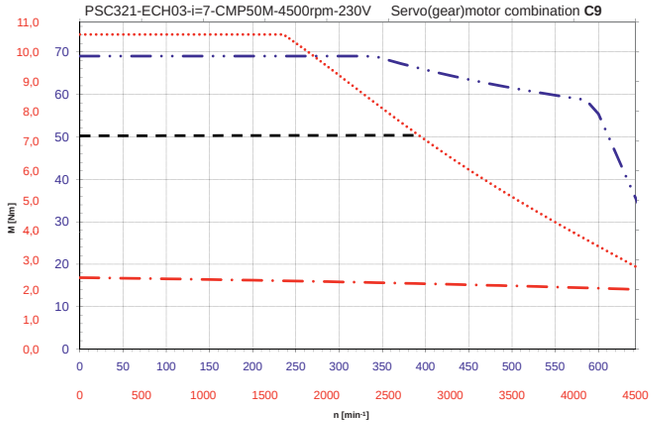
(to enhance ease of reading, individual characteristic curves might not be visible as a result of scaling)

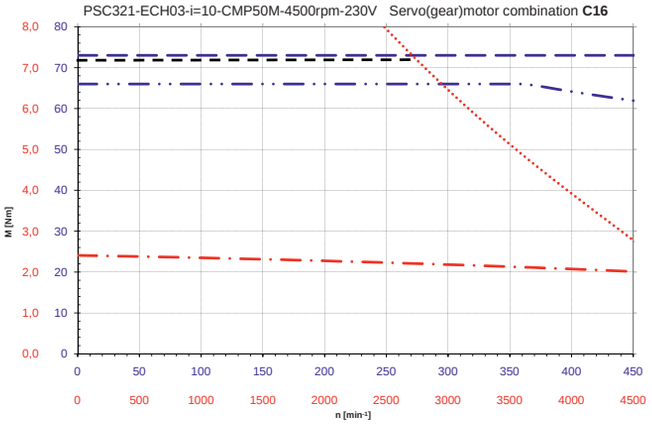












- M_{max_output} of CMP Motor LTX combination
- M_{apk} PSKC_21 ECH i=x
- M_{azul} PSKC_21 ECH i=x
- M_{pk} CMP 4500 rpm
- M S1 CMP

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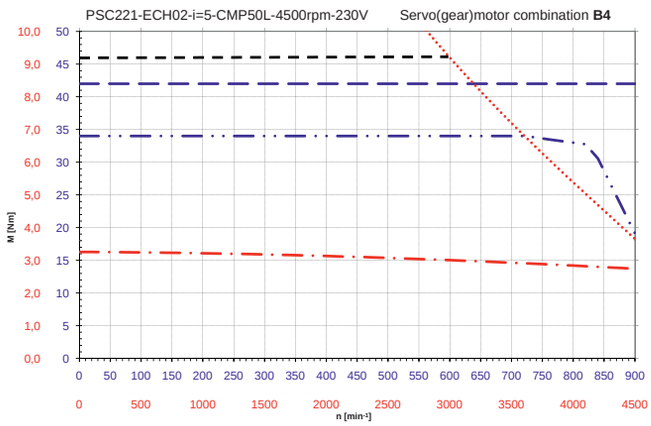

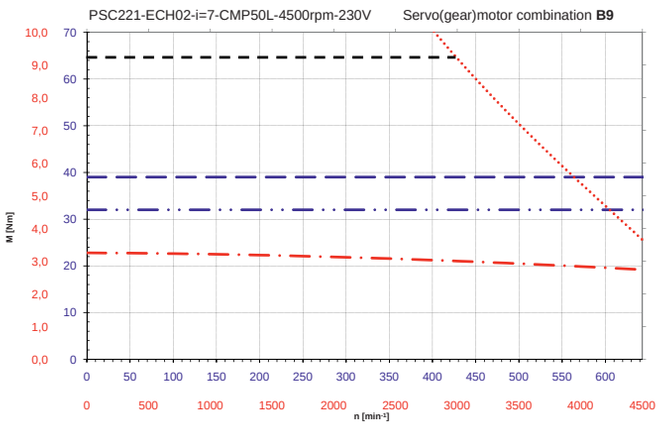

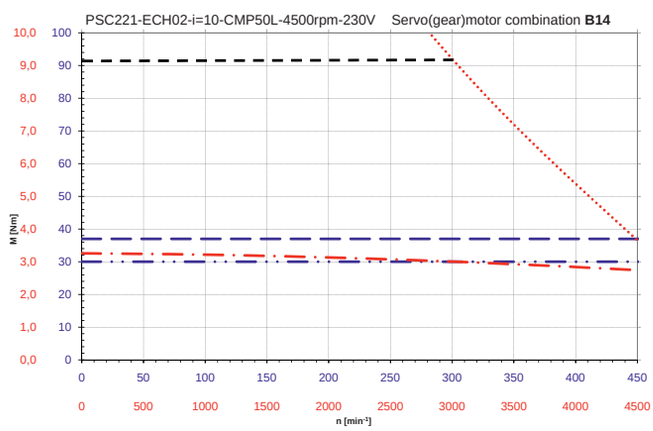

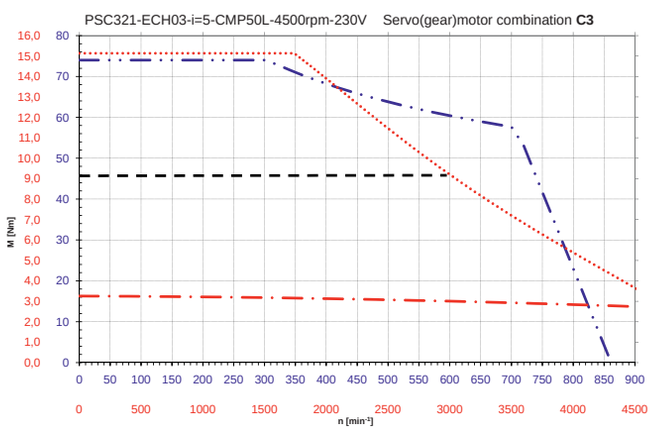

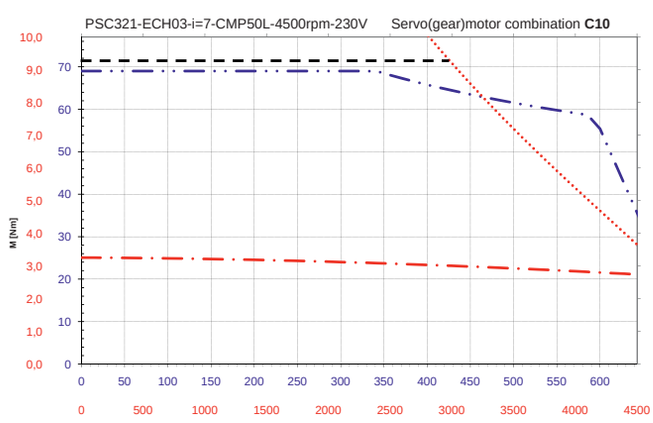

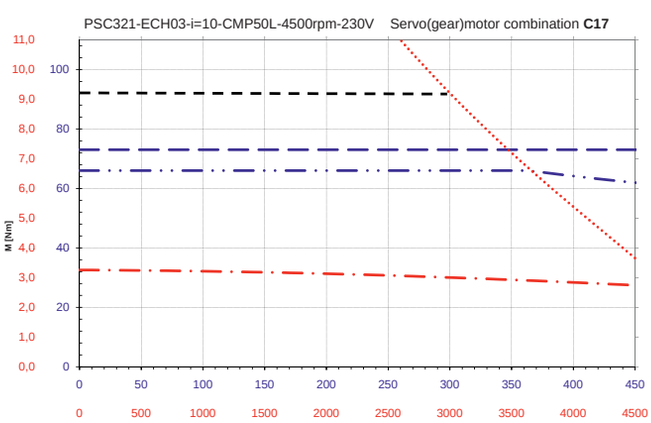

- M_{max_output} of CMP Motor LTX combination
- M_{apk} PSKC_21 ECH i=x
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- M_{pk} CMP 4500 rpm
- M S1 CMP

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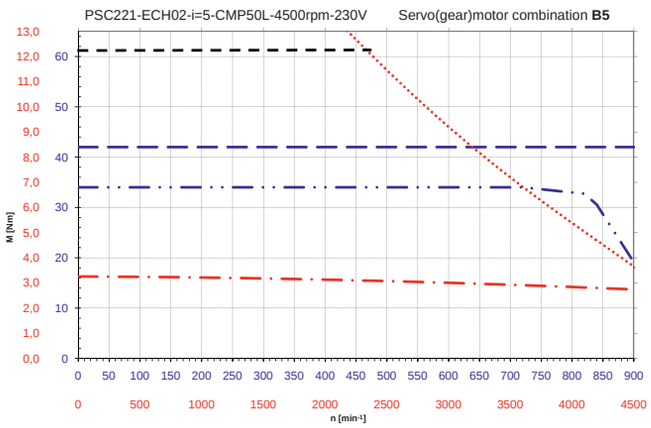

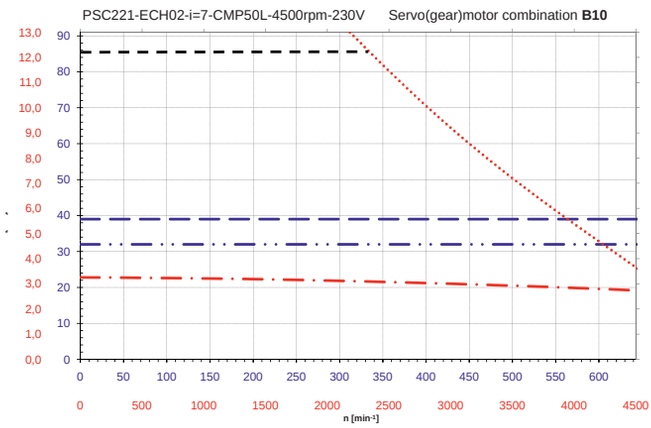

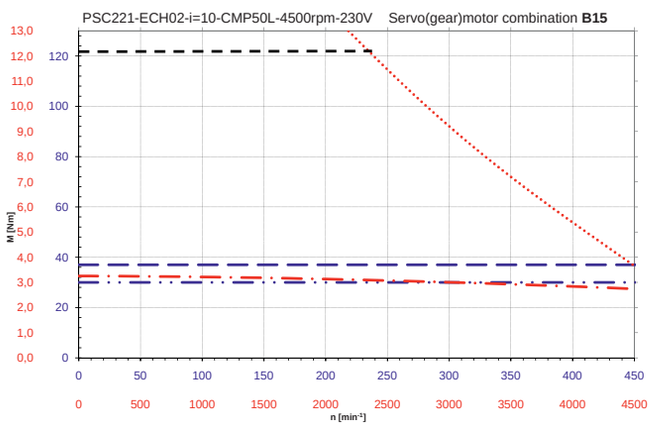

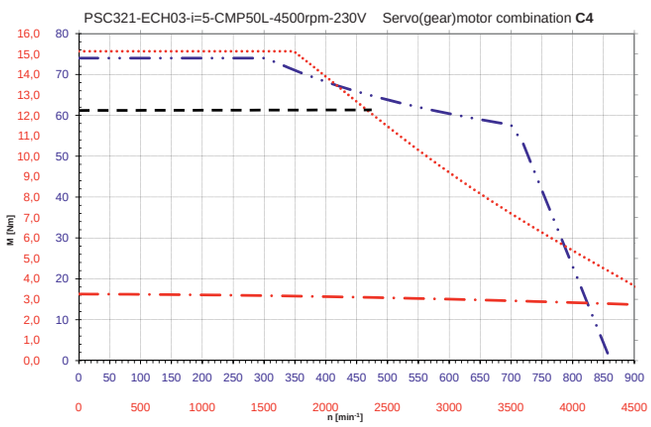

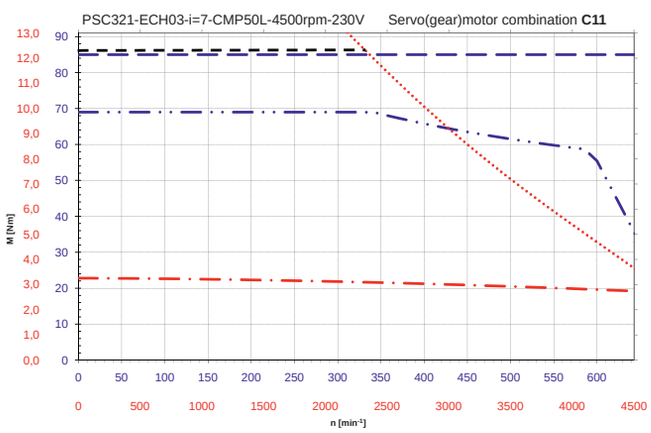

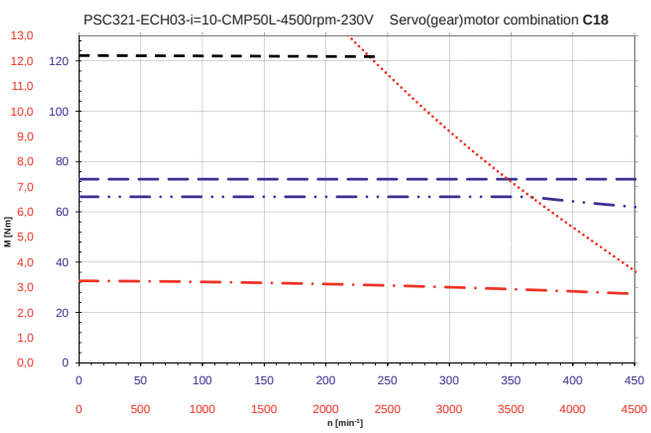

M_{max_output} of CMP Motor LTX combination

M_{apk} PSKC_21 ECH i=x

M_{azul} PSKC_21 ECH i=x

M_{pk} CMP 4500 rpm

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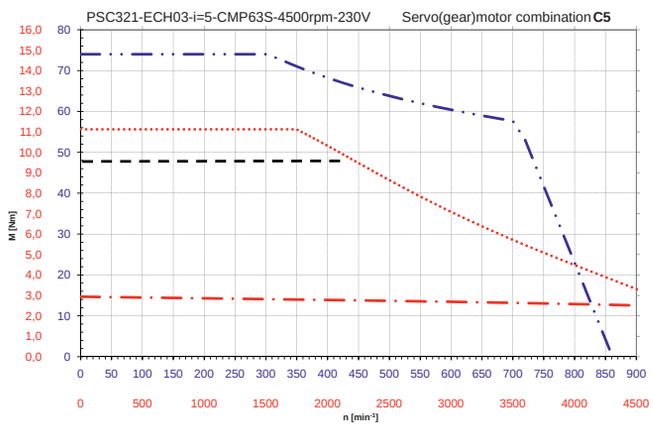

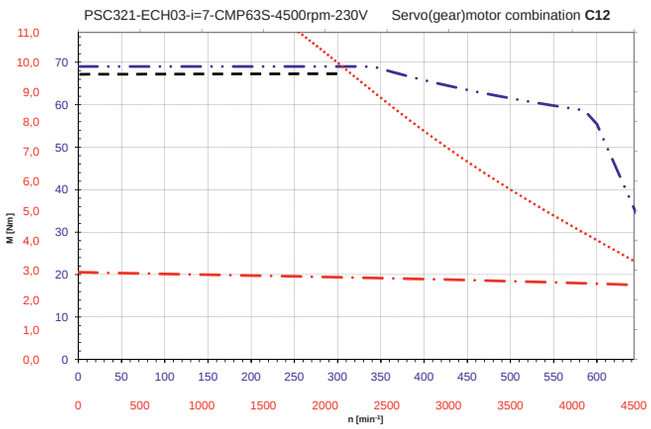

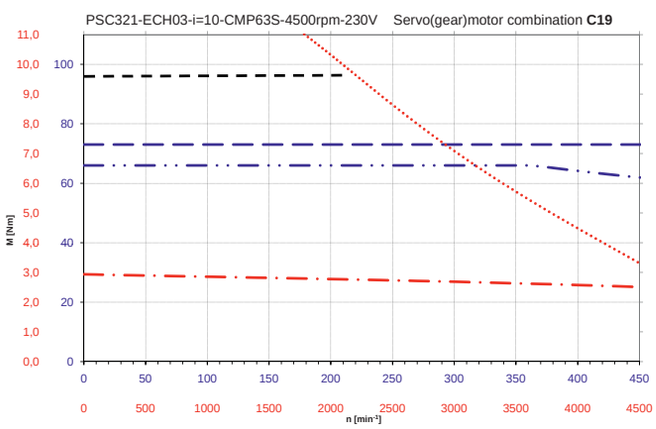

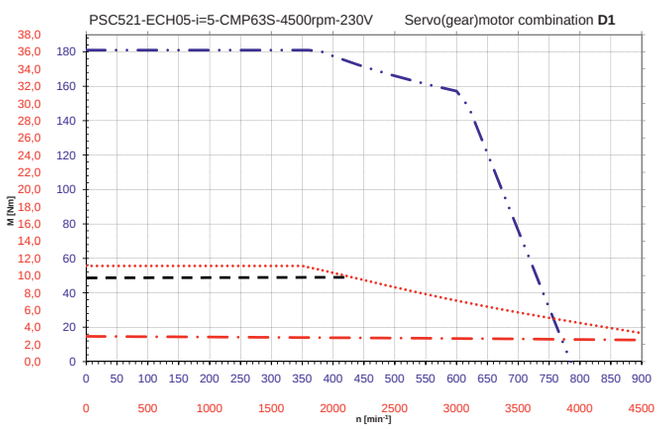

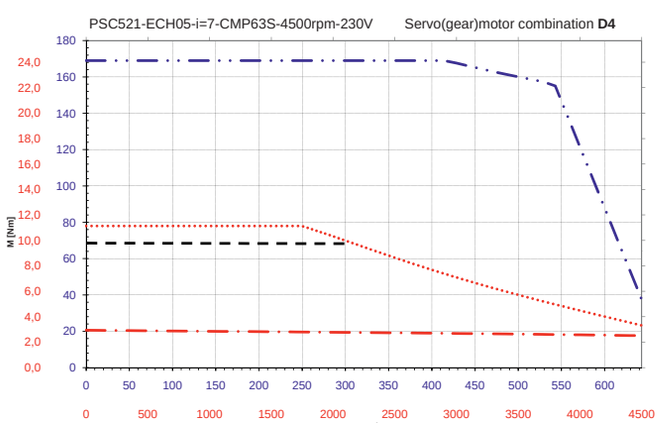

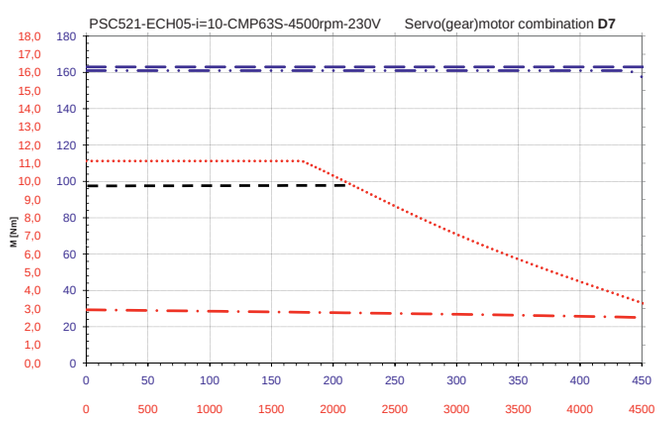

- M_{max_output} of CMP Motor LTX combination
- M_{apk} PSKC_21 ECH i=x
- M_{azul} PSKC_21 ECH i=x
- M_{pk} CMP 4500 rpm
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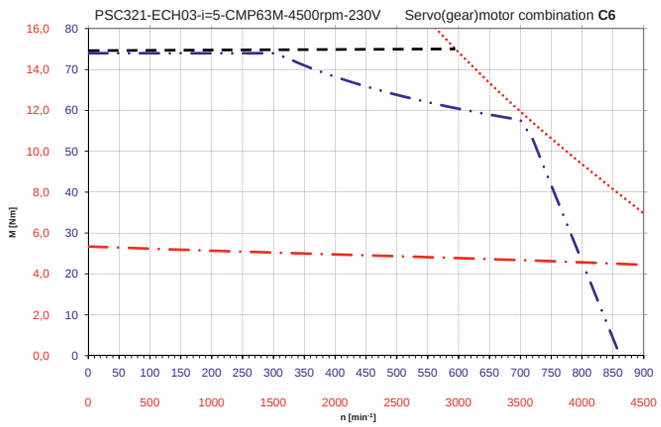

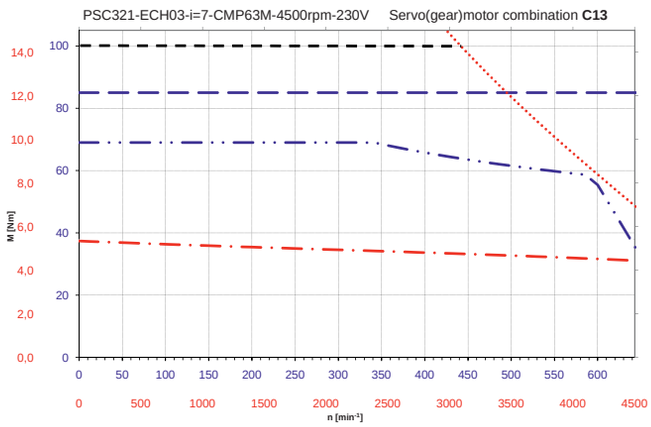

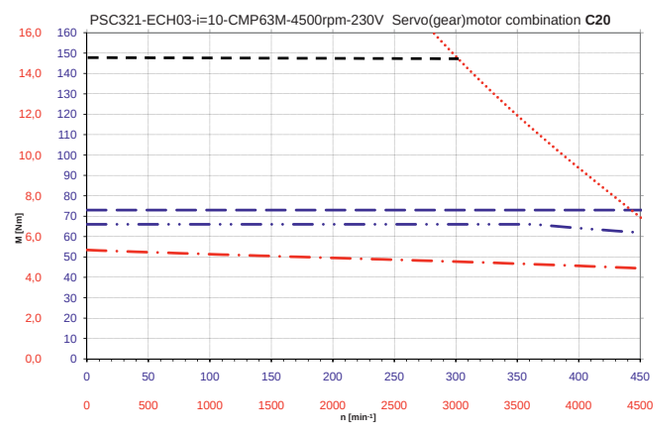

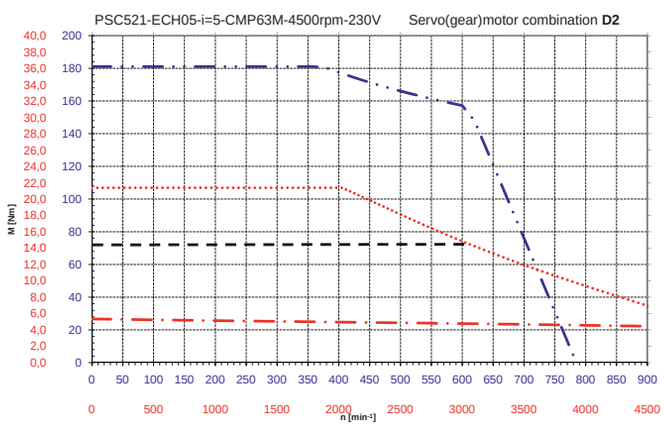

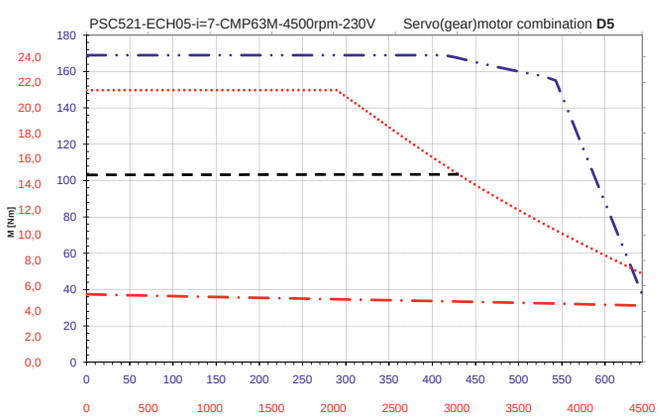

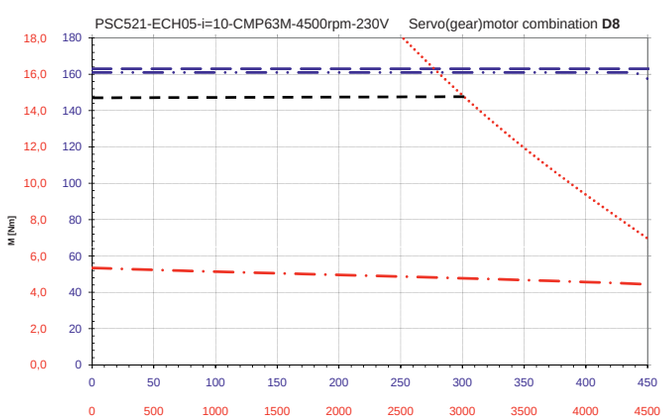

M_{max_output} of CMP Motor LTX combination

M_{apk} PSKC_21 ECH i=x

M_{azul} PSKC_21 ECH i=x

M_{pk} CMP 4500 rpm

M S1 CMP

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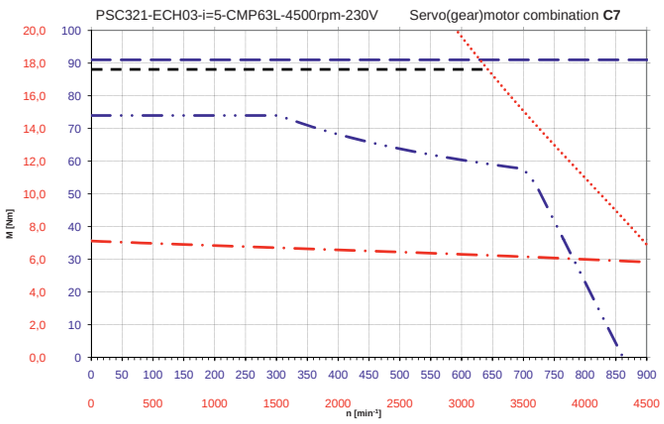

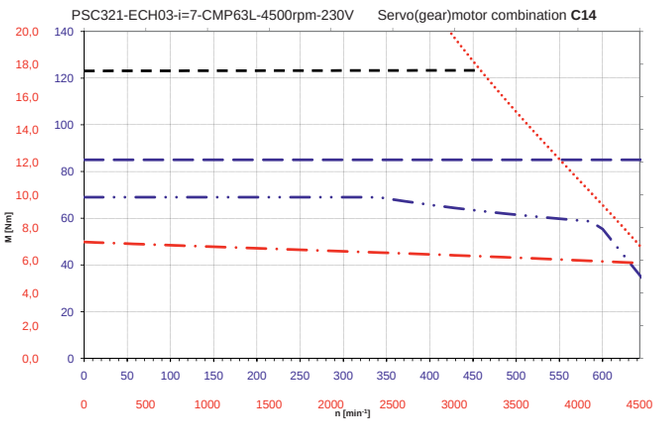

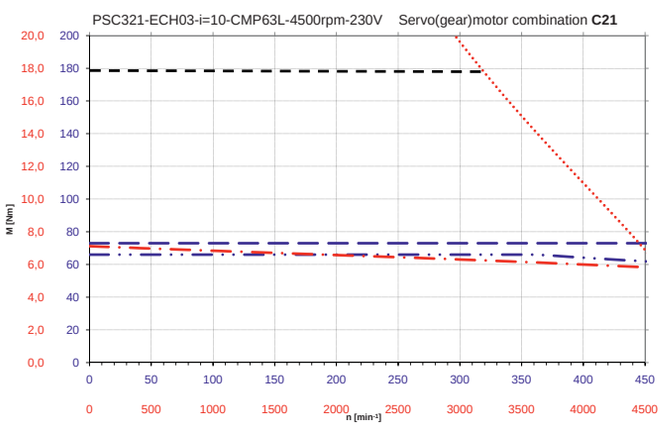

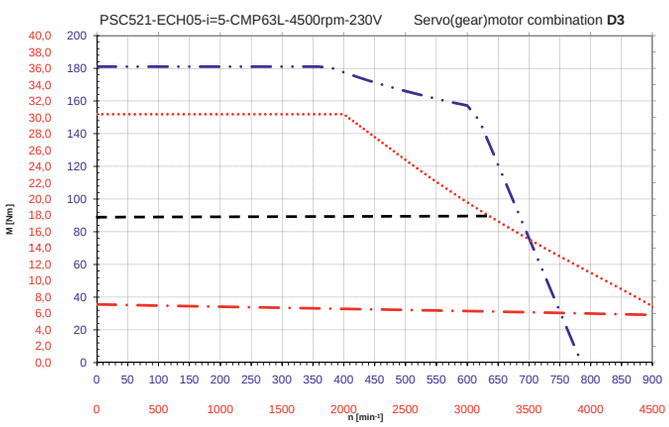

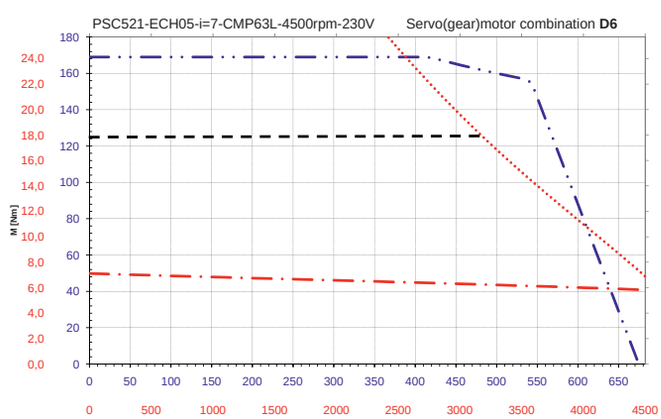

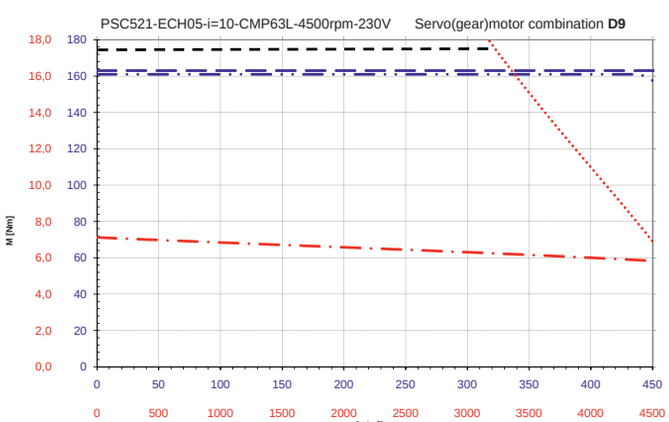

M_{max_output} of CMP Motor LTX combination

M_{apk} PSKC_21 ECH i=x

M_{azul} PSKC_21 ECH i=x

M_{pk} CMP 4500 rpm

M S1 CMP

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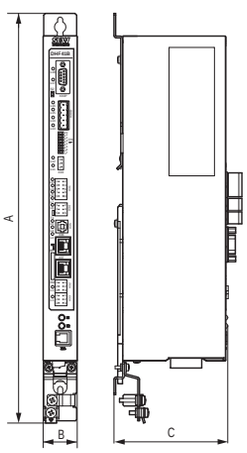
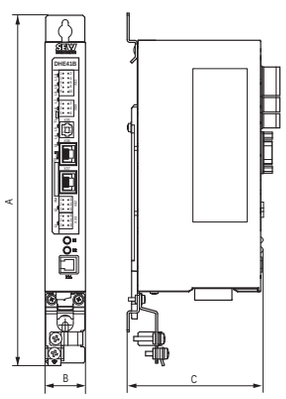
MOVI-PLC® controller

Controller/gateway		A	B	C
DHE21B/UOH11B &	mm	257.5	30	100
DHE41B/UOH11B &	inch	10.14	1.18	3.94
DFx/UOH11B				
DHF21B/UOH21B &	mm	358.5	30	100
DHF41B/UOH21B &	inch	14.11	1.18	3.94
DHR21B/UOH21B &				
DHR41B/UOH21B				

DHF/UOH21B
DHR/UOH21B

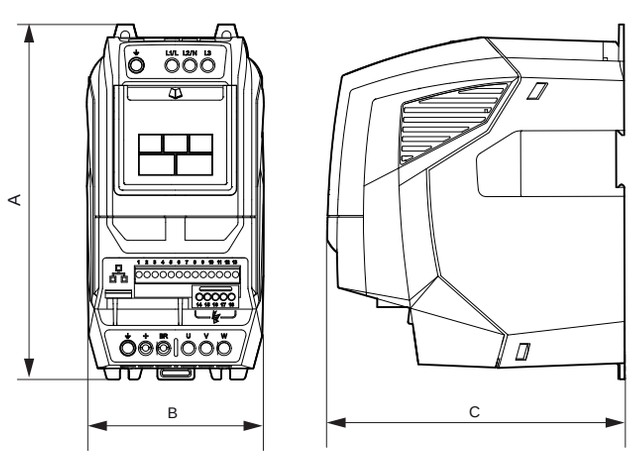


DFx/UOH11B
DHE/UOH11B



MOVITRAC® LTX universal inverter

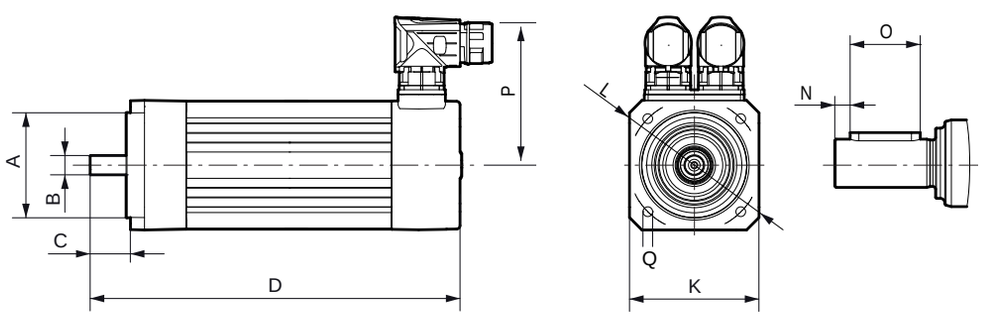
Dimensions		Size 2	Size 3
A (height)	mm	221	261
	inch	8.68	10.28
B (width)	mm	110	132
	inch	4.33	5.2
C (depth)	mm	185	205
	inch	7.28	8.07



CMP40-63 servomotors

Motor type	A	B	C	D	D (with brake)	K	L	N	O	P	Q
CMP40M	40j6	9k6	20	192.5	222	57	63	4	12	77	4.5
CMP50S	60j6	11k6	23	211.5	240	73	75	3.5	16	85.5	5.5
CMP50M	60j6	11k6	23	250.5	279	73	75	3.5	16		
CMP50L	60j6	11k6	23	289.5	318	73	75	3.5	16		
CMP63S	80j6	14k6	30	246	274	88	100	4	22	91.5	6.5
CMP63M	80j6	14k6	30	296	324	88	100	4	22		
CMP63L	80j6	14k6	30	346	374	88	100	4	22		

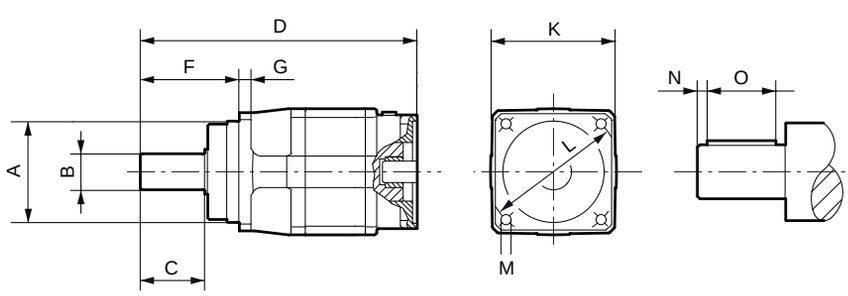
(Dimensions in mm)



PSKC planetary servo gear units

Gear unit	Adapter	Prepared motor mounting	A	B	C	D	F	G	K	L	M	N	O
PSKC 221	ECH02/01/02	CMP40	60 g6	16 k6	28	149	48	8	65	68	5.5	2	25
	ECH02/08/04	CMP50				152							
PSKC 321	ECH03/08/04	CMP50	70 g6	22 k6	36	172	56	10	76	85	6.6	4	28
	ECH03/13/06	CMP63				179							
PSKC 521	ECH05/13/06	CMP63	90 g6	32 k6	58	237	88	13	105	120	9	4	50

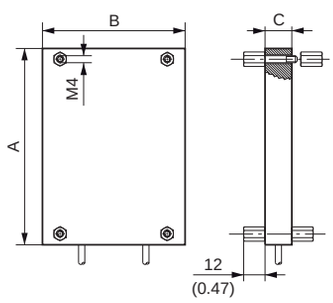
(Dimensions in mm)



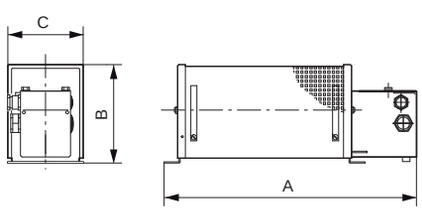
Braking resistors

Type	Design		Main dimensions				Weight
			A	B	C		
BW047-003	A	mm	110	80	50	kg	0.3
		inch	4.33	3.1	0.59	lb	0.7
BW047-005	A	mm	216	80	15	kg	0.6
		inch	8.50	3.1	0.59	lb	1
BW147-T	B	mm	549	120	185	kg	4.9
		inch	21.6	4.72	7.28	lb	11

A: : Flat design

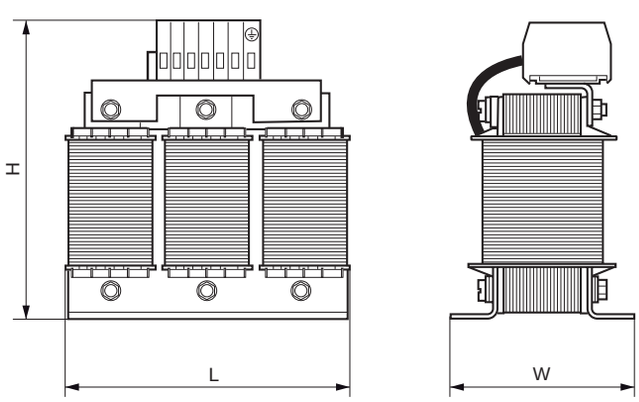


B: Round wire



Line chokes, three-phase circuit

Type		Main dimensions				Weight
		L	W	H		
ND LT 010 290 53	mm	125	71	127	kg	2.5
	inch	4.92	2.8	5.0	lb	5.51
ND LT 036 081 53	mm	155	77	185	kg	7.2
	inch	6.10	3.03	7.28	lb	15.81



Conversion help

Formula tables

Torques	
Translational	$M = F \cdot r = (F \cdot D) / 2 \quad M\ [Nm] = (F\ [N] \cdot D\ [mm]) / 2000$
Rotational	$M = J \cdot \alpha \quad M\ [Nm] = J\ [kgm^2] \cdot ((n\ [min^{-1}]) / 9.55 \cdot t_A\ [S]))$

Object	**Position of the rotary axis**	**Moment of inertia J**
Circular ring, thin Hollow cylinder, thin-walled	Perpendicular to the ring plane	$J = m \cdot r^2$
Solid cylinder	Longitudinal axis	$J = 1/2 \cdot m \cdot r^2$
Hollow cylinder, thick-walled	Longitudinal axis	$J = 1/2 \cdot m \cdot (r_1^2 + r_2^2)$
Circular disk	Perpendicular to the plane of the disk	$J = 1/2 \cdot m \cdot r^2$
Circular disk	Axis of symmetry in the plane of the disk	$J = 1/4 \cdot m \cdot r^2$
Rod, thin with length l	Perpendicular to the middle of the rod	$J = 1/12 \cdot m \cdot l^2$

Static resistive forces	**Static and dynamic friction**
Friction force	$F_R = \mu \cdot F_N$
Weight	$F_N = m \cdot g \cdot \cos \alpha$
Resistance to motion	$F_F = m \cdot g \cdot (2 / D \cdot (\mu_L \cdot d / 2 + f) + c)$
Rolling friction	$F = m \cdot g \cdot ((2 \cdot f) / D)$
Bearing friction	$F = m \cdot g \cdot \mu_L \cdot d / D$
Track friction	$F = m \cdot g \cdot c$
Vertical hoist	$F = m \cdot g$
Grade resistance	$F = m \cdot g \cdot \sin \alpha$
Dynamic resisting forces	
Linear motion	$F = m \cdot a$
Rotation	$M = J \cdot \alpha$

F_R = friction force [N]
μ = coefficient of friction
F_N = weight perpendicular to the surface [N]
m = mass [kg]
g = gravitational acceleration [m/s^2]
α = gradient angle [°]
F_F = resistance to motion [N]
D = carrying wheel diameter [mm]
μ_L = bearing friction value
d = lever arm of rolling friction [mm]
c = wheel flange and side friction coefficient

Value information tables

Power transmission elements	Conditions	Efficiency
Wire rope	per complete loop of the rope roll (with friction or plain bearing)	0.91 – 0.95
Rubber bands	per complete loop / rollers with friction bearings (normal tension of the band)	0.81 – 0.85
Toothed belt	per complete loop / rollers with friction bearings (normal tension of the band)	0.90 – 0.96
Chains	per complete loop / wheels with friction bearing (depending on chain size)	0.90 – 0.96

Material pairing	Type of friction	Coefficient of friction	Lever arm
Steel on steel	Static friction (dry)	μ_0 = 0.12 – 0.60	f ≈ 0.5 mm
	Dynamic friction (dry)	μ = 0.08 – 0.50	
	Static friction (greased)	μ_0 = 0.12 – 0.35	
	Dynamic friction (greased)	μ = 0.04 – 0.25	
Plastic belt on steel	Static friction (dry)	μ_0 = 0.25 – 0.45	
	Dynamic friction (dry)	μ = 0.25	
Steel on plastic	Dynamic friction (dry)	μ_0 = 0.20 – 0.45	
	Dynamic friction (greased)	μ = 0.18 – 0.35	
Plastic on steel			f ≈ 2 mm
Hard rubber on steel			f ≈ 7 mm
Hard rubber on concrete			f ≈ 10 – 20 mm

Conversion tables

Conversion of forces		
	N	pound-force / lbf
1 N =	1	$2.24809 \cdot 10^{-1}$
1 lbf =	4.44822	1

Conversion of torques

	Nm	lbf in
1 Nm =	1	8.85075
1 lbf in =	$1.12985 \cdot 10^{-1}$	1

Conversion of power

	kW	horsepower hp
1 kW =	1	1.34102
1 hp	$7.45700 \cdot 10^{-1}$	1

Conversion of masses

	kg	pound lb = lbm
1 kg =	1	2.20462
1 lb = 1 lbm =	$4.53592 \cdot 10^{-1}$	1

Conversion of moments of inertia

	kg cm^2	kg m^2	lb in^2	lbf in s^2
1 kg cm^2 =	1	10^{-4}	$3.41717 \cdot 10^{-1}$	$8.85075 \cdot 10^{-4}$
1 kg m^2 =	10^4	1	3417.17	8.85075
1 lb in^2 =	2.92640	$2.92640 \cdot 10^{-4}$	1	$2.59008 \cdot 10^{-3}$
1 lbf in s^2 =	1129.85	$1.12985 \cdot 10^{-1}$	386.089	1

Conversion of lengths

	mm	cm	m	Inch/in	Feet/ft
1 mm =	1	10^{-1}	10^{-3}	$3.93701 \cdot 10^{-2}$	$3.28084 \cdot 10^{-3}$
1 cm =	10	1	10^{-2}	$3.93701 \cdot 10^{-1}$	$3.28084 \cdot 10^{-2}$
1 m =	1000	100	1	39.3701	3.28084
1 in =	25.4	2.54	$2.54 \cdot 10^{-2}$	1	$8.33333 \cdot 10^{-2}$
1 ft =	304.8	30.48	$3.048 \cdot 10^{-1}$	12	1

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